AC100V/200V AC Servo Motor

SV-NET Driver

TAD8811 Series

Installation/Operation Instruction Manual

EU RoHS Directive compliant product

TAMAGAWA SEIKI CO.,LTD

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Memo:

Safety Precautions

■ Warning indications regarding safety

This document uses the following terms to describe items that must be observed in order to prevent personal injury and equipment damage. Examples of misuse that could result in bodily harm or material damage are shown as follows and classified according to the degree of potential harm or damage. The matters described here are important for safety. Please be sure to comply with these warnings.

Danger

- This indication signifies a hazardous situation that could result in death, serious injury, or fire if not avoided.

Caution

- The heat sink might become hot. Do not touch the heat sink. Failure to observe this instruction could result in burns.

Caution

- Failure to observe this instruction could result in an electrical shock. This indication signifies a hazardous state that could result in death, serious injury, or fire if not avoided.

Caution

- This indication signifies a hazardous situation that could result in a medium-level injury, light injury, fire, or property damage if not avoided.

Important

- This indication signifies a precaution that you are required to observe without fail. The precaution is on a level that is not expected to lead to equipment damage. This level includes issue of alarms, etc.

■ Icon Indications

The following icons are provided to clarify the contents.

Supplement **shows information, operation, or example of settings in order to deepen understanding.**

■ Please make sure to observe the following matters for safety purposes.

General Precautions

⚠ Danger

- **You are required to read this manual in order to use this product safely.**
- **Please keep this manual at hand and make sure that it will be delivered to the end user of this product.**
- **Do not remove covers, cables, connectors, or optional equipment while the driver is energized.**
  Otherwise, an electrical shock and/or stoppage or burning of the product might occur.
- **Use the product at the power supply specifications (number of phases, voltage, frequency, and current) appropriate for the product.**
  Failure to observe this instruction could result in burning, electrical shocks, and/or fire.
- **Be sure to connect the grounding terminal (frame ground) of the driver to the grounding electrode (earth** (PE)**).**
  Failure to observe this instruction could result in electrical shocks and/or a fire.
- **Do not disassemble, repair, or modify the product.**
  Failure to observe this instruction could result in a fire or a failure. Disassembled, repaired, or modified products are not covered under the warranty.

⚠ Caution

- **Do not touch the heat sink of the driver while it is energized.**
  Failure to observe this instruction could result in burns.

⚠ Caution

- **Do not touch the terminal while the product is energized, and for one minute after the power is turned off.**
  Failure to observe this instruction could result in an electric shock.

⚠Caution

- **Do not damage the cables, pull strongly on them, exert excessively large force on them, place a heavy object on them or crimp them.**
  Failure to observe this instruction could result in a failure, damage, or electrical shock.

- **Never use the product in a place where water might get in or on it, in a corrosive atmosphere, in a combustible-gas atmosphere, or in an atmosphere where an electrically conductive foreign object such as a metal piece might penetrate into the product or near a combustible material.**
  Failure to observe this instruction could result in an electrical shock and/or fire.

Precautions for Storage

⚠Caution

- **For a storage location, select an environment that meets the following conditions.**
  - Locations not subject to direct sunlight
  - Ambient temperature: -10 to 65°C (non-condensing)
  - Relative humidity: 90%RH or less (non-condensing)
  - Locations with no condensation from rapid temperature fluctuations
  - Locations with no corrosive gases and/or combustible gases
  - Locations with no combustible materials nearby
  - Locations where there is little dust, dirt, salt, and metal powder
  - Locations in which the product will not be subject to water, oil, chemicals, etc.
  - Locations in which the product will not be subject to vibrations and mechanical shocks (product specifications must not be exceeded.)

  If the product is stored in an environment that does not meet the above conditions, it may suffer a failure and/or damage.

Precautions for Transportation

⚠Caution

- **Transport the product appropriately according to its mass without damaging it.**

- **This product is precision equipment. Do not drop it or subject it to strong impacts.**
  Failure to observe this instruction could result in a failure or damage.

- **Do not exert impacts on the connectors.**
  Failure to observe this instruction could result in poor connections or device failures.

Precautions for Mounting (Installation)

⚠ Caution

- **Install the product in a place that can support its weight.**
- **Attach the driver and the regenerative resistor to a non-combustible article.**
  Attaching them directly to or near a combustible article could result in a fire.
- **Leave a specified mounting distance between the driver and the internal face of the control panel or other devices.**
  Failure to observe this instruction could result in a fire or a device failure.
- **Mount the driver in the specified orientation.**
  Failure to observe this instruction could result in a fire or a device failure.
- **Do not place a heavy object on the product.**
  Failure to observe this instruction could result in a device failure, damage, and/or injury.
- **Make sure of installing the driver within the control panel.**
- **Install the product appropriately so that shocks and vibrations exerted on it will not exceed the product specifications.**

Precautions for Wiring

⚠ Danger

- **Do not change wiring while the product is energized.**
  Failure to observe this instruction could result in an electrical shock and/or injury.
- **Wiring and inspections must be made by a qualified engineer.**
  Failure to observe this instruction could result in an electrical shock and/or a failure of the product.

⚠ Caution

- **Wiring and inspections must be made when the CHARGE lamp is off after at least one or more minutes have passed since power-off of the product. Since high voltage may remain in the driver after the power-off, do not touch the power terminal while the CHARGE lamp is on.**
  Failure to observe this instruction could result in an electrical shock.

⚠ Caution

- **During wiring and trial run, observe the precautions described in this manual.**
  Failure to observe this instruction could result in a failure of the driver due to wrong wiring, applying an incorrect voltage, etc. leading to device damage and physical injury.

- **Be sure to use an AWG14 (2.5 sq) wire rod as an electric wire for establishing a connection to the grounding terminal (frame ground). Firmly tighten the terminal at the specified torque.**
  Insufficient tightening could cause heating of the wire and the terminal block due to a poor contact, leading to a fire.

- **For wiring, use the cables we specify, whenever possible.**
  If you need to use a cable other than those we specify, select an appropriate one by considering usage conditions such as the rated current of the relevant model and its operating environment.

- **When wiring, use only wire rods with temperature rating of 75°C or higher.**

- **Use copper conductor electrical wires for the wiring.**

- **Firmly tighten the lockscrews and locking mechanisms of cable connectors.**
  Insufficient tightening could result in disconnection of a cable connector during operation.

- **Do not run a heavy-current line (a main circuit cable) and a light-current line (an input/output cable and a sensor cable) in the same duct or bundle them together. If a heavy-current line and a light-current line cannot be placed in separate ducts, leave a wiring distance of 30 cm or more between them.**
  Wiring that is too close together could result in malfunctions due to noise on the low-current line.

Precautions for Operation and Running

Danger

- **Implement a trial run while the product is isolated from the machine with the servo motor fixed in place.**
  Failure to observe this instruction could result in injury.

- **Before operating the product while it is attached to the machine, correctly set the input and output signals and those of parameters appropriately for the machine.**
  Running the product without making appropriate settings could result in unexpected machine movement or failure and/or physical injury.

- **Do not assign extreme values to any parameter.**
  Assigning an extreme parameter value could cause unstable motion, resulting in machine damage and/or injury.

- **To prevent unexpected accidents, implement safety measures such as installing limit switches at the end point of movement sections of the machine.**
  Failure to observe this instruction could result in machine damage and/or injury.

Important

- **In gain adjustment at system start-up, confirm by observing the torque waveform and speed waveform that no vibration occurs.**
  Vibration generated due to high gain could result in early damage to the servo motor.

- **Do not frequently turn the power supply on and off. After the start of actual operation (ordinary operation), allow at least one hour or more between turn-on and turn-off of the power supply. Do not use this product in applications that require frequent turn-on and turn-off of the relevant power supply.**
  Failure to observe this instruction could result in early deterioration of driver components.

- **After completion of trail runs of the machine and equipment, create a backup file of driver parameters by using a PC application software. This backup file will be used for making parameter settings after driver replacement.**
  If backed-up parameter values are not copied, a driver replaced due to a failure and so on cannot operate normally. In such cases, the machine and/or equipment could suffer failures and/or damage.

Precautions for Maintenance and Inspection

Danger

- **Do not change wiring while the product is energized.**
  Failure to observe this instruction could result in an electrical shocks and/or injury.

- **Wiring and inspection must be implemented by a specialized engineer.**
  Failure to observe this instruction could result in an electrical shock and/or a failure of the product.

- **Wiring and inspections must be made when the CHARGE lamp is off after at least one or more minutes have passed since power-off of the product. Since high voltage may remain in the driver after the power-off, do not touch the power terminal while the CHARGE lamp is on.**
  Failure to observe this instruction could result in an electrical shock.

- **When it is necessary to replace the driver, back up the parameter values of the driver before its replacement. Copy the backed-up parameter values into the new driver and confirm that the values have been correctly copied.**
  If backed-up parameter values are not copied, or if the copying operation is not correct, the replaced driver cannot operate normally. In such a case, the machine and/or equipment could suffer failure and/or damage.

- **If the safety device (a circuit breaker) installed in the power supply is activated, eliminate the cause of the activation, and then energize the driver. Securely eliminate the cause of the activation of the safety device by implementing repair, replacement, and wiring check related to the driver.**
  Failure to observe this instruction could result in a fire, an electric shock, and/or injury.

Caution

- **If an alarm is issued, first eliminate the cause of the alarm to ensure safety. After that, reset the alarm or turn on the power supply again to restart operation.**
  Failure to observe this instruction could result in injury and/or machine damage.

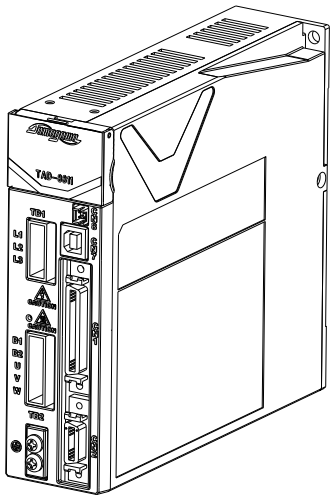
1. Before You Begin

Thank you very much for purchasing the SV-NET Driver.
After you receive and unpack the product, please check to see if it is the same model you ordered and for any damage that may have occurred during transportation. Should your product have any problems, please contact the dealer from whom you purchased the product.

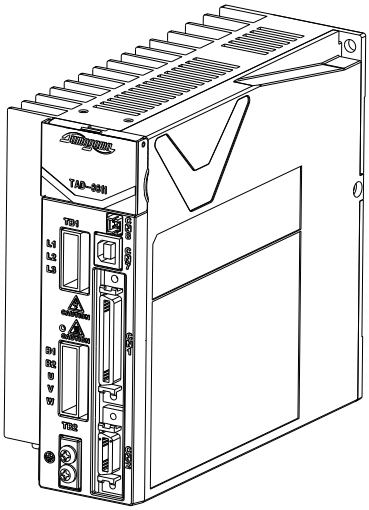
1.1. Overview of the Product

The SV-NET Driver TAD8811 Series is the latest servo driver with the fastest speed and most advanced functions.
It has a compact main unit and auto-tuning function that works in combination with a personal computer to ensure easy and convenient use. It uses our own original fieldbus SV-NET as a network. Combined with the SV-NET controller (TA8441), it allows multi-axis interpolation. In spite of its compact dimensions, the driver supports I/O control with pulse and analog commands in addition to communication commands through SV-NET. The sensor can be selected from a wire-saving incremental encoder, a serial encoder, or a brushless resolver, or an external encoder may be used.

• 400W

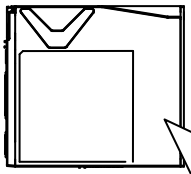


• 750W



■ Model check

When you receive the product, check the model of the driver.



Details of described model

TAD8811 N 3 4 3 E 2 39

(1) (2) (3)(4) (5) (6)

(1) Basic model TAD8811 Series

(2) Sensor type
1: Wire-saving incremental encoder(INC-SE)
3: Serial encoder(Smart-ABS/INC)
7: Brushless resolver (Smartsyn)

(3) I/F voltage, drive voltage

1: 5V (I/F) / AC100V
2: 5V (I/F) / AC200V
3: 24V (I/F) / AC100V
4: 24V (I/F) / AC200V

(4) Driver rated output current (maximum current)

1: 1 Arms (3.4 Arms)
2: 2 Arms (5.9 Arms)
3: 4 Arms (11.3 Arms)
4: 6 Arms (15.0 Arms)

(5) Sensor specifications Refer to Table 1 (differs by sensor type)

(6) Motor model Refer to Table 2 Standard Motor Models

Table 1 Sensor Specifications

N No. / E No.	N1□□	N3□□	N7□□
E0△△	—	—	
E1△△	2000 C/T wire-saving incremental encoder	17-bit absolute encoder	1X brushless resolver
E2△△	2048 C/T wire-saving incremental encoder	17-bit incremental encoder	(2X brushless resolver)
E3△△	2500 C/T wire-saving incremental encoder	—	(4X brushless resolver)
E4△△	—	—	—
E5△△	—	23-bit absolute encoder	—
E6△△	—	23-bit incremental encoder	—
E7△△	—	—	—

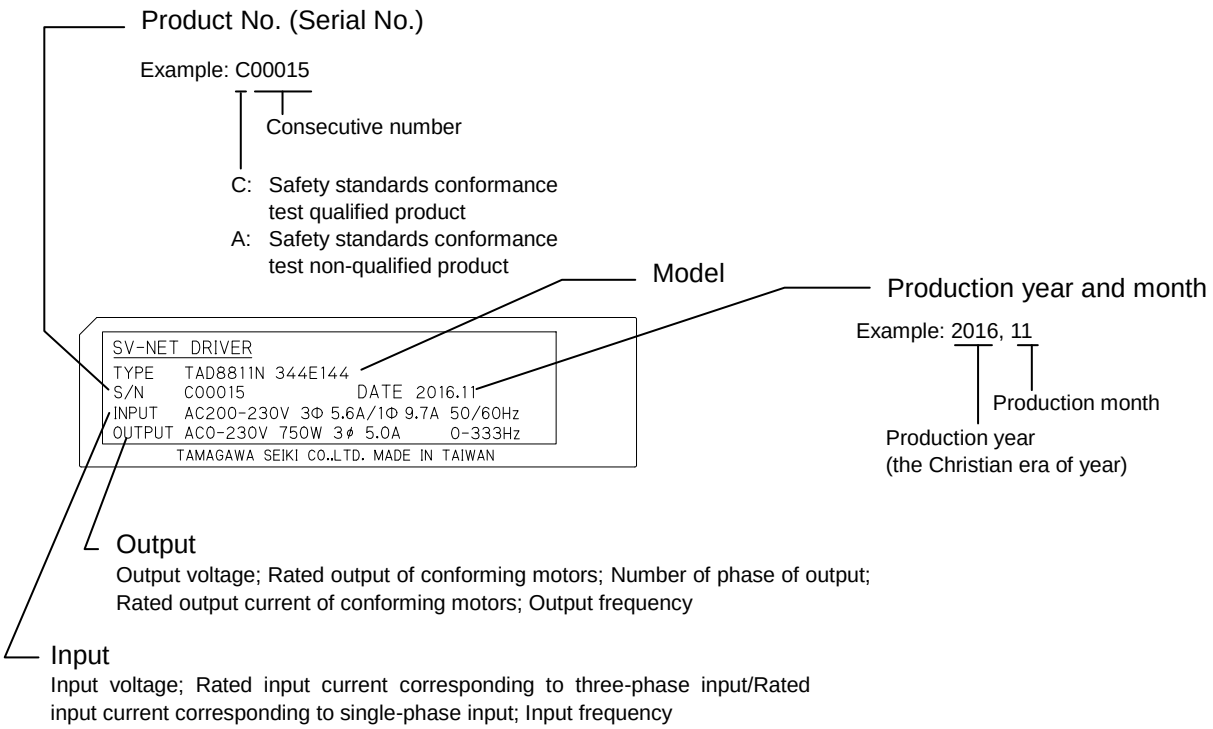
Note:
- Those in ( ) will be supported in the future.
- "Wire-saving incremental encoder" is shown as "wire-saving INC" hereafter.
- "17-/23-bit absolute encoder" is shown as "17-/23-bit-ABS" hereafter.
- "17-/23-bit incremental encoder" is shown as "17-/23-bit-INC" hereafter.
- "Brushless resolver" is shown as "BRX" hereafter.
- In the driver format, the format after E900 is a special specification, please see the dedicated product specifications.

Table 2 Standard Motor Models

TBL-i II Series	
Motor model	E No. △△
TS4601 (30W – 200V)	E*31
TS4602 (50W – 200V)	E*32
TS4603 (100W – 200V)	E*33
TS4604 (150W – 200V)	E*34
TS4606 (100W – 200V)	E*36
TS4607 (200W – 200V)	E*37
TS4609 (400W – 200V)	E*39
TS4610 (600W – 200V)	E*40
TS4611 (200W – 200V)	E*41
TS4612 (400W – 200V)	E*42
TS4613 (600W – 200V)	E*43
TS4614 (750W – 200V)	E*44
TS4601 (30W – 100V)	E*51
TS4602 (50W – 100V)	E*52
TS4603 (100W – 100V)	E*53
TS4604 (150W – 100V)	E*54
TS4606 (100W – 100V)	E*56
TS4607 (200W – 100V)	E*57
TS4609 (400W – 100V)	E*59
TS4611 (200W – 100V)	E*58

TBL-i IV Series	
Motor model	E No. △△
TSM3101 (30W – 200V)	E*70
TSM3102 (50W – 200V)	E*71
TSM3104 (100W – 200V)	E*72
TSM3201 (100W – 200V)	E*73
TSM3202 (200W – 200V)	E*74
TSM3204 (400W – 200V)	E*75
TSM3301 (200W – 200V)	E*76
TSM3302 (400W – 200V)	E*77
TSM3303 (600W – 200V)	E*78
TSM3304 (672W – 200V)	E*79
TSM3101 (30W – 100V)	E*90
TSM3102 (50W – 100V)	E*91
TSM3104 (100W – 100V)	E*92
TSM3201 (100W – 100V)	E*93
TSM3202 (200W – 100V)	E*94
TSM3301 (200W – 100V)	E*96

TBL-i4s Series	
Motor model	E No. △△
TSM4102 (50W – 200V)	E*61
TSM4104 (100W – 200V)	E*62
TSM4202 (200W – 200V)	E*64
TSM4204 (400W – 200V)	E*65
TSM4303 (600W – 200V)	E*68
TSM4304 (750W – 200V)	E*69



■ Contents of nameplate

■ Check if the Driver Model Is Compatible with the Combined Motor

Use the tables below to check if the driver model is compatible with the motor you use.

Please specify based on the model appearance for combinations other than those listed below.

The current settings for each supported motor are as follows. These are the same regardless of resolution or sensor type.

(Ir: Rated current setting, Is: Stall current setting,
Ip: Instantaneous maximum current setting)

- TBL-i II Series (I/F voltage 24 V)

Motor			Current setting			Compatible driver
Power supply specifications	Rated output	Model	Ir (Arms)	Is (Arms)	Ip (Arms)	Model
AC200V	30W	TS4601 N**** E200	0.4	0.3	0.9	TAD8811 N*41 E*31
	50W	TS4602 N**** E200	0.6	0.5	1.6	TAD8811 N*41 E*32
	100W	TS4603 N**** E200	1.1	1.0	3.0	TAD8811 N*41 E*33
	150W	TS4604 N**** E200	1.5	1.4	4.3	TAD8811 N*42 E*34
	100W	TS4606 N**** E200	0.9	0.8	2.6	TAD8811 N*41 E*36
	200W	TS4607 N**** E200	1.7	1.6	4.9	TAD8811 N*42 E*37
	400W	TS4609 N**** E200	3.3	3.2	9.7	TAD8811 N*43 E*39
	600W	TS4610 N**** E200	5.1	4.9	14.9	TAD8811 N*44 E*40
	200W	TS4611 N**** E200	1.5	1.4	4.2	TAD8811 N*42 E*41
	400W	TS4612 N**** E200	2.8	2.6	8.0	TAD8811 N*43 E*42
	600W	TS4613 N**** E200	4.4	4.3	12.8	TAD8811 N*44 E*43
	750W	TS4614 N**** E200	5.0	4.8	14.5	TAD8811 N*44 E*44
AC100V	30W	TS4601 N**** E100	0.7	0.5	1.6	TAD8811 N*31 E*51
	50W	TS4602 N**** E100	1.1	1.0	3.0	TAD8811 N*31 E*52
	100W	TS4603 N**** E100	1.8	1.7	5.3	TAD8811 N*32 E*53
	150W	TS4604 N**** E100	3.0	2.9	8.8	TAD8811 N*33 E*54
	100W	TS4606 N**** E100	1.8	1.7	5.1	TAD8811 N*32 E*56
	200W	TS4607 N**** E100	3.5	3.3	9.8	TAD8811 N*33 E*57
	400W	TS4609 N**** E100	5.6	5.4	15.0	TAD8811 N*34 E*59
	200W	TS4611 N**** E100	3.1	2.8	8.7	TAD8811 N*33 E*58

Note: Items with an asterisk differ by motor or sensor specifications.

Danger

Running the equipment with a driver whose model is incompatible with the motor may result in damage not only to the driver and motor but also to the installed equipment. Such use may also result in unexpected machine movement and/or physical injury. Always use a driver compatible with the motor.

**(Ir: Rated current setting, Is: Stall current setting,
Ip: Instantaneous maximum current setting)**

■ TBL-i IV Series (I/F voltage 24 V)

Motor			Current setting			Compatible driver
Power supply specifications	Rated output	Model	Ir (Arms)	Is (Arms)	Ip (Arms)	Model
AC200V	30W	TSM3101 N**** E200	1.1	0.8	3.4	TAD8811 N*41 E*70
	50W	TSM3102 N**** E200	1.1	0.9	3.4	TAD8811 N*41 E*71
	100W	TSM3104 N**** E200	1.4	1.3	4.7	TAD8811 N*42 E*72
	100W	TSM3201 N**** E200	1.4	1.2	4.6	TAD8811 N*42 E*73
	200W	TSM3202 N**** E200	2.2	2.0	7.3	TAD8811 N*43 E*74
	400W	TSM3204 N**** E200	3.5	3.4	11.3	TAD8811 N*43 E*75
	200W	TSM3301 N**** E200	2.1	1.9	6.9	TAD8811 N*43 E*76
	400W	TSM3302 N**** E200	3.7	3.5	11.3	TAD8811 N*43 E*77
	600W	TSM3303 N**** E200	4.8	4.6	15.0	TAD8811 N*44 E*78
	672W	TSM3304 N**** E200	6.0	6.0	15.0	TAD8811 N*44 E*79
AC100V	30W	TSM3101 N**** E100	2.2	1.9	6.9	TAD8811 N*33 E*90
	50W	TSM3102 N**** E100	2.1	1.9	6.8	TAD8811 N*33 E*91
	100W	TSM3104 N**** E100	2.1	2.0	7.3	TAD8811 N*33 E*92
	100W	TSM3201 N**** E100	2.5	2.2	8.1	TAD8811 N*33 E*93
	200W	TSM3202 N**** E100	4.4	4.1	14.6	TAD8811 N*34 E*94
	200W	TSM3301 N**** E100	4.2	3.8	13.7	TAD8811 N*34 E*96

Note: Items with an asterisk differ by motor or sensor specifications.

Danger

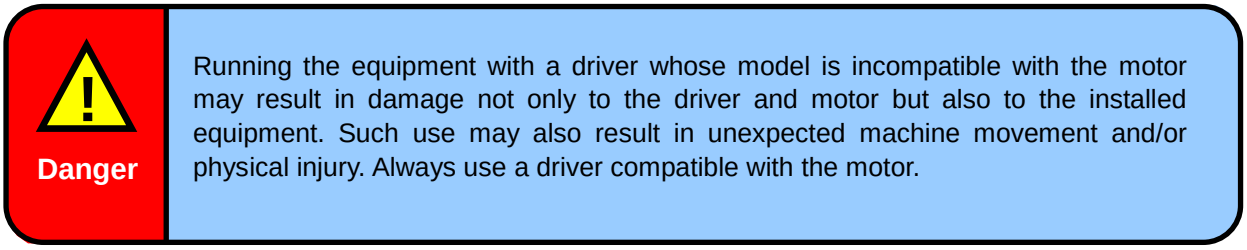
Running the equipment with a driver whose model is incompatible with the motor may result in damage not only to the driver and motor but also to the installed equipment. Such use may also result in unexpected machine movement and/or physical injury. Always use a driver compatible with the motor.

**(Ir: Rated current setting, Is: Stall current setting,
Ip: Instantaneous maximum current setting)**

■ TBL-i4s Series (I/F voltage 24 V)

Motor			Current setting			Compatible driver
Power supply specifications	Rated output	Model	Ir (Arms)	Is (Arms)	Ip (Arms)	Model
AC200V	50W	TSM4102 N**** E205	0.8	0.7	2.5	TAD8811 N*41 E*61
	100W	TSM4104 N**** E205	0.9	0.8	3.0	TAD8811 N*41 E*62
	200W	TSM4202 N**** E205	1.7	1.6	5.9	TAD8811 N*42 E*64
	400W	TSM4204 N**** E205	2.8	2.7	9.5	TAD8811 N*43 E*65
	600W	TSM4303 N**** E205	4.4	4.3	15.0	TAD8811 N*44 E*68
	750W	TSM4304 N**** E205	4.9	4.7	15.0	TAD8811 N*44 E*69

Note: Items with an asterisk differ by motor or sensor specifications.



1.2. Specifications

Item		Specifications							
Power supply specifications	**Model**	N*1*/N*3*				N*2*/N*4*			
		100 VAC drive power supply				**200 VAC drive power supply**			
		Single-phase: 100-115 VAC±10%, 50/60 Hz				Single-phase/three-phase: 200-230 VAC±10%, 50/60 Hz			
	Model	N**1	N**2	N**3	N**4	N**1	N**2	N**3	N**4
Rated continuous output current (Maximum value)		1.1 Arms	2.0 Arms	4.0 Arms	5.6 Arms	1.1 Arms	2.0 Arms	4.0 Arms	6.0 Arms
Maximum momentary output current (Maximum value)		3.4 Arms	5.9 Arms	11.3 Arms	15.0 Arms	3.4 Arms	5.9 Arms	11.3 Arms	15.0 Arms
Input current		Differs depending on the motor combination. See the next page.							
Environmental condition	Operating temperature	0 to +40°C							
	Storage temperature	-10 to +65°C (no freezing and no condensation)							
	Operating humidity	90%RH or less (no freezing and no condensation)							
	Storage humidity	90%RH or less (no freezing and no condensation)							
	Vibration resistance	4.9 m/s^2 or less							
	Shock resistance	19.6 m/s^2 or less							
	Pollution degree	2 or 1							
	Elevation	1,000 m or less above sea level							
Conformance to standards	Euro EC Directives (*1)	EMC Directive	EN55011 group1 classA EN61000-6-2 EN61800-3 (category C3)						
		Low Voltage Directive	EN61800-5-1:2007						
	UL standards (*2)	UL508C							
Short-circuit current rating (SCCR)		5,000 A							
Overvoltage category		III							
USB communication specifications		USB 2.0 CDC Class original protocol							
SV-NET communication specifications		Communication protocol: SV-NET Physical layer: CAN Maximum number of connections: 63							
Sensor		Wire-saving incremental encoder INC-SE			Serial encoder Smart-ABS/INC			Brushless resolver Smartsyn	
Position resolution		4x sensor resolution (*3)			2^{17} 2^{23}(1/rev) (*5)			(*4)	
LEAD/LAG/Z output		Yes							
Monitor output		Yes							
Combined motor		TBL-i II,TBL-i IV, TBL-i4s Series							
Maximum output of motor combinationr		400W				750W			
Mechanical brake control output		No (control signal output is possible)							
Dynamic brake circuit		Yes							
Regeneration circuit		Yes (resistor externally installed)							
Number of control rotations		6000 rpm max (*5)							
Rotation direction definition		CCW rotation as seen from the motor shaft end shall be the forward direction. (*6)							
Recommended load inertia		Not more than 30 times the motor inertia							
External dimensions (mm)		N**1 to N**3:145 × 43 × 160 (height × width × depth) N**4:145 × 63 × 160 (height × width × depth) (Excluding connector dimensions)							
Mass		N**1 to N**3: Approx. 0.8 kg N**4: Approx. 1.0 kg							

(*1) Products produced in 2016 or earlier (first letter of Serial No. is "A") do not conform to this standards test.

(*2) Products produced in 2016 or earlier (first letter of Serial No. is "A") and products other than the standard types described in this instruction manual do not conform to this standards test.

(*3) In wire-saving incremental encoders, the position resolution is four times the number of sensor C/Ts.
Example: In the 2048C/T wire-saving incremental encoder, the position resolution is 8192 (1/rev).

(*4) In brushless resolvers, the position resolution is [the number of shaft angle multipliers] × 2048 (1/rev).
Example: 1X resolver: 2048 (1/rev)

(*5) Differs depending on the motor combination.

(*6) The rotation direction definition can be changed by altering the parameters.

▪ **Input current and loss (I/F voltage 24V)**

Model	Motor combination models	Rated motor output (W)	Input current		Driver loss (W)
			Three-phase input (Arms)	Single-phase input (Arms)	
TAD8811N*41E*31	TS4601N****E200	30	0.6	0.8	10.4
TAD8811N*41E*32	TS4602N****E200	50	0.7	1.1	11.3
TAD8811N*41E*33	TS4603N****E200	100	1.2	2.0	17.3
TAD8811N*42E*34	TS4604N****E200	150	1.5	2.6	17.1
TAD8811N*41E*36	TS4606N****E200	100	1.1	1.9	13.6
TAD8811N*42E*37	TS4607N****E200	200	1.7	3.0	19.0
TAD8811N*43E*39	TS4609N****E200	400	3.3	5.6	30.1
TAD8811N*44E*40	TS4610N****E200	600	4.2	7.7	40.8
TAD8811N*42E*41	TS4611N****E200	200	1.8	3.2	17.8
TAD8811N*43E*42	TS4612N****E200	400	3.1	5.3	25.4
TAD8811N*44E*43	TS4613N****E200	600	4.2	7.7	50.0
TAD8811N*44E*44	TS4614N****E200	750	5.6	9.7	53.9
TAD8811N*41E*70	TSM3101N***E200	30	0.7	1.1	11.6
TAD8811N*41E*71	TSM3102N***E200	50	0.9	1.3	12.7
TAD8811N*42E*72	TSM3104N***E200	100	1.2	2.1	19.4
TAD8811N*42E*73	TSM3201N***E200	100	1.2	1.9	15.9
TAD8811N*43E*74	TSM3202N***E200	200	1.9	3.3	18.1
TAD8811N*43E*75	TSM3204N***E200	400	3.0	5.4	35.1
TAD8811N*43E*76	TSM3301N***E200	200	1.9	3.2	21.4
TAD8811N*43E*77	TSM3302N***E200	400	3.0	5.4	32.7
TAD8811N*44E*78	TSM3303N***E200	600	4.0	7.6	46.7
TAD8811N*44E*79	TSM3304N***E200	672	4.7	8.8	64.0
TAD8811N*31E*51	TS4601N****E100	30	—	1.2	9.7
TAD8811N*31E*52	TS4602N****E100	50	—	1.6	12.0
TAD8811N*32E*53	TS4603N****E100	100	—	2.7	17.0
TAD8811N*33E*54	TS4604N****E100	150	—	3.6	21.4
TAD8811N*32E*56	TS4606N****E100	100	—	2.6	15.6
TAD8811N*33E*57	TS4607N****E100	200	—	4.4	27.0
TAD8811N*34E*59	TS4609N****E100	400	—	8.1	46.7
TAD8811N*33E*58	TS4611N****E100	200	—	4.4	23.3

The above-listed values are net values corresponding to the rated motor output.

▪ **Input current and loss (I/F voltage 24V)**

Model	Motor combination models	Rated motor output (W)	Input current		Driver loss (W)
			Three-phase input (Arms)	Single-phase input (Arms)	
TAD8811 N*33 E*90	TSM3101 N****E100	30W	—	1.4	11.4
TAD8811 N*33 E*91	TSM3102 N****E100	50W	—	1.8	13.1
TAD8811 N*33 E*92	TSM3104 N****E100	100W	—	2.8	13.7
TAD8811 N*33 E*93	TSM3201 N****E100	100W	—	2.7	13.9
TAD8811 N*34 E*94	TSM3202 N****E100	200W	—	4.6	29.7
TAD8811 N*34 E*96	TSM3301 N****E100	200W	—	4.5	27.5
TAD8811N*41 E*61	TSM4102N****E205	50W	0.7	1.1	14.9
TAD8811N*41 E*62	TSM4104N****E205	100W	1.1	1.9	16.4
TAD8811N*42E*64	TSM4202N****E205	200W	1.8	3.1	18.2
TAD8811N*43E*65	TSM4204N****E205	400W	3.0	5.3	28.7
TAD8811N*44E*68	TSM4303N****E205	600W	4.2	7.8	39.4
TAD8811N*44E*69	TSM4304N****E205	750W	5.1	9.2	48.6

The above-listed values are net values corresponding to the rated motor output.

1.3. Standard Functions

Control mode		Position, speed, current, and simplified control
Pulse command input	Pulse command input	▪ Forward/reverse pulse ▪ Pulse/rotation direction
	Positioning accuracy	Within ±1 pulse (regulated standard) (*1)
Analog command input	Speed command input Current command input	Command scale and polarity settable with parameters Factory settings:5,000 rpm/10 V, 5 Arms/10 V
	Specified resolution	±11 bit
Electronic gear		Increases specified pulse by (N/M) times and controls position N: Number of command pulses that are input to rotate the motor shaft by M turns (1 to 2^{30}) M: Number of turns of the motor shaft for the number of command pulses (N) (1 to 2^{14})
Gain switch function		Servo gain pattern switching possible with position deviation, speed command values. Also switchable with signals
External encoder input		Load shaft encoder is fed back and allows control in the fully closed position.
Recommended load inertia		Not more than 30 times the motor inertia
Rotation direction		Variable using parameters (normal direction set as CCW in factory settings)
Parameters		Parameters can be set using communication (USB, SV-NET, RS485, ModbusRTU) or the front settings panel. ▪ Control mode ▪ Position loop gain ▪ Speed loop gain ▪ Speed loop accumulated time ▪ Feed forward amount ▪ Resonance filter ▪ Speed limit ▪ Current limit ▪ In-position range ▪ Analog command scale ▪ Analog command offset ▪ Acceleration limit ▪ Encoder division output settings ▪ Electronic gear ratio ▪ Overspeed alarm level ▪ Overload alarm level Other
Sensor		Wire-saving incremental encoder (wire-saving INC) Serial encoder (17bit-ABS, 17bit-INC, 23bit-ABS, 23bit-INC) Brushless resolver (1X-BRX) Sensor selectable from these
Regeneration function		Built-in regeneration circuit Resistor installed externally (option)
Dynamic brake		Built-in dynamic brake Operating conditions set using parameters
Mechanical brake drive output		None (brake control signal settable in I/O output)
Sensor signal output		LEAD, LAG, Z output
Monitor output		Motor current, speed feedback, other monitor output
Protective functions	Hardware errors	Overspeed, power element error (overcurrent), sensor error, drive power error, EEPROM error, CPU error, etc.
	Software errors	Overload, excessive deviation, etc.
Alarm history		Records the past 8 alarms, including present one Saving/viewing function for alarm details
Display, settings		5 rows for display LEDs 4 setting buttons Shows control mode, alarm, control signal input status, etc.
Communication		USB × 1 SV-NET(CAN) × 2 RS-485 × 2 ModbusRTU × 2 } Selected by a parameter

(*1) Theoretical value for drivers. The actual positioning accuracy is determined depending on the motor load and the sensor accuracy.

1.4. SV-NET

SV-NET is a medium-speed field network that uses the CAN physical layer. It uses a simple protocol designed solely for motion control and with unnecessary functions eliminated to reduce transmission time.

■ MAC-ID

SV-NET uses master and slave relationships. A master is a host controller such as a motion controller or a PC. A slave is a driver or an I/O unit. There is one master device, but more than one slave device may be connected. Therefore media access control identifiers (MAC-IDs) unique within the network must be set for each slave. Setting non-unique identifiers causes data collision, leading to incorrect communication.

■ Host controller (master) MAC-ID

The MAC-ID for the host controller (master) is always "0."

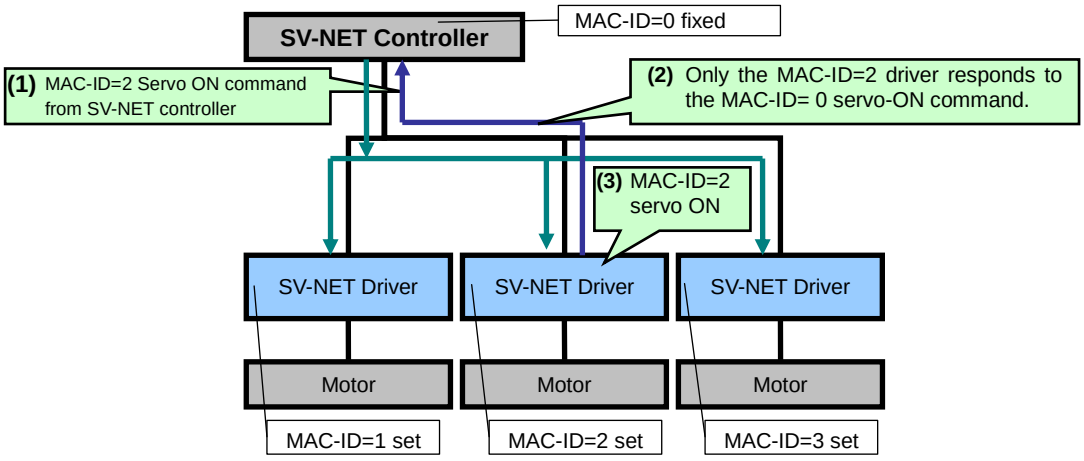
■ Driver (slave) MAC-ID

The MAC-ID of a driver can be set to a value from 1 to 63.

Any number can be set as long as it is unique.

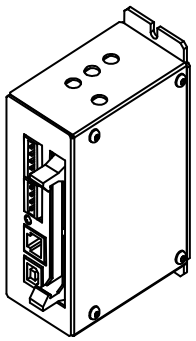
■ Configuration of the SV-NET Motion Control System

Example: Connect three drivers to the host controller and set the servo ON for the driver (motor) of MAC-ID=2.



1.5. SV-NET Motion Controller

■**SV-NET**
Controller TA8441



The SV-NET controller is the motion controller for SV-NET.
Up to eight axes of drivers can be connected, allowing for linear interpolation, circular interpolation, and sync control. Functions such as programming and real-time monitoring using a PC and stand-alone operations that use programming created by the user can be used. It comes equipped with I/O as standard, allowing you to build a compact motion control system using the SV-NET controller, driver, and motor.
(There are also models compatible with Ethernet and CC-Link.)

1.6. Operating from a Personal Computer

TAD8811 is capable of making parameter changes, auto-tuning, and simple operating tests directly from a personal computer via USB communication with the driver main unit.
We provide "Motion Designer Drive" and "Motion Adjuster" as dedicated applications (for free). When you first use this product, use "Motion Designer Drive."

・URL for downloading the dedicated applications:
http://sv-net.tamagawa-seiki.com/download/download_software.html

You can browse the instruction manual for each dedicated application by using the help function of the application.

1.7. Maintenance and Inspection of Servo Driver

The following explains the maintenance and inspection of the driver.

■ Inspection of driver

To safely use the driver, conduct the following inspections at least once a year.

Inspection item	Inspection method
Appearance inspection	Check that there is no dirt, dust, or oil adhering.
Loosen screws and connectors	Check that terminals and connectors are not loose.

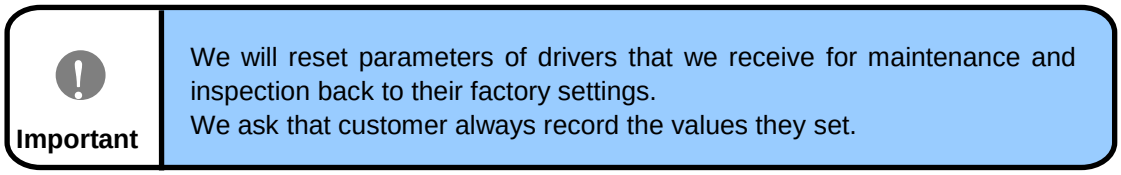
■ Replacement of driver parts

The electric and electronic parts inside the driver deteriorate over time. To ensure preventive maintenance of those parts, contact us at the time of parts replacement by referring to the standard replacement periods shown in the table below as a guide.

Part name	Standard replacement period
Smoothing capacitors	4 to 5 years
Other aluminum electrolyte capacitors	4 to 5 years
Relays	-
Battery for calendar function backup	4 to 5 years

Note) The following usage conditions are assumed for the above replacement periods.

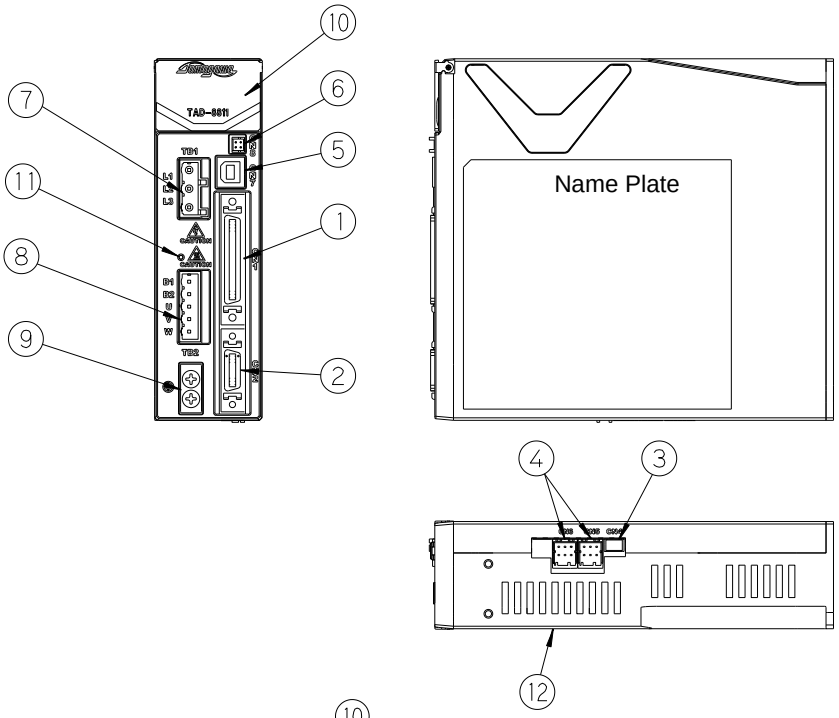
- Ambient temperature: annual average of 30°C
- Load factor: 80% or less
- Operation rate: 20 hours or less per day



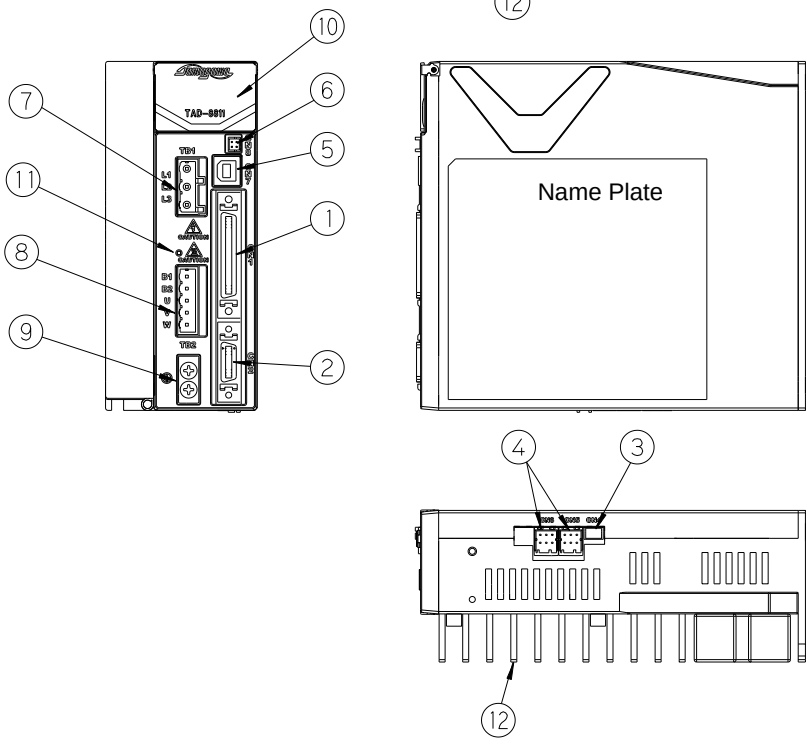
2. Names and Functions of Parts

2.1. Names of Parts

● 400W

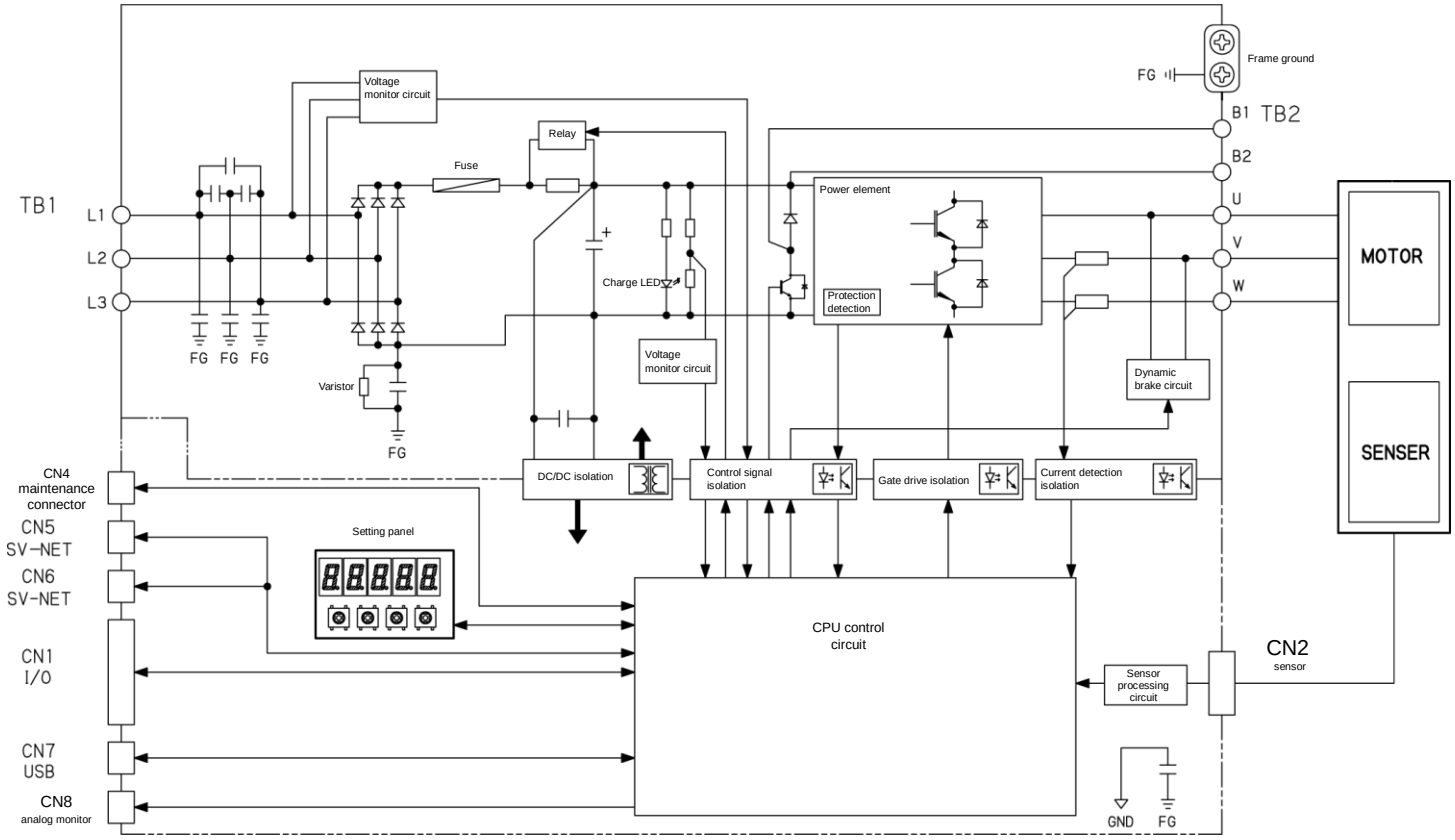


● 750W



(1) I/O connector (CN1)
(2) Sensor connector (CN2)
(3) Manufacturer maintenance connector (CN4)
(4) SV-NET/485 connector (CN5/6)
(5) USB connector (CN7)
(6) Analog monitor output connector (CN8)
(7) Drive power supply connector (TB1)
(8) Motor/external resistor connector (TB2)
(9) Grounding terminal (Frame ground)
(10) Settings panel
(11) CHARGE lamp
(12) Heat sink

2.2. Block Diagram

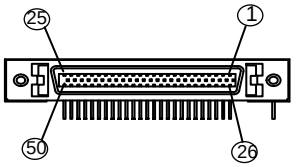


TB1, TB2: Hazardous voltage DVC C (Decisive voltage class C)
CN1, CN2, CN4, CN5, CN6, CN7, CN8: Safe voltage DVC A (Decisive voltage class A)

2.3. Functions of Parts

(1) I/O connector

Connect in order to control using analog and pulse commands. This connector connects other input and output signals.



Header
10250-52A2PL
(made by 3M)

Pin No.	Signal Name	Function (factory settings)	I/O
1	+CON	Common power supply for digital input	
2	+CON	Common power supply for digital input	
3	IN1	Input 1 (servo ON input)	General-purpose digital input
4	IN2	Input 2 (Forward-rotation drive disable input)	General-purpose digital input
5	IN3	Input 3 (Reverse-rotation drive disable input)	General-purpose digital input
6	IN4	Input 4 (alarm reset input)	General-purpose digital input
7	IN5	Input 5 (deviation reset input)	General-purpose digital input
8	IN6	Input 6 (external alarm input)	General-purpose digital input
9	IN7	Input 7 (origin point sensor input)	General-purpose digital input
10	IN8	Input 8 (pulse input disable command)	General-purpose digital input
11	N▪C		Unconnectable
12	N▪C		Unconnectable
13	N▪C		Unconnectable
14	N▪C		Unconnectable
15	F-PLS1+	Pulse input 1 (Forward-rotation command pulse)	Open collector input or line driver input
16	F-PLS+		
17	F-PLS-		
18	N▪C		Unconnectable
19	R-PLS1+	Pulse input 2 (Reverse-rotation command pulse)	Open collector input or line driver input
20	R-PLS+		
21	R-PLS-		
22	N▪C		Unconnectable
23	+5V	Internal control supply power +5V	Unconnectable
24	ANALOG-IN+	Analog command input	Analog input
25	ANALOG-IN-	Analog command GND	
26	MONITOR2	Analog monitor output 2	
27	MONITOR1	Analog monitor output 1	
28	GND	Digital ground	
29	GND	Digital ground	
30	OUT1+	Output 1 (alarm signal)	General-purpose digital output
31	OUT1-		
32	OUT2+	Output 2 (in-position signal)	General-purpose digital output
33	OUT2-		
34	OUT3+	Output 3 (servo ready signal)	General-purpose digital output
35	OUT3-		
36	OUT4+	Output 4 (brake control signal)	General-purpose digital output
37	OUT4-		
38	OUT5+	Output 5 (stop speed status signal)	General-purpose digital output
39	OUT5-		
40	EX-LEAD+	External encoder input	Line driver input
41	EX-LEAD-		
42	EX-LAG+		
43	EX-LAG-		

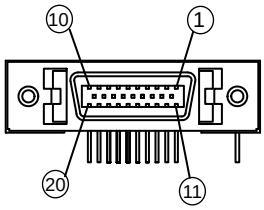
	Pin No.	Signal Name	Function (factory settings)	I/O
	44	LEAD+	Sensor signal output	Line driver output
	45	LEAD-		
	46	LAG+		
	47	LAG-		
	48	Z+		
	49	Z-		
	50	GND	Digital ground	

■ Opposite connector
Plug 10150-3000PE (made by 3M)
Shell 10350-52F0-008 (made by 3M)

Tightening torque (M2.6 screws): 0.15 to 0.25 N·m

(2) Sensor connector

This connector connects the sensor cable of the motor.



Header
10220-52A2PL
(made by 3M)

Pin No.	Smartsyn	Encoder 17-/23-Bit-INC/ABS	Encoder Wire-saving INC
1	S2 (resolver output)	—	A , UE
2	S4 (resolver output)	—	A/, UE/
3	S1 (resolver output)	—	B , VE
4	S3 (resolver output)	—	B/, VE/
5	R1 (resolver excitation)	SD	Z , WE
6	R2 (resolver excitation)	SD/	Z/, WE/
7	—	—	—
8	—	—	—
9	—	+5V	+5V
10	—	GND	GND
11	—	—	—
12	—	—	—
13	—	—	—
14	—	—	—
15	—	—	—
16	—	—	—
17	—	—	—
18	—	—	—
19	Shield	Shield	Shield
20	—	—	—

■ Opposite connector
Plug 10120-3000PE (made by 3M)
Shell 10320-52A0-008 (made by 3M)

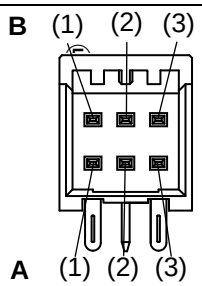
Tightening torque (M2.6 screws): 0.15 to 0.25 N·m

(3) Manufacturer maintenance connector

This connector is used for manufacturer maintenance. It is not used in ordinary operation.

(4) SV-NET/RS485 connector

This connector is used to connect the SV-NET/RS485 cable.



Header 1-1827876-3
(made by TE Connectivity)

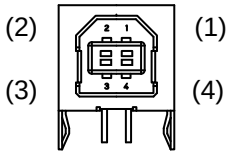
Pin No.	Function
A1	CAN H (+)/RS485(A)
B1	CAN L (-)/RS485(B)
A2	+5V
B2	GND
A3	* 120 Ω terminator resistor end
B3	GND

■ Opposite connector
Receptacle housing 1-1827864-3 (made by TE Connectivity)
Receptacle contact 1827588-2 (made by TE Connectivity) AWG24–28

* The 120 Ω terminator resistor is internally wired to CAN (-).

(5) USB connector

This connector connects the USB cable.

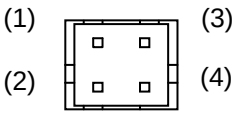


Header 8968-B04COORW
(made by OUPIN)

Pin No.	Function
1	
2	USB-DM
3	USB-DP
4	GND

(6) Analog monitor output connector(debugging connector)

Output for the monitor is provided.
Analog monitor outputs 1 and 2 are shared with the I/O connector.
"OUT2/" is the signal from "output 2" of the I/O connector. It is a source signal that is not photocoupler isolated.



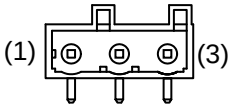
Header 2417RJ-04-PHD
(made by Neltron)

Pin No.	Function
1	Analog monitor output 1
2	Analog monitor output 2
3	OUT2/(in-position signal/)
4	GND

■ Opposite connector
Terminal 2418TJ-PHD (made by Neltron) AWG24-28

(7) Drive power supply connector

This is the connector for inputting the driver power supply.



Connector
0135-39-6589-03
(made by DINKLE)

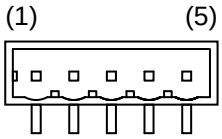
Pin No.	Function
1	L1
2	L2
3	L3

■ Opposite connector (accessory):
Socket 0134-32-6588-03 (made by DINKLE)

* Connect to L1 and L3 for single-phase 100 VAC.

(8) Motor/external resistor connector

This connector connects the motor cable of the motor.



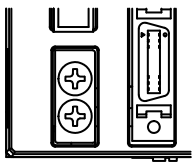
Connector 0135-1505
(made by DINKLE)

Pin No.	Function
1	B1
2	B2
3	U-phase
4	V-phase
5	W-phase

■ Opposite connector (accessory): Socket 0134-1105 (made by DINKLE)

(9) Grounding terminal (Frame ground)

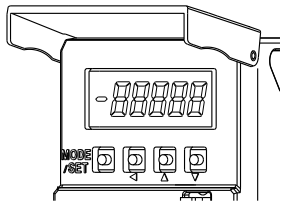
This is the ground terminal directly connected to the frame.



Remarks
Be sure to connect it to the grounding electrode (earth (PE)) by using M4 screws. Tightening torque: 0.7 to 0.8 N·m Use AWG14 (2.5 sq) as wire rod.

(10) Settings panel

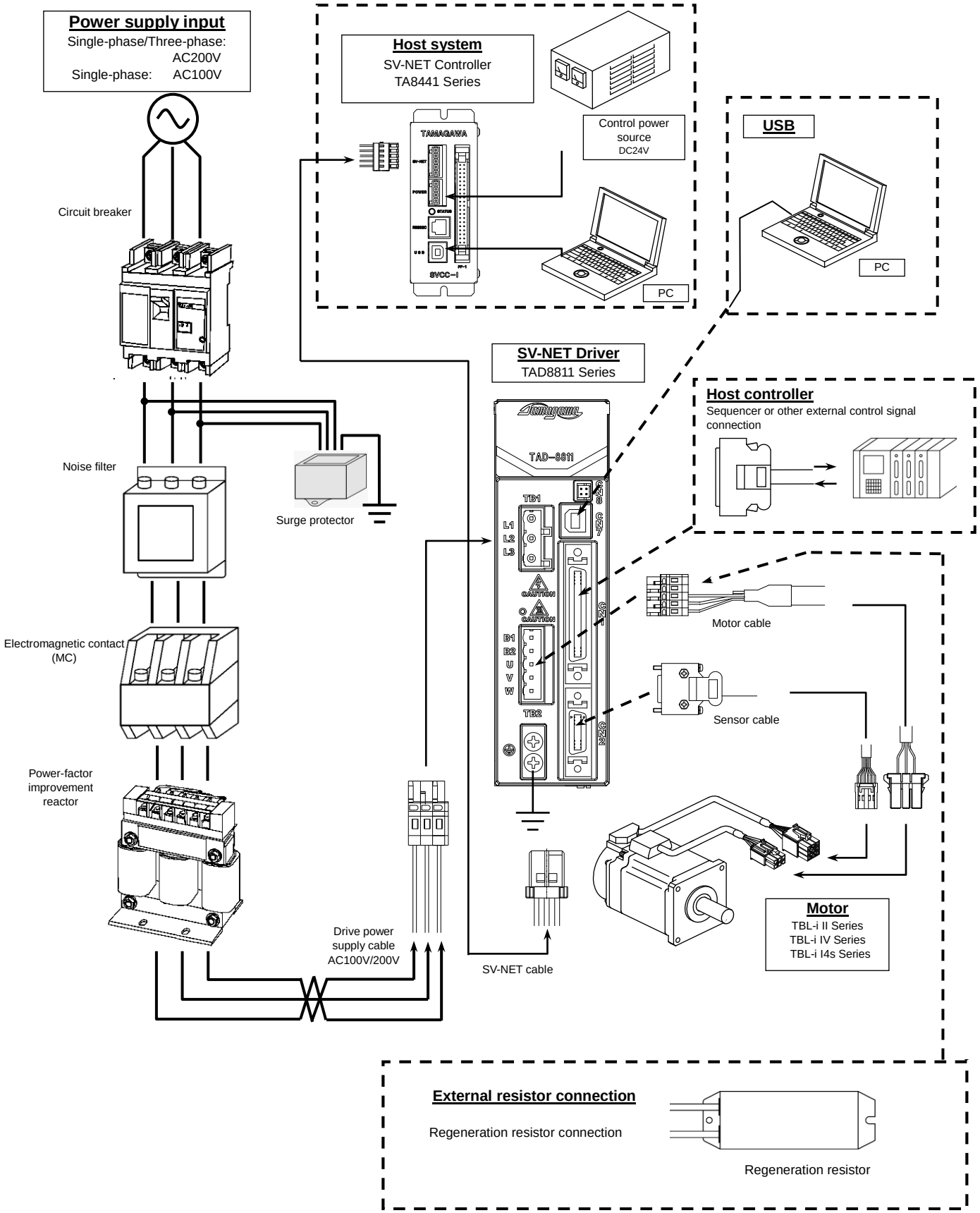
This is the panel for making driver settings using the buttons.

	Remarks
	Refer to ❑20 "Settings Panel Operation" for details.

(11) CHARGE lamp

This lamp indicates that the driver still contains an electrical charge.

3. Connection Example



4. Conformance to Standards

■ EC Directives

To facilitate the conformance of incorporated machines and equipment to EC Directives, we comply with standards related to the Low Voltage Directive.

- Equipment environment

  Use the product under an environment at a pollution degree 2 or 1.

  Make sure to connect the power supply to a circuit breaker that meets IEC standards and UL standards (rated voltage: 230 V; rated current: 15 A).

  For wiring, use AWG14 (2.5 sq) copper conductor wires with a temperature rating of 75°C or higher.

- Short-circuit current rating (SCCR)

  This servo driver is compatible with a power supply of 253 VAC or lower with symmetrical waveform current of 5,000 A or less.

- Grounding system

  The grounding method for the power distribution system supports the TT/TN system.

- Grounding

  Be sure to connect the grounding terminal (frame ground) of the servo driver to the grounding electrode (PE) by using a wire rod of AWG14 (2.5 sq) or higher.

- Installation

  Be sure to mount the product within a metal case (control panel).

■ Conformance to European EMC Directives

Servo drivers are not intended for use in ordinary households and with low-voltage public communication lines. Connection to such circuits may cause radio frequency interference.
We use noise filters, surge protectors, and ferrite cores in the EMC Directive conformance tests. Machine and equipment conformance with EMC Directives needs to be confirmed by using the final machine and equipment into which a servo driver and a servo motor are incorporated.

■ Conformance to US UL Standards

- Equipment environment

  Use the product under an environment of pollution degree 2 or 1.

  Make sure to connect the power supply to a circuit breaker qualified by the IEC standards and the UL standards (rated voltage: 230 V; rated current: 15 A).

  For wiring, use AWG14 (2.5 sq) copper conductor wires with a temperature rating of 75°C or higher.

- Short-circuit current rating (SCCR)

  This servo driver is compatible with a power supply of 253 VAC or lower with symmetrical waveform current of 5,000 A or less.

- Branch circuit protection

  The short-circuit protection circuit within the product cannot be used for branch circuit protection.

  Implement branch circuit protection in accordance with the National Electrical Code (NEC) and relevant regional standards.

- Overload protection and overheat protection

  The servo driver is equipped with an overload protection function.

  The overload protection function works at 105% or more of the rated output current.

- Grounding system

  The grounding method for the power distribution system supports the TT/TN system.

- Grounding

  Be sure to connect the grounding terminal (frame ground) of the servo driver to the grounding electrode (PE) by using a wire rod of AWG14 (2.5 sq) or higher.

- Installation

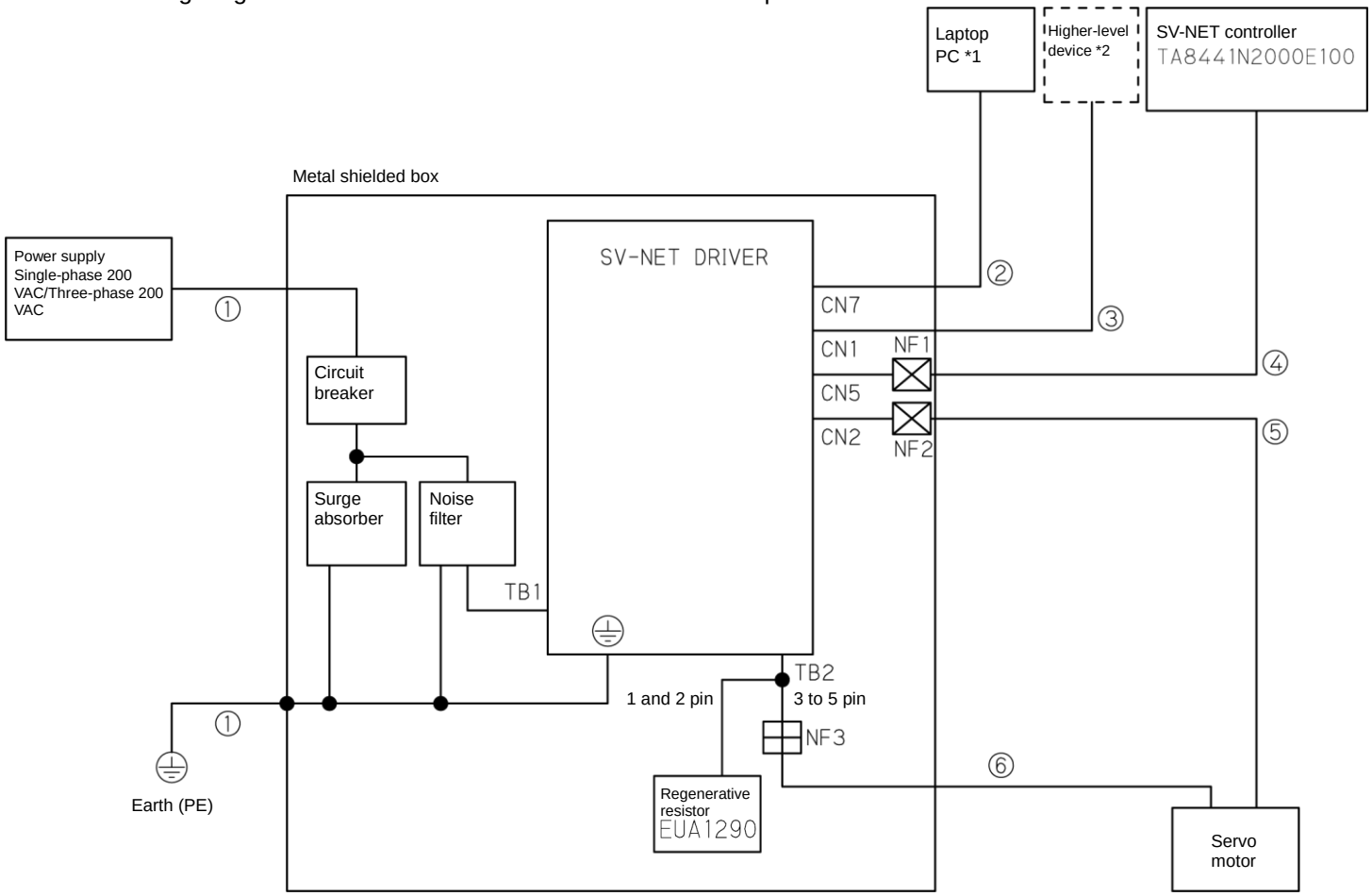
  Be sure to mount the product within a metal case (control panel).

4.1. Conformance to Standards

Euro EC Directives	EMC Directives	EN55011 group1 ClassA EN61000-6-2 EN61800-3 (Category C3)
	Low Voltage Directive	EN61800-5-1:2007
UL standards		UL508C

4.2. EMC Installation Environment

The following diagrams illustrate installation conditions for EMC qualification tests.



Symbol	Name	Our models and specifications
(1)	Power cable, ground wire	AWG14 wire, UL1015
(2)	USB cable	EUA1459 (shielded wire)
(3)	I/O cable	EUA1424 (shielded wire)
(4)	SV-NET cable	EUA1354 (shielded wire)
(5)	Sensor cable	EUA1283 (shielded wire)
(6)	Motor cable	EUA1280 (shielded wire)

*1. Dedicated application software: Motion Designer Drive
*2. Host controllers are not connected.

■Conditions necessary for conforming to European EMC Directives

- The servo driver shall be installed within a metal case (control panel).
- A noise filter and a lightning surge protecting part (surge protector) shall be installed on the power line.
- Shield braid cables shall be used for input and output signal (I/O) cables and sensor cables.
- As illustrated in the connection diagram on p. 33, a ferrite core and a core filter shall be installed on each cable connected to the servo driver.

The above conditions are the installation conditions used in our EMC Directive qualification tests. In actual application with your equipment, the EMC level differs depending on the connected devices and the wiring status. Since this product is incorporated into other equipment, it is necessary to confirm its performance on your final machine and equipment for which EMC measures have been implemented.

- Ferrite core

  NF1, NF2: E04SR200932 (Seiwa Electric Mfg. Co., Ltd.)

- Core filter

  NF3: RN603620MD (FDK)

  In installation of a core filter, collectively wind the U, V, and W lines on the core by several turns to ensure effective noise reduction (Do not pass the FG line through the core). If the required noise reduction is not achieved then increase the turns or implement some other measure.

- Circuit breaker

  Install a circuit breaker that meets IEC standards and UL standards (rated voltage: 230 V; rated current: 15 A) between the power supply and the noise filter.

- Noise filter

  3SUP-HU10-ER-6 (Okaya Electric Industries Co., Ltd.)

  For detailed noise filter specifications, please contact the noise filter manufacturer.

- Surge protector

  R•A•V-781BXZ-4 (Okaya Electric Industries Co., Ltd.)

  For the detailed surge protector specifications, please contact the surge protector manufacturer.

- Grounding terminal

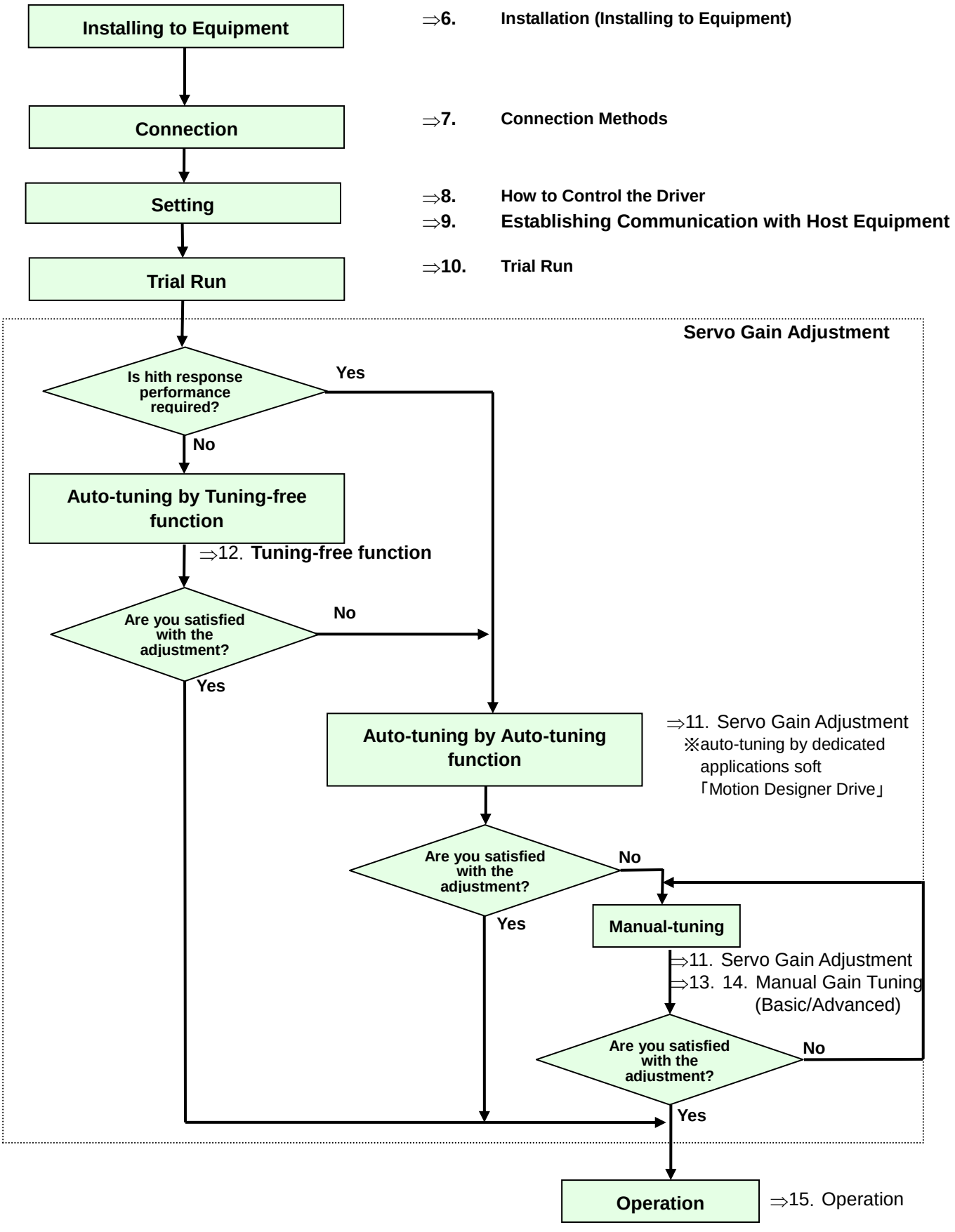
  Be sure to connect the grounding terminal (frame ground) of the servo driver to the metal case (control panel) in order to prevent electrical shocks.

- Structure of the metal case (control panel)

  In the metal case (control panel), openings made at the holes for cables, holes for mounting the console, the door, and so on might cause leakage and intrusion of radio waves. To prevent this, comply with the following items when designing and selecting a control panel.

  - Be sure to use a metal control panel (make sure it is electrically conductive).
  - Ground all units mounted within the case to it.

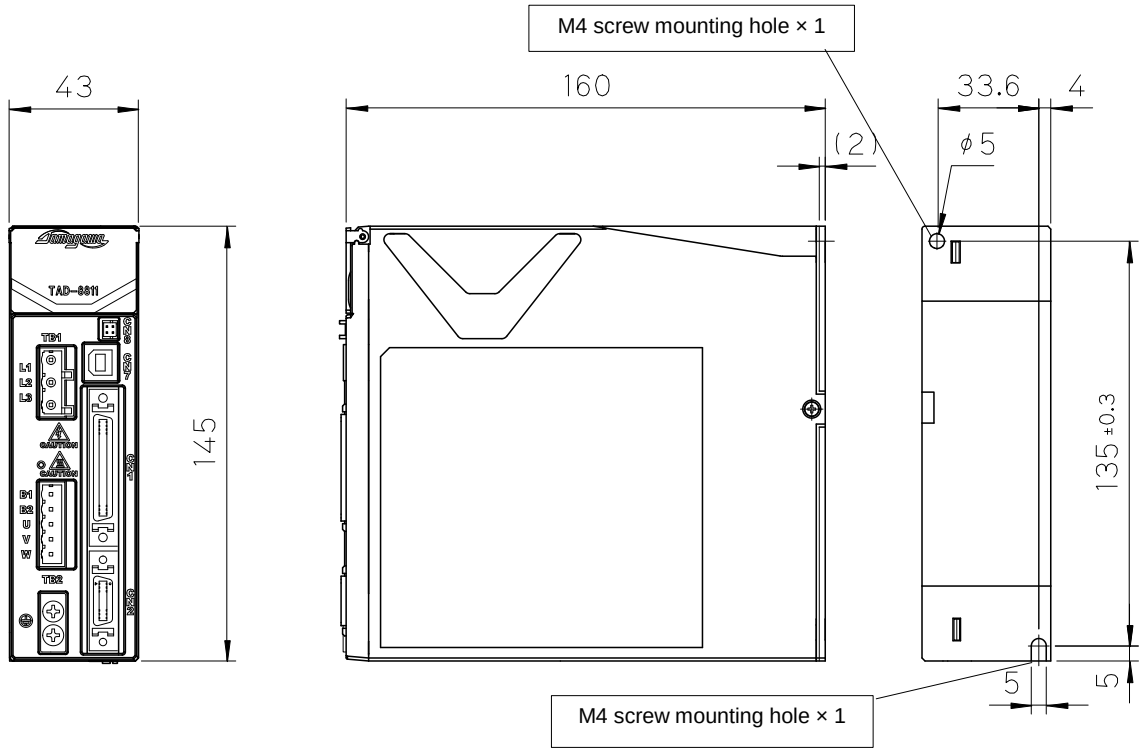
5. Process Flow



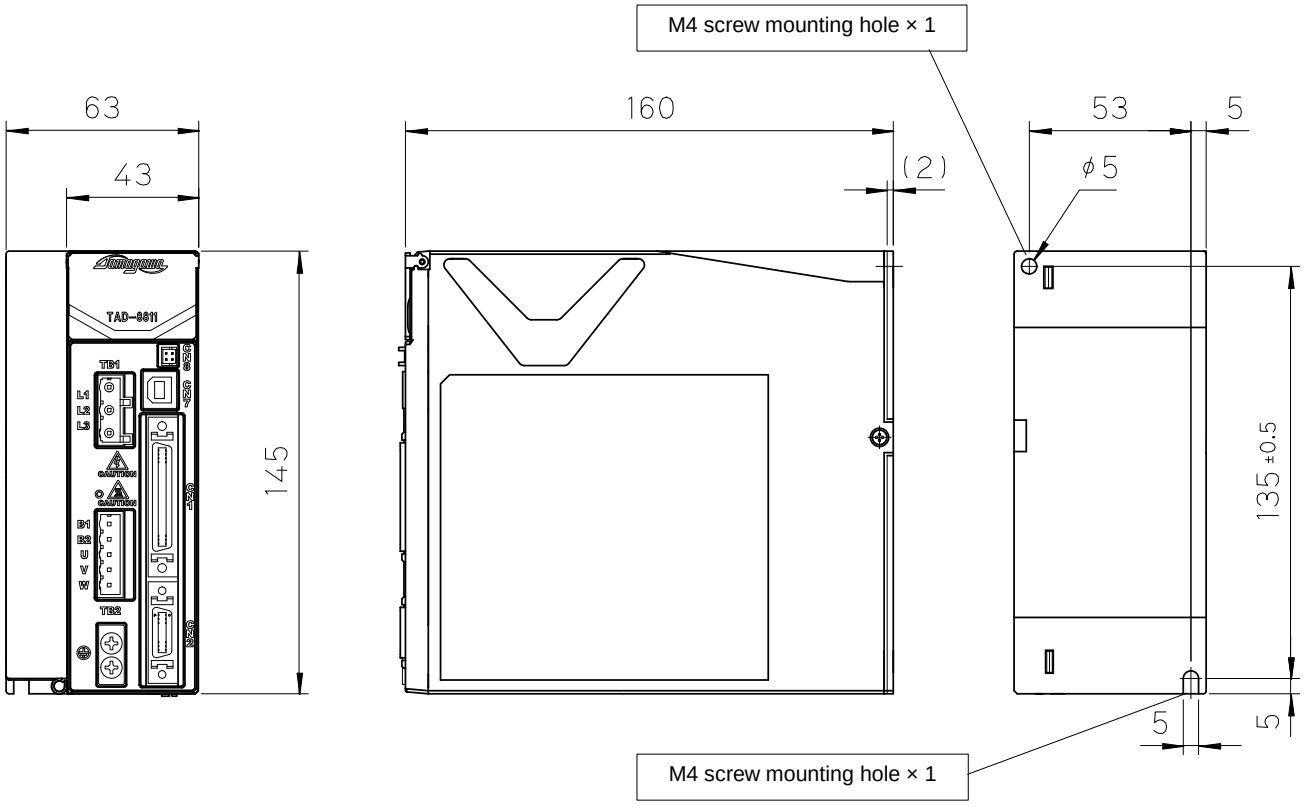
6. Installation (Installing to Equipment)

When mounting the driver (installation to the equipment), use the M4 screw mounting holes on the base chassis (two holes).

■ **400W (N No. Model: N**1 to N**3)**



■ **750W (N No. Model: N**4)**

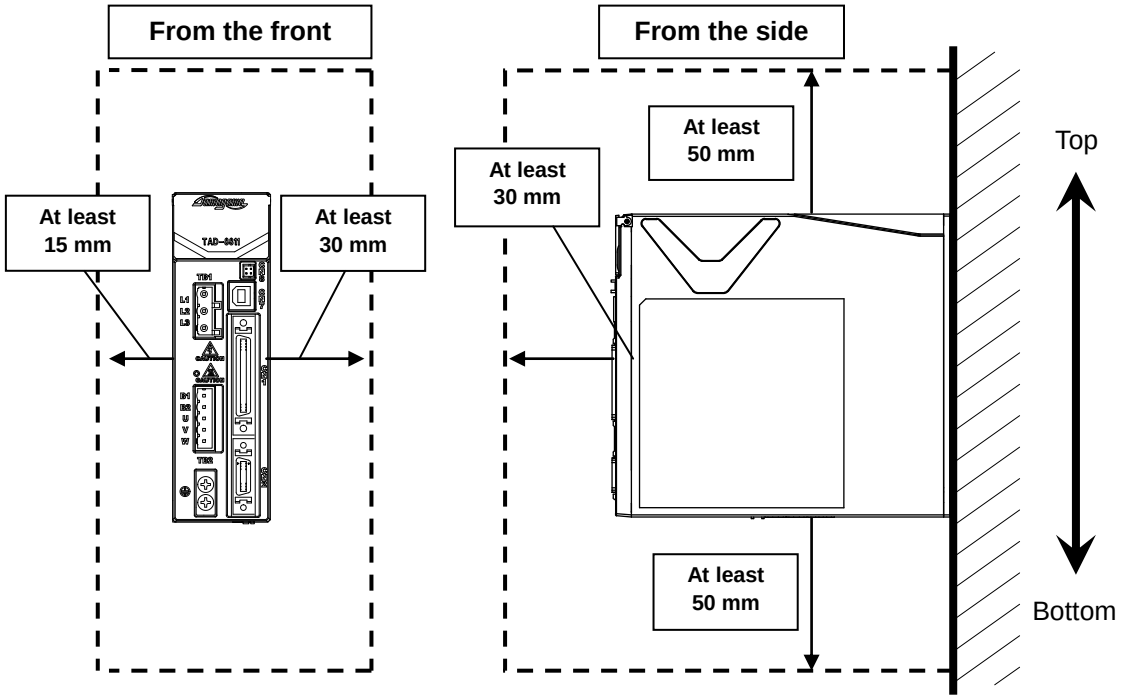


■ Installation place

Mount the driver in a control panel (metal case) in an indoor location that is not subject to rainwater and direct sunlight and that is surrounded only by non-combustible objects.

■ Installation gaps with other equipment

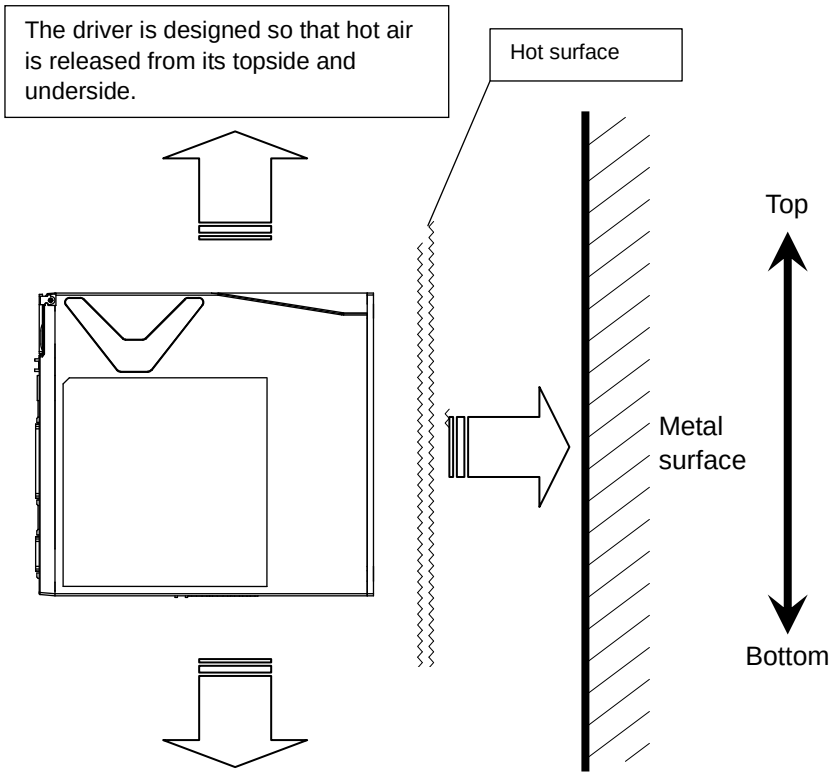
The driver requires a surrounding air space for ventilation. Install the driver while maintaining the predetermined distances shown below from the other equipment.



■ Measures to cool the driver

Repeatedly running the driver close to its ratings results in more heat being generated. In such cases, the ambient temperature of the driver might increase under environments where the heat does not easily dissipate such as enclosed spaces. When the ambient temperature of the driver is expected to exceed its operating temperature range, implement the following cooling measures within the control panel and install the driver appropriately so that its ambient temperature will be within its operating temperature range. To find the steady loss of the driver (at the rated output) see "1.2 Specifications."

- Install a cooling fan or ventilation opening.
- Install the driver on a metal surface, which provides greater heat dissipation.
  (Driver heat sink: Aluminum (ADC12))



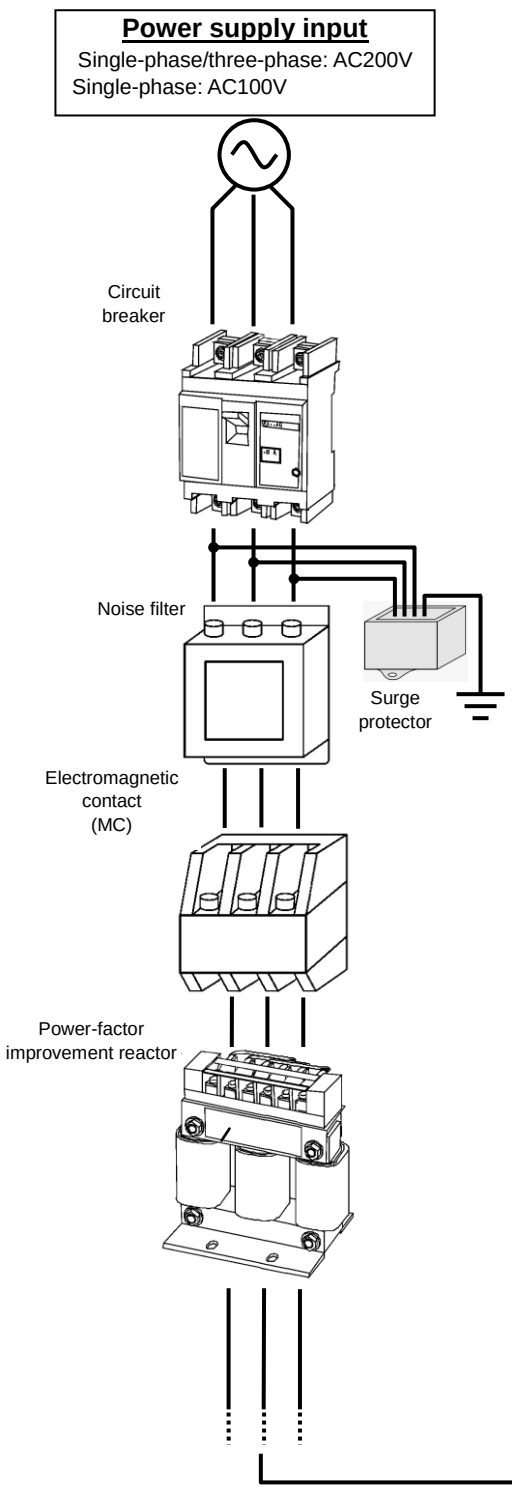
7. Connection Method

Caution

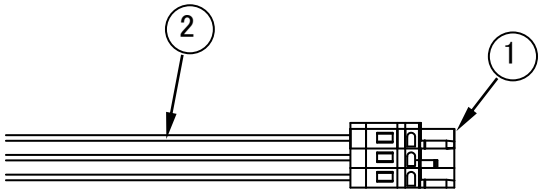
Turn off the power before performing connection operations. After turning off the power, allow adequate time to check the voltage with a tool such as a tester before performing connection and wiring operations. Wiring errors may cause failures and/or fires.

7.1. Connecting the Power Supply

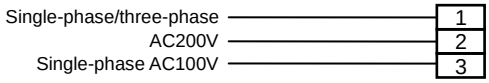
■ Example of power supply connection



○ Power Supply Cable



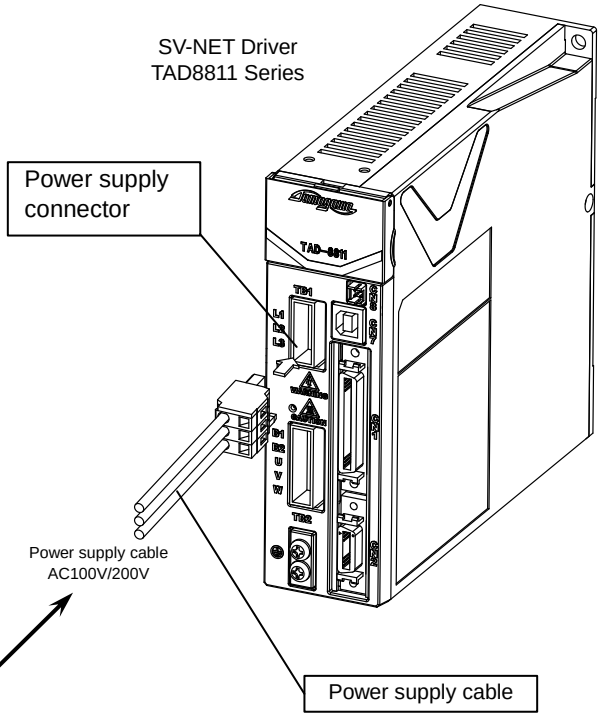
■ Connection example



■ Parts for power supply cable

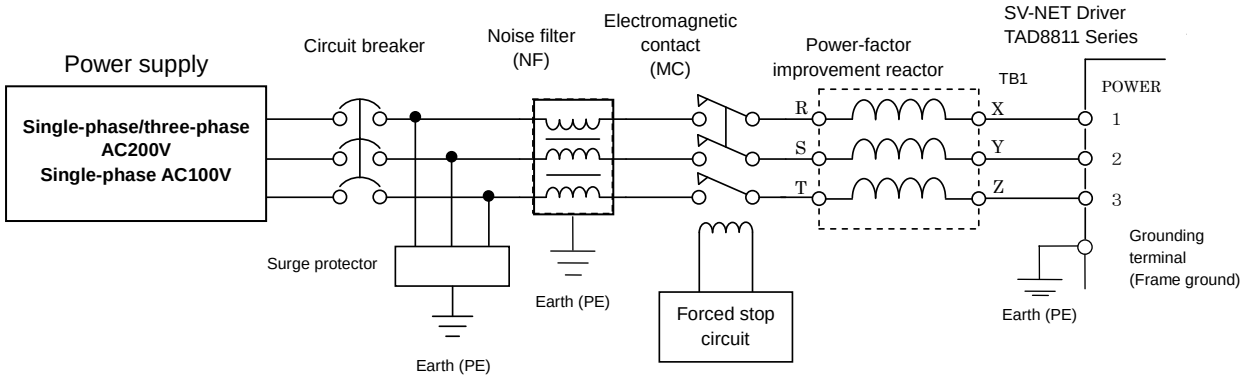
Part name	Model or spec.	Maker	Remarks
(1) Housing	0134-3103	DINKLE	
(2) Cable	AWG 14 or equivalent	-	

⇒ ❑ Refer to 22.1 "Optional Parts"



■ Peripherals connection example

This information is for reference only. Set up peripherals according to the system to be built.



Power supply

- Applied voltage must be within the specification range.
- Symmetrical waveform current must be 5,000 Arms or less.

Circuit breaker

- Be sure to install a circuit breaker that meets IEC standards and the UL standards (rated current: 15 A) as an overcurrent protective device.

Noise filter (NF)

- The noise filter reduces high-frequency noise generated by the power supply to prevent malfunction. It also reduces effects from driver noise.

Electromagnetic contact (MC)

- Use the electromagnetic contact to shut off the power supply for safety purposes if an alarm or system error occurs.
- Wire it so that the power supply to the main circuit can be shut off and the servo turned off if an error occurs.
- Select an appropriate type for the output of the servo motor to be connected.

Power-factor improvement reactor

- The power-factor improvement reactor improves input power factors.
- It reduces the harmonic current of the power supply.

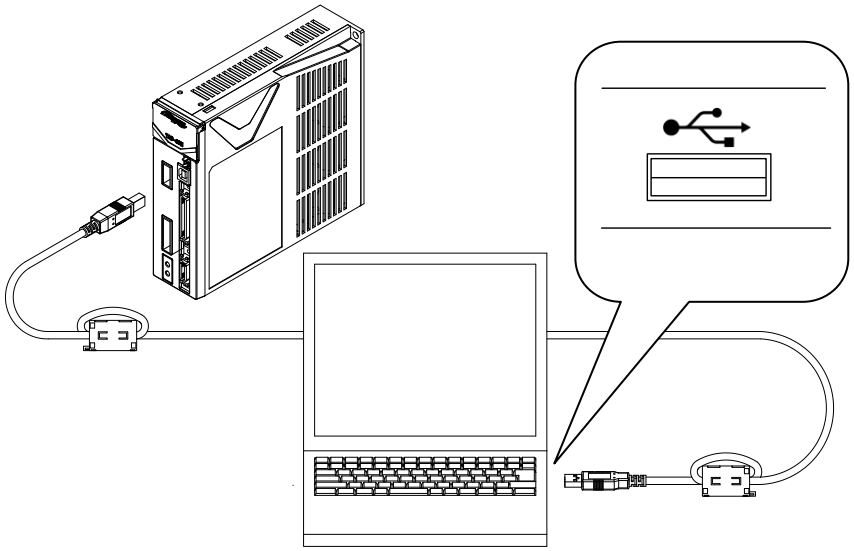
Surge protector

- The surge protector protects the system from sudden high voltage and high current such as from induced lightning.

Grounding

- Be sure to connect the grounding terminal (frame ground) of the driver to the grounding electrode (earth (PE)) by using an AWG14 (2.5 sq) wire.

7.2. Connecting the USB



Parameter management and running tests can easily be implemented by using a dedicated application (free application), "Motion Designer Drive" or "Motion Adjuster." (The SV-NET motion controller is not necessary.)

Supplement **To find methods for using the dedicated applications, see the relevant instruction manual by using the help function of each application.**

USB cable

As a USB cable, use the specified cable (EUA1459) below. We do not guarantee operation with any cable other than the specified cable.

Personal computer

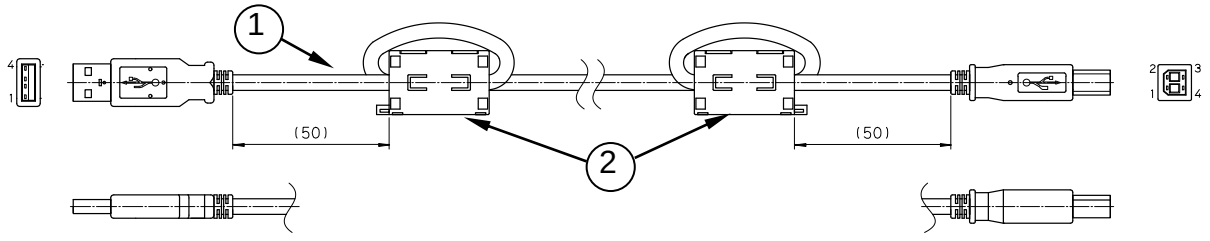
Since some types of personal computers are easily affected by noise, their USB connection tends to often disconnect. Note that this tendency is particularly strong when using a desktop computer or using in connection via a USB hub.

Successful connection to all USB communication devices is not guaranteed.

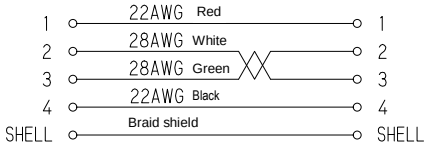
■ **Specifications of designated cable**

USB cable (between the personal computer and the driver)

Model: EUA1459N****



■ **Connection**



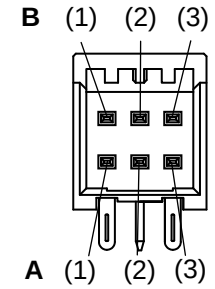
■ **Parts for USB cable**

Part name	Model or spec.	Maker	Remarks
(1) Shielded cable	USB2.0 A (male) - B (male)		
(2) Ferrite core	E04SR211132	Seiwa Electric Mfg. Co., Ltd.	Number of turns: 2

7.3. Connection by SV-NET/RS485

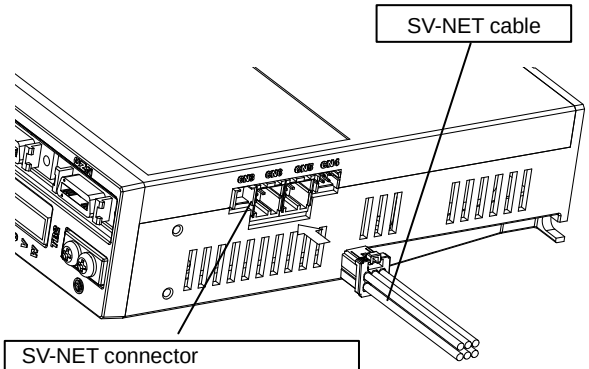
This driver is equipped with two connectors for SV-NET/RS485 communication. However, since these are daisy-chain connection connectors, their communication specifications are exclusive. Therefore, the two connectors cannot be used independently for different communication specifications. Select either SV-NET or RS485 by using ID141 "Special Function Switching."
The driver-driver connecting SV-NET cable (EU1287) and the SV-NET terminal connector (EUA1294) can also be used for RS485 communication.
⇒ The internal circuit is illustrated in ❑22.2 "External Connection Diagram."

■ SV-NET connector



Header 1-1827876-3
(made by TE Connectivity)

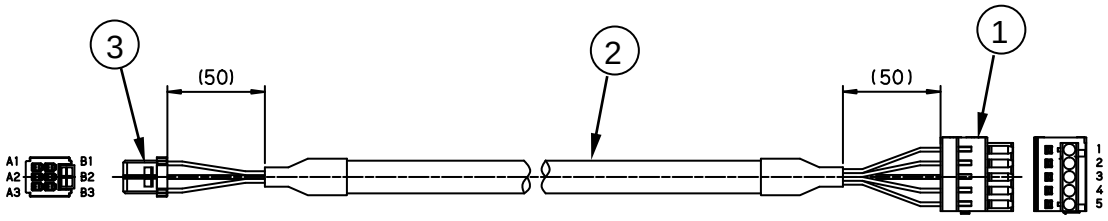
Pin No.	Function
A1	CAN H (+)/RS485(A)
B1	CAN L (-)/RS485(B)
A2	+5V
B2	GND
A3	120 Ω terminator resistor end
B3	GND



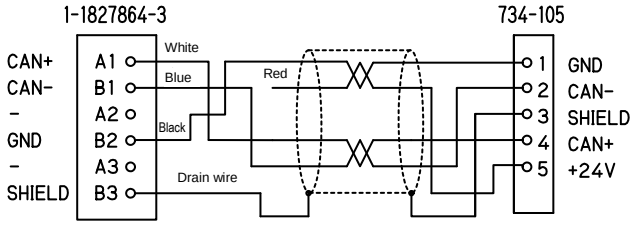
■ Cable specifications

SV-NET Cable (between Controller and Driver)

Model: EUA1354N****



■Connection



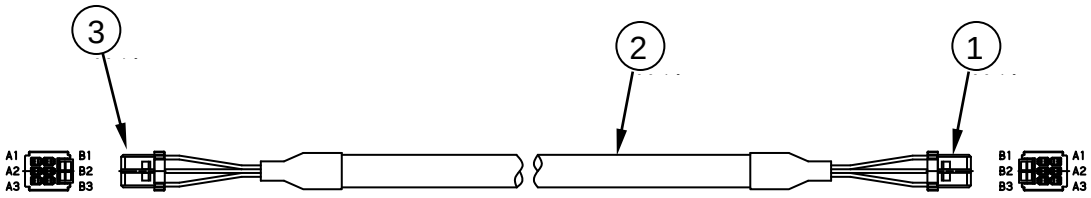
■ Parts for SV-NET cable

Part name	Model or spec.	Maker	Remarks
(1) Connector	734-105	WAGO	
(2) Device net cable			
(3) Connector	1-1827864-3	TE Connectivity	

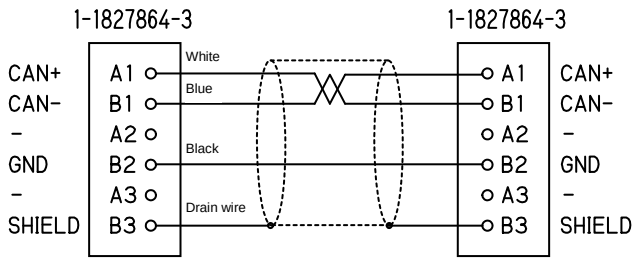
⇒ Refer to ❑22.1 "Optional Parts."

SV-NET Cable (between Driver and Driver)

Model:EUA1287N****



■ Connection



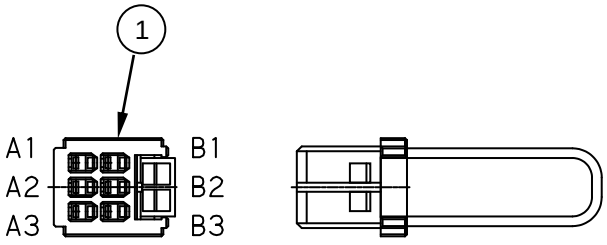
■ Parts for SV-NET cable

Part name	Model or spec.	Maker	Remarks
(1) Connector	1-1827864-3	TE Connectivity	
(2) Device net cable			
(3) Connector	1-1827864-3	TE Connectivity	

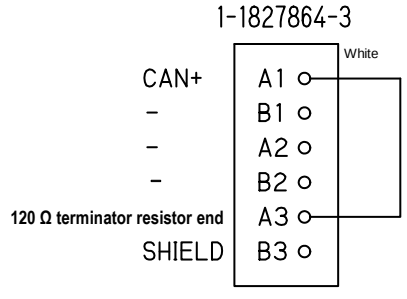
⇒ Refer to ❑22.1 "Optional Parts."

SV-NET terminal connector

Model: EUA1294



■ Connection



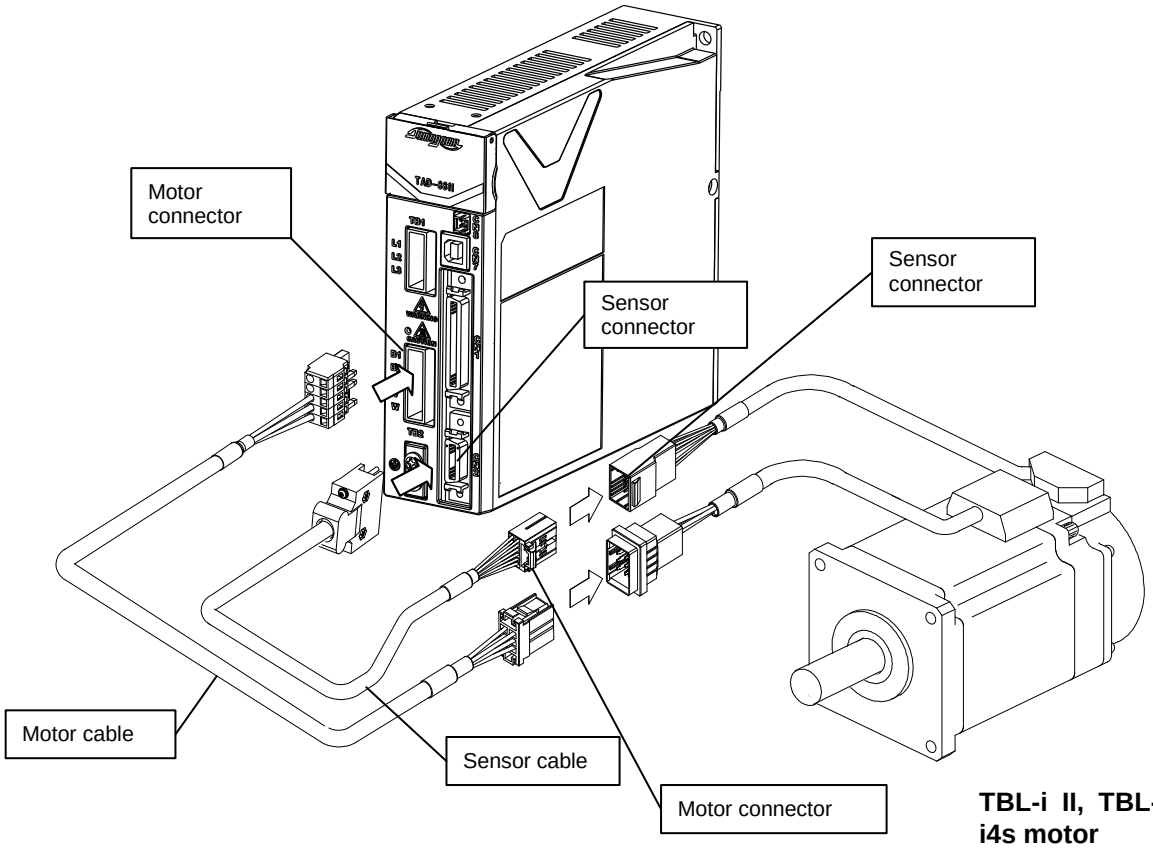
■ Parts for SV-NET cable

Part name	Model or spec.	Maker	Remarks
(1) Connector	1-1827864-3	TE Connectivity	

* The 120 Ω terminator resistor is wired to CAN (-) inside the driver.

⇒ Refer to ❑22.1 "Optional Parts."

7.4. Connecting the Motor



TBL-i II, TBL-i IV, TBL-i4s motor

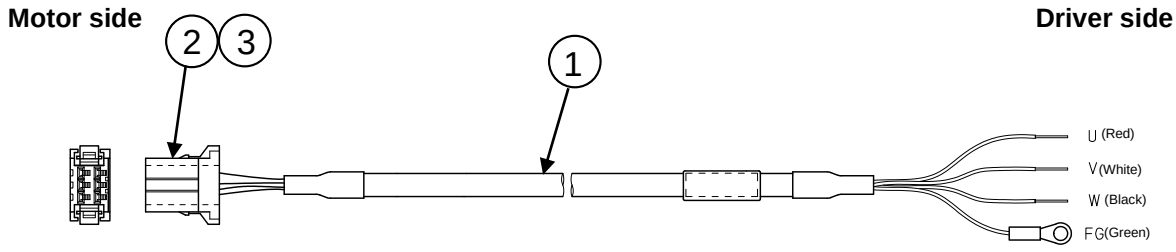
Motor cables and sensor cables will differ depending on the motor with which they are combined. The description in this section is made on the assumption of use of TBL-i II, TBL-i IV and TBL-i4s series AC servo motor.

You must meet the following requirements if a motor cable other than the motor cables we specify as illustrated on the next page is to be used.

- Wire size/voltage endurance: AWG18 wire (0.75 sq)/300 VAC or higher

■ Cable specifications(For iⅡ,iⅣ Motor)

Motor Cable (for brakeless) — Model EUA1280N****



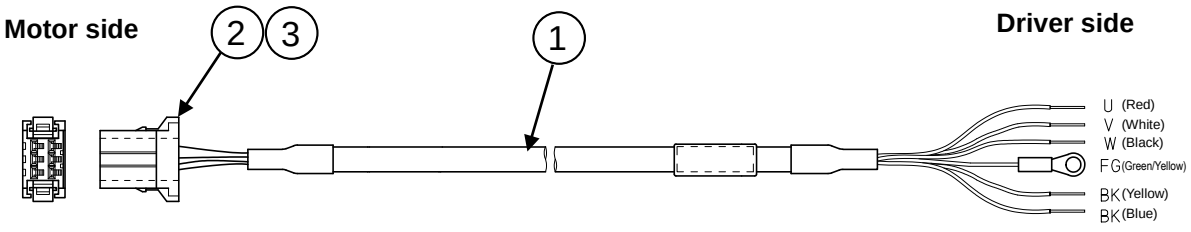
■ Connection

■ Parts for motor cable

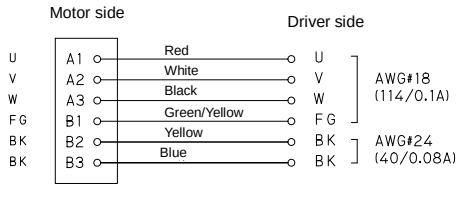
Part name	Model or spec.	Maker	Remarks
(1) Cable			
(2) Housing	178289-3	TE Connectivity	
(3) Contact	175218-2	TE Connectivity	For AWG16

⇒ Refer to ❑22.1 "Optional Parts."

Motor Cable (for braked) — Model EUA1292N****



■ Connection



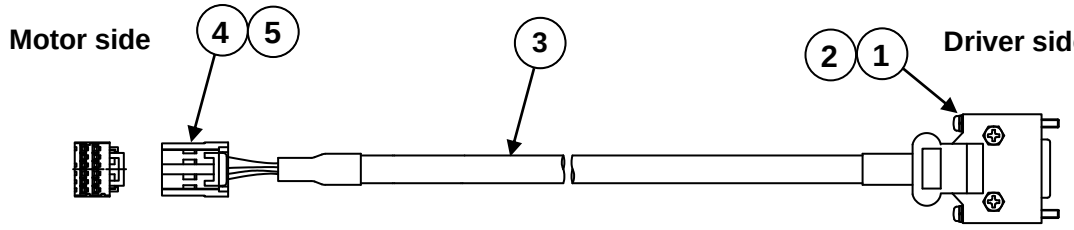
■ Parts for motor cable

Part name	Model or spec.	Maker	Remarks
(1) Cable			
(2) Housing	178289-3	TE Connectivity	
(3) Contact	175218-2	TE Connectivity	AWG18 For AWG24

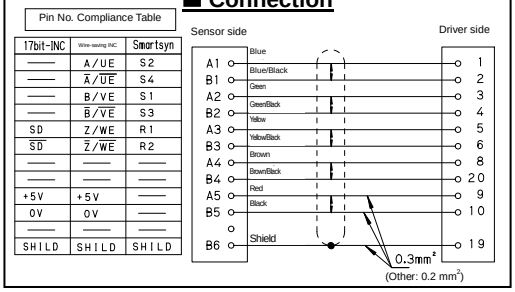
⇒ Refer to ❑22.1 "Optional Parts."

Sensor Cable (For wire-saving INC, 17-/23-bit-INC, BRX)

Model EUA1281N****



■ Connection



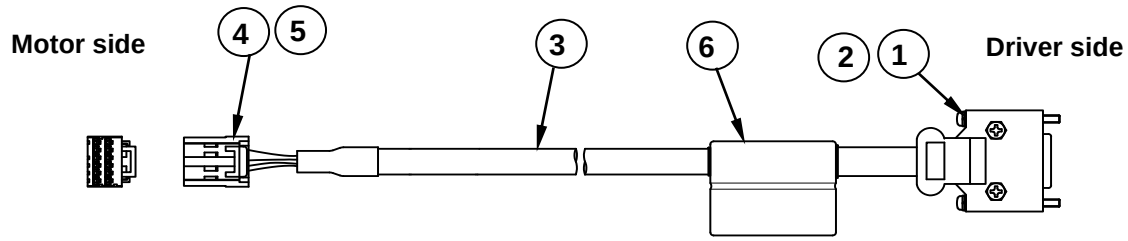
■ Parts for sensor cable

Part name	Model or spec.	Maker	Remarks
(1) Plug	10120-3000PE	3M	
(2) Shell	10320-52A0-008	3M	
(3) Cable			
(4) Housing	1-1318118-6	TE Connectivity	
(5) Contact	1318107-1	TE Connectivity	A5,B5,B6
(5) Contact	1318108-1	TE Connectivity	A1,A2,A3,A4 B1,B2,B3,B4

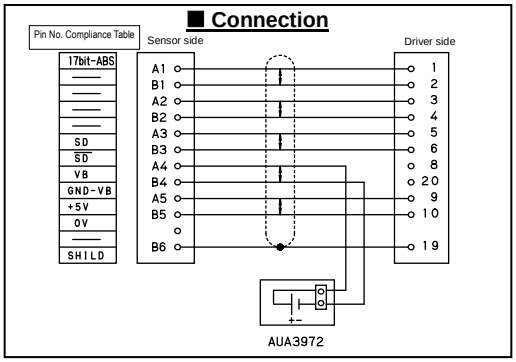
⇒ Refer to ❑22.1 "Optional Parts."

Sensor Cable (for 17-/23-bit-ABS)

Model EUA1283N****



■ Connection



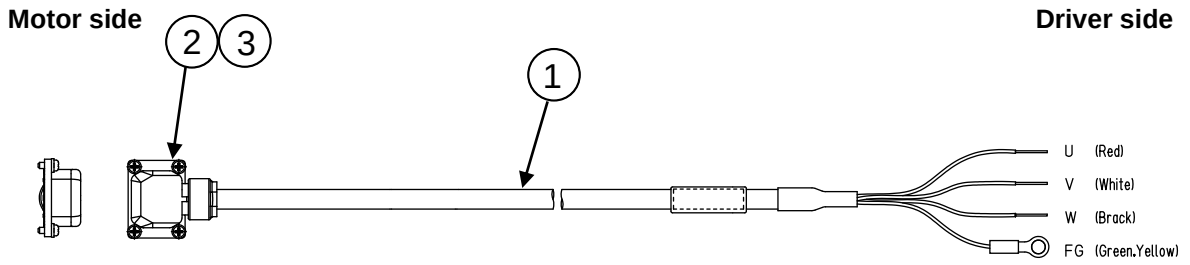
■Parts for sensor cable

Part name	Model or spec.	Maker	Remarks
(1) Plug	10120-3000PE	3M	
(2) Shell	10320-52A0-008	3M	
(3) Cable			
(4) Housing	1-1318118-6	TE Connectivity	
(5) Contact	1318107-1	TE Connectivity	A5,B5,B6
(5) Contact	1318108-1	TE Connectivity	A1,A2,A3,A4, B1,B2,B3,B4
(6) Battery unit	AUA3972		

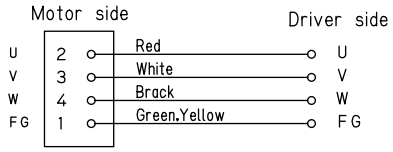
⇒ Refer to ❑22.1 "Optional Parts."

■ Cable specifications (For i4s Motor)

Motor Cable — Model EUA9201N****



■ Connection

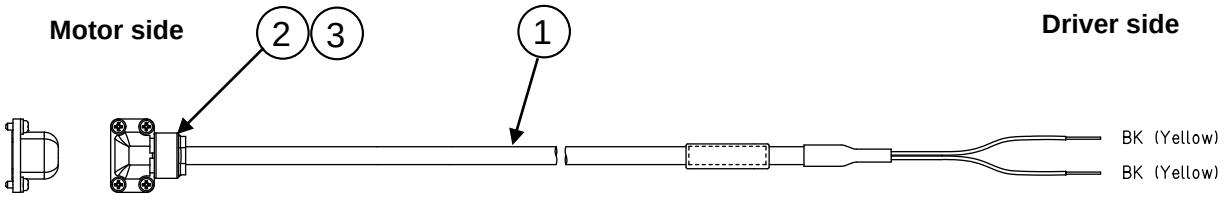


■ Parts for motor cable

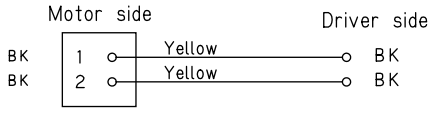
Part name	Model or spec.	Maker	Remarks
(1) Cable			
(2) Connector	JN6FS04SJ2	JAE	
(3) Contact	ST-JN5-S-C1B-100-(A534G)	JAE	For AWG19

⇒ Refer to ❑22.1 "Optional Parts."

Braked Cable — Model EUA9202N****



■ Connection



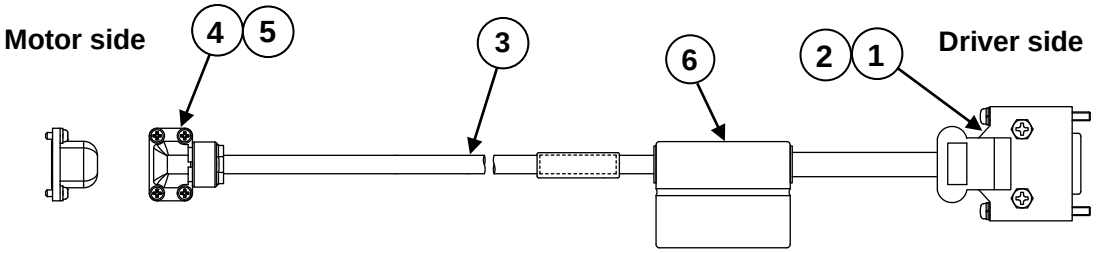
■ Parts for motor cable

Part name	Model or spec.	Maker	Remarks
(1) Cable			
(2) Connector	JN6FS04SJ2	JAE	
(3) Contact	LY10-C1-A1-10000	JAE	For AWG23

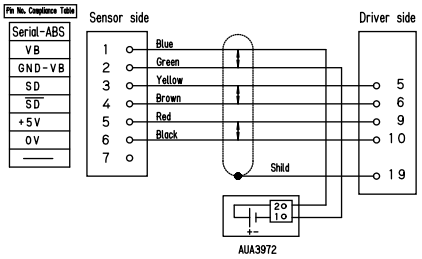
⇒ Refer to ❑22.1 "Optional Parts."

Sensor Cable (For serial-ABS)

Model EUA9203N****



■ Connection



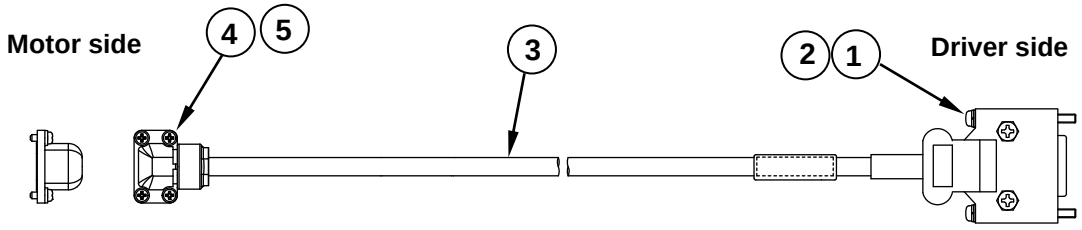
■ Parts for sensor cable

Part name	Model or spec.	Maker	Remarks
(1) Plug	10120-3000PE	3M	
(2) Shell	10320-52A0-008	3M	
(3) Cable			
(4) Connector	JN6FR07SM1	JAE	
(5) Contact	LY10-C1-A1-10000	JAE	For AWG26
(6) Battery unit	AUA3972		

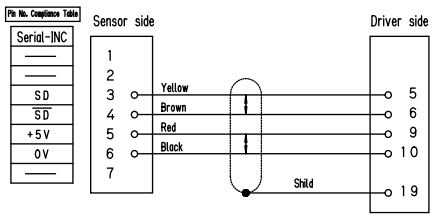
⇒ Refer to ❑22.1 "Optional Parts."

Sensor Cable (For serial-INC)

Model EUA9204N****



■ Connection



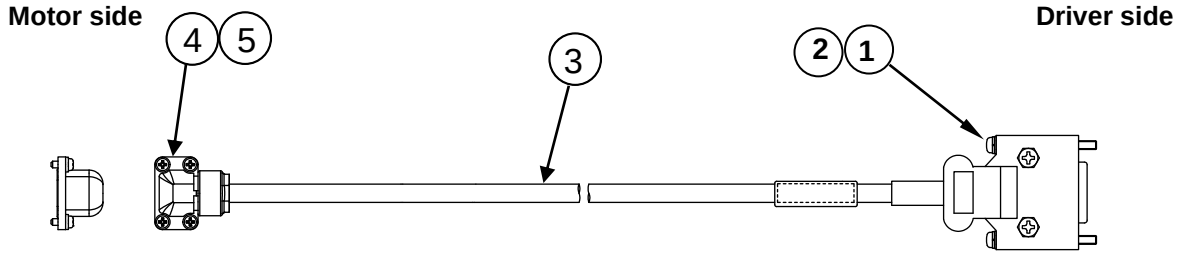
■Parts for sensor cable

Part name	Model or spec.	Maker	Remarks
(1) Plug	10120-3000PE	3M	
(2) Shell	10320-52A0-008	3M	
(3) Cable			
(4) Connector	JN6FR07SM1	JAE	
(5) Contact	LY10-C1-A1-10000	JAE	For AWG26

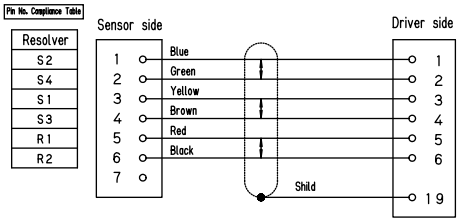
⇒ Refer to ❑22.1 "Optional Parts."

Sensor Cable (For resolver)

Model EUA9205N****



■ Connection

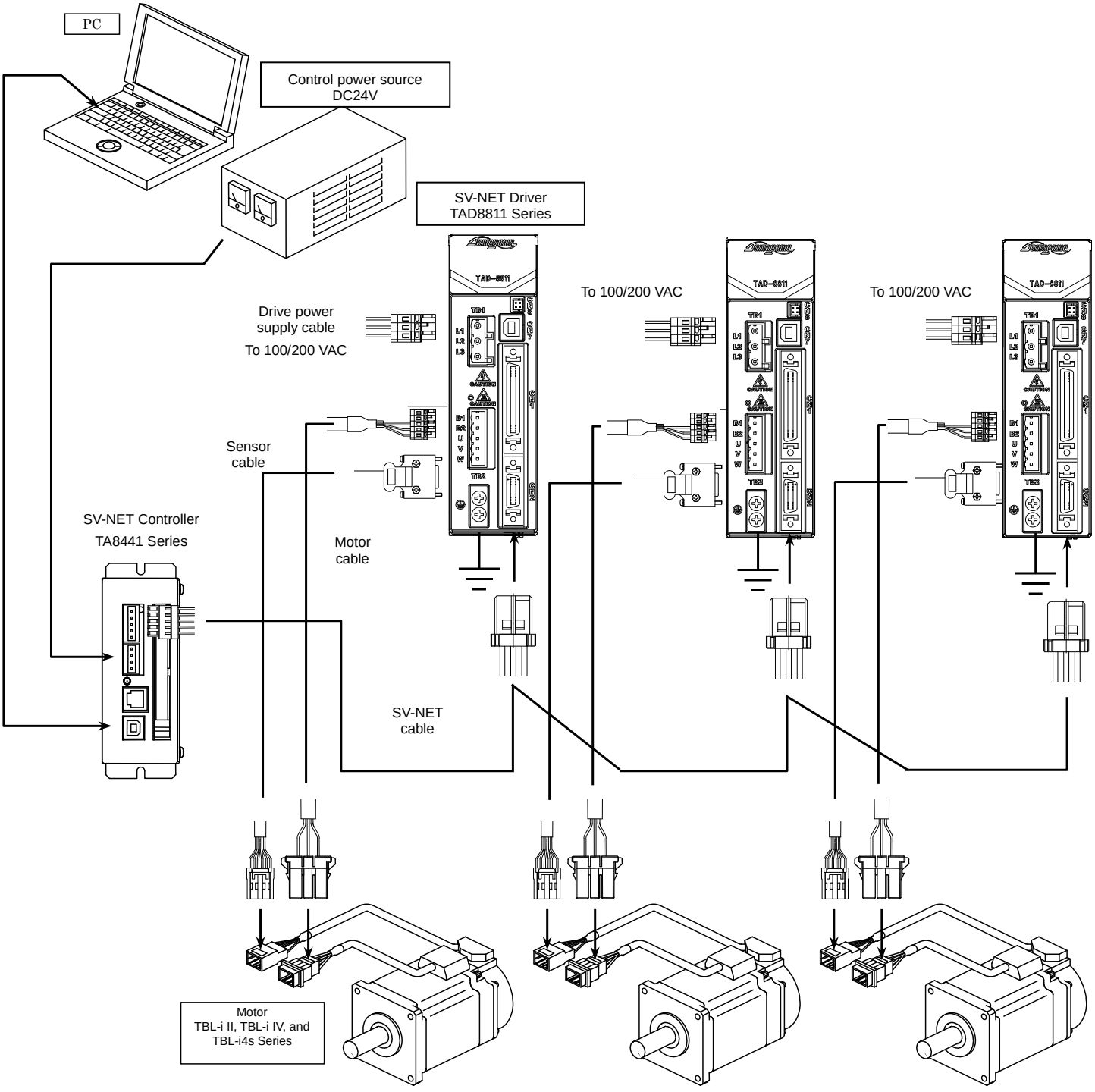


■ Parts for motor cable

Part name	Model or spec.	Maker	Remarks
(1) Plug	10120-3000PE	3M	
(2) Shell	10320-52A0-008	3M	
(3) Cable			
(4) Connector	JN6FR07SM1	JAE	
(5) Contact	LY10-C1-A1-10000	JAE	For AWG26

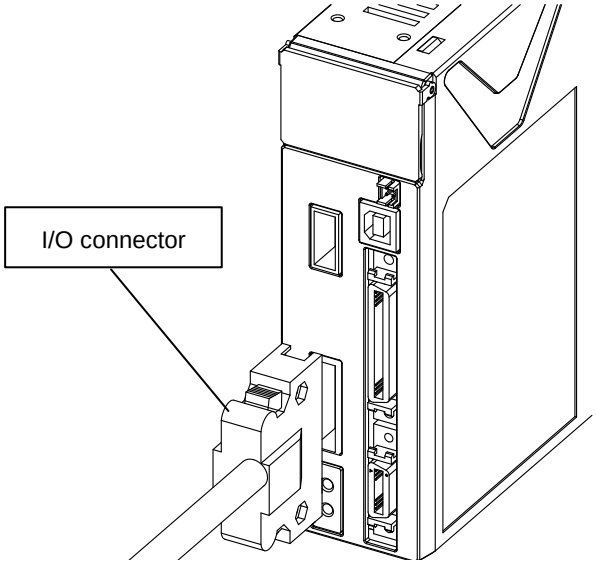
⇒ Refer to ❑22.1 "Optional Parts."

7.5. Example of SV-NET Motion Controller and Motor/Driver (3-Axis) Connection



7.6. Connecting the I/O cable

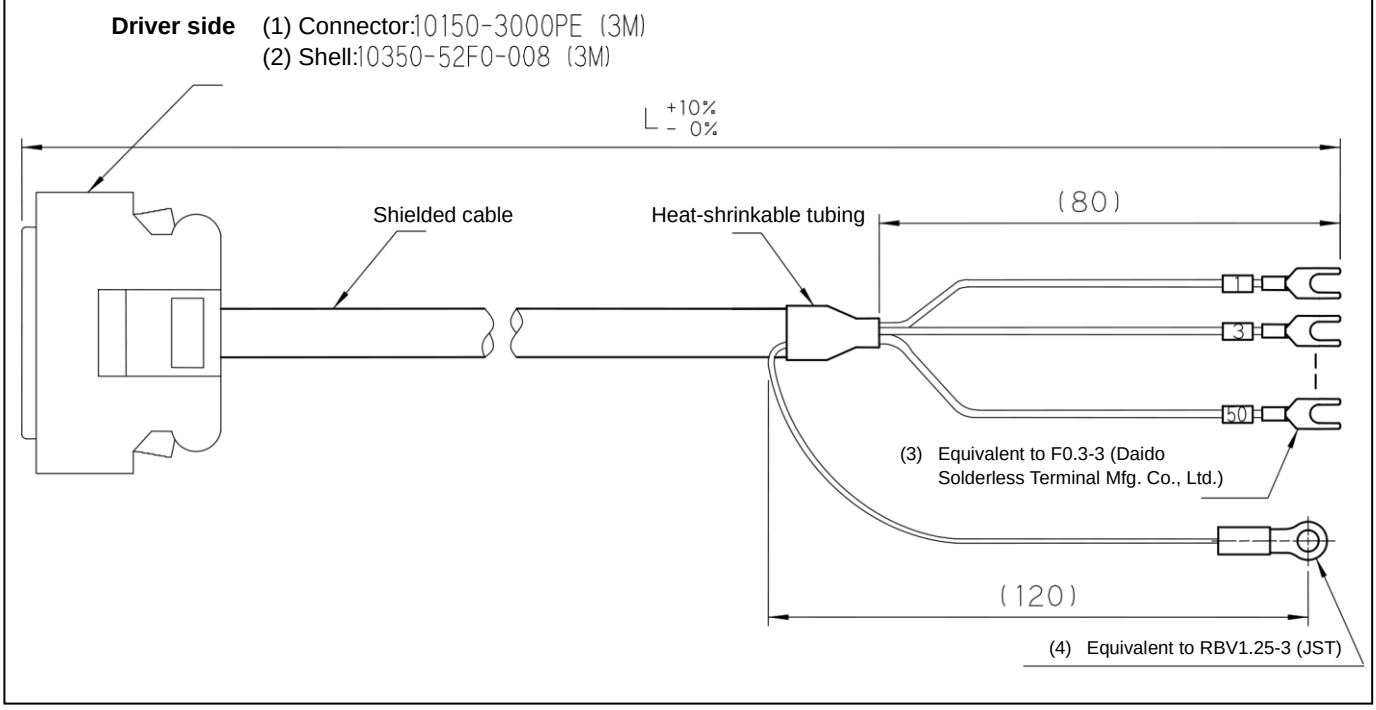
■ I/O Cable connection



■ Cable specifications

I/O cable (command pulse, line driver)

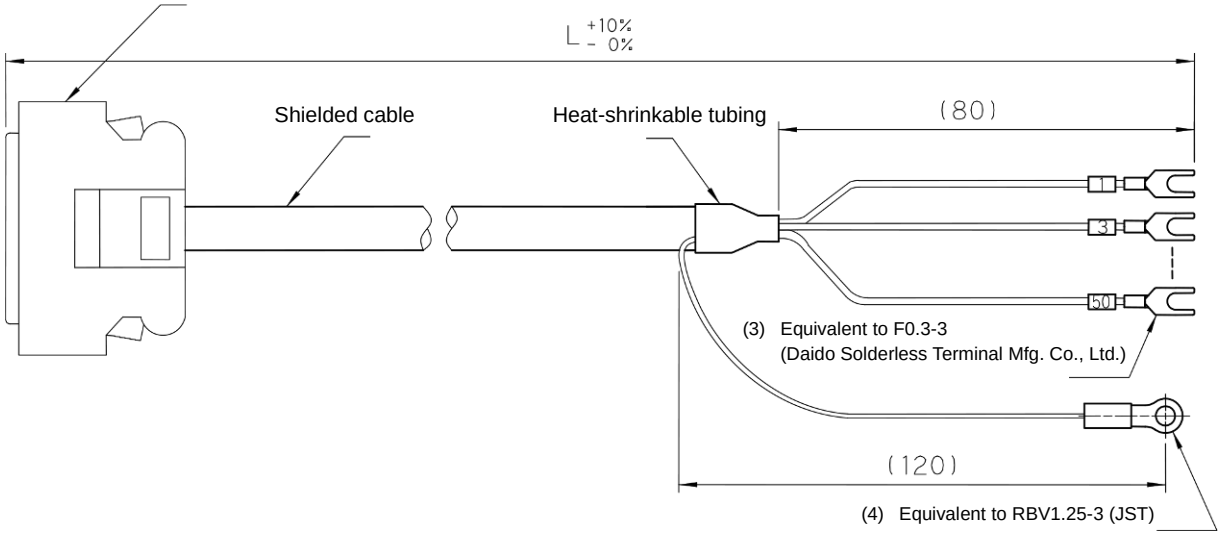
Model: EUA1424N****



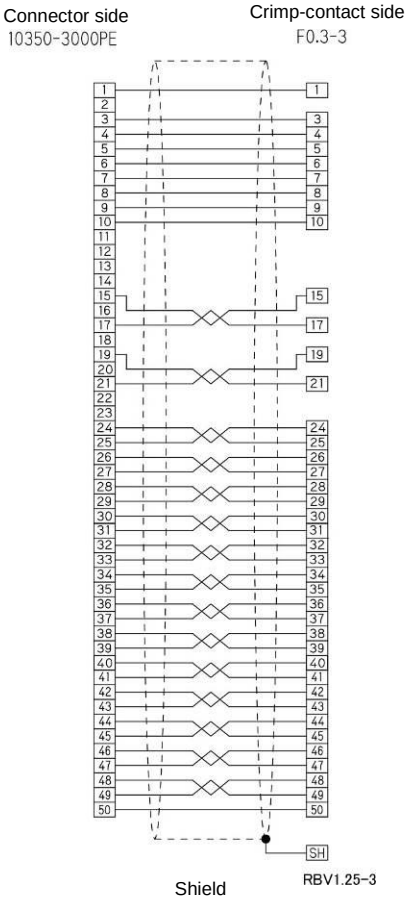
■ I/O Cable (command pulse, open collector)

Model: EUA1425N****

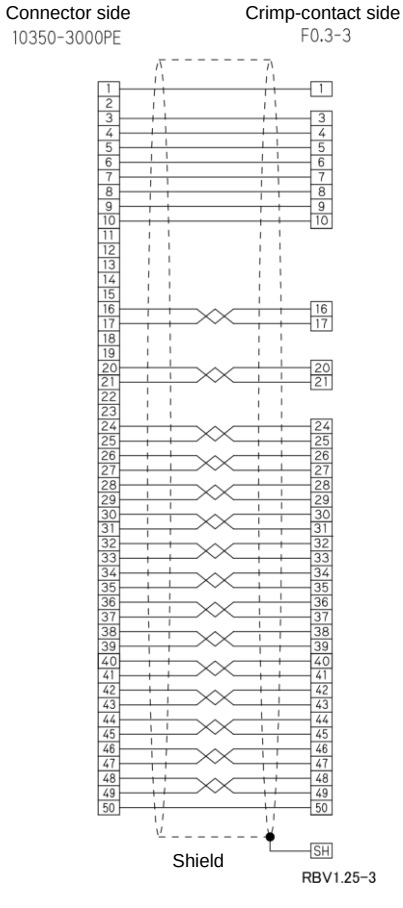
Driver side (1) Connector:10150-3000PE (3M)
(2) Shell:10350-52F0-008 (3M)



■EUA1425 Connection



■EUA1424 Connection

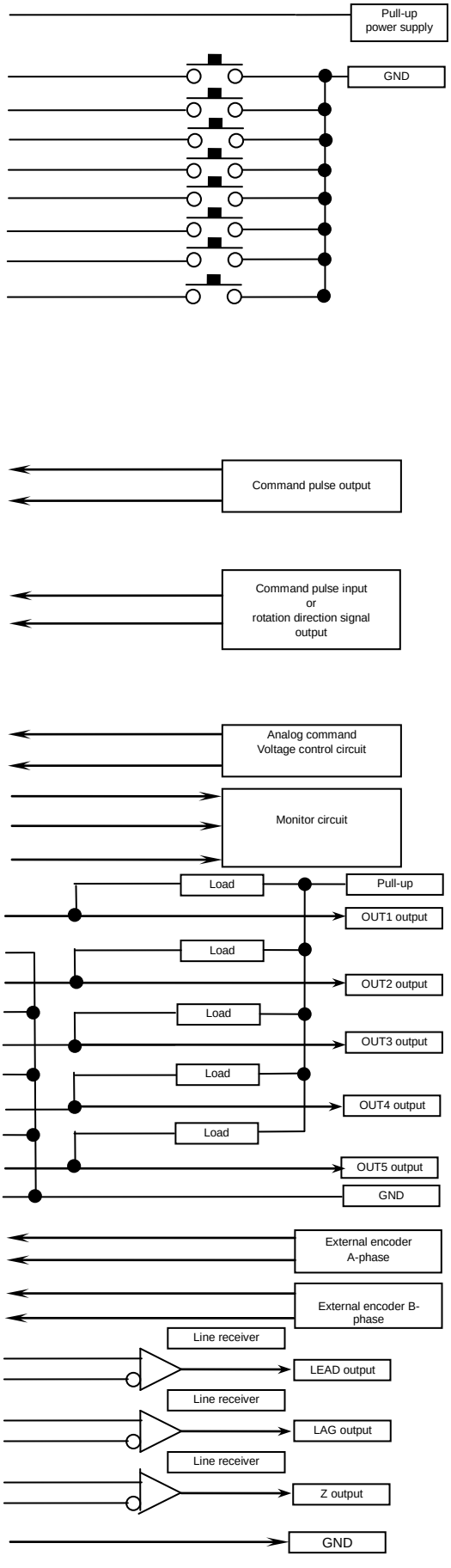


Important

It is recommended that the shield of the I/O cable be connected to the signal ground of a higher-level device. ⇒ Refer to ❑22.2 "External Connection Diagram."

7.7. Wiring the I/O Connector

Pin No.	Signal Name	Function (factory settings)	Remarks
1	+CON	Common power supply for digital input	
2	+CON	Common power supply for digital input	
3	IN1	Input 1 (servo ON input)	General-purpose digital input
4	IN2	Input 2 (Forward-rotation drive disable input)	General-purpose digital input
5	IN3	Input 3 (Reverse-rotation drive disable input)	General-purpose digital input
6	IN4	Input 4 (alarm reset input)	General-purpose digital input
7	IN5	Input 5 (deviation reset input)	General-purpose digital input
8	IN6	Input 6 (external alarm input)	General-purpose digital input
9	IN7	Input 7 (origin point sensor input)	General-purpose digital input
10	IN8	Input 8 (pulse input disable command)	General-purpose digital input
11	N·C		Unconnectable
12	N·C		Unconnectable
13	N·C		Unconnectable
14	N·C		Unconnectable
15	F-PLS1+	Pulse input 1 (Forward-rotation command pulse)	Open collector input or line driver input
16	F-PLS+		
17	F-PLS-		
18	N·C		Unconnectable
19	R-PLS1+	Pulse input 2 (Reverse-rotation command pulse)	Open collector input or line driver input
20	R-PLS+		
21	R-PLS-		
22	N·C		Unconnectable
23	+5V	Internal control supply power +5V	Unconnectable
24	ANALOG-IN+	Analog command input	Analog input
25	ANALOG-IN-	Analog command GND	
26	MONITOR2	Analog monitor output 2	
27	MONITOR1	Analog monitor output 1	
28	GND	Digital ground	
29	GND	Digital ground	
30	OUT1+	Output 1 (alarm signal)	General-purpose digital output
31	OUT1-		
32	OUT2+	Output 2 (in-position signal)	General-purpose digital output
33	OUT2-		
34	OUT3+	Output 3 (servo ready signal)	General-purpose digital output
35	OUT3-		
36	OUT4+	Output 4 (brake control signal)	General-purpose digital output
37	OUT4-		
38	OUT5+	Output 5 (stop speed status signal)	General-purpose digital output
39	OUT5-		
40	EX-LEAD+	External encoder input	Line driver input
41	EX-LEAD-		
42	EX-LAG+		
43	EX-LAG-		
44	LEAD+	Sensor signal output	Line driver input
45	LEAD-		
46	LAG+		
47	LAG-		
48	Z+		
49	Z-		
50	GND	Digital ground	



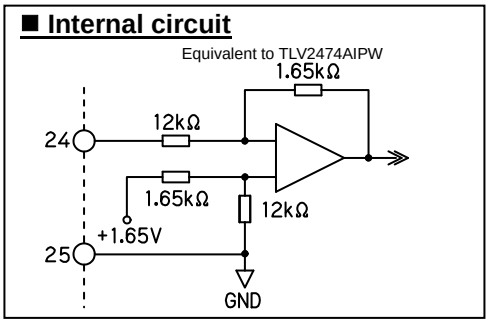
■ Analog input: Pin 24 (analog command input)

Establish this connection to use a voltage change as a speed or current command.

- Input voltage: Max. +10 VDC; Min. -10 VDC
- Connect GND of the input signal to pin number 25.
- Input is enabled by setting parameter ID75 "Speed Command Select" or ID76 "Torque Command Select" for analog input.

  ⇒ ❑ Refer to 19.7 "Parameters for Setting Control Functions"

■ Internal circuit



- Analog input setting parameters and analog input offsets need to be adjusted.

  ⇒ ❑ Refer to 15.2 "To run with an analog command from the I/O connector" in.2 "Speed Control Mode"

  ❑ Refer to 15.3"To run with an analog command from the I/O connector" in.3 "Current Control Mode"

■ Digital input: Pins 15 to 21

Establish this connection to use a pulse signal as a position control command.

- Use the input pulse at 500 kHz for line driver input and 200 kHz or less for open collector input.
- Input is enabled by setting parameter ID74 "position command select" for pulse input.

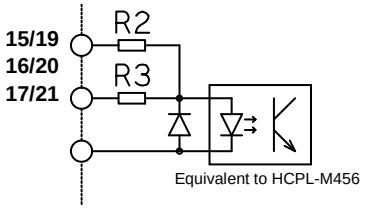
⇒ ❑Refer to 19.7 "Parameters for Setting Control Functions

- The command pulse type can be selected by using the parameter ID 120.

⇒ ❑Refer to 15.1.1 "Pulse Input Signal Types"

- The command pulse resolution per motor rotation can be set by using parameter ID121 and ID122

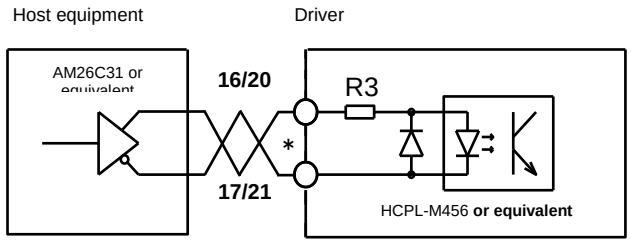
■ Internal circuit



R2:1.6 KΩ (24 V open collector)
R3:240 Ω (line driver input)

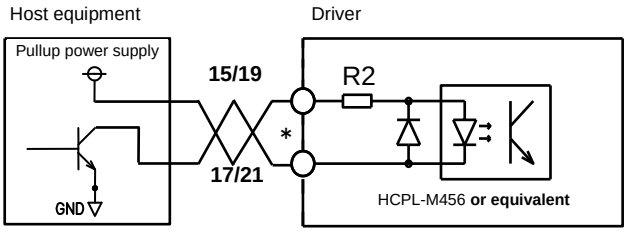
Connection example

Line driver output



* Twisted pair

24 V open collector output



* Twisted pair

List of pulse command input pin functions

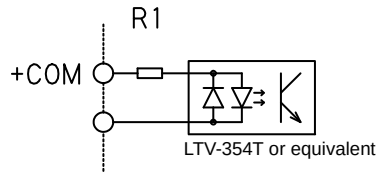
Pin No.	Pin name	Command description		
		Forward/reverse pulse	Pulse/rotation direction	90°-phase-difference two-phase pulse
15	F-PLS1+	Forward-rotation command pulse +	Command pulse +	A-phase pulse +
16	F-PLS+			
17	F-PLS-	Forward-rotation command pulse -	Command pulse -	A-phase pulse -
19	R-PLS1+	Reverse-rotation command pulse +	Rotation direction +	B-phase pulse +
20	R-PLS+			
21	R-PLS-	Reverse-rotation command pulse -	Rotation direction -	B-phase pulse -

■ Digital input: Pins 3 to 10

These pins input different kinds of digital signals. The function of each pin can be changed from the parameters.

- The input voltage (+COM) is 5 VDC or 24 VDC (depending on the model).
- In factory settings, the L level (with the photocoupler energized) is ON, and the H level or the open state (without energizing the photocoupler) is OFF. The logic can be reversed from the parameters.
- The function selection of each pin can be set with parameter IDs 100 to 107.See the table below for settable functions.
- The I/O filter time can be changed.

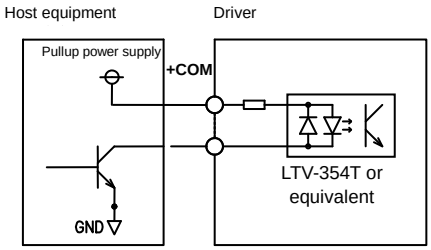
■ Internal circuit



Note: R1: 330 Ω for 5 V interface
3.3 KΩ for 24V interface

Connection example

■ Connected to the open collector



Parameters for Setting Digital Input Pin Functions

Pin No.	Signal name (Factory setting)	Parameters		
		ID	Name	Reference
3	IN1 (servo ON input)	100	Input 1 setting	⇒❑19. 10
4	IN2 (Forward-rotation drive disable input)	101	Input 2 setting	
5	IN3 (Reverse-rotation drive disable input)	102	Input 3 setting	
6	IN4 (alarm reset input)	103	Input 4 setting	
7	IN5 (deviation reset input)	104	Input 5 setting	
8	IN6 (external alarm input)	105	Input 6 setting	
9	IN7 (origin sensor input)	106	Input 7 setting	
10	IN8 (pulse input disable command)	107	Input 8 setting	

Settable Digital Input Functions

This function can also be operated by setting the value of driver parameter ID30 (Servo Command) with various communication.
To find details of each status, refer to ❑16.3 "Servo Command."

Function name	Description
Servo ON	Sets the servo to ON.
Forward-rotation drive disable	Sets the speed command to 0 and disables forward-direction rotation. Effective at the time of position and speed control.
Reverse-rotation drive disable	Sets the speed command to 0 and disables reverse-direction rotation. Effective at the time of position and speed control.
Alarm reset	Clears driver alarms.
Deviation reset	Clears the position error counter.
Profile operation enabled	Enables profile operation to move to the target position in position control.
Origin sensor input	Detects an origin signal.
External alarm	If set to ON, the servo is set to OFF when the driver detects an alarm.
Gain switch	Switches between Gain 1 and Gain 2.
Analog input 0-point adjustment	Automatically adjusts offset for analog input.
Second current limit switch	Switches between the first and second current limits.
Pulse input disable command	Stops pulse command inputs from being read.
Homing start command	Starts homing, and restores to the original control mode automatically once homing is complete.
Analog input forced-0 command	Forces the analog input command to 0.
Simplified control input 1 to 8	Used for input in the simplified control mode.
Control mode switch	Switches the control mode.
Hard stop	Automatically stops the motor.
Smooth stop	Stops the motor by reducing speed.
Emergency stop input	Turns off the brake output and forces the motor to stop. Then, turns off the servo by applying ID143 “servo off delay time.” *BITO (servo on) of ID30 “Servo command” is not automatically cleared.
Ignore input	Nothing happens. (Used in operations, such as acquisition only of I/O logic information from a higher level.)

"I/O filter time"

Instantaneous signals due to noise etc. can be canceled by increasing the set value of parameter ID117.

A stable input signal is valid for the period of time set when the I/O input signal changes.

This setting is used for the following I/O digital inputs.

CN7 connector (I/O connection)

Pin No.	Signal name (Factory setting)	Parameters		
		ID	Name	Reference
3	IN1 (servo ON input)	117	I/O filter time	⇒❑19. 10
4	IN2 (Forward-rotation drive disable input)			
5	IN3 (Reverse-rotation drive disable input)			
6	IN4 (alarm reset input)			
7	IN5 (deviation reset input)			
8	IN6 (external alarm input)			
9	IN7 (origin sensor input)			
10	IN8 (pulse input disable command)			

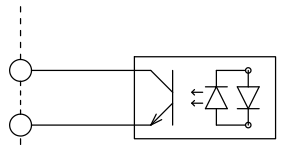
Supplement This function cancels instantaneous signals. However, it also prolongs the time necessary for detecting ordinary signals.
In particular, during immediate stopping by origin signal (I/O) in homing operation, etc. a check for a change in the origin position must always be made after changing this parameter.
There may also be effects on the stop operation due to the limit signal or similar (I/O).

■ Digital output: Pins 30 to 39

These pins output different kinds of digital signals.

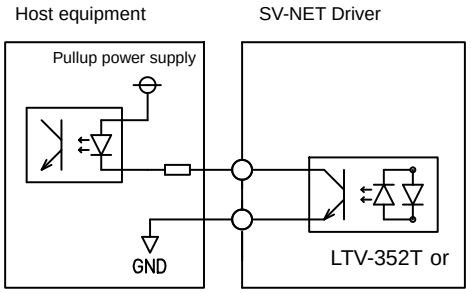
- Collector current: Max. 100 mA
- Max voltage: 30 VDC
- Use parameter IDs 110 to 114 to set the functions of each pin.

■ Internal circuit



Connection example

■ Connecting the photo coupler input



Parameters for Setting Digital Output Functions

Pin No.	Signal name (Factory setting)	Parameters			Remarks
		ID	Name	Reference	
30,31	OUT1 (alarm signal)	110	Output 1 setting	⇒❑19. 10	For changing the logic: ID69 "Control Selection Flag" ⇒ Refer to ❑19.7 "Parameters for Setting Control Functions"
32,33	OUT2 (in-position signal)	111	Output 2 setting		
34,35	OUT3 (servo ready signal)	112	Output 3 setting		
36,37	OUT4 (brake control signal)	113	Output 4 setting		
38,39	OUT5 (stop speed status signal)	114	Output 5 setting		

Overview of Functions Settable in Digital Output

The various flags assigned in ID20 (Servo Status) can be output in digital output.
To find details of each status, refer to ❑15.5 "The Driver Operation Status."

Function name	Description
Servo ON	ON while servo ON
During profile operation	ON during profile operation
In-position signal	ON when the position deviation falls within the in-position range
Alarm signal	Is set to ON if an alarm is detected.
Forward limit	ON when the current position exceeds the value set in forward-direction move limit
Reverse limit	ON when the current position exceeds the value set in the reverse-direction move limit
Torque limit	ON when the current exceeds the limit value
Speed limit	ON when the speed exceeds the limit value
Position excessive deviation	ON when the position deviation exceeds the limit value
Servo ready signal	Is set to ON if servo control is possible.
During homing	ON during homing operation
During switching to second gain	ON when Gain 2 is used
Backup battery voltage low	ON when the backup battery voltage of the sensor is low
Drive power supply disconnection	ON when the voltage of the drive power supply is low
Stop speed status signal	Is ON if the motor speed is below the judgment speed.
Brake control signal	ON when the brake control signal is released
Alarm bit code signal 0 to 2	Displays the alarm type if an alarm is detected. * Uses three outputs.
Profile command arrival	Turns ON when the target position is reached during profile operation.

■ +5V: Pin 23

This is the 5V control power supply within the driver.

This cannot be used as a control power supply for external devices.

■ GND: Pins 28,29,50

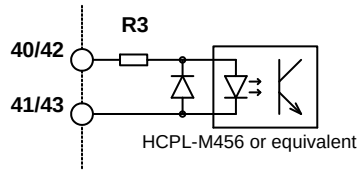
These GNDs are shared between each control signal.

■ External encoder input: Pins 40 to 43 (line driver input)

This input is connected when an external encoder input signal is to be used as a feedback signal in position control.

- This is enabled by setting Parameter ID73, "Position Feedback Selection," in the external encoder.

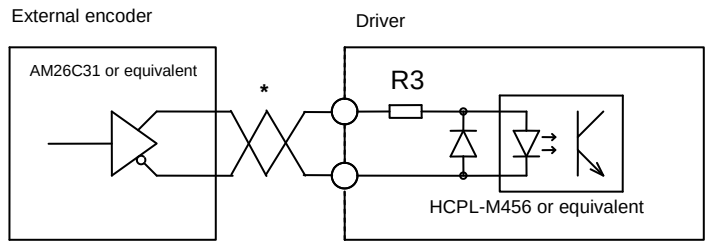
■ Internal circuit



Note: R3: 240 Ω

Connection example

■ Line driver output connection



* Twisted pair

Note: R3: 240 Ω

List of Digital Input Pin Functions

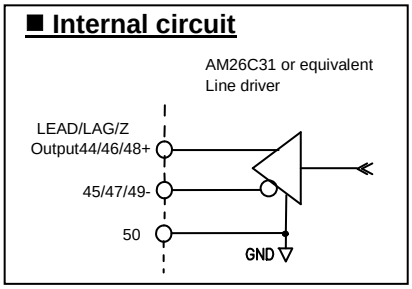
Pin No.	Signal name
40	LEAD+
41	LEAD-
42	LAG +
43	LAG -

■ LEAD/LAG/Z output: Pins 44 to 49 (line driver output)

Line driver output

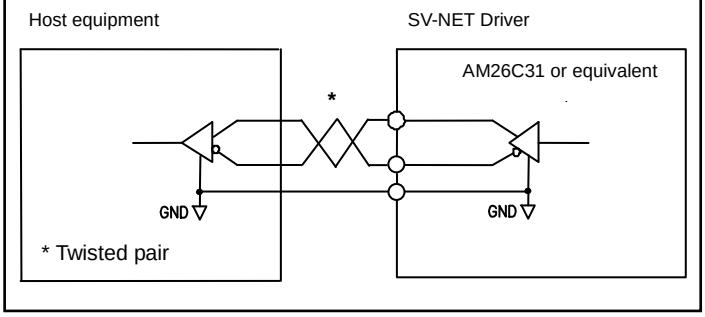
・ Line driver　AM26C31 or equivalent

■ Internal circuit



Connection example

■ Connecting to the line receiver



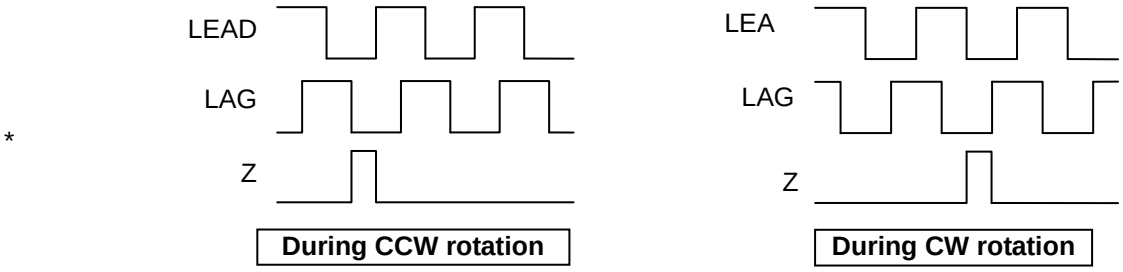
LEAD/LAG/Z output function

The parameter ID126 can be used to set the output resolution.

Pin No.	Signal name	Function
44, 45	LEAD	○ **Brushless resolver 1X-BRX** **1X-BRX** (outputs Z signal once per rotation): Outputs a sensor signal in the resolution range of 1 to 512 per motor rotation.
46, 47	LAG	○ **Wire-saving incremental encoder 2048C/T, 2000C/T, 2500C/T wire-saving INC** Outputs a sensor signal in the resolution range of 1 to the number of C/Ts of the used sensor per motor rotation. ○ **Serial encoder 17Bit-INC/ABS, 23Bit-INC/ABS** Outputs a sensor signal in the resolution range of 1 to 2048 per motor rotation.
48, 49	Z	○ **Brushless resolver 1X-BRX** Outputs the Z signal generated by R/D conversion. ○ **Wire-saving incremental encoder 2048C/T, 2000C/T, 2500C/T wire-saving INC** Outputs the sensor Z signal. ○ **Serial encoder 17Bit-INC/ABS, 23Bit-INC/ABS** Outputs the Z signal generated from the sensor signal.

Supplement When Bit 13 or 14 of ID 69 "Control Switch" is 1 (enabled), this setting becomes invalid, and the position pulse of the encoder is output as the LEAD/LAG/Z output without being changed.

LEAD/LAG/Z output waveform

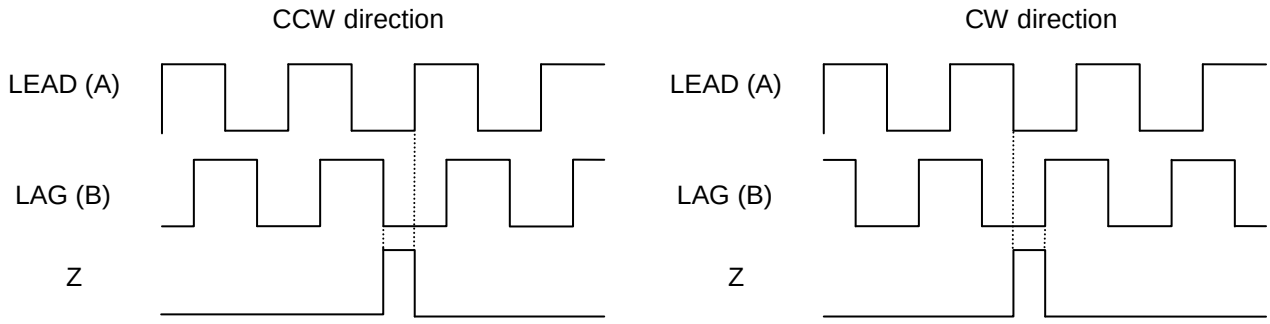


*

LEAD/LAG/Z output patterns

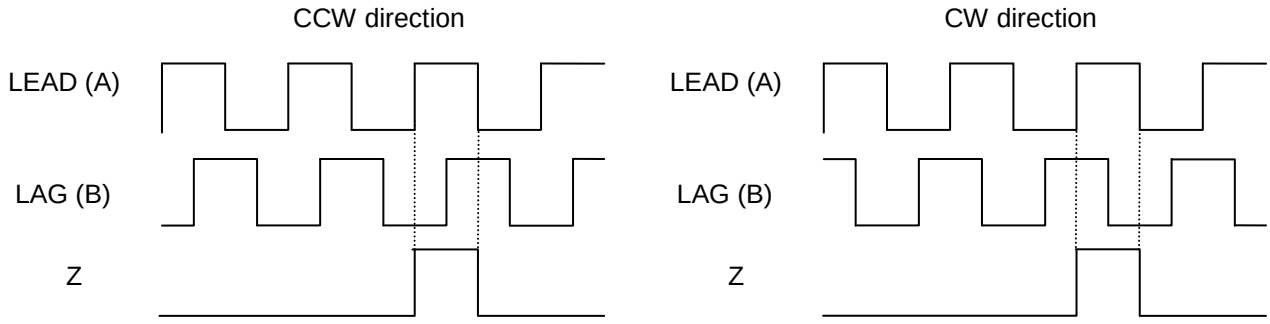
The output pattern of the Z phase differs as follows depending on the settings for the Z-signal output waveform selection (Bit 6 of parameter ID69).

When Bit 6 = "0" in parameter ID69 (factory setting)



Z signal becomes Hi when both LEAD and LAG are Low.

When Bit 6 = "1" in parameter ID69



Z signal becomes Hi by synchronizing with the Hi state of the LEAD signal.

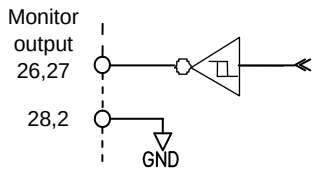
When Bit 15 of parameter ID69 is "1," the LEAD and LAG signals will be interchanged.
This is a logical inversion of the rotation direction.
Also in this case, the Z signal will be output at the above-described timing.

■ Monitor output: Pins 26, 27

The difference parameter values are output in analog signal form.

- They are output within the range ±10 V using GND as the standard.
  (The output is linear in the range up to ±8 V.)
- The parameter IDs and magnification targeted for monitor output can be selected with parameters.

■ Internal block diagram



Parameters for Setting Monitor Output

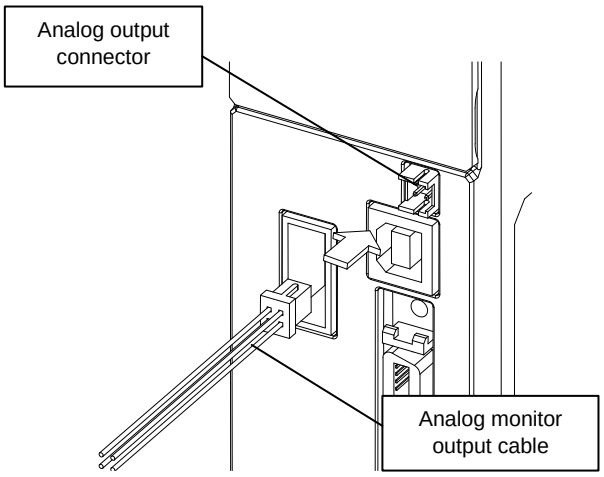
Pin No.	Signal name	Parameters		
		ID	Name	Reference
27	MONITOR1	118	Monitor 1 setting	⇒❑19.11
		185	Monitor 1 gain	
26	MONITOR2	119	Monitor 2 setting	
		186	Monitor 2 gain	

Factory settings

Monitor output 1:
Feedback current (ID42)

Monitor output 2:
Feedback speed (ID41)

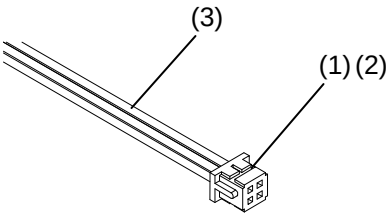
7.8. Connecting the Analog Monitor Output Connector



■ Cable specifications

■ Analog monitor output cable

Model EUA1289



■ Parts for analog monitor cable

Part name	Model or spec.	Maker	Remarks
(1) Socket	2418HJ-04-PHD	Neltron	
(2) Terminal	2418TJ-PHD	Neltron	
(3) Cable	AWG24-28 or equivalent	—	

■ Analog monitor output connector (debugging connector)

These are shared with Analog Monitor Output 1 and 2 (Pins 26 and 27) of the I/O connector.

The OUT2/output is the same signal as OUT2 from the I/O connector. However, it is a source signal that does not undergo photocoupler isolation.

The logic is inverted and output as 0/3.3 V.

Pin No.	Function	Remarks
1	Monitor output 1	Analog output
2	Monitor output 2	Analog output
3	OUT2/(In-position signal/)	Digital output
4	GND	Common

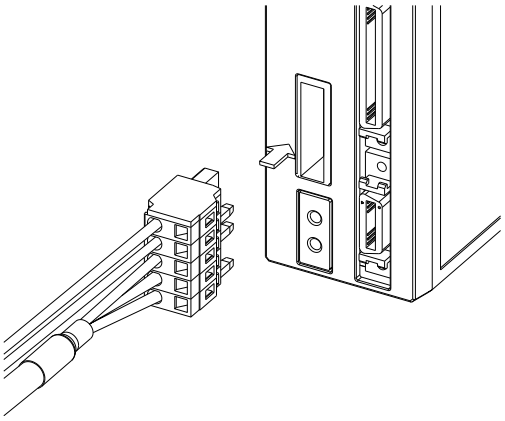
7.9. Connecting External Resistors

External resistors (regenerative resistors) will be connected to the B1 and B2 terminals, connectors for connecting motors and external resistors.

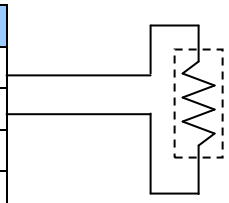
■ Wiring the regenerative resistor

Applying a sudden deceleration or external rotation torque subjects the motor to a counter electromotive force due to regeneration effects, resulting in a rise in the drive voltage occurring inside the driver.

Connecting the regeneration resistor to the TAD8811 Series allows the regeneration protective circuit, which is built into the regeneration resistor, to protect the driver and motor by controlling such a rise in the drive voltage.

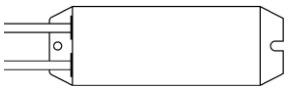


Pin No.	Function
1	B1
2	B2
3	U-phase
4	V-phase
5	W-phase



Regeneration resistor

■ **Regeneration resistor** Model EUA1290



47Ω 80W

Select an appropriate resistor so that the maximum power capacity will be four times the regenerative power generated or larger.
If the capacity of the standard regeneration resistor illustrated in the left is insufficient, use a commercially-available cement resistor (47 Ω) with a higher capacity.

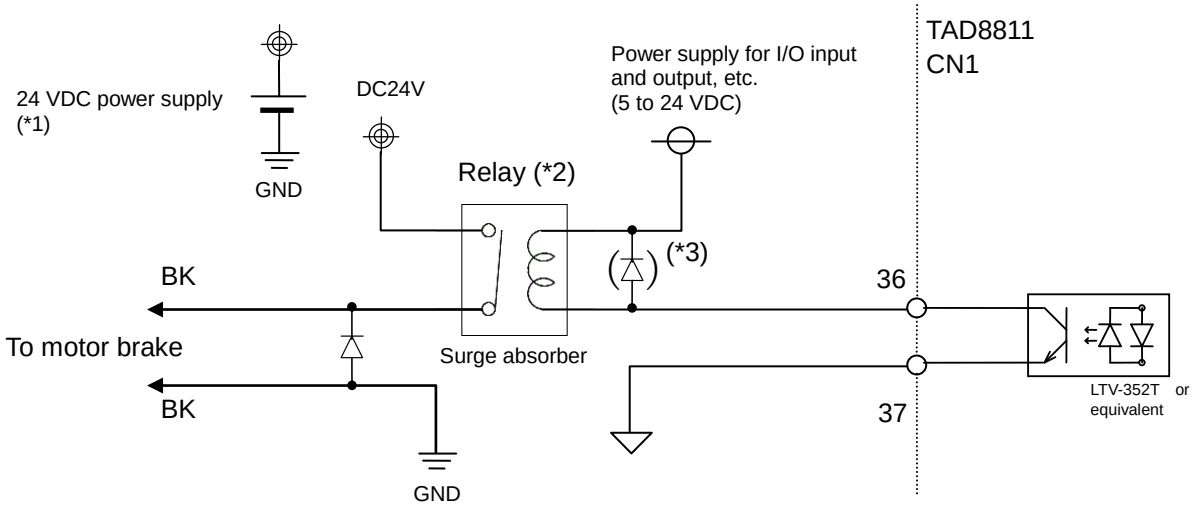
Caution

Regenerative resistors may become hot under some usage conditions.

- When connecting a regenerative resistor, attach it to a non-combustible article such as a metal object.
- Consider additionally using an external protecting device, such as a thermal fuse and a thermal protector.

7.10. Mechanical Brake

This driver is not equipped with a circuit for releasing a mechanical brake.
When a motor with a mechanical brake is to be used, it is necessary to prepare a 24-VDC power supply separately.
When it is necessary to synchronize the control of the mechanical brake with the servo ON/OFF of the driver, establish a connection with the following circuit and then use the "brake control signal" available as the I/O output. ⇒ Refer to ❑7.7 "Wiring the I/O Connector."



*1: Be sure to prepare a 24 VDC power supply (0.5 A or more) for the brake separately from power supplies for I/O input and output (CN1), etc.
*2: As the relay, select a coil-resistance product handling a current of 50 mA or less under an input voltage of 24 VDC or less.
*3: It is unnecessary when a relay with a built-in coil-surge absorber is used.
*4: his is a factory setting. The output terminal can be changed by parameter setting.

7.11. Other Considerations for Wiring

- For wiring, use cables we specify, to the greatest extent possible. When it is necessary to use a non-specified cable, select one by considering its usage environment, rated voltage, and rated current.
- Meet the following requirements if a motor cable other than the motor cables we specify is to be used.
  Wire size/voltage endurance = AWG18 wire (0.75 sq)/300 VAC or higher
- Do not run a heavy-current line (a main circuit cable) and a light-current line (an I/O input and output cable and an encoder cable) in the same duct or bundle them together. If a heavy-current line and a light-current line cannot be placed in separate ducts, separate them by a distance of 30 cm or more. Wiring that is too close together may result in malfunctions due to noise on the light-current line.
- Firmly tighten the locking mechanisms and lockscrews of cable connectors.

8. How to Control the Driver

The driver is controlled mainly by SV-NET communication, pulse commands, or analog commands. With either method, parameters must be set first. Parameters can be set via the USB communication of the driver or by SV-NET communication with a higher-level device.
There are many types of parameters and corresponding functions. In some cases, controllers or other higher-level devices may control the driver while reading and writing these parameter values.

This section provides a broad overview of the parameters.

⇒Refer to ❑19 "List of Parameters"

Parameter type	Basic description
Communication parameters	Sets MAC-IDs, communication speed, and other parameters for SV-NET.
Parameters for initializing and saving parameters	Used mainly to save parameter values in a nonvolatile memory.
Status parameters	Used for driver status acquisition, alarm detection, etc.
Control command parameters	These are parameters that are directly involved with motor operation such as servo ON and control method selection.
Servo feedback parameters	Acquires motor sensor information.
Servo gain parameters	Sets various kinds of servo gains. Used for adjustment.
Parameters for setting control functions	Selects electronic gears and the function of each control mode.
Parameters for setting homing operation	Sets homing operation.
Control mode switching parameter	Sets the method for switching the control mode.
Parameters for setting I/O (input, output)	Used to set I/O functions.
Parameters for setting analog monitor	Sets the analog monitor output.
Parameters for setting pulses	Sets input/output pulses and related settings.
Parameters for setting the analog input	Sets the analog input and related settings.
Special servo parameters	Used for more advanced control.
Parameters for setting error detection	Sets values to be detected as errors.
Parameters for internal monitor	Sets the analog monitor output and related settings.
Extension parameters	Sets highly sophisticaterd control.

Most parameters are not changed once they have been set at the beginning. Depending on the usage, however, various kinds of parameters may need to be set before the driver is installed and run on equipment. Note that turning off the driver without saving the set parameters to nonvolatile memory will return the parameters to their original settings. After parameters have been changed, they must be saved.

9. Establishing Communication with Host Equipment

On the basis of our unique communication formats, the specifications of TAD8811 defines SV-NET communication and RS485 (Tamagawa Format and MobdusRTU Format) for communication with host equipment. For the details of the specifications, refer to each communication specification (SV-NET Communication Specification: SPC009568Y00; Serial Communication Specification: SPC009256W00; ModbusRTU Communication Specification: SPC009819W00). This chapter describes the communication specifications and the settings of MAC-ID and communication speed as initial settings for establishing communication with host equipment.

9.1. Procedure for Specifying Communication Specifications

First, make the settings of TAD8811 to specify necessary communication specifications. At factory default, it is set for SV-NET communication. When specifying different communication specifications, follow the procedure below to set parameters.

Supplement **To find methods for changing parameter values by using dedicated applications, see the relevant instruction manual by using the help function of each application.**

■ Specifying communication specifications

1. Check that the power supply is OFF.
2. Connect TAD8811 to the PC via USB connection.
3. After the power supply has been turned on, wait for at least two seconds before starting the next operation.
4. Use the dedicated application to set the parameters by following the procedure below.

   Communication specifications can be specified by using the Bit 1 and Bit 2 of ID 141 "Special Function Switching." For example, when designating RS485 ModbusRTU format as communication specifications, set ID 141 to "0x04." When a setting is changed, the change must always be saved by setting "1" in ID 17 "Parameters save."

Step	ID	Parameter name	Setting value
(1)	**141**	Special Function Switching	Bit2/Bit1 : SV-NET-RS485 Sets the communication protocol for CN5 and CN6 00=SV-NET enabled 01=RS485(Tamagawa Format)enabled 10=RS485(ModbusRTU Format)enabled
(2)	**17**	Parameters save	1

9.2. Procedure for Setting a MAC-ID

Before performing motor control or making a setting change to a parameter via communication, set MAC-ID to establish communication. The MAC-ID is set to "63" as a default value; you must set a MAC-ID that is unique and not already used on the network.

Supplement **To find methods for changing parameter values by using dedicated applications, see the relevant instruction manual by using the help function of each application.**

Supplement **To find methods for changing parameter values via communication using host equipment, see each communication specification** (SV-NET Communication Specification: SPC009568Y00; Serial Communication Specification: SPC009256W00; ModbusRTU Communication Specification: SPC009819W00).

■ Setting a MAC-ID via USB communication

When it is necessary to change a setting via USB communication of the driver main unit, use a dedicated application to set ID5 "MAC-ID."

■ Setting MAC-IDs using SV-NET/Serial communication

1. Check that the power supply is OFF.
2. Connect only the driver on which you wish to set a MAC-ID to host equipment using the SV-NET cable (or a serial communication cable). Disconnect communication cables from other drivers.
3. After the power supply has been turned on, wait for at least two seconds before starting the next operation.
4. Set the parameters via SV-NET communication (or serial communication) by following the procedure below. ID5 "MAC-ID" can be set to a value from 1 to 63. When a setting is changed, the change must always be saved by setting "1" in ID17 "Parameters save."

Step	ID	Parameter name	Setting value
(1)	5	MAC-ID	1–63
(2)	17	Parameters save	1

Caution

If parameter values are changed, save the parameters.
Turning OFF the power supply without saving will return the parameter values to their original settings. ⇒ Refer to ❑16.1 "Storing Parameters"

Important

Changed MAC-IDs are enabled when the power is turned on.
After the power has been turned on, wait for at least two seconds before starting SV-NET communication.

9.3. Procedure for Setting the Communication Speed

This section describes a procedure for setting the communication speed for the communication specifications specified in ID 141 "Special Function Switching." It is recommended that the SV-NET communication speed be maintained at the 1 Mbps (factory setting). However, if communication becomes unstable because the SV-NET cable is long, setting a slower communication speed may improve stability.

When changing the communication speed, record the communication speed you have set in order to avoid forgetting it. Changing the setting without due care and attention could lead to a problem in communication. Set and save communication speed properly.

Supplement **To find methods for changing parameter values by using dedicated applications, see the relevant instruction manual by using the help function of each application.**

Supplement **To find methods for changing parameter values via communication using host equipment, see each communication specification** (SV-NET Communication Specification: SPC009568Y00; Serial Communication Specification: SPC009256W00; ModbusRTU Communication Specification: SPC009819W00).

1. Turn ON the power supply.
2. Set parameters in accordance with the following procedure by using host equipment or a dedicated application. Set ID6 "Baud Rate" to a number corresponding to the communication speed in accordance with the communication specifications. When a setting is changed, the change must always be saved by setting "1" in ID 17 "Parameters save."

Example) When designating SV-NET = 1Mbps, RS232 = 56,000 bps, RS485 = 19,200 bps, an even parity for ModbusRTU, and stop bit = 1: ID6 = "0x2244"

* If a communication error occurs due to the surrounding environment or the cable state, designate a lower communication speed.

Step	ID	Parameter name	Setting Value
(1)	6	Communication Speed	SEG0 (Bit0-3): SV-NET communication speed 0: 125 kbps 1: 250 kbps 2: 500 kbps 4: 1 Mbps (factory default setting) SEG2 (Bit8-11): RS485 (ModbusRTU) communication speed 0: 115,200 bps (factory initial value) 1: 9,600 bps 2: 19,200 bps 3: 38,400 bps 4: 56,000 bps 5: 57,600 bps 6: 115,200 bps SEG3 (Bit12-15): ModbusRTU character setting 0: No parity, stop bit = 1 (factory default setting) 1: No parity, stop bit = 2 2: Even parity, stop bit = 1 3: Even parity, stop bit = 2 4: Odd parity, stop bit = 1 5: Odd parity, stop bit = 2
(2)	17	Parameters save	1

3. Turn OFF the power supply.
4. Turn ON the power supply again and then wait for at least two seconds.
5. Adjust the communication speed of the host equipment or the dedicated application to the communication speed set to the driver, and then check whether communication can be established.

Caution

If parameter values are changed, save the parameters.
Turning OFF the power supply without saving will return the parameter values to their original settings. ⇒ Refer to ❑16.1 "Storing Parameters"

Important

The changed communication speed will be enabled when the power is turned on. Once the communication speed has been changed, turn the power supply back on.

10. Trial Run

After the environment has been made ready for parameter changes, connect all of the required cables and then perform a trial run on each driver and motor set, one by one. Check whether the motor rotates normally. To prevent unexpected accidents, separate the motor from other equipment, and with nothing connected to the motor shaft, and then perform the trial run in a no-load state.
In a trial run, various types of operations can be performed, including a simple JOG operation from the settings panel of the driver main unit, speed control and position control under parameter settings close to those for an actual run via communication from host equipment, and speed control and position control via USB communication (dedicated application) from the driver main unit.

Supplement To find methods for operation by using dedicated applications, see the relevant instruction manual by using the help function of each application.

Supplement To find methods for setting parameter values via communication using host equipment, see each communication specification (SV-NET Communication Specification: SPC009568Y00; Serial Communication Specification: SPC009256W00; ModbusRTU Communication Specification: SPC009819W00).

10.1. Trial Run from Settings Panel

The speed and current can be controlled in a step-by-step fashion simply by using the settings panel.
To find more details, refer to ❑20.9 "Operations in JOG Operation Mode."

1. Turn ON the power supply and then wait for at least two seconds.
2. If "AL**" appears on the settings panel (the asterisk (*) represents a certain numerical value), an alarm has been detected. In that case, eliminate the cause of the alarm and reset it with reference to 17 "Alarm Detection."
3. If no alarm is detected, start a trial run.
4. Perform a trial run by using the settings panel to take the following steps:
   (Details of the following operations are described in ❑ 20.9 "Operations in JOG Operation Mode.")

Step	Operation
(1)	Press the MODE button several times to make the display read .
(2)	Press the ◀ button to make the display read .
(3)	Press the ▲ or ▼ button to select for step-by-step speed control or for step-by-step current control.
(4)	Press the ◀ button to open the command value setting screen, and then use the ▲ or ▼ button to set a command value. Set a value in units of rpm and 0.01 A for step-by-step speed control and step-by-step current control, respectively. (When you put the driver into operation for the first time, you are advised to set a value between "30" and "60" (30 to 60 rpm) for step-by-step speed control and a value between "30" and "50" (0.3 to 0.5 A) for step-by-step current control.)
(5)	Press the ◀ button for a few seconds to make the display read .
(6)	Again press the ◀ button for a few seconds until three hyphens (-) appear like ; the servo will be turned ON, and the display will change to or .
(7)	While the ▲ button is being held down, forward-direction commands are given to make the motor rotate.(*1) While the ▼ button is being held down, reverse-direction commands are given to make the motor rotate. Releasing the buttons stops the motor (command = 0).
(8)	To finish the trial run, press the MODE button.

(*1) The definition of the forward rotation direction can be changed by ID 72 "Reference Direction."

5. Check that control can be performed as set and that the motor rotates smoothly.

10.2. Speed Control Trial Run

1. Turn ON the power supply and then wait for at least two seconds.
2. If "AL**" appears on the settings panel (the asterisk (*) represents a certain numerical value), an alarm has been detected. In that case, eliminate the cause of the alarm and reset it with reference to 17 "Alarm Detection."
3. If no alarm is detected, start a trial run.
4. Set the parameters by following the procedures below.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to speed control.																	
	31	Control Mode	2															
(2)	Servo ON. Servo ON fixes the motor shaft.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(3)	Set the rotation speed. (Example: 500 rpm). After this has been set, the motor will rotate.																	
	37	Real-time Command Speed	500															
(4)	Change the rotation speed. (Example: 1000 rpm). After this has been set, the rotation speed will change.																	
	37	Real-time Command Speed	1000															
(5)	Rotation stop. Stop the rotation using servo OFF.																	
	30	Servo Command	0x0000	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5. Check that control can be performed as set and that the motor rotates smoothly. Proceed to a position control trial run.

Supplement **To perform a trial run again after use with pulse input and analog signal input, set IDs 75 "Speed Command Select" and 74 "Position Command Select" to "0," and then send commands via communication.**

10.3. Position Control Trial Run

1. Set parameters in accordance with the following steps.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to position control.																	
	31	Control Mode	1															
(2)	Reset the current position. Set the current position to "0."																	
	30	Servo Command	0x4000	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3)	Servo ON. Servo ON fixes the motor shaft.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(3)	Set the move target position. (Example: Move in the forward direction (CCW) by 0x20000 (131072) pulses.)																	
	32	Target Position	0x00020000															
(4)	Set the target speed. (Example: 100 rpm)																	
	33	Target Velocity	100															
(5)	Set the acceleration/deceleration. (Example: Set the acceleration/deceleration speed in units of 10 rpm/sec. For example, set "100" for an acceleration/deceleration speed of 1000 rpm/sec.)																	
	34	Acceleration	100															
	35	Deceleration	100															
(6)	Profile ON. Once set, the motor will rotate to the position set in (3).																	
	30	Servo Command	0x0003	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(7)	Servo OFF. Set servo OFF after rotation stops.																	
	30	Servo Command	0x0000	B14	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

2. Check that control can be performed as set and that the motor rotates smoothly. Perform trial runs for all the connected drivers and motors and check their operation.

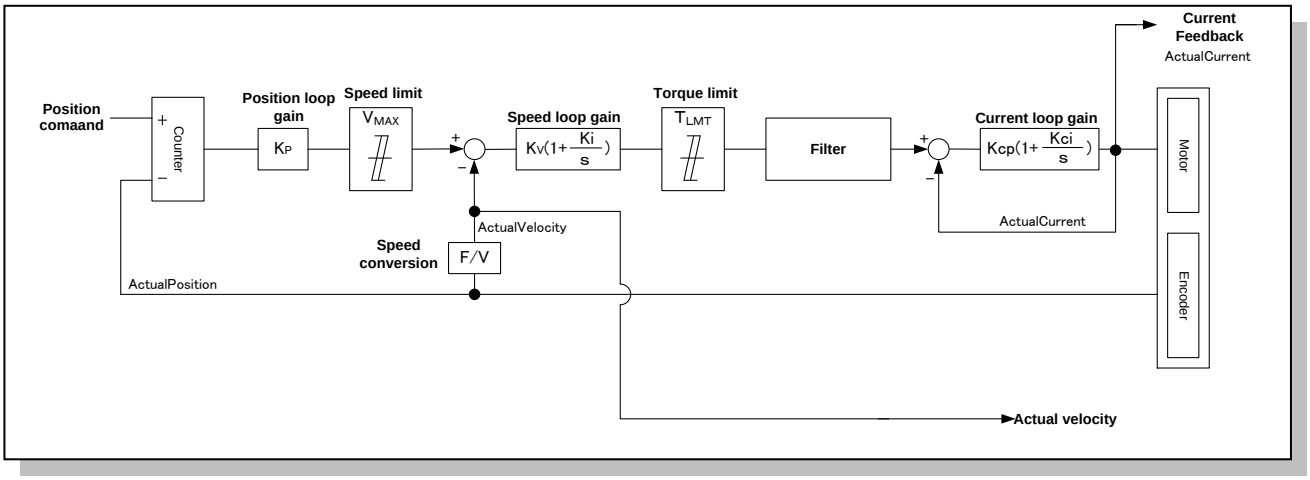
Supplement **To perform a trial run again after use with pulse input and analog signal input, set IDs 75 "Speed Command Select" and 74 "Position Command Select" to "0," and then send commands via communication.**

11. Servo Gain Adjustment

After the motor has been installed on equipment, various kinds of gains need to be adjusted to control the motor under optimal conditions. The servo gains set at the factory are set with a focus on ensuring safe operation. Adjust the servo gains if a more suitable setting is required to optimize operation of the equipment, or if adjusting the load inertia fails to resolve an overshoot (stoppage after the target has been passed) or vibration.

Supplement **The auto tuning function is implemented on the dedicated application "Motion Designer Drive."**
To find the details of the auto tuning function, refer to the relevant instruction manual by using the help function of the dedicated application.

11.1. Servo Block Diagram



■Automatic adjustment

・Tuning-free function

The tuning-free function estimates the load characteristics of the machine in actual operation in real time and automatically set the basic gain corresponding to the value of the stiffness parameter on the basis of the estimation. It is useful when the user is not sufficiently used to gain adjustment, or when gain adjustment is necessary for a multiaxial mechanism.

・Auto tuning function

The auto tuning function is an enhanced function used in the position or speed control mode. It uses the auto tuning function of the dedicated application "Motion Designer Drive" to set the machine stiffness and the positioning settling time, thereby improving response. It is useful when further improvement in response is necessary after adjustment by the tuning-free function. Since the adjustment is performed in uniaxial reciprocating operation, this function is effective in uniaxial gain adjustment.

■Manual adjustment

・Manual gain tuning (basic)

This function is used to set the basic gain manually. It is useful when further improvement in response is necessary after adjustment by the auto tuning function.

・Manual gain tuning (advanced)

This function is an enhanced function used in the position or speed control mode to stabilize operation by advanced control. It is useful when further improvement in response and stability is necessary after adjustment by the auto tuning function.

■List of Control Gain Parameter IDs

Parameter IDs that can be set for each function of automatic adjustment and manual adjustment are shown below.

Classification		Name	Symbol	Corresponding parameters to be set	
Manual adjustment	Automatic adjustment			ID	Name
Manual gain tuning (advanced) / Manual gain tuning (basic)	Auto tuning function / Tuning-free function	Position loop gain	Kp	50/60	Position loop proportional gain 1 Position loop proportional gain 2 *1
		Speed loop gain	Kv	51/61	Speed loop proportional gain 1 Speed loop proportional gain 2 *1
			Ki	52/62	Speed loop integral gain 1 Speed loop integral gain 2 *1
		Current loop gain	Kcp	56	Current loop proportional gain
			Kci	57	Current loop integral gain
		Load inertia	Load	59	Load inertia
		Position feedforward	-	68	Position feedforward gain
		Friction compensation	-	300	Friction compensation torque in the CW direction
				301	Friction compensation torque in the CCW direction
				302	Friction compensation viscous friction coefficient
		Filters	-	53/260	Low-pass filter cutoff frequency 1–2
				261	Low-pass filter order 2
				54/63/270/273 /276/279/282	Notch filter center frequency 1–7
				55/64/271/274 /277/280/283	Notch filter attenuation 1–7
				272/275/278 /281/284	Bandwidth of notch filter 3 to 7
		Speed feedforward	-	290	Speed feedforward gain
				291	The number of speed feedforward filters
		Weight compensation		303	Weight compensation torque
		Disturbance observer	-	310	Disturbance observer gain
				311	Disturbance observer LPF cut-off frequency
		Speed stabilizing control	-	320	Speed stabilizing control time estimation
				321	Speed stabilizing control gain 1
				322	Speed stabilizing control gain 2
		Position command Damping filter	-	390	Position command damping filter 1 center frequency
				391	Position command damping filter 1 center attenuation
				392	Position command damping filter 1 width

*1: Switching between Gain 1 (Kp1, Kv1, and Ki1) and Gain 2 (Kp2, Kv2, and Ki2) can be specified by gain switch settings (ID80 to 82).

12. Tuning-Free Function

The tuning-free function is a function of the driver to automatically tune the servo gain. During controlling by position control or speed control, the servo driver estimates the load inertia and friction correction value on a real time basis. With this, the optimum gain tuning is automatically conducted in accordance with the response settings set in advance.

This function is available with the driver software Ver. 6.00 or later..

12.1. Precautions for Use

The tuning-free function may not be correctly conducted in some cases under the following conditions:

- In the case where operation whose speed is less than 120 [rpm] is continued.
- In the case where operation whose acceleration/deceleration speed does not exceed 4000 [rpm/s].
- In the case where the torque at the time of acceleration/deceleration is too small.
- In the case where the load inertial is extremely small or large (not more than twice as much or 20 times as much as or more than the rotor inertia).
- In the case where the load inertia largely fluctuates.
- In the case where a large torque is added during acceleration/deceleration.
- In the case where mechanical rigidity is extremely low.
- In the case where a mechanical play is extremely large.

In the case where tuning is not correctly conducted, change the operating conditions or use auto-tuning by the dedicated application software “Motion Designer Driver,” or conduct manual tuning.

When the tuning-free function is activated, as the following parameters are automatically updated, manual changes in settings are not accepted.
ID59 “load inertia,” “ID50 “position loop proportional gain,” “ID51 “speed loop proportional gain 1,” ID52 “speed loop integration gain 1,” ID60 “position loop proportional gain 2,” ID61 “speed loop proportional gain 2,” ID62 “speed loop integration gain 2,” ID56 “current loop proportional gain,” ID57 “current loop integration gain,” ID68 “position feed forward gain,” ID260 “low-pass filter cutoff frequency 2,” ID261 “low-pass filter order 2,” ID300 “friction compensation torque in the CW direction,” ID301 “friction compensation torque in the CCW direction,” and ID302 “friction correction viscosity friction coefficient.”
If you want to change settings manually, deactivate the tuning-free function.

When the tuning-free function is activated, parameters are automatically saved once in 30 minutes.
If you do not want to have parameters be saved automatically, deactivate the tuning-free function.

12.2. Settings of Tuning-Free Function

In the tuning-free function, the following three parameters are set.

ID360 “tuning-free function mode”

0: tuning-free function is disabled.

1: only load inertia is estimated.
ID59 “load inertia” is automatically estimated and set.

2: load inertia and friction correction values are estimated.
ID59 “load inertia,” ID300 “friction compensation torque in the CW direction,” ID301 “friction compensation torque in the CCW direction,” and ID302 “friction correction viscosity friction coefficient” are automatically estimated and set.

* The parameters for friction correction (ID300 to 302) are not used for controlling unless otherwise Bit 2 of ID256 “special function switching 2” is set to “1.”

ID361 “tuning-free function response setting”

When the tuning-free function is enabled, the targeted servo response is set.

The setting range is 0 to 29 (factory setting 14). The larger the value is, the higher the response tuning becomes. But if the value is set to be too large, oscillation could be caused.

Use it within the scope not to cause oscillation.

ID361 set value	Response speed	Guide for equipment
29	Fast	Mounter bonder
28		
27		
26		Machine tool
25		
24		
23		
22		
21		
20		
19		
18		
17		
16		Articulated robot
15		
14		
13		
12		
11		
10		Belt conveyor
9		
8		
7		
6		
5		
4		
3		
2		
1	Slow	
0		

ID256 “special function switching 2” (Bit 12)

In the case where oscillation is detected when the tuning-free function is enabled, it is possible to set whether the response setting is automatically lowered or not.

●In the case of Bit 12=0 of ID256,

Automatic setting of response setting at the time when oscillation is detection is “Enabled.”

In the case where motor oscillation is detection within 10 minutes after the tuning-free function is enabled for the first time, the value of ID361 “tuning-free function response setting” is automatically lowered.

●In the case of Bit 12=1 of ID256,

Automatic setting of response setting at the time when oscillation is detection is “Disabled.”

Even if motor oscillation is detected, the value of ID361 “tuning-free function response setting” is not changed.

*“The tuning-free function is enabled for the first time” means that ID360 “tuning-free function mode” is changed from “0” to “1” or “2” in the state where ID59 “load inertia” is set to “0.”

In the case where the power is turned on in the state where the tuning-free function is enabled in advance, or in the case where the tuning-free function is enabled in the state where ID59 “load inertia” is set, response setting at the time when oscillation is detected is not automatically set.

■The method of setting in the case where the tuning-free function is used for the first time.

Procedures	Operation		
	ID	Parameter name	Set value/Read value
①	Load inertia is set to “0.”		
	59	Load inertia	0 (g·cm^2)
②	Tuning-free function response setting is set.		
	361	Tuning-free function response setting	[Any value]（0～29） For safety, set lower values initially. For reference, in the case of high rigidity due to ball screws and others, set the value at about 13 to 14, and in the case of low rigidity due to belt driving and others, set the value at about 6 to 10.
③	The tuning-free function mode is selected from the following:		
	360	Tuning-free function mode	1: Only load inertia is estimated. 2: Load inertia and friction correction values are estimated. In the case where the friction correction function is used (“2”), set Bit 2 of ID256 “special function switching” to “1.”
④	Drive by position control or speed control. As for the type of command, use the type that is actually used. As for operation, operate it with the operation patterns pursuant to the aforementioned precautions for use.		

The tuning-free function judges the initial tuning on the following conditions:
Conditions: In the state where the value of ID59 “load inertia” is “0,” ID360 “tuning-free function mode” is changed from “0” to “1” or “2.”
In the case where tuning is judged as the initial tuning, the estimated value of ID59 “load inertia” is changed to high speed first, and the value is leveled with time and changes are reduced.
*Though the value of ID59 “load inertia,” which is immediately updated at the first time, may vary greatly in some cases due to speed at the time of initial operation/acceleration and deceleration speed/friction and others of machine, the value converges to the estimated value while operation is continued for a while.

If you want to change the response setting after of tuning is started, change the value of ID361 “tuning-free function response setting. In the case where the value is increased and oscillation (vibration) is caused, this point is the threshold value.
In the case of Bit 12=”0” of ID256 “special function switching 2,” the function to automatically reduce the value of ID361 “tuning-free function response setting” would work with oscillation detection only if ID360 “tuning-free function mode” is changed from “0” to “1” or “2” for the first time. This function is enabled only for 10 minutes immediately after ID360 “tuning-free function mode” is changed from “0” to “1” or “2.”
When the tuning-free function is enabled, parameters are saved automatically once in 30 minutes.

■The method of setting in the case where tuning is already conducted for 30 minutes or longer.
Tuning is resumed from the value set previously at the time when the power is turned on. Unlike the initial tuning, the estimated value of ID59 “load inertia” is leveled from the start and does not sharply change.

■The method of setting in the case where the load inertia is known in advance.

Procedures	Operation		
	ID	Parameter name	Set value/Read value
①	Load inertia is set.		
	59	Load inertia	[Any value] (g·cm^2)
②	Tuning-free function response setting is set.		

	361	Tuning-free function response setting	[Any value] (0～29) For safety, set lower values initially. For reference, in the case of high rigidity due to ball screws and others, set the value at about 13 to 14, and in the case of low rigidity due to belt driving and others, set the value at about 6 to 10.
③	The tuning-free function mode is selected from the following:		
	360	Tuning-free function mode	1: Only load inertia is estimated. 2: Load inertia and friction correction values are estimated. In the case where the friction correction function is used (“2”), set Bit 2 of ID256 “special function switching 2” to “1.”
④	Drive by position control or speed control. As for the type of command, use the type that is actually used. As for operation, operate it with the operation patterns pursuant to the aforementioned precautions for use.		

In the case where ID360 “tuning-free function mode” changes from “0” to “1” or “2” in the state that the value of ID59 “load inertia” is those other than “0,” the tuning is not judged as the initial tuning. Therefore, the estimated value of ID59 “load inertia” is leveled from the start and does not sharply changes, and it changes gradually from the default value to the estimated value.
*In the case where the value of ID59 “load inertia,” which is set in advance, is not more than 2.5 times as much as the rotor inertia value of combination motor, the value of ID59 “load inertia” is renewed to the value 2.5 times as much as the motor rotor inertia.

● Parameters to be renewed

The tuning-free function renews the following parameters on a real time basis by using load characteristic estimated value in accordance with the setting of ID360 “tuning-free function mode.”

ID360 set value	ID	Parameter name
1 / 2	**59**	Load inertia
2	**300**	Friction correction CW directional torque
2	**301**	Friction correction CCW directional torque
2	**302**	Friction correction viscosity friction coefficient

● Parameters to be set in accordance with response settings

The tuning-free function sets the following parameters in accordance with the set value of ID361 “tuning-free function response setting.”

ID	Parameter name
50	Position loop proportional gain 1
51	Speed loop proportional gain 1
52	Speed loop integration gain 1
260	Low-pass filter cutoff frequency 2
56	Current loop proportional gain
57	Current loop integration gain

● Parameters to be set to fixed values

The tuning-free function sets the following parameters to fixed values.

ID	Parameter name	Set value
68	Position forward gain	30 [%]
261	Low-pass filter order 2	1 [First order]

13. Manual Gain Tuning (Basic)

13.1. Servo Gain

■ Speed loop proportional gain (Kv)

As the load inertia increases, the speed loop response is reduced. For the speed loop proportional gain, the standard setting is determined in proportion to the inertia ratio between the load and motor. Increasing the speed loop proportional gain causes the motor to start vibrating during a run and stop. The value at which this happens is the speed loop proportional gain limit. Set it to approximately 80% of the limit value, keeping in mind variations between equipment.

■ Speed loop integral gain (Ki)

This gain has the effect of increasing the speed loop response. Increasing the speed loop integral gain to a certain amount increases the rigidity of the servo system. However, increasing it too much results in vibration in response.

Also increase the speed loop integral gain if adjusting the speed loop proportional gain fails to reduce overshooting during acceleration/deceleration, if there is significant rotational unevenness, or if you wish to reduce the positioning time. Set it to the highest value within the range that causes no vibration.

■ Position loop proportional gain (Kp)

The position loop proportional gain cannot be increased higher than the speed loop response. Therefore, before adjusting the position loop proportional gain, adjust the speed loop gain.

A greater position loop proportional gain improves the response to a position command. However, increasing it excessively contributes to increasing the overshoot that occurs after rotation has stopped. For equipment with low rigidity, the position loop proportional gain cannot be set to a high value.

■ Optimal servo gain adjustment

Adjust the three basic gains to their highest possible values so that the motor will stop without overshoot or any vibrations when it is stopped during high-speed rotation.

Important

Cautions for servo gain adjustment

The optimal servo gain value varies greatly according to the state of the load. Re-adjustment is required if the load conditions change.

The machine might generate large vibrations during gain adjustment. Therefore, perform gain adjustment in a state allowing rapid servo OFF or power shutdown.

13.2. Setting the Load Inertia

When the rigidity of the load is high, favorable servo performance can be obtained simple by using the inertia estimation function to estmate load inertia.During tuning, the motor repeats the forward-direction (CCW) and reverse-direction (CW) rotations.
It is recommended that when the inertia estimation function is to be used for adjustment, the adjustment be started in a state where each parameter is in the factory setting. Set the parameters in accordance with the following steps.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to inertia estimation mode.																	
	31	Control Mode	5															
(2)	Set the speed loop proportional gain for tuning. For a high load, however, the setting will need to be changed. ⇒ Refer to ❑19.14 "Special Servo Parameters"																	
	145	Speed loop proportional gain	200 (factory setting)															
(3)	Servo ON. Servo ON starts inertia estimation.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(4)	During tuning, the motor rotates for several seconds. Wait for the motor to stop.																	

Performing the above operations estimates the load inertia automatically, setting it in ID59 "Load Inertia."

Caution

In auto tuning, servo ON causes the motor to alternate between forward (CCW) direction rotation and reverse (CW) direction rotation.
Before operating, check that the environment surrounding the motor is safe and then set the servo ON.

To set the load inertia manually, directly set the parameter ID59 "Load Inertia."

ID	Parameter name	Description	Factory setting	Setting range
59	Load Inertia	[g•cm^2]	0	0-50000 (*)

* 0-3000 for software ver. 4.30 or earlier

Supplement **To efficiently make adjustments when the load inertia cannot be estimated, estimate the inertia by using the inertia estimation function and then increase/decrease the setting based on the estimated value.**

13.3. Adjusting the Basic Gains

■ Adjusting the speed loop proportional gain and speed loop integral gain in speed control mode

To adjust servo gain, first use the speed control mode.

Set the parameters by following the procedures below, and then rotate the motor to check the conditions when the motor is stopped.

Supplement **The steps shown in the following table should be performed when Bit 7 "Acceleration limit ON" of ID30 "Servo Command" has been set to OFF. If it is set to ON, set "30000" in ID35 "Deceleration."**

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to speed control.																	
	31	Control Mode	2															
(2)	Servo ON.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(3)	Set the rotation speed to 3000 rpm. Rotate the motor at 3000 rpm.																	
	37	Real-time Command Speed	3000															
(4)	Set the rotation speed to 0 rpm. Monitor the state of the load after rotation has stopped.																	
	37	Real-time Command Speed	0															

○ If the motor overshoots when it stops

Increase the speed loop proportional gain (Kv1). Increasing the speed loop integral gain (Ki1) is also effective.

○ If the motor vibrates when it stops

Slightly reduce the speed loop proportional gain (Kv1) or the speed loop integral gain (Ki1).

Reducing the low-pass filter cutoff frequency (LPF-f) value may deaden vibrations and allow you to increase the speed loop proportional gain (Kv1).

⇒ Refer to ❑13.4 "Filter Adjustment"

Supplement **More reliable gain adjustment can be achieved by adjusting gains while checking servo rigidity by adding a force to the load when the motor is not operating, or by other methods.**

ID	Parameter name	Description	Factory setting	Setting range
51	Kv1	Speed loop proportional gain 1	200	0-2000
52	Ki1	Speed loop integral gain 1	50	0-2000
53	LPF-f	Low-pass Filter Cutoff Frequency (Hz)	Resolver: 600 Other: 1000	0-1000

■ Adjusting the position loop proportional gain (Kp1) in position control mode

After optimal gains have been set in speed control mode, use position control mode to check that there is no vibration after rotation stops. Set the parameters by following the procedures below, and then rotate the motor to check the conditions when the motor is stopped.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to position control.																	
	31	Control Mode	1															
(2)	Reset the current position. Set the current position to "0."																	
	30	Servo Command	0x4000	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
(3)	Servo ON. Servo ON fixes the motor shaft.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(4)	Set the move target position. (Example: When a motor with a 1X resolver is rotated 100 turns in the forward direction)																	
	32	Target Position	204800															
(5)	Set the target speed. Set to 3000 rpm.																	
	33	Target Velocity	3000															
(6)	Set acceleration and deceleration. Set to 10000 rpm/sec.																	
	34	Acceleration (10 rpm/sec)	1000															
	35	Deceleration (10 rpm/sec)	1000															
(7)	Profile ON. Rotation starts. The motor stops at the set position. Monitor the state.																	
	30	Servo Command	0x0003	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
(8)	After the state during the rotation stop has been checked, turn the servo off.																	
	30	Servo Command	0x0000	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Supplement **In profile operation, acceleration are based on the value set in ID34"Acceleration",deceleration are based on the value set in ID35"Deceleration"**

○ If vibration occurs during the rotation stop after a positional move

Reduce the position loop proportional gain (Kp1).

ID	Parameter name	Description	Factory setting	Setting range
50	Kp1	Position loop proportional gain 1		0–799

○ If position excessive deviation (Alarm 42) occurs

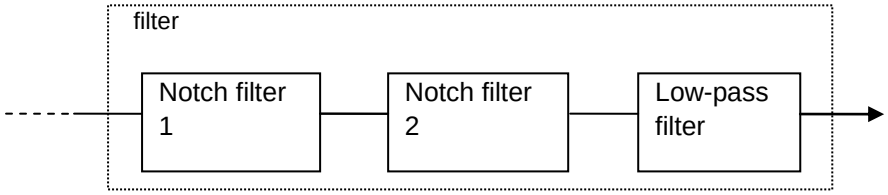
Increase the position loop proportional gain (Kp1).

If the situation does not change, readjust the gain of the load inertia and that of the speed loop.

In addition, increase the value for the ID202 "Position Deviation Error Detection Pulse Count."

13.4. Filter Adjustment

In addition to servo gains, the driver also has a low-pass filter and a notch filter. Adjusting the frequency has the effect of reducing vibrations, which may allow servo gains to be set to greater values.



■ Adjusting the low-pass filter

Inserting the low-pass filter into a current command may reduce vibrations. Setting the cutoff frequency of the filter properly can further improve servo gains. The setting range for the cutoff frequency is usually approximately 100 to 1000 (Hz). Setting "0" disables the low-pass filter.

ID	Parameter name	Description	Factory setting	Setting range
53	LPF-f	Low-pass filter cutoff frequency (Hz)	For resolver: 600 Others: 1000	0–1000

No, 2 low-pass filter is a low-pass filter of IIR type capable of switching from primary to secondary and vice versa. This parameter is automatically set at the time of auto-tuning.

ID	Parameter name	Description	Factory setting	Setting range
260	Low-pass filter cutoff frequency 2	No. 2 low-pass filter cutoff frequency (Hz) 0 or lower and 5001 or higher: low-pass filter 2 disabled 1 to 5000: cutoff frequency set	0	0～5000
261	Low-pass filter order 2	No. 2 low-pass filter order 0: secondary 1: primary	0	0～1

■ Adjusting the notch filter

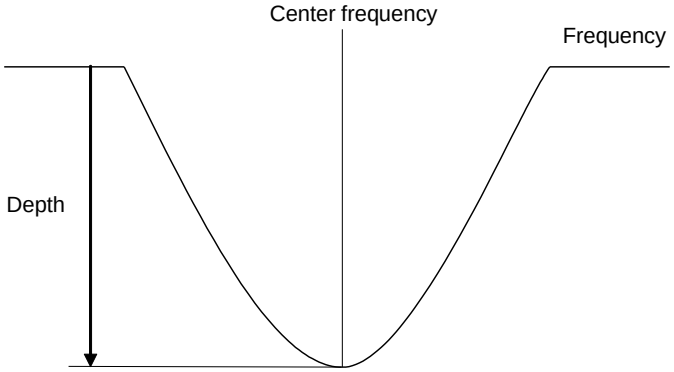
The notch filter attenuates a specific frequency, allowing machine oscillation to be suppressed without reducing the system response.

- Both the center frequency and the magnitude of attenuation of the notch filter can be adjusted.
- Setting the center frequency to “0” or “1000”, or the magnitude of attenuation to "0" disables the notch filter.
- Guide for attenuation level: 30: -3 dB, 50: -5dB, 75: -12dB, 87: -18dB.

Caution

If the magnitude of attenuation is too large, oscillation could be caused. Set the magnitude of attenuation usually at 30 or lower for use.

ID	Parameter name	Description	Factory setting	Setting range
54	NF-f1	Notch filter center frequency 1 (Hz)	0	0-1000
55	NF-d1	Notch filter attenuation 1 (dB)	0	0-1000
63	NF-f2	Notch filter center frequency 2 (Hz)	0	0-1000
64	NF-d2	Notch filter attenuation 2 (dB)	0	0-100



The setting method of the notch filters 3 to 7 is different from that of the notch filters 1 to 2.
・The center frequency, magnitude of attenuation and width of the notch filer can be adjusted respectively.
・Setting the center frequency to “0” or “5001” disables the notch filter.
・Guide for magnitude of attenuation: 100: 0dB, 70: -3dB, 40: -8dB, 20: -15dB, 0: -20dB, 0: -75dB.

ID	Description	Factory setting	Setting range
270/273/276/279/282	Center frequency of notch filter 3 to 7 (Hz)	0	0～5000
271/274/277/280/283	Magnitude of attenuation of notch filter 3 to 7 (dB)	0	0～100
272/275/278/281/284	Width of notch filter 3 to 7 (Hz)	50	1～100

注意

Do not set Center frequency of notch filter to less than 50 Hz. Motor runaway and vibration may occur. With driver software version 5.03 or later, settings below 50 Hz are automatically set to 50 Hz.

13.5. Confirming the Set Gains

Perform the following steps to check whether or not the set value is appropriate.Set the parameters (data IDs) by following the procedures below.Evaluate the setting by monitoring the state of the load when the motor has stopped following high-speed rotation.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to speed control.																	
	31	Control Mode	2															
(2)	Servo ON.																	
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(3)	Set the rotation speed to 3000 rpm. Rotate the motor at 3000 rpm.																	
	37	Real-time Command Speed	3000															
(4)	Set the rotation speed to 0 rpm. Monitor the state of the load after rotation has stopped.																	
	37	Real-time Command Speed	0															

■ **Monitoring the load state after the motor is stopped from high-speed rotation**

If there is no overshoot (stoppage after the target has been passed) or vibration after the motor has been stopped when running at high-speed rotation, the load inertia has been successfully adjusted. If overshoot and vibration persist,set the load inertia to a value at which less overshoot and vibration occur,and adjust the servo gains as described in the next chapter.

13.6. Gain-switch Function

In cases such as when the equipment is loose (backlash) or experiences vibrations during a rotation stop, using the gain-switch function may enable stabilization to be achieved more quickly.
By setting ID80 "Gain-Switch Method Select" to specify how to switch between Gain 1 (Kp1, Kv1, and Ki1) and Gain 2 (Kp2, Kv2, and Ki2), control performance can be improved.

■ Gain 1

ID	Parameter name	Description
50	Kp1	Position loop proportional gain 1
51	Kv1	Speed loop proportional gain 1
52	Ki1	Speed loop integral gain 1

■ Gain 2

ID	Parameter name	Description
60	Kp2	Position loop proportional gain 2
61	Kv2	Speed loop proportional gain 2
62	Ki2	Speed loop integral gain 2

■ Gain-switch method select

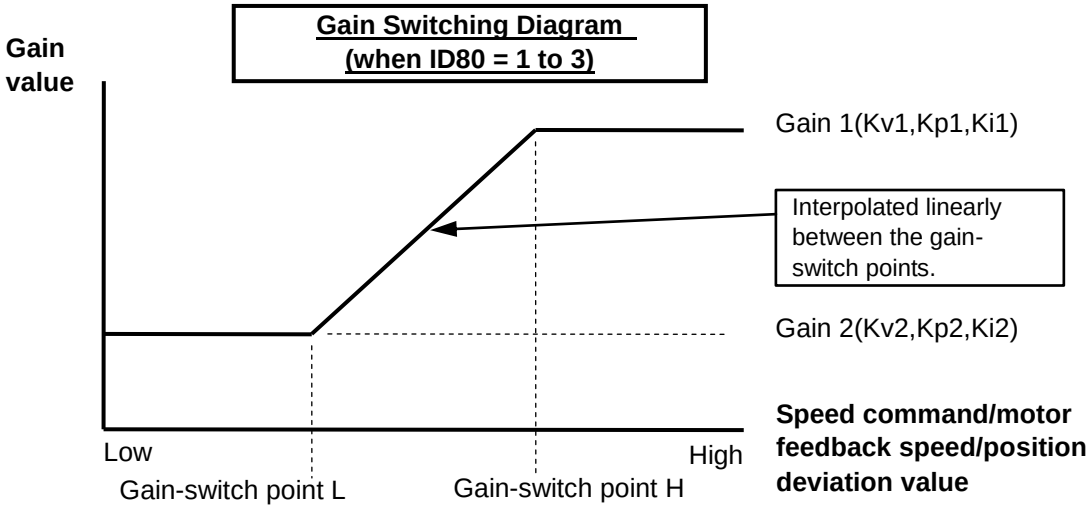
ID	Parameter name	Setting value	Description
80	Select Gain-switch Method	0	No switching (fixed to gain 1)
		1	Automatically switched by speed command
		2	Automatically switched by motor feedback speed
		3	Automatically switched by position deviation value
		4	Switched by I/O input command
		5	Switched by Bit 11 of ID30 "Servo Command"
		6	Switched when motor stopping command is continued for the specified time or longer
		7	Switched when motor stopping command is continued for the specified time or longer with a current command lower than or equal to the specified value
		9	No switching (fixed to gain 2)

The factory setting is "0."

■ Gain-switch point

The gain-switch point is enabled when ID80 "Gain-Switch Method Select" is 1 to 3. Switchover to Gain 1 takes place when the speed or deviation exceeds the gain-switch point H, and switchover to Gain 2 takes place when it falls below the gain-switch point L. Switchover takes place smoothly between the two points while interpolating between Gains 1 and 2.

ID	Parameter name	Description	Factory setting	Setting range
81	GainChangePoint_H	Gain-switch point H [rpm] or [pulse] Set in units of rpm if ID80 "Gain-Switch Method Select" is set to 1 or 2 and in units of pulses if it is set to 3.	100	0-32767
82	GainChangePoint_L	Gain-switch point L [rpm] or [pulse] Set in units of rpm if ID80 "Gain-Switch Method Select" is set to 1 or 2 and in units of pulses if it is set to 3.	50	0-32767



Speed command/motor feedback speed/position deviation value	Gain used
Gain-switch point: H or more	Gain 1
Gain-switch point: Between H and L	Value linearly interpolated
Gain-switch point: L or less	Gain 2

■ Switching gains by "Servo Command"

When it is necessary to switch gain by the Bit 11 "second gain switch" of ID30 "Servo Command," the ID80 "Gain-Switch Method Select" needs to be set to "5" in advance.

ID	Parameter name	Setting value	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	0×0800	*	*	*	*	1	*	*	*	*	*	*	*	*	*	*	*

ON (1) : Gain 2
OFF (0) : Gain 1

■ Switching gains in response to motor rotation/stop

When ID80 "Gain-Switch Method Select" is set at 6 or 7, gain is switched in response to the rotation/stop of the motor. Note that the descriptions for ID81 and ID82 are different from those that ordinarily apply.

ID	Description
81	Stop Speed Judgment Time [msec] Gain is switched when the motor stopping command (position control: no change in command value; speed control: speed 0 command) is continued for the set value of time or longer.
82	Stop Speed Judgment Current Command [0.01 A] (only when ID80 = 7) Gain is switched when the current command is the set value or lower in addition to the judgment from Stop Command Time.

■Speed limit switching

By setting Bit 11 “speed limit switching” of ID256 “special function switching 2” to “1,” the speed limit can also be changed at the time of gain switch.

When ID80 “gain switch method select” is set to between 1 and 3, in the case of gain-switch point of H or higher, the speed limit changes to ID88 “speed limit,” and in the case of gain-switch point of L or lower, the speed limit changes to ID89 “speed limit 2, and at the midpoint, the speed limit is interpolated by speed limit 1 and speed limit 2 and changes smoothly.

13.7. Saving Parameters

After parameter setting has been completed, the new parameters need to be saved to nonvolatile memory. Turning off the driver without saving them to nonvolatile memory will result in the set values being erased. This section describes how to save set values to nonvolatile memory.

1. To use pulse or analog input for position, speed, and torque commands, pre-set the control method in ID74 "Position Command Select," ID75 "Speed Command Select," and ID76 "Torque Command Select."
2. Perform the following steps to save parameters:

Step	Operation		
	ID	Parameter name	Setting value
(1)	Save parameters to nonvolatile memory.		
	17	Parameters save	1

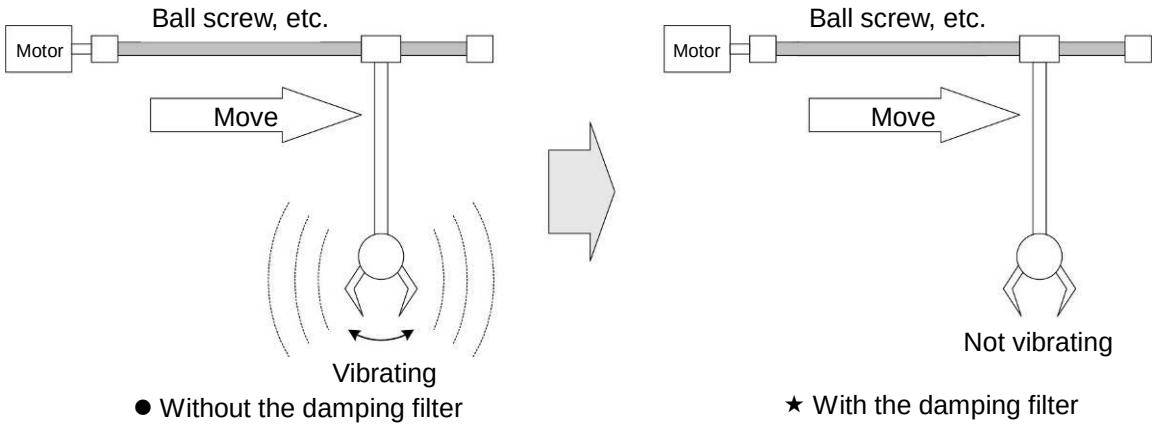
Those parameters whose "M" column field is marked with ○ in ❑19 "List of Parameters" are saved to the nonvolatile memory by this operation. Usually you should store parameters with the servo OFF. After the parameter storing has been completed, the value returns to "0."

14. Manual Gain Tuning (Advanced)

This chapter assumes the use of the dedicated application "Motion Designer Drive."
"Motion Adjuster" does not support the monitoring function and automatic settings.

14.1. Position Command Damping Filter

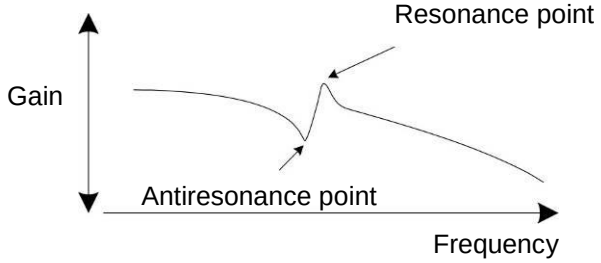
The position command damping filter suppresses vibrations at the tip of the device during position control.
It is effective for relatively low frequencies at about 1 to 100 Hz.



This function is available with the driver software Ver. 4.61 or later.

This function can be used only in the position control mode with the fine rotation axis, regardless of the type of command: profile operation, position command via communication, and pulse input.

The position command damping filter suppresses vibrations by removing the device's vibration frequency component from the position command.
The frequency to be set for filtering can be measured by using the frequency sweep function provided by "Motion Designer Drive."
When the frequency analysis screen is displayed by the frequency sweep function, find a point where the gain drops (Antiresonance point), and set the frequency at the point to ID390 "Position Command Damping Filter 1 Center Frequency."
It may be more effective to set a value that is 5 to 10% lower than the frequency at the antiresonance point obtained from an actual measurement.



Note that, under any of the following conditions, the filter cannot produce the damping effect and requires adjustment in a different way.

(1) When the vibration frequency is 100 Hz or higher
→ Try the notch filter.
(2) When vibration is caused by an external force
→ Increase the gain or try the disturbance observer.
(3) When the load is heavy and the torque (current) is saturated for a long time during movement
→ Adjust the acceleration or deceleration for example, by using the smoothing function.

■ Method for setting the position command damping filter

Step	Operation		
	ID	**Parameter name**	**Setting/read value**
(1)	Measure the frequency characteristic of the device by using the frequency sweep function provided by Motion Designer Drive.		
(2)	Set the center frequency of the damping filter.		
	390	Position Command Damping Filter 1 Center Frequency	Arbitrary (0.1 Hz) Set a value in the range of 10 to 1000. Set a value that is about 5 to 10% lower than the frequency at the antiresonance point obtained from an actual measurement.
(3)	Set the attenuation as needed.		
	391	Position Command Damping Filter 1 Attenuation	Arbitrary Usually, keep the default value (0). Rough standard for attenuation: 70 = -3 dB, 20 = -15 dB, 10 = -20 dB, 0 = -75 dB
(4)	Set the width as needed.		
	392	Position Command Damping Filter 1 Width	Arbitrary Usually, keep the default value (50). As this setting value becomes smaller, the attenuated frequency range becomes narrower and steeper.

14.2. Speed Stabilization Control

By using the speed stabilization control, it is possible to improve the accuracy of speed calculation and reduce harmful speed ripples due to calculation errors.
This enables high gain (high rigidity) adjustment even for sensors with relatively low resolution.
This control also has the effect of reducing noise unique to analog sensors such as resolvers.

This function can be used only in the position control mode with the finite rotation axis.
Do not use this function for operation in speed or current control mode.
This function uses the value of parameter ID59 "Load Inertia" and must not be used for a system in which the load inertia is unknown or varies significantly.

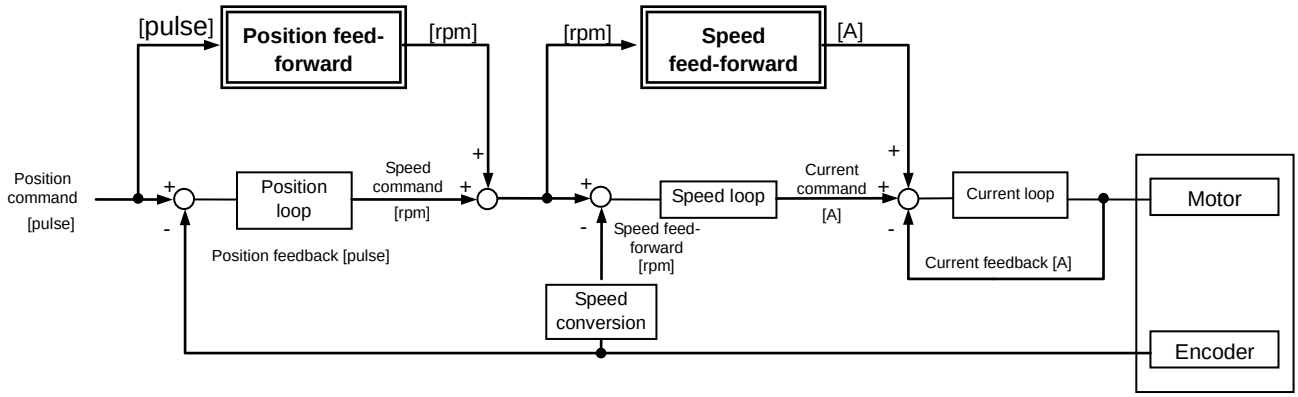
This function is automatically set by auto tuning by "Motion Designer Drive."
Selecting "Enable speed stabilization control" during auto tuning sets the optimum value for the type and resolution of the sensor and the load inertia.

The following parameters are changed by automatic setting:

- Bit 4 of ID257 "Observer Switch"
- ID320 "Speed Stabilization Control Estimated Time"
- ID321 "Speed Stabilization Control Gain 1"
- ID322 "Speed Stabilization Control Gain 2"

14.3. Feed-forward Functions

"Position Feed-forward" and "Speed Feed-forward" functions are available as functions for hastening responses to commands.
The position feed-forward function adds a theoretical speed command calculated from a position command to a speed command directly without the position loop, and has the effect of reducing position deviations.
The speed feed-forward function adds the theoretical current command calculated from a speed command and the inertia to a current command directly without the speed loop, and has the effect of reducing speed deviations.



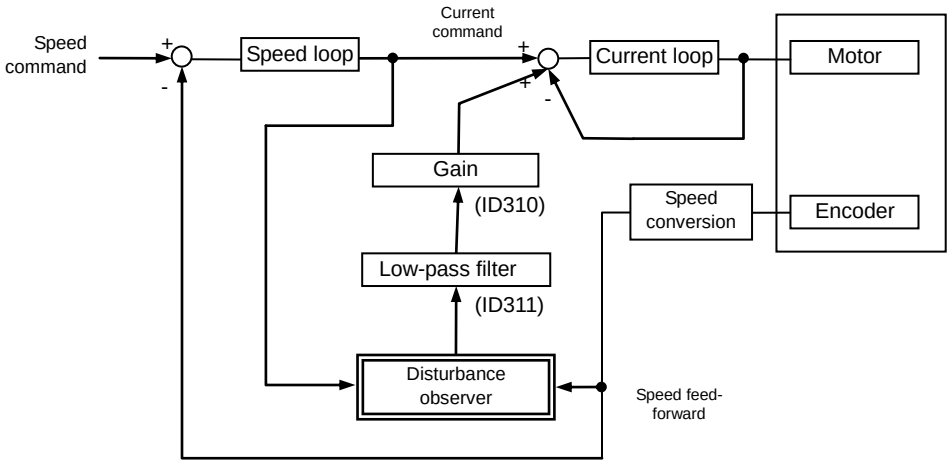
Set ID68 "Position Feed-forward Gain" to hasten position responses, and set ID290 "Speed Feed-forward Gain" to hasten speed responses.
Both gains are to be set in percentage [%]. Set 0 [%] to disable the feed-forward function(s), or set 100 [%] for 100% feed-forward commands or namely for the theoretical zero-deviation control.

The speed feed-forward gain can be set not only up to 100% but also up to 500%.
In addition, the speed feed-forward can be filtered by averaging according to the setting of ID291 "Speed Feed-forward Filter Number." It may be better to set the filter for example, when analog speed commands are significantly affected by noise.
The speed command acceleration calculation cycle can be set at Bit 3-0 of ID291 "Speed Feed-forward Filter Number", and the averaged number of speed feed-forward commands can be set at Bit 7-4 thereof.

Increasing the feed-forward gain improves the responsiveness and decreases the deviation, but increasing it excessively may result in problems such as large overshoot and vibration (oscillation) from effects due to disturbances and the device rigidity. When setting the feed-forward functions, increase their gains gradually from 0 [%] after making the usual gain adjustment.

14.4. Disturbance Observer

The disturbance observer is a control function that estimates the disturbance torque from a current command and a speed feedback and corrects the current command to negate the disturbance torque. This function can improve the motor shaft response performance to external disturbances.
The disturbance observer can also be used to hasten speed responses while keeping the speed loop gain low, and as such it can be expected to produce a damping effect.



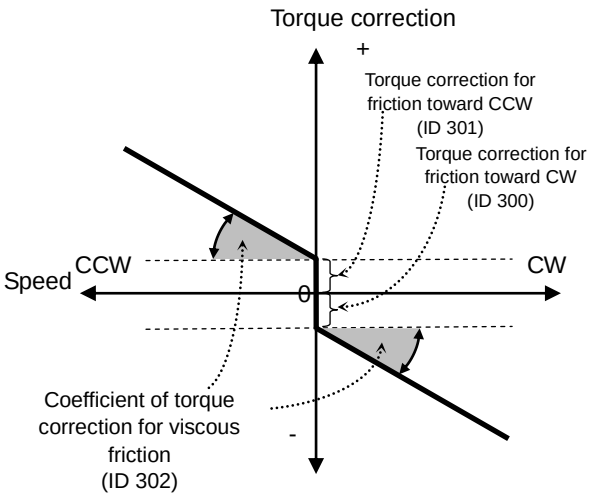
Set Bit 0 of ID257 "Observer Switch" to "1" to enable the disturbance observer.
Set the intensity of the disturbance observer in ID310 "Disturbance Observer Gain." The unit is [%] and the intensity is set until 500%.
The intensity is to be set at percentage [%] and can be set to up to 500%.
When there is an annoying sound due to noise and other harmonic components, setting ID311 "Disturbance Observer LPF Frequency" can remove frequency components above the setting value.

■ Method for setting the disturbance observer

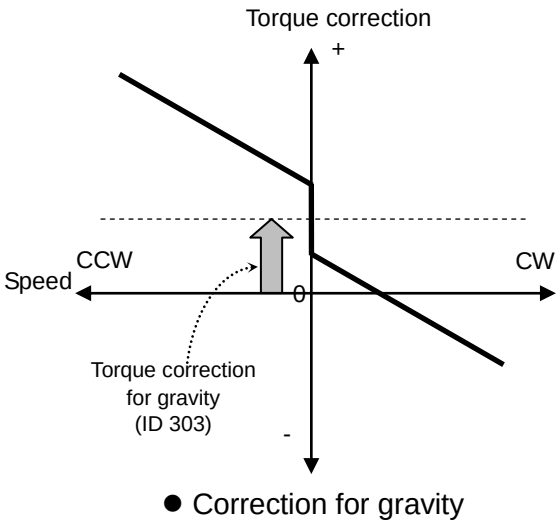
<table>
<tr><th rowspan="2">Step</th><th colspan="18">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th colspan="16">Setting/read value</th></tr>
<tr><td rowspan="3">(1)</td><td colspan="18">Enable the disturbance observer.</td></tr>
<tr><td rowspan="2">257</td><td rowspan="2">Observer Switch</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>*</td><td>1</td></tr>
<tr><td rowspan="2">(2)</td><td colspan="18">Gradually increase the disturbance observer gain.</td></tr>
<tr><td>310</td><td>Disturbance Observer Gain</td><td colspan="16">Arbitrary (%)
Set a value in the range of 1 to 500.</td></tr>
<tr><td rowspan="2">(3)</td><td colspan="18">Adjust the disturbance observer LPF frequency as needed.</td></tr>
<tr><td>311</td><td>Disturbance Observer LPF Frequency</td><td colspan="16">Arbitrary (Hz)
Set a value in the range of 1 to 3000.</td></tr>
<tr><td colspan="20">・ As the disturbance observer gain becomes higher, the responsiveness to disturbances increases. However, when the disturbance observer gain is too high, it may cause problems, such as a loud driving sound and oscillation.
・ Decreasing the disturbance observer LPF frequency lowers the responsiveness performance, but may render the effect of reducing the driving sound.</td></tr>
</table>

14.5. Correction for Friction and Gravity

Correcting for friction and gravity cancels friction and gravity torques to reduce delay in response to torque fluctuations by including the current corresponding to the torque components associated with friction and own weight of a device in the current command.
The function is particularly effective for addressing quadrant protrusion experienced by precision machines.
Correction can be made with torques from static friction, viscous friction, and gravity.



● For static and viscous friction



● Correction for gravity

Corrections for friction and gravity are illustrated in the figures above.

Correction for friction is enabled by assigning "1" for Bit 2 in ID 256 "Special Function Switching 2."
Correction for friction is enabled by assigning "1" for Bit 3 in ID 256 "Special Function Switching 2."

When correction for friction is enabled, the current corresponding to ID 300 "Friction Compensation Torque in the CW Direction" [0.01 A] is deducted from the torque command when the motor shaft rotates CW.
In contrast, the current corresponding to ID 301 "Friction Compensation Torque in the CCW Direction" [0.01 A] is added to the torque command when the shaft rotates CCW.
Torques from friction components are cancelled in this manner.
Note that the value of 0 for ID 302 "Friction Compensation Viscous Friction Coefficient" brings the slope in the above figure to nil. In this case, the correction is performed only for static friction, which fact makes the friction correction constant regardless of the speed.
When any value is assigned for ID 302 "Friction Compensation Viscous Friction Coefficient," the friction correction grows larger in proportion to the speed increase. The greater the assigned value, the steeper the slope becomes for the friction correction. Viscous friction can be cancelled when the slope coincides with the characteristic of a device.

Assign a value to ID 303 "Weight Compensation Torque" [0.01A] in order to add gravity correction torque for a vertical shift by the amount of correction. The correction is made in the positive direction when a positive value is assigned, and the negative direction when a negative value is assigned.
Torques corresponding to gravity can be cancelled in this manner. A positive assigned value indicates that CW is directed upward.

14.5.1. Auto-configuration

Auto-configuration can be made with ID 300 "Friction Compensation Torque in the CW Direction," ID 301 "Friction Compensation Torque in the CCW Direction," and ID 303 "Weight Compensation Torque."
Note that auto-configuration is not possible with ID 302 "Friction Compensation Viscous Friction Coefficient." It must be manually configured.

<table>
<tr><th rowspan="2">Step</th><th colspan="19">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th colspan="17">Setting/read value</th></tr>
<tr><td rowspan="2">(1)</td><td colspan="19">Choose torque estimation mode for making a correction for friction.</td></tr>
<tr><td>31</td><td>Control mode</td><td colspan="16">6</td></tr>
<tr><td rowspan="3">(2)</td><td colspan="19">Servo On: Once the servo is turned on, the motor shaft makes four round trips at around 3 rpm at 2-second intervals.</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Servo command</td><td rowspan="2">0x0001</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>(3)</td><td colspan="19">Auto-configuration is completed in about 20 seconds.
Once auto-configuration is complete, the motor shaft stops at 0 rpm.</td></tr>
<tr><td>(4)</td><td colspan="19">Once auto-configuration is complete, values are assigned to ID 300, ID 301, and ID 303.</td></tr>
<tr><td rowspan="3">(5)</td><td colspan="19">Servo Off: Turn off the servo and go back to the original control mode.</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Servo command</td><td rowspan="2">0x0000</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
</table>

Automatically assigned values for correction for static friction and gravity may include nonuniformities and errors in measurements depending on the stiffness and backlash of your device in some cases.
If an errors is a problem for you, fine tune the settings manually after the auto-configuration.
Note that auto-configuration is not possible with ID 302 "Friction Compensation Viscous Friction Coefficient." It must be manually configured. ⇒Refer to ❑14.5.2 "Manual Configuration"
In order to use a set parameter for correction, "1" must be assigned to Bit 2 and Bit 3 in ID 256 "Special Function Switching 2."

14.5.2. Manual Configuration

Caution

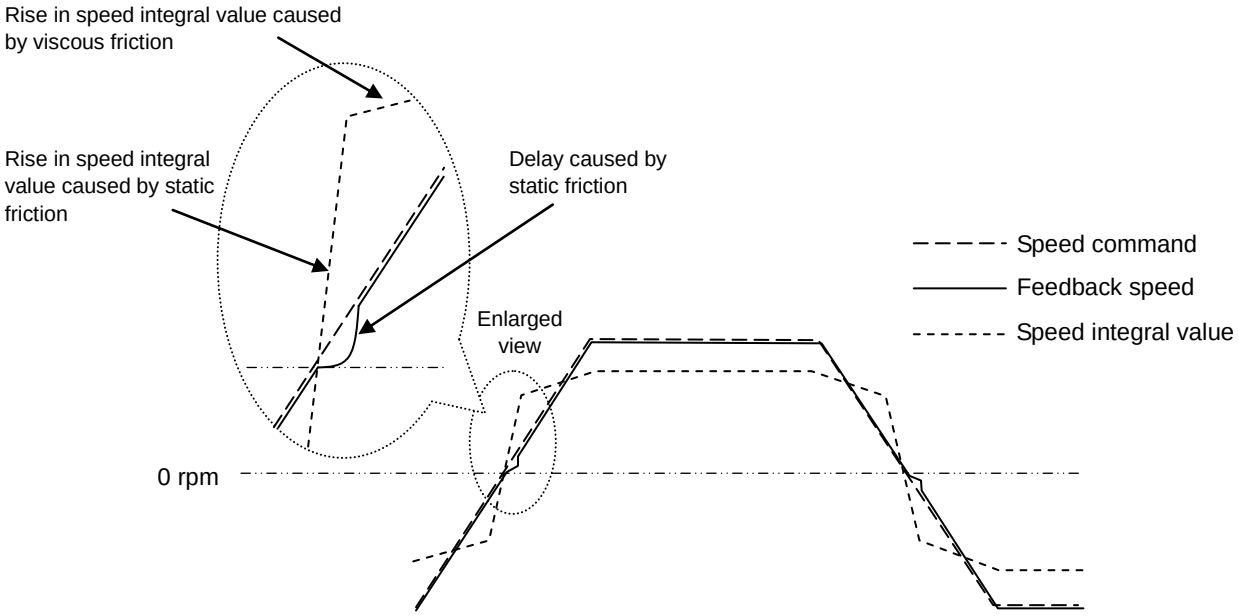
- Assignment of a value far beyond the optimal value may make the motor uncontrollable or cause large vibrations. Gradually assign larger values while ensuring safety in the surrounding area.
- During manual configuration, a shaft being adjusted may suddenly stop or start oscillating. Leave a sufficient margin of movable range to make an adjustment.

- Friction correction

First, make an ordinary gain adjustment and drive the target device under typical operating conditions.
Then, use the digital oscilloscope function in Motion Designer Drive to display the waveforms for adjustment of "instantaneous speed" (= feedback speed) by type of speed log in the log setting, Parameter ID 462 "Internal Speed Command Monitor 2" (= speed command), and ID 470 "Speed Integration Monitor" (Speed integral value).

A considerably large value assigned for the gain makes it difficult to identify spots affected by friction just by observing the feedback speed waveform. Additional observation of the speed integral value facilitates discrimination of such subtle impacts.

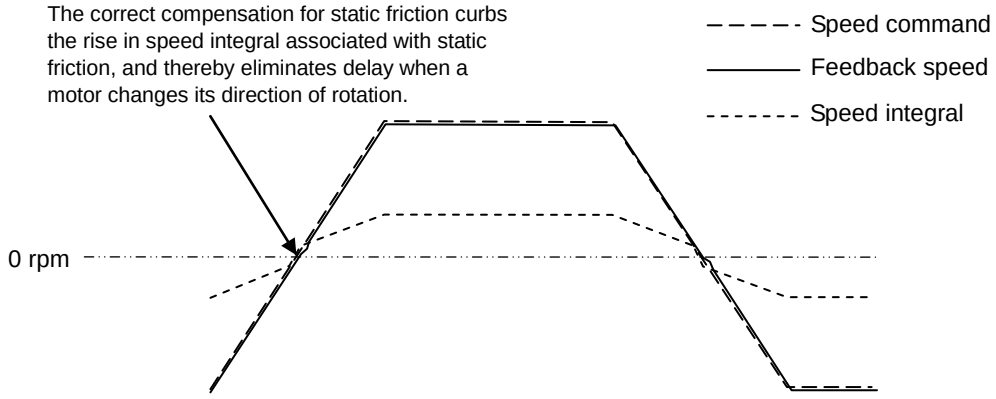
The figure below presents a digital oscilloscope waveform when a trapezoidal speed command was given around 0 rpm without correcting for friction.



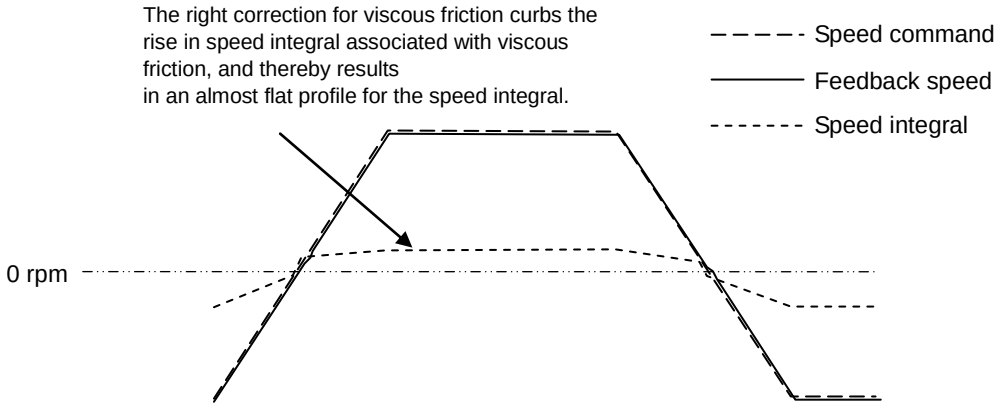
Without correction for friction, the feedback speed lags behind the speed command during sign transition (change in the direction of motor rotation).
In this event, the speed integral value steeply rises in order to compensate for the change in static friction torque.
The motor speed catches up with the command speed when the speed integral value increases. Given that a faster speed results in a greater torque associated with viscous friction, the speed integral value continues to rise proportionately to the speed.

In order to perform correction for friction, enable the function by assigning "1" to Bit 2 in ID 256 "Special Function Switching 2."
Then, gradually increase the assigned values for ID 300 "Friction Compensation Torque in the CW Direction" [0.01 A] and ID 301 "Friction Compensation Torque in the CCW Direction" [0.01 A] to curb the rise in speed integral associated with static friction. Adjust to bring this rise in speed integral close to 0.

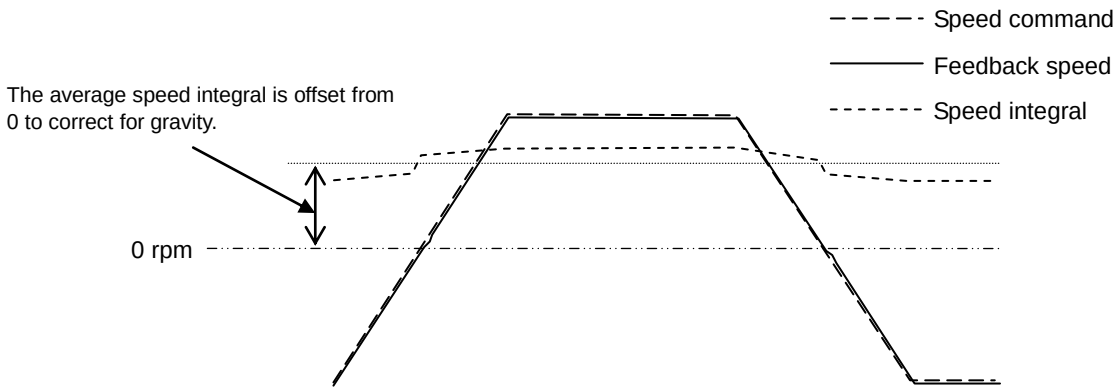
Assignment of an excessively large value leads the sign transition of speed integral value. In order to avoid such over-compensation, assign a smaller value.



Next, gradually increase the assigned value for ID 302 "Friction Compensation Torque in the CCW Direction" to curb the rise in speed integral caused by viscous friction. Adjust to bring the rise in speed integral close to 0.
Assigning an excessively large value leads the sign transition of the speed integral value. In order to avoid such over-compensation, assign a smaller value.



- Correction for gravity
  Vertical shafts and other shafts subject to effects from gravity constantly generate torque to compete with and overcome gravity.
  In the same way as manual configuration of correction for friction, a waveform displayed with the digital oscilloscope function of Motion Designer Drive offsets the impact from gravity from the speed integral of 0.



In order to perform correction for gravity, enable the function by assigning "1" to Bit 3 of ID 256 "Special Function Switching 2."
Correction for gravity is made when a value is assigned to ID 303 "Weight Compensation Torque" [0.01 A] to shift the speed integral upward or downward.
Increase an assigned value in the positive direction when CW is directed upward. Increase an assigned value in the negative direction wen CCW is directed upward.
Once the center of speed integral is adjusted to 0, the gravity torque is cancelled out.

15. Operation

15.1. Position Control Mode

Operations in position control mode are divided into three control types.

1. Profile Operation

In this operation type, the driver calculates trapezoidal-path movement patterns based on the target position, target speed, acceleration, deceleration, and other settings. This method allows easy operation because the host controller does not need to calculate operation patterns. However, this method cannot be used for complex movements other than trapezoid-path movement patterns.

2. Real-Time Position Command (SV-NET)

In this operation type, the SV-NET controller constantly sends position commands so that the driver can operate following those position commands. The SV-NET controller controls the driver by continuously sending a position command at specified time intervals. The motor operates at a constant speed if the amounts of change in command values are constant; it accelerates or decelerates if they are not constant. The real-time position command method allows fast and complex movements, but to control the motor steplessly and smoothly, the SV-NET controller needs to perform somewhat advanced calculations.

3. Command Pulse Input

In this operation type, the driver operates according to a position command pulse signal that is input from the I/O connector. This operation type is mainly used when the host controller serves as a sequencer or similar means to control the driver by way of pulse signals.

This section describes the general operational procedures for these operation types.

To run in profile operation

<table>
<tr><th rowspan="2">Step</th><th colspan="4">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th colspan="2">Setting/read value</th></tr>
<tr><td rowspan="2">(1)</td><td colspan="4">Set Position Command Select to communication command.</td></tr>
<tr><td>74</td><td>Position Command Select</td><td colspan="2">0×00</td></tr>
<tr><td rowspan="2">(2)</td><td colspan="4">Set the control mode to position control.</td></tr>
<tr><td>31</td><td>Control Mode</td><td colspan="2">1</td></tr>
<tr><td rowspan="3">(3)</td><td colspan="4">Set to servo ON (ID30; Bit 0: ON). Servo ON fixes the motor shaft.</td></tr>
<tr><td>30</td><td>Servo Command</td><td>0x0001</td><td>B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1</td></tr>
<tr><td rowspan="2">(4)</td><td colspan="4">Read the current position.</td></tr>
<tr><td>40</td><td>Feedback Position</td><td colspan="2">Current position (pulse)</td></tr>
<tr><td rowspan="6">(5)</td><td colspan="4">Set the target position.</td></tr>
<tr><td>32</td><td>Target Position</td><td colspan="2">Current position + Move distance (pulse)</td></tr>
<tr><td colspan="4">Set the target speed.</td></tr>
<tr><td>33</td><td>Target Velocity</td><td colspan="2">Arbitrary (rpm)</td></tr>
<tr><td colspan="4">Set acceleration and deceleration.</td></tr>
<tr><td>34</td><td>Acceleration</td><td colspan="2">Arbitrary (10 rpm/sec)</td></tr>
<tr><td></td><td>35</td><td>Deceleration</td><td colspan="2">Arbitrary (10 rpm/sec)</td></tr>
<tr><td rowspan="3">(6)</td><td colspan="4">Set Profile Operation Enabled to ON (ID30; Bit 1: ON). Move starts.</td></tr>
<tr><td>30</td><td>Servo Command</td><td>0x0003</td><td>B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 1</td></tr>
<tr><td>(7)</td><td colspan="4">Regardless of whether or not the motor is running, the target position, target speed, acceleration, and deceleration can be changed. If these values are changed, the new values are reflected immediately whether the motor is in operation or not. However, if the target position is changed to a closer position during deceleration to cause a gap between the stop position after deceleration and the target position, the motor decelerates to stop, and then goes back to the target position.</td></tr>
<tr><td rowspan="2">(8)</td><td colspan="4">While profile operation is enabled, Bit1 "During profile operation" of ID20 is ON. Entering the stop position range sets Bit2 "In Position" of ID20 to ON.
If Bit 1 of ID69 "Control switch" is set to 1, Bit 1 of ID30 and Bit 1 of ID20 are automatically set to OFF after a single profile operation, which ends profile operation.</td></tr>
<tr><td>20</td><td>Servo Status</td><td colspan="2">B31 B30 ------ B4 B3 B2 B1 B0
* * - - - - - - * * 1 1 1</td></tr>
</table>

To run with real-time position commands

Step	Description																
	ID	Parameter name	Setting/read value														
(1)	Set Position Command Select to communication command.																
	74	Position Command Select	0x00														
(2)	Set the control mode to position control.																
	31	Control Mode	1														
(3)	Set to servo ON (ID30; Bit 0: ON). Servo ON fixes the motor shaft.																
	30	Servo Command	0x0001	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
(4)	Check the current position.																
	40	Feedback Position	Current position (pulse)														
(5)	Set the real-time position command.																
	36	Real-time Command Position	Current position + Move distance (pulse)														
(6)	Repeatedly input ID36 "Real-time Command Position." In this case, the SV-NET controller controls speed, acceleration, and deceleration.																

To run with a pulse command from the I/O connector

Step	Description		
	ID	Parameter name	Setting/read value
(1)	Set position command select to pulse input.		
	74	Position Command Select	0x01
(2)	Set the pulse input type (for details, refer to the next page).		
	120	Pulse Input Mode	Bit 0 = 0: Forward/reverse pulse Bit 0 = 1: Pulse/rotation direction The polarity is reversed when Bit 7 is 1.
(3)	Set the control mode to position control.		
	31	Control Mode	1
(4)	Parameter save. Store the pulse input setting.		
	17	Parameters save	1
(5)	Restart the power supply (after changing and saving the pulse input setting parameter, restart the power supply).		
(6)	Turn on the IN5 (input 5: deviation reset input) signal. The deviation counter is reset.		
(7)	Turn on the IN1 (input 1: servo ON input) signal. Servo ON fixes the motor shaft.		
(8)	Rotation starts when pulses selected in ID120 "Pulse Input Mode" are input through the I/O connector. In this case, speed, acceleration, and deceleration are controlled by a host system that generates the pulses.		

15.1.1. Pulse Input Signal Types

ID	Parameter name	Setting value
120	Pulse Input Mode	0: Forward /reverse pulse 1: Pulse/rotation direction 2: 90°-phase-difference two-phase pulse mode The polarity is reversed when Bit 7 is 1.

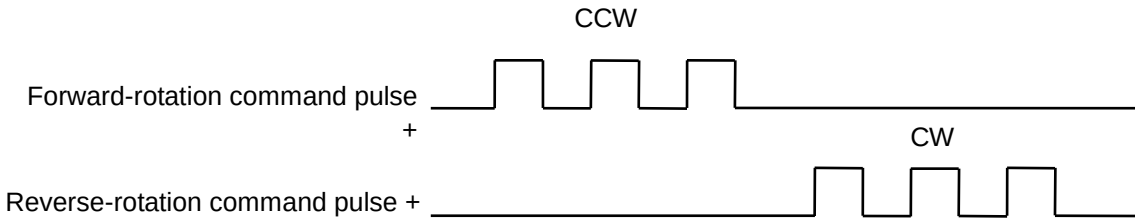
When the motor is operated by using the pulse input from the I/O connector as the position command signal, a pulse input signal type can be selected from between two types by setting "Pulse Input Signal Mode Select." This section describes the two pulse input signal types on the assumption that ID72 "Reference Direction" is set to "0," or its factory setting (forward direction (CCW)).

Forward rotation pulse/reverse rotation pulse

- I/O connector input pin

Pin No.	Function	Description
15,16	Pulse input 1	Forward-rotation command pulse +
17		Forward-rotation command pulse -
19,20	Pulse input 2	Reverse-rotation command pulse +
21		Reverse-rotation command pulse -

- Pulse input type

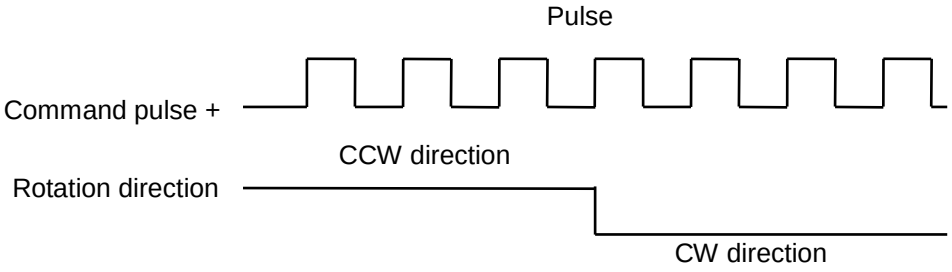


Pulse/rotation direction

- I/O connector input pin

Pin No.	Function	Description
15,16	Pulse input 1	Command pulse +
17		Command pulse -
19,20	Pulse input 2	Rotation direction +
21		Rotation direction -

- Pulse input type

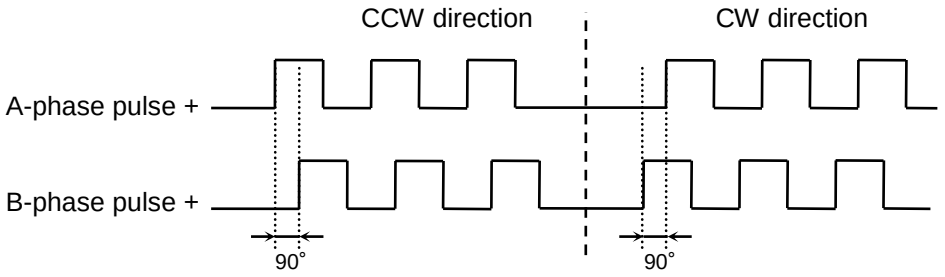


90°-phase-difference two-phase pulse mode

- I/O connector input pin

Pin No.	Function	Description
15,16	Pulse input 1	A-phase pulse +
17		A-phase pulse -
19,20	Pulse input 2	B-phase pulse +
21		B-phase pulse -

- Pulse input type



- The direction is forward when the A-phase pulse leads by 90°. The direction is reverse when the B-phase pulse leads by 90°.
- Pulses are counted at each edge.

15.1.2. Pulse Command Software Filter Function

ID	Parameter name	Setting value
120	Pulse Input Mode	Bit 5 and Bit 4: Pulse command software filter 00: No filter 01: 500 kHz (allowable frequency) 10: 250 kHz (allowable frequency) 11: 125 kHz (allowable frequency)

This function can set a filter for pulse commands, that acts as a lowpass filter for the set frequency.

15.1.3. Setting the Pulse Input Signal Resolution (Setting the Electronic Gear)

ID	Parameter name	Factory setting	Setting range
121	Pulse Input Signal Resolution: numerator (N)	2048	1-1073741825
122	Pulse Input Signal Resolution: denominator (M)	1	1-16384

Factory setting: 2048 pulses

In operation using pulse input for position control, the resolution of pulse input signals (the rotation angle of the motor shaft per pulse of input command from a higher-level device) can be arbitrarily set by changing the data of "ID121" and "ID122" (electronic gear). The pulse command resolution corresponding to one turn is given by the following expression.

$$\text{Pulse command resolution corresponding to one turn} = \frac{\text{Numerator of pulse input signal resolution}}{\text{Denominator of pulse input signal resolution}} = \frac{N}{M}$$

Example) When ID121 = 20480 and ID122 = 5, the motor shaft rotates by five turns for 20480 pulses.

Important

Under normal circumstances, set the pulse command resolution to equal to or less than the position control resolution of the driver. (The position resolution differs depending on the motor sensors) ⇒ Refer to ❑1.2. "Specifications."

Important

ID 121/ID 122 "Pulse Input Signal Resolution: numerator/denominator" are enabled when ID 74 "Position Command Select" is set to "1" for pulse input. This is not reflected in the position commands sent from SV-NET.

Important

Make an appropriate setting so that the value of [ID122 × sensor resolution] will be 0x70000000 or lower.

Important

Whenever ID121/ID122 is changed, make sure to backup data and restart the power supply.

15.1.4. Deviation Reset

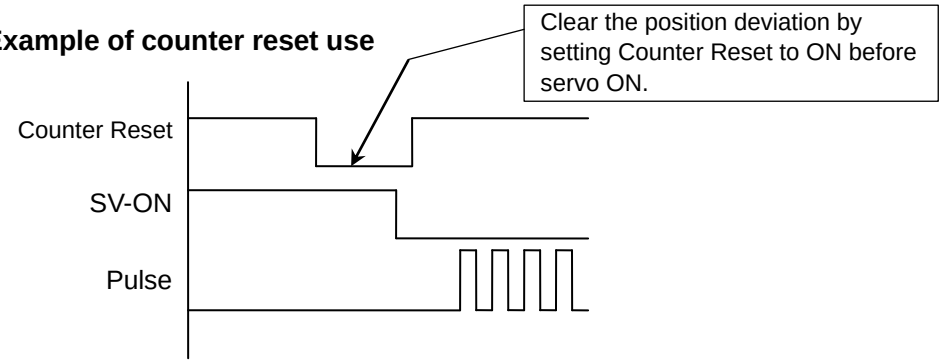
Deviation reset by I/O

I/O connector

Pin No.	Function (Factory setting)
7	Input 5 (deviation reset)

This function is used mainly to operate using position control pulse inputs. Setting Deviation Reset to ON (L level) resets the position deviation counter to "0." Setting Counter Reset to ON during pulse input stops motor rotation. Until set to OFF, the position deviation remains fixed at 0. Before starting operation using position control pulse inputs, set the Counter Reset to ON before servo ON in order to avoid a position deviation error.

Example of counter reset use



Automatic deviation counter reset

If the Control Selection Flag Bit 0 is set to "1," the position deviation counter is fixed at "0" while the servo is OFF.

ID	Parameter name	Setting	Factory setting	Reference
69	Control Switch	Automatic deviation reset Bit 0: 0: Disable, 1: Enable	0x0001	⇒❑19.7

15.1.5. Pulse Input Disable Function

I/O connector

Pin No.	Function (Factory setting)
10	Input 8 (pulse input disable command)

This function is used to operate using position control pulse inputs. When the pulse input disable command is set to ON, the motor ignores pulse commands from the host controller, and stops rotating. It does not rotate until the command is set to OFF.

If the motor stops with Deviation Reset ON, moving the motor shaft by external force does not change the position deviation, which remains 0. The static rigidity is therefore lowered. A stop due to the pulse input disable function causes a deviation from the rotation of the motor shaft, and the motor is made to stop at the latest command position under position control.

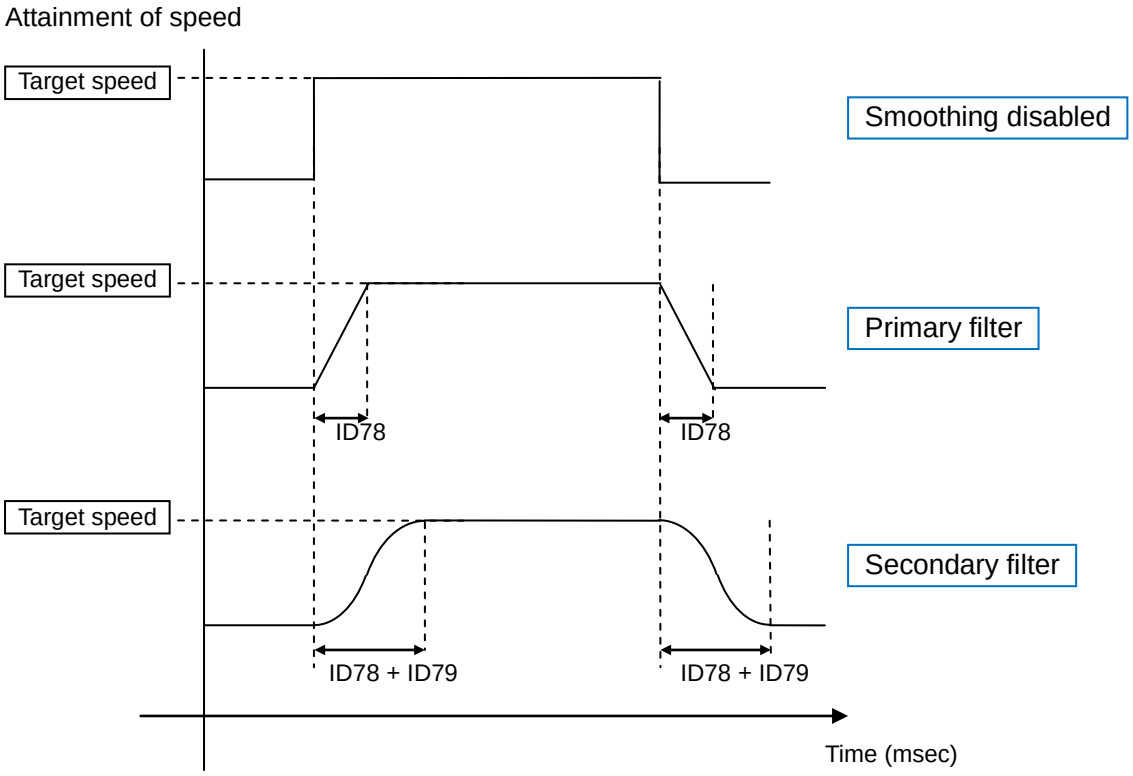
15.1.6. Smoothing Time Setting Function

ID	Parameter name	Factory setting	Setting range
78	Smoothing Time 1	0 [msec]	0 to 1638 DEC
79	Smoothing Time 2	0 [msec]	0 to 1638 DEC

This setting is made when smoother operation is needed in position control.
Motion in response to the position command is smoothed by applying a moving average for the set time to the amount of change in the position command value.
This function acts as a primary filter when only Smoothing Time 1 is set. It acts as a secondary filter when both Smoothing Time 1 and 2 are set.
When Smoothing Time 1 is set to "0," Smoothing Time 1 and 2 will be disabled.

Caution

Do not change the set values during servo ON.
Such an operation might cause unexpected motion.



Supplement

When the smoothing time is set, the position deviation is given as the difference between the position specified by the position command after filtering and the current position.

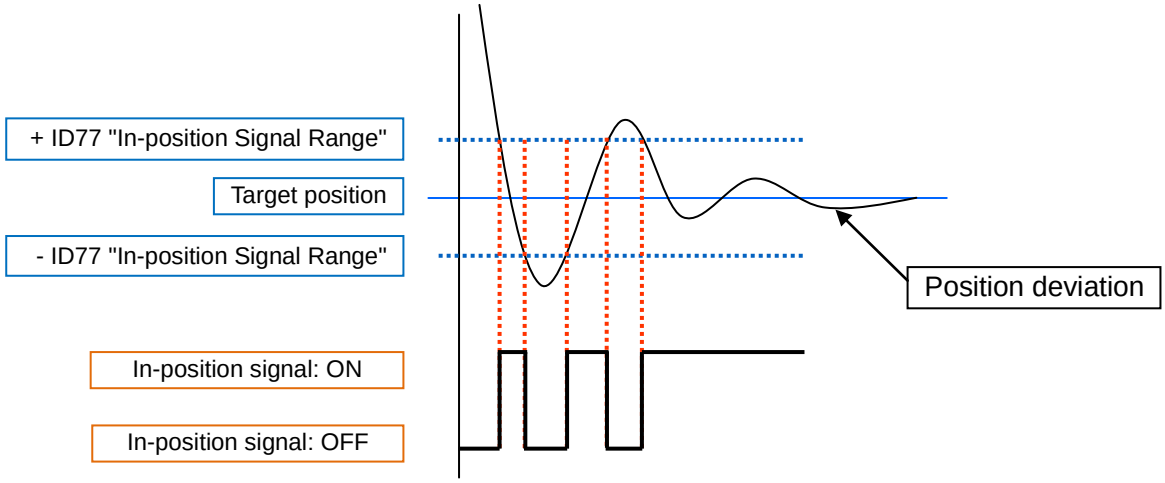
15.1.7. Positioning Completion Signal (In-position) Function

I/O connector

Pin No.	Function (factory setting)
32 and 33	Ouput 2 (in-position signal)

ID	Parameter name	Factory setting	Setting range
77	In-position (positioning completion) signal range	Using a sensor	1 to 32767

The positioning completion status can be found by checking Output 2 (in-position). In position control, Output 2 (in-position signal) is ON when the value of the position deviation is smaller than or equal to the in-position (positioning completion) signal range set by ID77.



15.2. Speed Control Mode

Speed control operation has two control types.

1. Real-time speed command (SV-NET)

This control type operates the motor with speed commands sent from the SV-NET controller. When a command speed value sent from the SV-NET controller is received, the motor starts to rotate and maintains the same speed. By continuously changing the speed, acceleration/deceleration can be controlled.

2. Analog speed command

Operation is achieved by using the analog signal input through the I/O connector as the speed command.

To run with a real-time speed command

Step	Operation																
	ID	Parameter name	Setting/read value														
(1)	Set Speed Command Select to speed command via communication.																
	75	Speed Command Select	0x00														
(2)	Set the control mode to speed control.																
	31	Control Mode	2														
(3)	Set Bit 7 "Acceleration limit ON" of ID30 to ON. Enable ID34 "Acceleration" and ID35 "Deceleration."																
	30	Servo Command	0x0080	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
(4)	Servo ON. Servo ON fixes the motor shaft.(*1)																
	30	Servo Command	0x0081	B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
				0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1
(5)	Set the acceleration.																
	34	Acceleration	Arbitrary (10 rpm/sec)														
(6)	Set the deceleration.																
	35	Deceleration	Arbitrary (10 rpm/sec)														
(7)	Set the real-time speed command. Rotation starts.																
	37	Real-time command speed	Arbitrary (rpm)														
(8)	To stop, set the rotation speed to 0 rpm.																
	37	Real-time command speed	0														

(*1) Turning the servo ON automatically sets the initial value of ID37 "Real-time command speed" to "0."

Supplement

To achieve smooth acceleration/deceleration with real-time speed commands, Bit 7 "Acceleration limit ON" of ID30 "Servo Command" should be set to ON. This enables the settings of ID34 "Acceleration" and ID35 "Deceleration," allowing you to adjust acceleration and deceleration.

To run with an analog command from the I/O connector

1. Setting the analog input speed conversion scale value and the offset

Step	Operation																	
	ID	Parameter name	Setting/read value															
(1)	Set the scale value of the speed equivalent of the analog input (factory setting: 6000 rpm). Set the speed (rpm) at 10 V (full scale) relative to 0 V. Example: If "6000" is set, the speed at 5 V is 3000 rpm and that at 10 V is 6000 rpm.																	
	130	Analog input signal speed conversion scale value	Arbitrary (rpm)															
(2)	Input the analog input signal to specify zero speed (reference) to the I/O connector (PIN No. 24, 25). Example: If ID130 is set to "6000" with reference to 0 V, the speed at 10 V is 6000 rpm and that at -10 V is -6000 rpm. Example: If ID130 is set to "6000" with reference to 5 V, the speed at 10 V is 3000 rpm and that at 0 V is -3000 rpm.																	
(3)	Start measuring the analog input offset value. Set "Analog Input 0-point Adjustment Command" (Bit 8 of ID30) to ON.																	
	30	Servo Command	0x0100	**B15**	**B14**	**B13**	**B12**	**B11**	**B10**	**B9**	**B8**	**B7**	**B6**	**B5**	**B4**	**B3**	**B2**	**B1**	**B0**
				0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
(4)	The analog signal input is measured automatically and the value is set in ID132 "Analog Input Offset." Example: A value of approximately 1195 is set relative to 5V as a reference.																	
(5)	Save the set speed conversion scale value and offset.																	
	17	Parameters save	1															

2. Running by inputting an analog signal

Step	Operation		
	ID	Parameter name	Setting/read value
(1)	Set speed command select to speed command by analog signal input.		
	75	Select Speed Command	0x01 (The analog signal polarity is reversed when Bit 7 is 1.)
(2)	Set the control mode to speed control.		
	31	Control Mode	2
(3)	Parameter storing. Store the set values. After the power is turned on again, the motor can be operated by performing operations (4) to (6).		
	17	Parameters save	1
(4)	Input an analog signal voltage to specify zero speed (reference) from the I/O connector (PIN No. 24, 25).		
(5)	Turn on the servo ON input signal (input 1: factory setting). Servo ON fixes the motor shaft.		
(6)	Rotation is started by changing the analog signal voltage.		

Supplement **Control speed, acceleration, and deceleration from the high-level system.**

15.2.1. Analog Input Zero Clamp Function

ID	Parameter name	Factory setting	Setting range
133	Analog Input Zero Clamp	0	0 to 1000 [0.01 V]

Set the analog input dead band. If the dead band is set, analog input commands within the range specified by this set value are treated as 0 for analog inputs.
If the analog input signal varies due to noise or other reasons, the motor may be unable to stop properly. This function must be set in such a case.

Example: When the analog input offset is set to 0 V and the analog input zero clamp value is set to "50" (0.5 V), analog input values in the range of ±0.5 V are treated as zero input commands.

15.2.2. Analog Input Filtering Function

ID	Parameter name	Setting value
134	Analog Input Filter	0: No averaging 1: Averaging of 2 analog input commands 2: Averaging of 4 analog input commands 3: Averaging of 8 analog input commands 4: Averaging of 16 analog input commands

Take the moving average of the analog input commands. This setting is effective when analog input commands vary due to noise or other reasons and cause the motor to malfunction.

Supplement **Analog inputs are read on a 50 μs cycle.**

15.2.3. Analog Input Forced-0 Command Function

I/O setting parameter

ID	Function	Setting value
100 to 107	Setting of I/O input 1 to 8 (IN1 to 8)	0x0E (14)

The analog input forced-0 command input can be used to set the analog input command to 0.

15.2.4. Speed Command Acceleration and Deceleration Setting Function

ID	Parameter name	Factory setting	Setting range
34	Acceleration	1000	0 to 65535 [10 rpm/sec]
35	Deceleration	1000	0 to 65535 [10 rpm/sec]

Acceleration and deceleration can be set in speed control.

15.3. Current Control Mode

Current control operation has two control types.

The AC servo motor generates a toque proportional to the motor current. Therefore, controlling the current in this mode enables control of the motor torque.

1. Real-time current command (SV-NET)

This control type operates the motor with current commands sent from the SV-NET controller. When the command current value sent from the SV-NET controller is received, the motor starts to rotate and the current is maintained. It also can perform current control by continuously varying the command current value.

2. Analog current command

Operation is achieved by using the analog signal input through the I/O connector as the current command.

To run with a real-time current command

<table>
<tr><th rowspan="2">Step</th><th colspan="19">Operation</th></tr>
<tr><th>ID</th><th colspan="2">Parameter name</th><th colspan="16">Setting/read value</th></tr>
<tr><td rowspan="2">(1)</td><td colspan="19">Set Torque Command Select to torque command via communication.</td></tr>
<tr><td>76</td><td colspan="2">Torque Command Select</td><td colspan="16">0x00</td></tr>
<tr><td rowspan="2">(2)</td><td colspan="19">Set the control mode to current control.</td></tr>
<tr><td>31</td><td colspan="2">Control Mode</td><td colspan="16">3</td></tr>
<tr><td rowspan="3">(3)</td><td colspan="19">Servo ON. In current control mode, the motor shaft is not fixed.(*1)</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Servo Command</td><td rowspan="2">0x0001</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td rowspan="2">(4)</td><td colspan="19">Set the real-time current command. Rotation starts.</td></tr>
<tr><td>38</td><td colspan="2">Real-time command current</td><td colspan="16">Arbitrary (0.01 A)</td></tr>
</table>

(*1) Turning the servo ON automatically sets the initial value of ID38 "Real-time command current" to "0."

To run with an analog command from the I/O connector

1. Setting the analog input current conversion scale value and the offset

<table>
<tr><th rowspan="2">Step</th><th colspan="4">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th colspan="3">Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="5">Set the scale value of the current equivalent of the analog input. Factory setting: 500 (0.01 A)
Set the current (A) at 10 V (full scale) relative to 0 V.
Example: 9 A at 5 V and 18 A at 10 V when "1800" is assigned.</td></tr>
<tr><td></td><td>131</td><td>Analog input signal current conversion scale value</td><td colspan="3">Arbitrary (0.01 A)</td></tr>
<tr><td>(2)</td><td colspan="5">Input the analog signal voltage for specifying zero current (reference) to the I/O connector (PIN No. 24, 25).
Example: If ID131 is set to "1800" relative to 0 V as a reference, the current is 18 A at 10 V and -18 A at -10 V.
Example: If ID131 is set to "1800" relative to 5 V as a reference, the current is 9 A at 10 V and -9 A at 0 V.</td></tr>
<tr><td>(3)</td><td colspan="5">Start measuring the analog input offset value.
Set ID30 "Analog Input 0-point Adjustment Command" (Bit 8) to ON.</td></tr>
<tr><td></td><td>30</td><td>Servo Command</td><td>0x0100</td><td colspan="2">B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0</td></tr>
<tr><td>(4)</td><td colspan="5">The analog signal input is measured automatically and the value is set in ID132 "Analog Input Offset."
Example: A value of approximately 1195 is set relative to 5V as a reference.</td></tr>
<tr><td>(5)</td><td colspan="5">Save the set current conversion scale value and the offset.</td></tr>
<tr><td></td><td>17</td><td>Parameters save</td><td colspan="3">1</td></tr>
</table>

2. Running by inputting an analog signal

<table>
<tr><th rowspan="2">Step</th><th colspan="3">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th>Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="3">Set torque command select to torque command by analog signal input.</td></tr>
<tr><td></td><td>76</td><td>Torque Command Select</td><td>1
(The analog signal polarity is reversed when Bit 7 is 1.)</td></tr>
<tr><td>(2)</td><td colspan="3">Set the control mode to current control.</td></tr>
<tr><td></td><td>31</td><td>Control Mode</td><td>3</td></tr>
<tr><td>(3)</td><td colspan="3">Parameter saving. Save the set values.</td></tr>
<tr><td></td><td>17</td><td>Parameters save</td><td>1</td></tr>
<tr><td>(4)</td><td colspan="3">Input the analog signal voltage corresponding to zero current (reference) from the I/O connector (PIN No. 24, 25).</td></tr>
<tr><td>(5)</td><td colspan="3">Turn on the servo ON input signal (input 1: factory setting). The motor is excited.</td></tr>
<tr><td>(6)</td><td colspan="3">Rotation is started by changing the analog signal voltage.</td></tr>
</table>

Supplement **Control current from the high-level system.**

15.3.1. Analog Input Zero Clamp Function

ID	Parameter name	Factory setting	Setting range
133	Analog Input Zero Clamp	0	0 to 1,000 [0.01 V]

Set the analog input dead band. If the dead band is set, analog input commands within the range specified by this set value are treated as 0 for analog inputs.
If the analog input signal varies due to noise or other reasons, the motor may be unable to stop properly. This function must be set in such a case.

Example: When the analog input offset is set to 5.0 V and the analog input zero clamp value is set to "50" (0.5 V), analog input values in the range of 5.0±0.5 V (4.5 to 5.5 V) are treated as zero input commands.

15.3.2. Analog Input Filtering Function

ID	Parameter name	Setting value
134	Analog Input Filter	0: No averaging 1: Averaging of 2 analog input commands 2: Averaging of 4 analog input commands 3: Averaging of 8 analog input commands 4: Averaging of 16 analog input commands

Take the moving average of the analog input commands. This setting is effective when analog input commands vary due to noise or other reasons and cause the motor to malfunction.

Supplement **Analog inputs are read on a 50 μs cycle.**

15.3.3. Analog Input Forced-0 Command Function

I/O setting parameter

ID	Function	Setting value
100 to 107	Setting of I/O inputs 1 to 8 (IN1 to 8)	0×0E (14)

The analog input forced-0 command input can be used to set the analog input command to 0.

15.3.4. Speed Limit Function

The speed limit can be used for protection in the current control mode.
In speed control mode, the analog signal input is used as the current limit for pseudo current control with speed limit.
When the analog signal polarity is negative, the speed command polarity is reversed automatically.

Supplement **When the motor speed reaches the limit value, the motor current is not controlled according to analog input commands but controlled as a result of motor speed.**

Step	Operation		
	ID	Parameter name	Setting/Read value
(1)	Set the analog current command.		
	⇒ Refer to ❑15.3 "Current Control Mode."		
(2)	Set torque command select to "Use analog signal input as torque command with speed limit."		
	76	Torque Command Select	3 (The analog signal polarity is reversed when Bit 7 is "1.")
(3)	Set the control mode to speed control.		
	31	Control Mode	2
(4)	Set the speed limit value.		
	37	Real-time Command Speed	Arbitrary (rpm)
(5)	Set Bit 2 of ID69 "Control Switch" to "1" if you do not want to clear ID37 "Real-time Command Speed" to 0 when the servo is turned ON.		
(6)	Input the analog signal voltage as the 0 current (reference) to the I/O connector (PIN No. 24, 25).		
(7)	Turn on the Servo ON input signal (Input 1: Factory setting) to excite the motor.		
(8)	Start rotation by changing the analog signal voltage. Use the host system to control the current command value.		
(9)	The current is limited by the current limit values (IDs 86, 87, 65, and 66) when they are smaller than the current command value set by this function.		

15.4. Homing Mode

In the homing mode, the origin return is executed and then the current position is reset to the value set in parameter ID 91 "Homing Preset Value."
The origin can be found in two different ways: using an origin signal or using a mechanical stopper.

Important

Homing operation cannot be conducted from the position in excess of the origin signal detection range. Homing operation should always be conducted in the state where the object is moved before the origin signal detection range.

Important

If the setting of the homing start direction is wrong, the homing operation cannot be correctly completed. Set the homing start direction correctly.

Homing with an origin signal

(1) Position preset by moving to the Z signal detection position after detecting an origin signal
For sensors other than wire-saving INC sensors (17/23Bit-INC, 17/23Bit-ABS, and 1X-BRX)

When an origin signal is detected, the motor decelerates to a stop and moves to the sensor Z signal detection position, and the current position is reset to the preset value.
In the case where homing is conducted from the position before the origin signal detection position, the motor always stops at the Z signal detection position before the origin signal detection range. But in the case of homing from the origin signal detection range when the Z signal detection position is within the origin signal detection range, the motor stops at the Z signal detection position in the origin signal detection range.

For wire-saving INC sensors

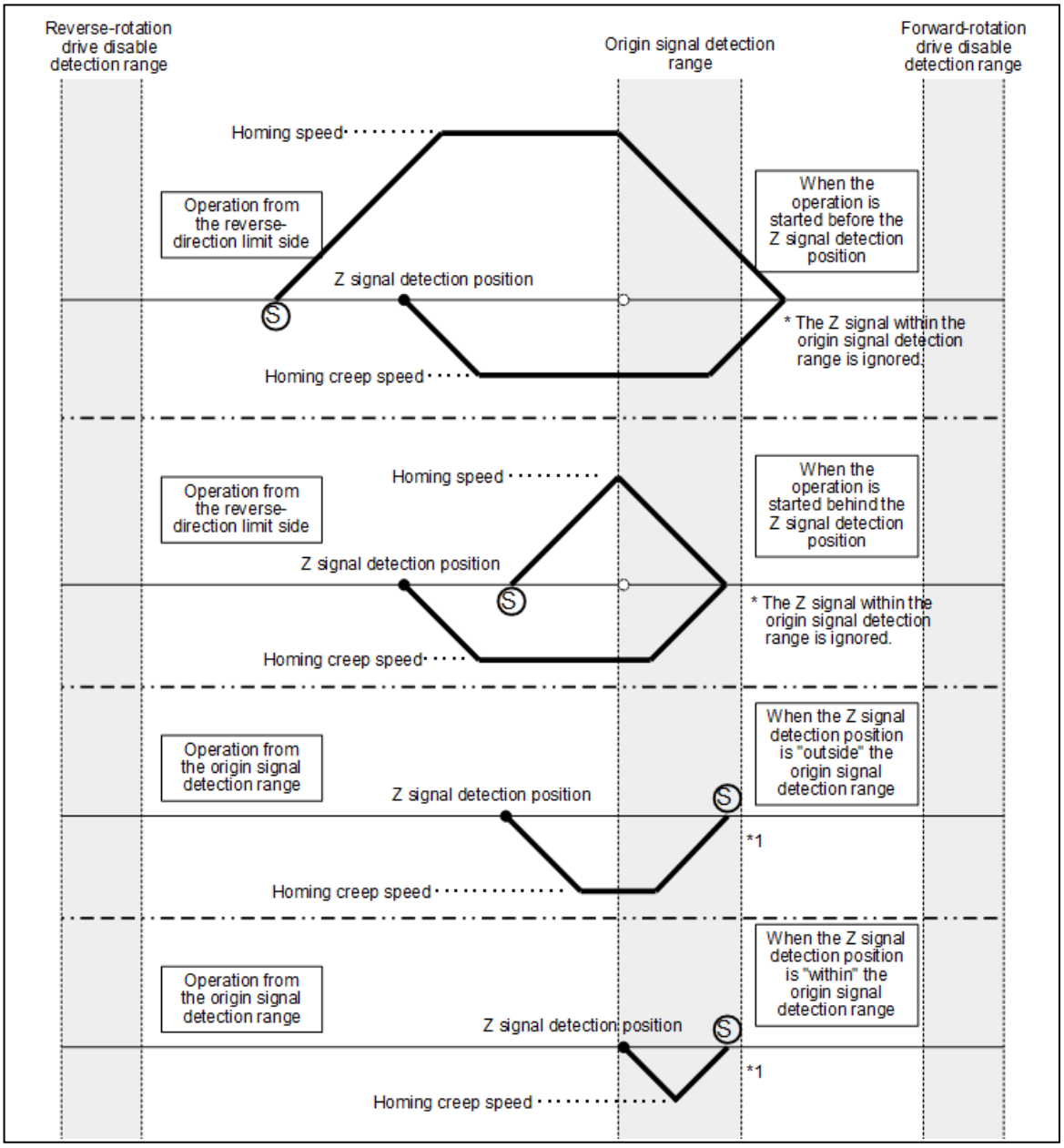
After power-on, if the sensor Z signal is not detected until the start of homing, the Z signal detection operation will first be performed when the homing operation is started.
The Z signal detection operation is an operation for detecting the Z signal position at the speed set in ID 94 "Homing creep speed" (when the set value is 50 [rpm] or larger, the speed is fixed to 50 [rpm]). When the Z signal is detected at least one time after power-on, the homing operation is performed as is the case of other sensors.

Supplement **Motors equipped with wire-saving incremental encoders can perform high-accuracy current control by detecting the sensor Z signal (Z-phase output position of the wire-saving incremental encoders) after power-on.**

Caution

After detection of the origin signal, when the position preset is performed by moving the motor to the Z signal detection position, the Z signal detection position must be within the operation range. If the Z signal is not detected within the operation range, the homing operation cannot normally be completed. For example, if the actual operation range is narrower than the range corresponding to one turn of the motor shaft, the motor needs to be attached to the equipment appropriately so that the Z signal can be detected within the operation range.

■For sensors other than wire-saving INC sensors (17/23 Bit-INC, 17/23 Bit-ABS, 1X-BRX)



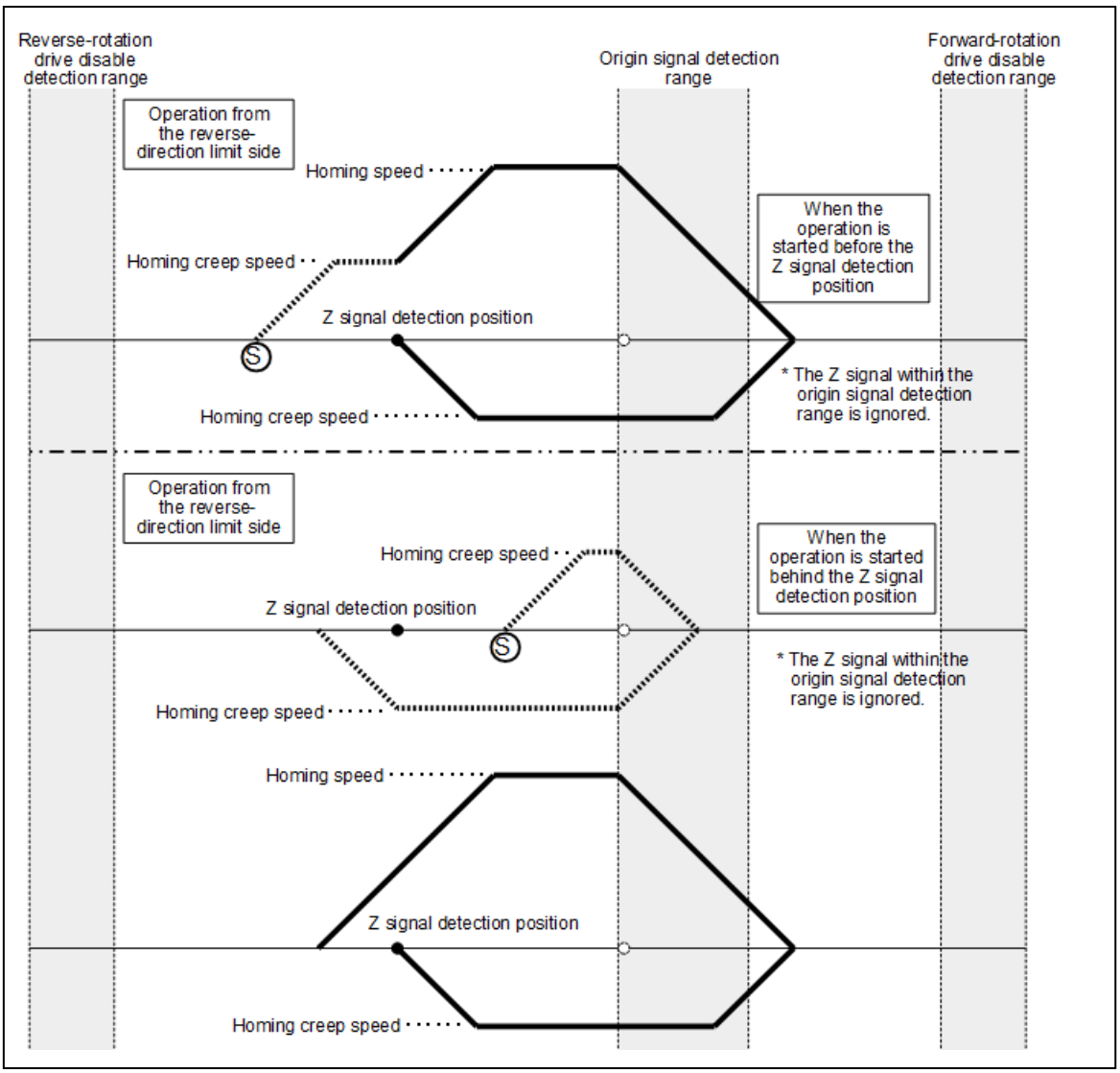
Ⓢ : Homing start point

The above diagram illustrates an example of operation that is produced when ID 72 "Reference Direction" is set to "0" (CCW), and ID 92 "Homing Start Direction" is set to "0" (forward direction).

Supplement Motors equipped with 17/23 Bit-INC or 17/23 Bit-ABS sensors perform absolute accuracy compensation (full absolute status confirmation) when their motor shaft rotates by 12 degrees (approximately 4,369 pulses for 17 Bit sensors; approximately 279,620 pulses for 23 Bit sensors) at most after power-on.

Supplement *1 Only when the homing operation from the origin signal detection range is performed with a 17/23 Bit-INC or 17/23 Bit-ABS sensor, the homing operation for absolute accuracy compensation (full absolution status confirmation) will first be performed after the motor shaft rotates by 12 degrees (approximately 4,369 pulses for 17 Bit sensors; approximately 279,620 pulses for 23 Bit sensors) at most.

■For wire-saving INC sensors



Ⓢ : Homing start point

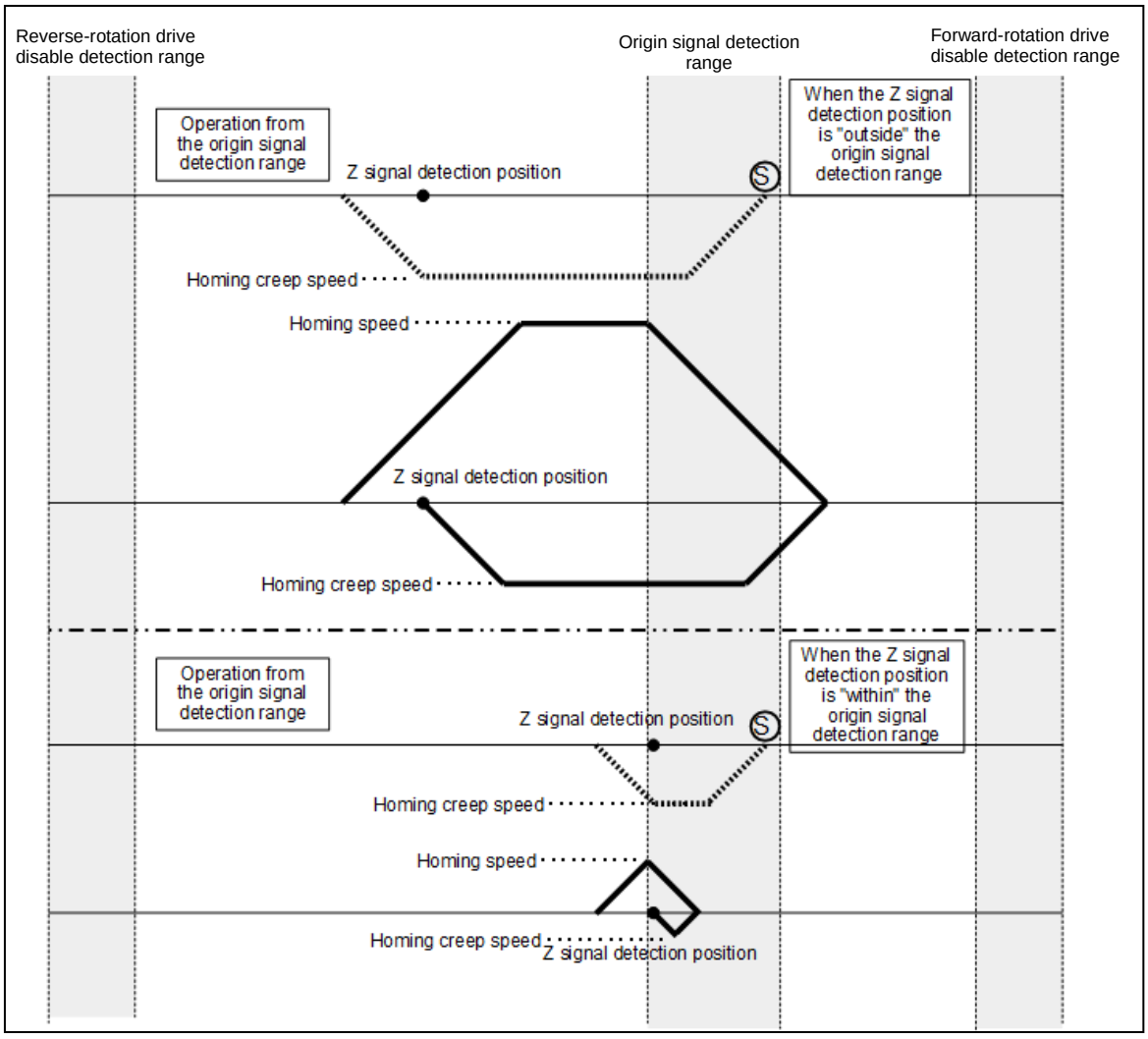
— (solid line) ; Homing operation

··· (dotted line) ; Z signal detection operation

The above diagram illustrates an example of operation that is produced when ID 72 "Reference Direction" is set to "0" (CCW), and ID 92 "Homing Start Direction" is set to "0" (forward direction).

Supplement

- The above diagram illustrates operation that is produced when the Z signal has never been detected before the start of the homing operation. When the Z signal has been detected, the homing operation is performed in the same manner as for other sensors.
- The Z signal detection operation is performed at the moving speed set in ID 94 "Homing Creep Speed." If the homing creep speed is set to 50 [rpm] or larger, the upper limit of the operation speed will become 50 [rpm]. Once the Z signal is detected, the homing creep speed in the operation will become the set value of ID 94.



Ⓢ : Homing start point

— (solid line) ; Homing operation

··· (dotted line) ; Z signal detection operation

The above diagram illustrates an example of operation that is produced when ID 72 "Reference Direction" is set to "0" (CCW), and ID 92 "Homing Start Direction" is set to "0" (forward direction).

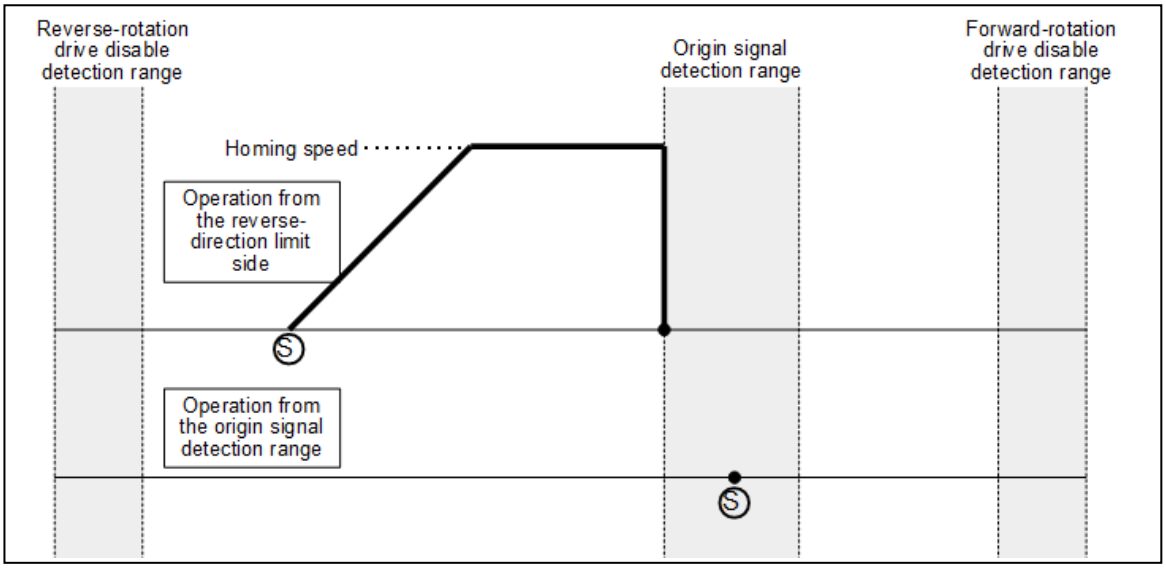
Supplement

- The above diagram illustrates operation that is produced when the Z signal has never been detected before the start of the homing operation. When the Z signal has been detected, the homing operation is performed in the same manner as for other sensors.
- The Z signal detection operation is performed at the moving speed set in ID 94 "Homing Creep Speed." If the homing creep speed is set to 50 [rpm] or larger, the upper limit of the operation speed will become 50 [rpm]. Once the Z signal is detected, the homing creep speed in the operation will become the set value of ID 94.

(2) Position preset by immediate stop with origin signal

When an origin signal is detected, the motor is immediately stopped, and the current position is reset to the preset value at that position.

In the case where homing operation is conducted from the origin signal detection range, the present position is the origin position.



Ⓢ : Homing start point

The above diagram illustrates an example of operation that is produced when ID 72 "Reference Direction" is set to "0" (CCW), and ID 92 "Homing Start Direction" is set to "0" (forward direction).

Supplement

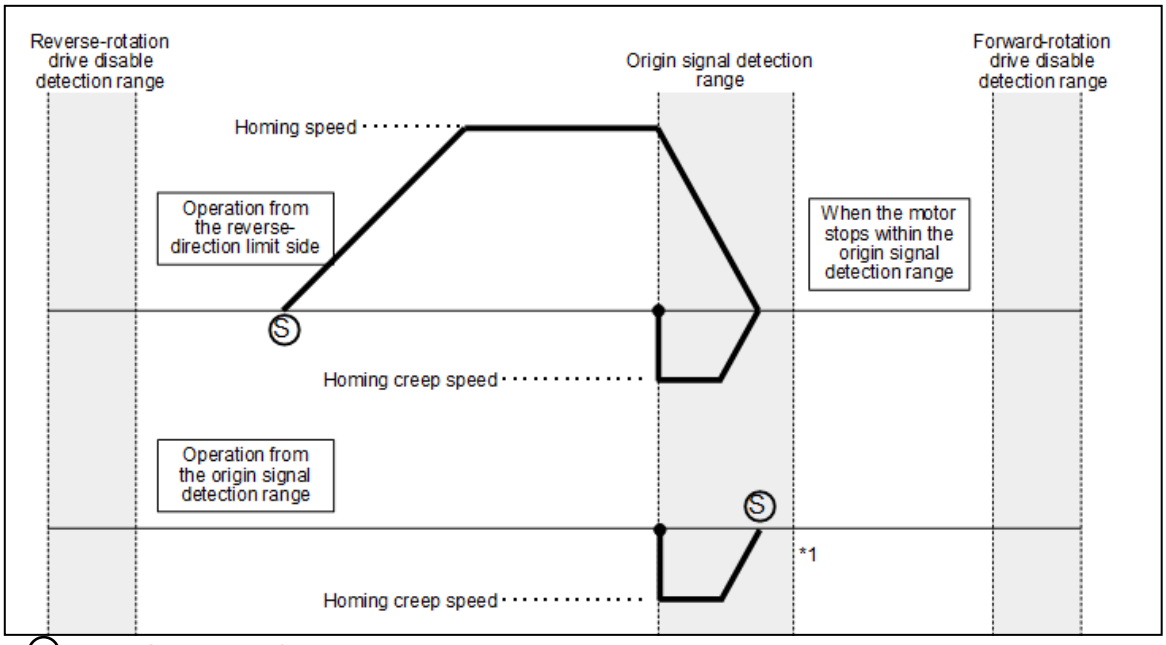
Motors equipped with wire-saving incremental encoders can perform high-accuracy current control by detecting the sensor Z signal (Z-phase output position of the wire-saving incremental encoders) after power-on.

Caution

When it is necessary to perform position preset with a wire-saving INC sensor by immediate stopping using the origin signal, the motor needs to be installed in the equipment appropriately so that the Z signal detection position will be within the operation range. If the Z signal cannot be detected because the Z signal detection position is not within the operation range, oscillation or unusual noise may occur due to the decreased accuracy of the electrical degree.

(3) Position preset after detecting an origin signal and returning until the triggering origin signal is cancelled

When an origin signal is detected, the motor returns to the origin signal cancellation position and immediately stops, and then the position is reset.



Ⓢ : Homing start point

The above diagram illustrates an example of operation that is produced when ID 72 "Reference Direction" is set to "0" (CCW), and ID 92 "Homing Start Direction" is set to "0" (forward direction).

Caution

In the process of position preset performed after detecting the origin signal and returning until the origin signal is canceled, if a stop is made outside the origin signal detection range, the motor cannot normally return to the origin signal cancellation position. Therefore, set the speed and deceleration of the motor appropriately.

Supplement Motors equipped with 17/23 Bit-INC or 17/23 Bit-ABS sensors perform absolute accuracy compensation (full absolute status confirmation) when their motor shaft rotates by 12 degrees (approximately 4,369 pulses for 17 Bit sensors; approximately 279,620 pulses for 23 Bit sensors) at most after power-on.

Supplement *1 Only when the homing operation from the origin signal detection range is performed with a 17/23 Bit-INC or 17/23 Bit-ABS sensor, the homing operation for absolute accuracy compensation (full absolution status confirmation) will first be performed after the motor shaft rotates by 12 degrees (approximately 4,369 pulses for 17 Bit sensors; approximately 279,620 pulses for 23 Bit sensors) at most.

Supplement Motors equipped with wire-saving incremental encoders can perform high-accuracy current control by detecting the sensor Z signal (Z-phase output position of the wire-saving incremental encoders) after power-on.

Caution

When it is necessary to perform position preset with a wire-saving INC sensor by returning until the origin signal is cancelled, the motor needs to be installed in the equipment appropriately so that the Z signal detection position will be within the operation range. If the Z signal cannot be detected because the Z signal detection position is not within the operation range, oscillation or unusual noise may occur due to the decreased accuracy of the electrical degree.

- **Origin detection methods**

  There are two different ways to detect an origin signal: origin detection by I/O and origin detection by the SV-NET controller (communication commands).

  Origin signal detection by I/O:

  An origin signal is detected by assigning the origin signal input to either of ID 100 to 107 of I/O setting parameters.

  ⇒ Refer to ❑19.10 "Parameters for Setting I/O."

  Origin signal detection by the SV-NET controller (communication commands):

  An origin signal is detected when the SV-NET controller sets Bit 13 "Origin detection notification" of parameter ID30 "Servo Command." ⇒ Refer to ❑19.4 "Control Command Parameters."

Homing by mechanical stopper

When thrust against the mechanical stopper is detected, the current position is reset to the preset value

Thrust time and thrust torque can be set.

Important

When performing the homing operation with the mechanical stopper, do not use the forward-rotation (reverse-rotation) disable input or the origin sensor input

Example) Do not install wiring for the I/O input specified at the factory default settings (IN2 "Forward-rotation disable input," IN3 "Reverse-rotation disable input," or IN7 "Origin sensor input").

(1) Position preset by thrust detection and stop

When thrust is detected, the motor stops, and the current position is reset to the preset value at that position.

Supplement

Motors equipped with wire-saving incremental encoders can perform high-accuracy current control by detecting the sensor Z signal (Z-phase output position of the wire-saving incremental encoders) after power-on.

Caution

When it is necessary to perform position preset with a wire-saving INC sensor after stopping by thrust detection, the motor needs to be installed in the equipment appropriately so that the Z signal detection position will be within the operation range. If the Z signal cannot be detected because the Z signal detection position is not within the operation range, oscillation or unusual noise may occur due to the decreased accuracy of the electrical degree.

(2) Position preset by moving to the Z signal detection position after detecting thrust

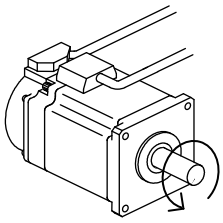
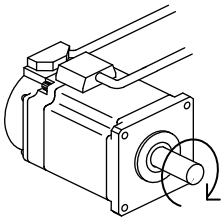
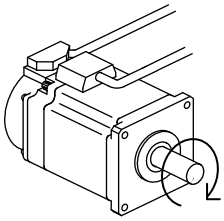
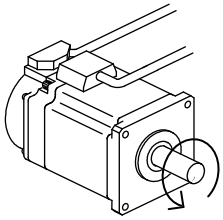
When thrust is detected, the motor stops and moves to the sensor Z signal detection position, and the current position is reset.

Supplement Motors equipped with wire-saving incremental encoders can perform high-accuracy current control by detecting the sensor Z signal (Z-phase output position of the wire-saving incremental encoders) after power-on.

Caution

When it is necessary to perform position preset with a wire-saving INC sensor after stopping by thrust detection and moving to the Z signal detection position, the motor shaft must make one turn or more in detection of the Z signal in the homing operation. If the thrust detection position corresponds to less than one turn of the motor shaft, the motor cannot normally move to the Z signal detection position.

15.4.1. Rotation Start Direction in Homing Mode

ID72	ID92	Rotation start direction of motor shaft
0	0	 CCW
0	1	 CW
1	0	 CW
1	1	 CCW

ID	Parameter name	Description	Reference
72	Reference Direction	Sets the forward rotation direction 0: CCW, 1: CW	⇒ ❑19.7

ID	Parameter name	Description	Reference
92	Homing Start Direction	Homing rotation direction 0: Forward direction; 1: Reverse direction	⇒ ❑19.8

15.4.2. Homing with an origin signal (origin detection by I/O)

<table>
<tr><th rowspan="2">Step</th><th colspan="3">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th>Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="3">Select a homing operation from the following.</td></tr>
<tr><td></td><td>90</td><td>Homing Mode</td><td>0: Position preset by moving to Z signal detection position after detecting origin signal
2: Position preset by immediate stop after detecting origin signal
3: Position preset after detecting origin signal and returning until triggering origin signal is canceled</td></tr>
<tr><td>(2)</td><td colspan="3">Set the position set after homing operation.</td></tr>
<tr><td></td><td>91</td><td>Homing Preset Value</td><td>Arbitrary (pulse)</td></tr>
<tr><td>(3)</td><td colspan="3">Set the homing start direction.</td></tr>
<tr><td></td><td>92</td><td>Homing Start Direction</td><td>0: Forward direction
1: Reverse direction</td></tr>
<tr><td>(4)</td><td colspan="3">Set the homing speed.</td></tr>
<tr><td></td><td>93</td><td>Homing Speed</td><td>Arbitrary (rpm), Factory setting: 500</td></tr>
<tr><td>(5)</td><td colspan="3">Set the homing creep speed.</td></tr>
<tr><td></td><td>94</td><td>Homing Creep Speed</td><td>Arbitrary (rpm), Factory setting: 50</td></tr>
<tr><td>(6)</td><td colspan="3">Set the acceleration</td></tr>
<tr><td></td><td>34</td><td>Acceleration</td><td>Arbitrary (10rmp), Factory setting: 1000</td></tr>
<tr><td>(7)</td><td colspan="3">Set the deceleration</td></tr>
<tr><td></td><td>35</td><td>Deceleration</td><td>Arbitrary (10rmp), Factory setting: 1000</td></tr>
<tr><td>(8)</td><td colspan="3">Use the I/O setting parameter to assign an origin signal to any of inputs 1 to 8.</td></tr>
<tr><td></td><td>100 to 107</td><td>Setting IN1 to IN8</td><td>0×07
Negative logic (usually ON) is set when Bit 7 is 1.</td></tr>
<tr><td>(9)</td><td colspan="3">Set to homing control.</td></tr>
<tr><td></td><td>31</td><td>Control Mode</td><td>4</td></tr>
<tr><td>(10)</td><td colspan="3">Set to servo ON (ID 30; Bit 0: ON). Homing control mode starts.</td></tr>
<tr><td></td><td>30</td><td>Servo Command</td><td>0x0001
B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1</td></tr>
<tr><td></td><td colspan="3">The motor starts moving according to the settings of ID92 "Homing Start Direction," ID93 "Homing Speed" and ID34 "Acceleration."</td></tr>
<tr><td>(11)</td><td colspan="3">The origin position is detected according to the origin signal set in (8).
[When the "position preset by moving to Z signal detection position after detecting origin signal" is selected]
The motor decelerates to a stop at the deceleration set in ID35 "Deceleration" and moves to the sensor Z signal detection position at the speed set in ID94 "Homing Creep Speed." The current position is then reset to the value set in ID91 "Homing Preset Value."
[When the "position preset by immediate stop after detecting origin position" is selected]
When receiving the speed 0 command, the motor stops and the current position is reset to the value set in ID91 "Homing Preset Value."
[When the "position preset after detecting origin signal and returning until the triggering origin signal is canceled" is selected]
The motor decelerates to a stop at the deceleration set in ID35 "Deceleration" and returns at the speed set in ID94 "Homing Creep Speed" until the origin signal is canceled. The current position is then reset to the value set in ID91 "Homing Preset Value."

After homing finishes, ID31 "Control Mode" is set to "1" (position control).
To store the setting after the homing operation, refer to ❑16.1 "Saving Parameters."</td></tr>
</table>

15.4.3. Homing with an origin signal (origin detection by communication commands)

<table>
<tr><th rowspan="2">Step</th><th colspan="3">Operation</th></tr>
<tr><th>ID</th><th>Parameter name</th><th>Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="3">Select a homing operation from the following.</td></tr>
<tr><td></td><td>90</td><td>Homing Mode</td><td>0: Position preset by moving to Z signal detection position after detecting origin signal
2: Position preset by immediate stop after detecting origin signal
3: Position preset after detecting origin signal and returning until the triggering origin signal is canceled</td></tr>
<tr><td>(2)</td><td colspan="3">Set the position set after homing operation</td></tr>
<tr><td></td><td>91</td><td>Homing Preset Value</td><td>Arbitrary (pulse)</td></tr>
<tr><td>(3)</td><td colspan="3">Set the homing direction.</td></tr>
<tr><td></td><td>92</td><td>Homing Start Direction</td><td>0: Forward direction
1: Reverse direction</td></tr>
<tr><td>(4)</td><td colspan="3">Set the homing speed.</td></tr>
<tr><td></td><td>93</td><td>Homing Speed</td><td>Arbitrary (rpm), Factory setting: 500</td></tr>
<tr><td>(5)</td><td colspan="3">Set the homing creep speed.</td></tr>
<tr><td></td><td>94</td><td>Homing Creep Speed</td><td>Arbitrary (rpm), Factory setting: 50</td></tr>
<tr><td>(6)</td><td colspan="3">Set the acceleration</td></tr>
<tr><td></td><td>34</td><td>Acceleration</td><td>Arbitrary (10rmp), Factory setting: 1000</td></tr>
<tr><td>(7)</td><td colspan="3">Set the deceleration</td></tr>
<tr><td></td><td>35</td><td>Deceleration</td><td>Arbitrary (10rmp), Factory setting: 1000</td></tr>
<tr><td>(8)</td><td colspan="3">Set to homing control.</td></tr>
<tr><td></td><td>31</td><td>Control Mode</td><td>4</td></tr>
<tr><td>(9)</td><td colspan="3">Set to servo ON (ID 30; Bit 0: ON). Homing mode starts.
30 Servo Command 0x0001
B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1
The motor starts moving according to the settings of ID92 "Homing Start Direction," ID93 "Homing Speed" and ID34 "Acceleration."</td></tr>
<tr><td>(10)</td><td colspan="3">Set "Origin Signal" (ID 30; Bit 13: ON) to detect the origin position.
30 Servo Command 0x2001
B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0
0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1
[When the "position preset by moving to Z signal detection position after detecting origin signal" is selected]
The motor decelerates to a stop at the deceleration set in ID35 "Deceleration" and moves to the sensor Z signal detection position at the speed set in ID94 "Homing Creep Speed," and the current position is reset to the value set in ID91 "Homing Preset Value."
[When the "position preset by immediate stop after detecting origin signal" is selected]
When receiving the speed 0 command, the motor stops and the current position is reset to the value set in ID91 "Homing Preset Value."
[When the "position preset after detecting origin signal and returning until the triggering origin signal is canceled" is selected]
The motor decelerates to a stop at the deceleration set in ID35 "Deceleration" and returns at the speed set in ID94 "Homing Creep Speed" until the origin signal (Bit 13 of ID30) is canceled. The current position is then reset to the value set in ID91 "Homing Preset Value."
After homing finishes, ID31 "Control Mode" is set to "1" (position control).
To store the setting after the homing operation, refer to ❑16.1 "Saving Parameters."</td></tr>
</table>

15.4.4. Homing by mechanical stopper

Step	Operation		
	ID	Parameter name	Setting/read value
(1)	Select a homing operation from the following.		
	90	Homing Mode	1: Position preset at that position by thrust detection and stop 4: Position preset by moving to the Z signal detection position after detecting thrust
(2)	Set the position set after homing operation.		
	91	Homing Preset Value	Arbitrary (pulse)
(3)	Set the homing start direction.		
	92	Homing Start Direction	0: Forward direction 1: Reverse direction
(4)	Set the homing start speed.		
	93	Homing Speed	Arbitrary (rpm), Factory setting: 500
(5)	Set the thrust time.		
	95	Homing Thrust Time	Arbitrary (msec), Factory setting: 1000
(6)	Set the thrust torque.		
	96	Homing Thrust Torque	Arbitrary (0.01A), Factory setting: 100
(7)	Set the acceleration		
	34	Acceleration	Arbitrary (10rmp), Factory setting: 1000
(8)	Set the deceleration		
	35	Deceleration	Arbitrary (10rmp), Factory setting: 1000
(9)	Set to homing control.		
	31	Control Mode	4
(10)	Set to servo ON (ID 30; Bit 0: ON). Homing mode starts.		

ID	Parameter name		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	0x0001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

The motor starts moving according to the settings of ID92 "Homing Start Direction," ID93 "Homing Speed" and ID34 "Acceleration."

(11) The motor stops after detection of thrust according to the settings of ID95 "Homing Thrust Time" and ID96 "Homing Thrust Torque."

[When the "position preset at that position by thrust detection and stop" is selected]

The position where the motor stopped is reset to the value set in ID91 "Homing Preset Value."

[When the "position preset by moving to the Z signal detection position after detecting thrust" is selected]

The motor further moves to the sensor Z signal detection position, and the current position is reset to the value set in ID91 "Homing Preset Value."

After homing finishes, ID31 "Control Mode" is set to "0" (servo OFF).

To store the setting after the homing operation, refer to ❑16.1 "Saving Parameters."

15.5. The Driver Operation Status

The driver status can be checked by reading the following parameter values.

Parameters by which the driver status can be checked

ID	Parameter name	Description	
20	Servo Status	Bit0: During Servo ON	ON while servo ON
		Bit1: During profile operation	ON during profile operation ⇒ Refer to ❑14.1 "Position Control Mode."
		Bit2: In-position	ON when the position deviation pulse falls within the range set in ID77 "In-position Signal Range."
		Bit3:Alarming	ON if stopped by detection of an alarm
		Bit4:Arrive at forward limit	ON when ID83 "Soft Limit Select" is set to "Enable" and the current position exceeds the value set in ID84 "Forward-direction soft limit"
		Bit5:Arrive at reverse limit	ON when ID83 "Soft Limit Select" is set to "Enable" and the current position exceeds the value set in ID85 "Reverse-direction soft limit"
		Bit6: Torque limit	ON when the current reaches the value set in ID86 "Forward-rotation Current Limit" or ID87 "Reverse-rotation Current Limit"
		Bit7: Speed limit	ON when the speed exceeds the value set in ID88 "Speed Limit"
		Bit8: Position excessive deviation	ON when the position deviation pulse exceeds the value set in ID202 "Deviation Error Detection Pulse" OFF when the position excessive deviation alarm (42) occurs and the motor stops.
		Bit9: Servo ready	ON when the servo is ready to be driven
		Bit10: During homing	ON during homing operation
		Bit11: During switching to second gain	ON when Gain 2 is used
		Bit12: Backup battery voltage low	ON when the battery voltage low alarm is received from the 17, 23bit-ABS encoder
		Bit13: Drive power supply disconnection	ON when the drive voltage is equal to or below the value set in ID206 "Power Supply Shutoff Detection Voltage"
		Bit14: Stop speed status	ON when the motor speed is equal to or below the value set in ID182 "Stop Speed Judgment Speed"
		Bit16: Mechanical brake output signal	ON when the brake control signal is released
		Bit20 to 22: Alarm bit code	Alarms detected can be identified by these bits. ⇒ Refer to ❑17 "Alarm Detection."
		Bit24: Arrival at profile command target position	Turns ON for 10 msec when the target position is reached during profile operation
	It is recommended to always monitor these parameters even during operation.		
21	I/O Status	Bit0 - Bit7 Bit8 - Bit12	IN1 - IN8 OUT1 - OUT5
	Can check the I/O status.		
22	Alarm Code	Obtains the alarm code when an alarm is detected.	
	Check the code when an alarm is detected. ⇒ Refer to ❑17 "Alarm Detection"		
40	Feedback Position	Current position (pulse)	
	Can be read at any time to check the current position.		
41	Feedback Speed	Current speed (rpm)	
	Can be read at any time to check the current position.		
42	Feedback Current	Present current (0.01 A)	
	Can be read at any time to check the current position.		

Special servo feedback parameters

ID	Parameter name	Description					
		Bits 47 to 40	Bits 39 to 32	Bits 31 to 24	Bits 23 to 16	Bits 15 to 8	Bits 7 to 0
43	Feedback PVC	ID40 "Feedback Position" Lower-order 2 bytes (pulse)		ID41 "Feedback Speed" (rpm)		ID42 "Feedback Current" (0.01A)	
44	Feedback SVC	ID45 "Sensor Position1" Lower-order 2 bytes (pulse)		ID41 "Feedback Speed" (rpm)		ID42 "Feedback Current" (0.01A)	

15.6. Control Mode Switch Function

The control mode switch function allows you to use two control modes while switching between them during servo operation.
To use the control mode switch function, set the following values to ID99 "second control mode."

- Bits 3 to 0: selection of second control mode
  - 0: Disable control mode switching
  - 1: Position control
  - 2: Speed control
  - 3: Current control

- Bit 12 to 15: Selection of a command to be used when switching to second control mode
  - 0: Reset the command value (Command for speed and current controls = 0, Command for position control = current position)
  - 1: Continue the command value that was used before switching

If you do not want to reset the command value when the control mode is switched to the second control mode, set Bit 12 to 1.
In this case, you need to set the desired command value before the control mode is switched.
Also, if you do not want to reset the command value when the control mode is switched to the first control mode, set Bit 2 of ID69 "Control Switch" to 1.

In speed and current controls, the command values in both the first and second control modes can be either real-time command values set by the parameter or analog input command values.
In position control, all of the real-time position command, profile position command, and pulse command can be used as commands, but the command before the start of first control can be continued at the time of switching of control mode only with profile position command. (In other controls, the first command is automatically initialized to the current position.)

Caution

Only position control, speed control, and current control can be set as the second control mode. When using the control mode switch function, also set any of position control, speed control, and current control as the first control mode. If any other control mode is set as the first control mode, an unexpected movement might occur at the moment the mode is switched.

The control mode can be switched by using Bit 9 of ID30 "Servo Command" or by setting control mode switch (16) to the setting parameters ID100 to ID107 and switching the mode through I/O.

⇒ Refer to ❑19.10 "Parameters for Setting I/O (Input)"

Example: Setting position control to the first control mode and speed control to the second control mode, and switching between modes by servo command

<table>
<tr><th rowspan="2">Step</th><th colspan="20">Operation</th></tr>
<tr><th>ID</th><th colspan="2">Parameter name</th><th colspan="17">Setting/read value</th></tr>
<tr><td rowspan="2">(1)</td><td colspan="20">Set the control mode to position control. (first control mode)</td></tr>
<tr><td>31</td><td colspan="2">Control mode</td><td colspan="17">1</td></tr>
<tr><td rowspan="2">(2)</td><td colspan="20">Set the second control mode to speed control and set no initialization of first command.</td></tr>
<tr><td>99</td><td colspan="2">Second control mode</td><td colspan="17">0x1002</td></tr>
<tr><td rowspan="3">(3)</td><td colspan="20">Servo ON.</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Servo command</td><td rowspan="2">0x0001</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>(4)</td><td colspan="20">Conduct position control by following the method described in 15.1 "Position Control Mode."</td></tr>
<tr><td>(5)</td><td colspan="20">Set the first speed command in advance by following the method described in 15.2 "Speed Control Mode."</td></tr>
<tr><td rowspan="3">(6)</td><td colspan="20">Switch to the second control mode.</td></tr>
<tr><td rowspan="2">30</td><td rowspan="2">Servo command</td><td rowspan="2">0x0201</td><td>B15</td><td>B14</td><td>B13</td><td>B12</td><td>B11</td><td>B10</td><td>B9</td><td>B8</td><td>B7</td><td>B6</td><td>B5</td><td>B4</td><td>B3</td><td>B2</td><td>B1</td><td>B0</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>1</td></tr>
<tr><td>(7)</td><td colspan="20">Conduct speed control by following the method described in 15.2 "Speed Control Mode."</td></tr>
</table>

- The control mode is switched to the first control mode when Bit 9 of ID30 is set to "0" and switched to the second control mode when it is set to "1."
- The control mode can also be switched by I/O input (Input 1 to Input 8).
  If "0x10 (16)" is set to I/O setting parameters ID 100 to 107, the corresponding I/O inputs serve as control mode switch inputs.

15.7. Simplified Control Mode

■ Overview

In the simplified control mode, the motor operation is executed according to a user-created program.
In the simplified control function, you can create any program having up to 128 steps. In each step, it is possible to perform a move command, command change during move, condition branch through I/O, contact output, homing, alarm reset, current position reset, and parameter change. To find detailed information for the simplified control mode, refer to the separately issued "TAD881x Simplified Control Operation Manual" (MNL000661W00).
To operate the driver in simplified control mode, you need to set parameter ID31 Control Mode to "14" in advance.

■ Editing the program

The program can be easily edited by using the dedicated application. To find detailed information on how to edit the program, refer to the application software manual.

■ Downloading and uploading the program

The program can also be downloaded from and uploaded to the driver by using the dedicated application. Refer to the application software manual.

■ Program start signal

The program starts up when the driver I/O input "Servo ON input" is turned on.
The driver's CN1-I/O input 1 (IN1) is set to "Servo ON input" at the factory.
Input 2 to Input 8 can be changed to the program start signal by changing the settings of I/O setting parameters ID100 to 107.
The program can also be kept running without I/O input by setting Bit 7 to "1" (I/O input = Negative logic) at the parameter ID that is set to "Servo ON input."

■ I/O inputs

To use I/O input (Input 1 to Input 8) in the branch condition setting in the created program, change the settings of corresponding I/O setting parameter ID100 to 107 to "0x0F."
Note that you need to assign one input to "Servo ON command" and so you can use the remaining seven inputs for the branch condition.

Example: To use I/O input (IN3) for the program start signal and use Input 1, Input 2, Input 4 to Input 8 for the program branch conditions, set the parameter IDs as follows:

ID100 = 0x0F
ID101 = 0x0F
ID102 = 0x01
ID103 to ID107 = 0x0F

■ I/O outputs

To use I/O outputs (Output 1 to Output 5) in the created program, change the settings for the corresponding I/O setting parameter IDs 110 to 114 to "0xFFFFFFFF."

Example: To use I/O outputs (Output 3 to Output 5) in the program, change the settings of the parameter IDs as follows:

ID112 to 114 = 0xFFFFFFFF

■ Commands

For types and details of commands available for the simplified control function, refer to the separately issued "TAD881x Simplified Control Operation Manual" (MNL000661W00).

■ Start of motor excitation

The "Servo ON input" of the I/O input signal is used as the program start signal. The motor is actually excited immediately after the "SVON" command is executed while the program is running.

16. Supplementary Explanation about Functions

16.1. Saving Parameters

ID	Parameter name	Setting value
17	Parameters save	1

Save parameters to a nonvolatile memory. Storable parameters are marked with ○ in the "M" column in ❑19 "List of Parameters." Usually you should save parameters with the servo OFF. After the parameter save has been completed, the value returns to "0."

Caution

If you turn the power supply OFF without doing this operation, the changes you made will be lost. Save parameters to enable the changes.

16.2. Initializing Parameters

ID	Parameter name	Setting value
16	Parameters init.	1

Initialize all parameters according to the driver's built-in default value table.
Note that initializing parameters does not save them to a nonvolatile memory.
Besides initialization, also save parameters as described in ❑16.1 "Saving Parameters."

Caution

This function does not always return all parameters to their factory settings. Do not use this function if either the driver or the motor is a special product designed to meet your specifications

16.3. Servo Command

■ Bit 0: Servo ON

ID	Parameter name	Setting														
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1

Setting Bit 0 of ID30 "Servo Command" to "1" turns the servo ON.
During position and speed control, the motor shaft is fixed. The servo ON signal can also be input from the I/O connector. ⇒ Refer to ❑ 7.7 "Wiring the I/O Connector."

Important

Do not turn the servo ON within 2 seconds after power has been turned on.

■ Bit 1: Profile Operation Enabled

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	*	*	*	1	*

When Bit 1 of ID30 "Servo Command" is "1," the position control (profile operation) is performed with the set target position, target speed, acceleration, and deceleration. Use this parameter when operating by setting a target position for position control.

■ Bit 2: Deviation Reset

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	*	*	1	*	*

Setting Bit 2 of ID30 "Servo Command" to "1" clears the deviation between the command position and the current position.

This function is enabled when the position control pulse input is used for operation. Setting "Deviation Reset" to ON during a pulse input stops rotation of the motor while maintaining the current position. After "1" (ON) is set, this Bit retains the value until "0" (OFF) is set.

■ Bit3: Alarm Reset

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	*	1	*	*	*

Setting Bit 3 of ID30 "Servo Command" to "1" clears an alarm.
Set Alarm Reset after eliminating the cause of the problem.
⇒ Refer to ❑17 "Alarm Detection."

■ Bit 4: Hard Stop

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	1	*	*	*	1

Setting Bit 4 of ID30 "Servo Command" to "1" automatically stops the motor when the speed 0 command is given.

Supplement **This function is also active during operation in any control mode other than speed control and during operation according to analog commands.**
When Hard Stop is ON, the motor does not rotate even when an operation command is given.

■ Bit 5: Smooth Stop

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	1	*	*	*	*	1

Setting Bit 5 of ID30 "Servo Command" to "1" decelerates the motor at the deceleration set in ID35 "Deceleration" until it stops.

Supplement

This function is also active during operation in any other control mode than speed control and during operation according to analog commands.
When Smooth Stop is ON, the motor does not rotate even when an operation command is given. Executing Smooth Stop immediately before completion of profile operation may cause an overshoot of the target position.

.

■ Bit 7: Enabling Acceleration/Deceleration during Speed Control

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	1	*	*	*	*	*	*	*

ID	Parameter name	Setting value	Factory setting	Setting range
34	Acceleration	[10 rpm/sec]	1000	0 to 65535 DEC
35	Deceleration	[10 rpm/sec]	1000	0 to 65535 DEC

When Bit 7 of ID30 "Servo Command" is "1," ID34 "Acceleration" and ID35 "Deceleration" are enabled during speed control by communication.

Supplement

This setting applies only to the speed control mode.
Acceleration and deceleration operations are executed unconditionally in the homing mode and at smooth stop.

■ Bit 8: Setting an Analog Input 0-point Adjustment Command

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	1	*	*	*	*	*	*	*	*

Setting Bit 8 of ID30 "Servo Command" to "1" samples the analog command signals for approximately 0.1 seconds. The average of these values is then set to ID132 "Analog Input Offset."

Set this parameter to use the analog signal for speed control or current control.

To execute an analog command signal offset setting, input an analog signal voltage equivalent to 0 speed or 0 current.

■ Bit 9: Second Control Mode Switch

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	1	*	*	*	*	*	*	*	*	*

OFF (0): First control mode (ID31)
ON (1): Second control mode (ID99)

Setting Bit 9 of ID30 "Servo Command" to "1" switches the control mode to the second control mode.

Use this parameter to switch between control modes while continuing the servo ON operation.

⇒ Refer to ❑15.6 "Control Mode Switch Function."

■ Bit 10: Second Current Limit Switch

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	1	*	*	*	*	*	*	*	*	*

OFF (0): First current limit (ID86 and ID87)
ON (1): Second current limit (ID65 and ID66)

Setting Bit 10 of ID30 "Servo Command" to "1" switches the current limit value to the second current limit.
Use this parameter to switch the current limit value only during a particular operation.

■ Bit 11: Second Servo Gain Switch

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	1	*	*	*	*	*	*	*	*	*	*	*

OFF (0): Gain 1 (ID50, ID51 and ID52)
ON (1): Gain 2 (ID60, ID61 and ID62)

Setting Bit 11 of ID30 "Servo Command" to "1" switches the control gain to Gain 2.

To switch between gains, the ID80 "Gain-Switch Method Select" needs to be set to "5" in advance.

⇒ Refer to ❑13.6 "Gain-Switch Function."

■ Bit 12: Smart ABS Sensor Alarm Reset

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	1	*	*	*	*	*	*	*	*	*	*	*	*

Setting Bit 12 of ID30 "Servo Command" to "1" clears alarms on the sensor side.

Use this parameter for Smart ABS sensors, such as 17, 23Bit-ABS.

⇒ Refer to ❑17.5 "Sensor Alarm Reset"

■ Bit 13: Origin Detection Notification

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	1	*	*	*	*	*	*	*	*	*	*	*	*	*

Setting Bit 13 of ID30 "Servo Command" to "1" to recognize the origin detection signal.

Use this parameter to detect the origin with the SV-NET controller during a homing operation in homing mode.

⇒ Refer to ❑15.4 "Homing Mode."

■ Bit 14: Current Position Reset

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*

ID	Parameter name	Setting value	Factory setting	Setting range
39	Position Reset Value	(pulse)	0x00000000	-2147483648 to 2147483647 DEC

Setting Bit 14 of ID30 "Servo Command" to "1" sets the current position to the value set in ID39 "Reset Position."

■ Bit 15: Smart ABS Sensor Alarm & Multi-rotation Reset

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

Setting Bit 15 of ID30 "Servo Command" to "1" clears alarms and multi-rotation data on the sensor side.

Use this parameter for a smart ABS sensor, such as 17, 23Bit-ABS.

⇒ Refer to ❑17.5 "Sensor Alarm Reset"

16.4. Servo OFF Delay Function

ID	Parameter name	Setting value	Factory setting	Setting range
143	Servo OFF Delay	Delay time (msec) before servo OFF	0	0 to 10000 DEC

When switching from servo ON to OFF, the time that elapses between when a servo OFF command is set to, and when the servo is actually turned OFF, can be adjusted. When the mechanical brake is controlled by Output 4 (brake control signal), setting ID143 to a value longer than the release time setting for the mechanical brake allows the servo to turn OFF after the mechanical brake is applied.

16.5. Defining the Forward Rotation Direction

ID	Parameter name	Setting value
72	Reference Direction	0: CCW 1: CW

The forward rotation direction can be changed to CW by setting ID 72 "Reference Direction" to "1."

Supplement **Note that changing the "Reference Direction" also changes the sign of the position data.**

16.6. Setting the Position Soft Limit

■ Setting soft limit enable/disable

ID	Parameter name	Setting value
83	Soft Limit Select	1: Enable 0: Disable

■ Positive-side soft limit

ID	Parameter name	Setting value	Setting range
84	Positive-side soft limit	(pulse)	-2147483648 to 2147483647 DEC

■ Reverse-side soft limit

ID	Parameter name	Setting value	Setting range
85	Reverse-side soft limit	(pulse)	2147483648 to 2147483647 DEC

A position limit can be set by software so that the motor does not move out of the intended range.

After the detection of position soft limit, the motor immediately stops (speed command 0) (only position and speed control is enabled).

Caution

Depending on the motor speed, the motor may stops in excess of the limit position. Therefore, make settings in consideration of operation conditions of the motor.

16.7. Servo OFF Using Communication Stop

The driver has a function which, for safety reasons, automatically turns the servo OFF if USB communication or SV-NET communication ceases for any reason.
Set the time for communication cease detection using ID 148 "Enable Off Time." The factory setting is 1000 [msec]. Therefore, the servo is turned OFF if no communication takes place for one second.

ID	Parameter name	Setting value	Setting range
148	Enable Off Timer	(msec)	1 to 10000 DEC 0: Cancel

Caution

Setting "0" cancels this function, so that the servo does not turn OFF even if communication ceases. Consider the equipment operating conditions before attempting to cancel this function.

17. Alarm Detection

If an alarm is detected, the driver turns the servo OFF to stop operation. If an alarm is detected, an alarm reset must be performed after first checking the details of the alarm from the alarm code and eliminating the cause of the problem. This chapter describes such alarm-related matters.

17.1. How to Detect an Alarm

■ Checking using the settings panel

If an alarm occurs, the alarm code (AL-**) will be displayed in the settings panel.

"**" represents an alarm code.

■ Checking an alarm with a parameter

An alarm turns on Bit 3 "Alarming" (alarm occurs) of ID 20 "Servo Status" and prompts an update of ID 22 "Alarm Code."

ID	Parameter name	Setting								
		B31	B30	.....	B5	B4	B3	B2	B1	B0
20	Servo Status	*	*	.....	*	*	1	*	*	*

ID	Parameter name	Read value
22	Alarm Code	(Decimal code)

Alternatively, Bit 20-22 "Alarm Bit Code (Ab0-Ab2) in ID 20 "Servo Status" also indicates if any alarm is issued and its rough classification.

Correspondence between alarm bit codes and alarm codes is as follows: Ab0 = Bit 20, Ab1 = Bit 21, and Ab2 = Bit 22.

Refer to ❑17.2 "List of Alarm" to find the correspondence between alarm bit codes and alarm codes.

Alarm bit codes (Ab0, Ab1, and Ab2) are all 0 when there is no alarm.

(Example) Alarm Code 71 "Excess Drive Voltage"

ID	Parameter name	Setting						
		B31	.....	B22 (Ab2)	B21 (Ab1)	B20 (Ab0)	.....	B0
20	Servo Status	*	.....	1	0	1	.....	*

Alarm bit codes Ab0 = 1, Ab1 = 0, Ab2 = 1

Once conditions for certain alarms are met, corresponding bits change to 1 in ID 29 "Warning Status Display."

⇒Refer to ❑17.10 "Alarm Detection Disabling Settings and Warning Status Display."

ID	Parameter name	Description
29	Warning Status Display	The corresponding Bit is 1 when the condition enclosed in parentheses in the following is met. Bit 0: Drive voltage low warning (The drive voltage drops, or Alarm 72 conditions are met.) Bit 1: Backup battery voltage low warning (The backup battery voltage is 3.1 V or less (only the absolute encoder).) Bit 3: Actual current overload warning (Alarm 21 conditions are met.) Bit 4: Command current overload warning (Alarm 22 conditions are met.) Bit 5: Overspeed warning (Alarm 31 conditions are met.) Bit 6: Multi-rotation warning (Alarm 41 conditions are met.) Bit 7: Excess position deviation warning (Alarm 42 conditions are met.) Bit 8: Driver temperature warning (Alarm 51 conditions are met.) Bit 9: External encoder count warning (Alarm 67 conditions are met.) Bit10: External encoder position error warning (Alarm 68 conditions are met.) Bit11: Excess regenerated volume warning (Alarm 74 conditions are met.) **! Important** In case any alarm is issued, Bit 3-11 in ID 29 "Warning Status Display" are fixed at a status corresponding to the alarm. These can be cleared by resetting the alarm.

■ Checking an alarm with a digital output from the I/O connector

An alarm turns on the corresponding digital output on the I/O connector.

(Factory setting: Pins 30 and 31 for Output 1)

Alarm bit codes can be checked with digital output by assigning Bit 20-22 in ID 20 "Servo Status Display" to any digital output.

⇒Refer to ❑7.7 "Wiring the I/O Connector"

⇒Refer to ❑19.10 "Parameters for Setting I/O" (Parameter ID 110-114)

17.2. List of Alarm

Alarm code	Alarm bit code			Name	Description	Situation	Main cause	Corrective action
	Ab2	Ab1	Ab0					
11	0	0	1	Overcurrent	Power drive area error, overcurrent An electric current exceeding the allowable current value of the driver flowed. Do not repeatedly the power turn on and off without a good reason when this alarm is issued. Instead, try troubleshooting by following instructions in the "Corrective action" section.	Occurs only when powering on. Alarm 11 occurs even when power is turned on by disconnecting the motor cable (U, V, and W).	Driver failure	Replace the driver.
						Occurs when servo is turned ON.	Motor wiring short	Check the motor wiring. Check that the connection of motor cable U, V, and W is not shorted. Check the branched-out wire out of the connector. Make a correct wiring connection.
							Motor winding short	Replace the motor. Check the balance of resister between each motor line, and if unbalance is found, replace the motor.
							Driver malfunction (Failure of the driver transistor (IPM/IGBT))	Replace the driver. Remove the motor cable and turn the servo on. If an error occurs immediately, replace the driver with a new (operating) driver.
						Occurs during acceleration/deceleration.	Driver adjustment failure	Reduce the gain.
							Driver malfunction	Replace the driver.
						—	Ground fault of the servo motor power cable (U, V, and W)	Fix the wiring.
						—	The overcurrent detection circuit has malfunctioned due to external noise.	Take noise countermeasures.
						—	The power cable or the motor cable is incorrectly wired or has a bad connection.	Fix the wiring.
						—	The inside of the motor cable (U, V, and W) is short-circuited or a ground fault has occurred.	The cable may have short-circuited. Replace the cable.
						—	The inside of the servo motor, motor cable or terminal block (U, V, and W) has short-circuited or a ground fault has occurred.	The servo motor may have failed. Replace the servo motor.
						—	The regeneration resistor is incorrectly wired or has a bad connection.	Fix the wiring.
						—	Frequent use of the dynamic brake (DB for emergency stop by the driver)	Change the methods of driver selection and operation or change the equipment to reduce the frequency of use of the DB. Replace the driver.
						—	The regeneration resistance value of the driver is too small.	Change to the one with the regeneration resistance specified for the driver.
						—	Malfunction resulting from noise	Take appropriate noise countermeasures such as wiring FG correctly. Use a thicker size wire for FG.

Alarm code	Alarm bit code			Name	Description	Situation	Main cause	Corrective action
	Ab2	Ab1	Ab0					
11	0	0	1	Overcurrent		—	Welding of the dynamic brake relay due to frequent Servo-ON/OFF operation.	Replace the driver. Discontinue the operation of the dynamic brake with Servo ON-OFF.
21 22	0	1	0	Actual current overload Command current overload	Overload protection is prompted in accordance with 16.9 "Characteristics of Overload Alarm Detection" when actual and command values in torque command exceed an overload level. An actual current overload turns on Bit 3 in ID 29 "Warning Status Display." A command current overload turns on Bit 4 in ID 29 "Warning Status."	The motor vibrates when servo is ON or in operation.	Adjustment failure	Re-adjust the gain.
						Occurs during acceleration/deceleration.	High acceleration/deceleration	Reduce acceleration/deceleration.
						Occurs during constant-speed rotation.	High load torque The servo motor is used at an output exceeding its rated output (rated current)	Check installed equipment. Reduce the load. Review the running pattern. Consider a higher output servo motor.
						Occurs when servo is turned ON.	Motor wiring Erroneous connection of the servo motor The output terminals U, V, and W of the servo driver do not match the input terminals U, V, and W of the servo motor.	Check the motor wiring.
31	0	1	1	Overspeed	The motor rotational speed has exceeded the set value of Over-Speed Alarm Detection Speed (ID 201). Bit 5 in ID 29 "Warning Status Display" is turned on.	Occurs during operation.	Speed overshoot	Re-adjust the gain. Do not give an excessive speed command. Check the command pulse input frequency and the electronic gear ratio. Make a gain adjustment when an overshoot has occurred due to a poor gain adjustment. Mak the sensor wiring connection as shown in the wiring diagram.
41	1	0	0	Counter Overflow	Driver position Counter error Bit 6 in ID 29 "Warning Status Display" is turned on.	Occurs during rotation.	The in-driver position counter has exceeded the specifications.	Allow the move distance from the origin to be within 0x70000000 (1,879,048,192) counts. Set Bit3 of the alarm mask (ID 209) to 1 in application as an infinite rotation axis.
42	1	0	0	Position excessive deviation	The position deviation pulse exceeds the set value of Position Deviation Error Detection Pulse Count (ID 202). Bit 7 in ID 29 "Warning Status Display" is turned on.	Occurs during pulse command input.	Pulse input without servo ON input.	Check the servo ON input.
							The forward-rotation drive disable input or the reverse-rotation drive disable input has not been input or set.	Check the wiring and settings.
							The motor movement has not followed the command.	Check if the motor rotates according to the position command pulses. Check with the torque monitor that the output torque is not saturated. Adjust servo gains (IDs 50 to 52). Set the highest possible value for Position Deviation Error Detection Pulse Count (ID 202).
							The current position corresponds to 0x70000000 (1,879,048,192) pulses or more.	Disable the speed stabilizing control and the position command damping filter.
						Occurs during acceleration/deceleration.	High acceleration/deceleration	Lower the acceleration/deceleration.

Alarm code	Alarm bit code			Name	Description	Situation	Main cause	Corrective action
	Ab2	Ab1	Ab0					
51	0	1	0	Over heat	Abnormal driver internal temperature is detected. Bit 8 in ID 29 "Warning Status Display" is turned on.	Occurs during operation.	Use under frequent overload conditions.	Relax operation conditions. Increase the capacity of the driver and motor. Set a longer acceleration/deceleration time. Reduce the load.
							Ambient temperature high	Improve heat dissipation conditions by installing a fan, for example. Improve the ambient temperature and cooling conditions of the driver.
61 — 69	0	1	1	Sensor error	Description depends on types of sensors. Refer to ❑17.3 "List of Sensor Alarm."			
71	1	0	1	Over Voltage	Drive power supply voltage increased and exceeded the predetermined value. AC100 V product Drive power supply voltage: Approx. 200 VDC AC200 V product: Drive power supply voltage: Approx. 400 VDC	Occurs during operation.	Insufficient capacity for regenerative protection	Add regenerative resistance.
						Occurs when power is turned on.	Wrong voltage specification is used if detected when power is turned on.	Exchange the driver. Measure the voltage between the power supply cables.
72	1	0	1	Voltage Down	The drive power supply voltage has fallen below the specified value. AC100 V product: Drive power supply voltage: Approx. 50 VDC (Approx. 35 VAC) AC200 V product: Drive power supply voltage: Approx. 150 VDC (Approx. 100 VAC) Bit 0 of ID 29 "Warning Status Display" is turned on regardless of the servo status.	Occurs during operation.	Insufficient power supply capacity	Increase the capacity of the power supply voltage. Change the power supply.
							Drive power supply line disconnection	
						Occurs when power is turned on.	Drive line disconnection	Check the wiring.
73, 74	1	1	0	Regeneration error	Regeneration protection operated continuously, which resulted in an exceeding of the threshold of the regeneration alarm detection capacity (ID 207). Bit 11 of ID 29 "Warning Status Display" is turned on.	Occurs during operation.	Insufficient capacity for regenerative resistance	Review the operation pattern.
							Regenerative resistance is not as specified.	Check if the regenerative resistance is as specified.
75	1	0	1	Drive power error	No drive voltage increase (P-N on DC side after rectification) despite detected power input (AC side)	Occurs when power is turned on.	Power voltage is too low.	Check the power voltage (ex. input of AC100 V to a device operating with AC200 V).
							Failure of a power circuit	Replace the driver.
81	1	1	1	External alarm	Detection of I/O input (external alarm input) ⇒ Refer to ❑19.10 "Parameters for Setting I/O"	Occurs during operation.	An external alarm was issued.	Cancel the alarm from the source.
							Disconnected I/O cable	Check the I/O cable.
91, 93	1	1	1	Flash Memory Error	Nonvolatile memory read error	Occurs when power is turned on.	IC nonvolatile memory or CPU malfunction	Replace the driver.
92	1	1	1		Nonvolatile memory write error	Occurs during parameter storing.		
98	1	1	1	Hardware Error	CPU error	Occurs during operation.	Malfunction resulting from noise	Install noise filter.
						Occurs when power is turned on.	Driver failure	Replace the driver.
99	1	1	1	Parameter Error	Parameter error	Occurs during parameter storing.	Parameter values written in nonvolatile memory were incorrect. (No write executed).	Check changed parameter values.

17.3. List of Sensor Alarm

■ Brushless resolver 1X-BRX

Alarm code	Name	Description	Situation	Main cause	Corrective action
61	Sensor error	Correct resolver signal detection failed.	Occurs when power is turned on.	Resolver signal has low amplitude or the cable is disconnected.	Check if the sensor cable and sensor are correctly connected. ・ Replace the driver. ・ Check the compatibility between the driver and motor models.
62				Resolver signal has too large an amplitude.	Check if the sensor cable and sensor are correctly connected. ・ Replace the driver. ・ Check the compatibility between the driver and motor models.

■ Encoder wiring-saving INC

Alarm code	Name	Description	Situation	Main cause	Corrective action
62	Sensor not Connect Error	Disconnection of the sensor cable was detected.	Occurs during operation.	No sensor cable connected	Check the connection.
63	Sensor initialization error 1	A/B/Z signals were abnormal immediately after the power was turned on (normally: high impedance).	Occurs when power is turned on.	・ The control power supply was immediately restored after being turned off. ・ Sensor cable disconnection ・ Sensor signal failure	・ After cutting off the power and the display on the setting panel turns off, turn on the power supply again. ・ Check the connection. ・ Replace the motor.
64	Sensor initialization error 2	・U/V/W signals was received (high impedance was not cancelled after the power was turned on). ・Power was turned on when the sensor cable was disconnected.			
65	Sensor initialization error 3	Data error was detected with U/V/W signals. (All of U/V/W were either High or Low.)			
66	Initial Z signal error	・Detection position of Z signal is abnormal. ・Z signal was detected.	Occurs after the motor rotates slightly when the power is turned on.	・ Sensor cable disconnection ・ Sensor signal failure	・Check the connection. ・Replace the motor.

■ External Encoder

Alarm code	Name	Description	Situation	Main cause	Corrective action
67	External Encoder Count Error	Correct receipt of external encoder signal failed. Bit 9 of ID 29 "Warning Status Display" is turned on.	Occurs when external encoder signals are input into the driver.	Disconnected external encoder or open phase	Check the external encoder output signals and input/output.
				Error in the input of external encoder signals to the I/O connector	Check the connection and wiring to the I/O connector.
68	External Encoder Position Error	There is a difference between the movement distance recognized by external encoder and that recognized by motor sensor. Bit 10 of ID 29 "Warning Status Display" is turned on.	Occurs when external encoder signals are input into the driver.	Inadequate setting of ID 124 "External Encoder Resolution"	・ Review the setting for ID 124. ・ Cancel this alarm by setting ID209 "Alarm Mask."

■ Encoder 17, 23Bit-ABS/17, 23Bit-INC

Alarm code	Name	Description	Situation	Main cause	Corrective action
61	Sensor Battery Error	Sensor backup battery error Bit 1 of ID 29 "Warning Status Display" is turned on.	Occurs when power is turned on.	The battery of the 17, 23Bit-ABS sensor was removed.	Clear the sensor alarm by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command." Use it after setting ID 140 "Abs Mode" to 0.
				The battery cable is disconnected.	Repair the cable Or, replace the battery.
				The battery voltage lowered to approximately 3 V or less.	Replace the battery.
62	Sensor not Connect Error	Motor-driver sensor connection line error	Occurs when power is turned on.	No sensor cable connected	Check the connection.
				Power was applied to the 17, 23Bit-ABS sensor for the first time.	Clear the sensor alarm by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command."
				The sensor cable was once disconnected and reconnected.	Check the sensor connection, then clear the sensor alarm by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command."
63	Counter Overflow Error	Error of multi-rotation counter of the sensor	Occurs when the motor is rotating.	The multi-rotation counter of the 17, 23Bit-ABS sensor has exceeded the specifications.	Reset the multi-rotation counter by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command." Set ID 140 "Abs Mode" to 0 in application as an infinite rotation axis.
64	1rev Count Error	One-rotation counter error of the sensor	Occurs when power is turned on. Occurs when the motor is rotating.	Error detected in the one-rotation counter of the 17, 23Bit sensor.	Clear the sensor alarm by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command."
66	Overspeed Error	Speed error	Occurs when power is turned on.	Battery backup The sensor rotated at a speed exceeding the specification during battery drive.	Clear the sensor alarm by setting Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command." Use it after setting ID 140 "Abs Mode" to 0. Set the number of motor rotations to less than 6000 rpm and turn on the control power supply.

17.4. Resetting Alarm

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	*	*	*	*	*	*	*	*	*	*	*	*	1	*	*	*

Caution

Clear the alarm after eliminating the cause of the problem.

17.5. Clearing a Sensor Alarm

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
30	Servo Command	1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

If the sensor is 17, 23Bit-ABS, the alarm codes 61, 63, 64, and 66 are alarms recorded on the sensor side.
Assign "1" to Bit 15 "Smart ABS sensor alarm & multi-rotation reset" of ID 30 "Servo Command" when it is necessary to clear alarms recorded on the sensor side.
Once sensor alarms are cleared, cancel the alarms by running a normal alarm reset.
⇒ Refer to ❑17.4 "Resetting Alarm"

17.6. Checking the Alarm History

Refer to "Alarm History-1" and "Alarm History-2" to see the past 8 alarm records.

ID	Parameter name	Read value	Description			
			Bit31 to 24	Bit23 to 16	Bit15 to 8	Bit7 to 0
23	Alarm History-1	Alarm code records 1 to 4	Record 4	Record 3	Record 2	Record 1
24	Alarm History-2	Alarm code records 5 to 8	Record 8	Record 7	Record 6	Record 5
■ Records 1 to 8 are in decimal.						

New alarm is registered in Alarm History-1 and the older ones are shifted down. The oldest history is deleted.

17.7. Checking Detailed Alarm Occurrence Information

Detailed information at the time of alarm occurrence can be checked (alarm recorder function)
Setting the alarm history code and information code you wish to check in parameter ID 25 "Select Alarm Occurrence Information to be Displayed" displays information at the time of alarm occurrence specified for parameter ID 26 "Alarm Occurrence Information."

ID	Parameter name	Description
25	Select Alarm Occurrence Information to be Displayed	Alarm occurrence information is displayed in ID 26 according to the following settings: ・ Bit 15 to 8 = Alarm history code 00: Record 1 (Latest), 01:Record 2, ・・・ 07:Record 8 ・ Bit 7 to 0 = Alarm information code 00: Alarm code 01: Month and day of occurrence [BCD] * The year is not displayed. 02: Hour and minute of occurrence [BCD] * The second is not displayed. 03: Total driver power ON time (minutes) 04: Servo Status (ID 20) 05: Feedback current [0.01 Arms] (ID 42) 06: Feedback speed [rpm] (ID 41) 07: Feedback position [pulse] (ID 40) 08: Drive power supply voltage [0.1 V] (ID 161) 09: Driver temperature [0.1°C] (ID 160) 0A: Overload monitor [0.1%] (ID 159) 0B: Command overload monitor [0.1%] Example: Set at 0x0306 when looking at the speed when the alarm Record 4 was generated.
26	Alarm occurrence information	Alarm occurrence information Displays the data specified with ID 25.

Supplement **To set the year/month/date and hour/minute of alarm occurrence (calendar function), refer to the next page.**
The value displayed for each servo data is actually the value just before the alarm occurred.

17.8. Setting the Calendar Function

To record "Month and day of occurrence" and "Hour and minute of occurrence" in Alarm Occurrence Information (alarm recorder function), the calendar function needs to be set in advance. Set the calendar function after purchasing this driver.
The calendar function is the Real Time Clock (RTC) function maintained by the driver's built-in lithium battery even when the power goes off. The date and time held by the calendar function are confirmed by referring to ID 240 "Current Date" and ID 241 "Current Time."
To change values, set new values by adding "88" to the most significant value as shown in the table below. The date and time values are automatically updated and the calendar restarts from the newly set values.

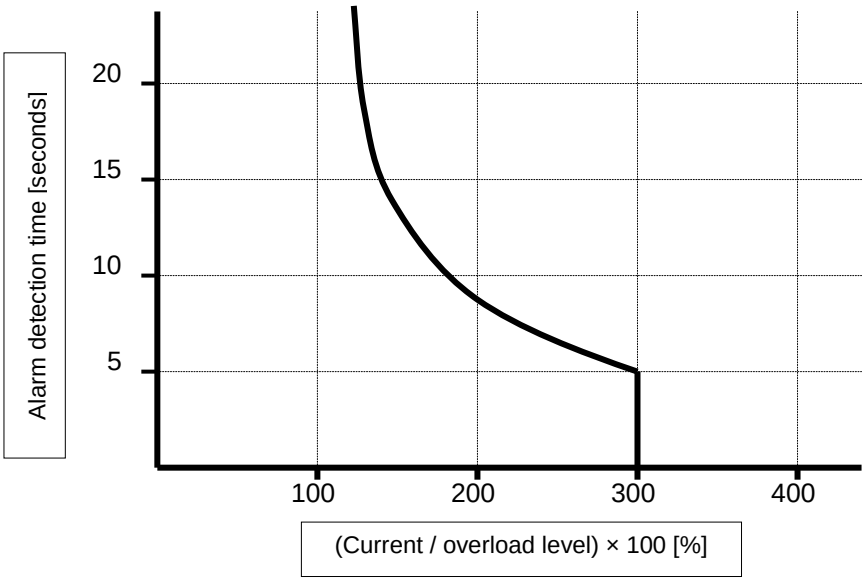
Supplement **The calendar function can be configured with a special application. Refer to the instruction manual of each application.**

ID	Parameter name	Description
240	Current Date	Calendar function: Current date Displays the date registered in the driver in binary coded decimal form. Example: November 23, 2013 → 0x00131123 To change the current date, set new values by adding 0x88 to the most significant 1 byte. Example: To change the current date to March 5, 2014, set 0x88140305. This parameter is saved when data is set. (Parameter storing does not have to be implemented.) **Important** **Setting the year to 00 is not allowed.**
241	Current Time	Calendar function: Current time Displays the current time registered in the driver in binary coded decimal (BCD) form. Example: 23h 12m 05sec → 0x00231205 To change the current time, set new values by adding 0x88 to the most significant 1 byte. Example: To change the current time to 11h 32m 01sec, set 0x88113201. This parameter is saved when data is set. (Parameters storing does not have to be implemented.)

The calendar function is maintained by the lithium battery in the driver. (Service life indication: approximately 4 to 5 years from the month of manufacture; a fee will be charged for battery replacement.)
After the battery expires, even if the calendar is reset, the current date and current time are cleared to 0x000000 due to power-off. If an alarm occurs under the condition, "Month and day of occurrence" and "Hour and minute of occurrence" in Detailed Alarm Occurrence Information, these are saved as 0x0000.
The calendar function is accurate within approximately 60 seconds per month.

17.9. Characteristics of Overload Alarm Detection

By comparing the motor current command and the detection level, an overload alarm is detected with the following time characteristics:
There are two types of overload alarms: Actual Current Overload (21) detected from the actual motor current and Command Current Overload (22) detected from the command current.
Actual current detection has the advantage because it allows detection that better reflects the actual increase in the motor temperature.
Command current detection has the advantage that it allows alarm detection even under abnormal motor wiring condition or other abnormal conditions.



17.10. Alarm Detection Disabling Settings and Warning Status Display

Issuance of some alarms can be disabled. Use this setting when you do not want to issue an alarm during the initial adjustment or experiment.
Note that ID29 "Warning Status Display" remains enabled even when alarm detection is disabled.

Caution

Continued operation while alarm conditions persist can cause failure of a device, a driver, or a motor. Use the alarm detection disabling settings only when safety measures have been implemented on the host system side. Any failures and damage caused by continued operation while alarm detection is disabled are not covered by warranty.

ID	Parameter name	Description
209	Alarm Mask	Disables detection of some alarms. Setting the specified bit to "1" disables the issuance of an alarm. Bit 0: 1 = Actual Current Overload Alarm (21) Bit 1: 1 = Command Current Overload Alarm (22) Bit 2: 1 = Overspeed Alarm (31) Bit 3: 1 = Multi-rotation Alarm (41) Bit 4: 1 = Position Excessive Deviation Alarm (42) Bit 5: 1 = Driver Temperature Alarm (51) Bit 6: 1 = External Encoder Count Alarm (67) Bit 7: 1 = External Encoder Position Error Alarm (68) Bit 8: 1 = Regeneration Capacity Alarm (74) Bit 12: 1= Drive power low alarm (72) Example: Set 0x0030 when disabling Excessive Deviation Alarm (42) and Circuit Board Overheat Alarm (51).
29	Warning Status Display	The corresponding Bit is 1 when the condition enclosed in parentheses in the following is met. Bit 0: Drive power supply voltage low warning (The drive power supply voltage is low, or the Alarm 72 conditions are met.) Bit 1: Backup battery voltage low warning (The backup battery voltage is 3.1 V or less (only the absolute encoder).) Bit 3: Actual current overload warning (Alarm 21 conditions are met.) Bit 4: Command current overload warning (Alarm 22 conditions are met.) Bit 5: Overspeed warning (Alarm 31 conditions are met.) Bit 6: Position counter overflow warning (Alarm 41 conditions are met.) Bit 7: Excess position deviation warning (Alarm 42 conditions are met.) Bit 8: Driver temperature error warning (Alarm 51 conditions are met.) Bit 9: External encoder count error warning (Alarm 67 conditions are met.) Bit 10: External encoder position error warning (Alarm 68 conditions are met.) Bit 11: Excess regenerated volume warning (Alarm 74 conditions are met.) **Important** In case any alarm is issued, Bit 3-11 in ID 29 "Warning Status Display" are fixed at a status corresponding to the alarm. They are cleared by resetting the alarm.

18. Troubleshooting

Classification/Trouble	Cause	Check method	Corrective action
Servo Motor Does Not Rotate **<Wiring and Installation>**	Power is not turned on.	Measure the voltage between power terminals.	Correctly wire the power supply.
	CN1 (I/O) is miswired or disconnected.	Check the input/output signal connections (CN1).	Correctly wire the input/output signals (CN1).
	The servo motor or sensor wiring is off.	Check the wiring condition.	Correct the wiring.
	The servo motor is overloaded.	Run the motor with no load and check the load status.	Reduce the load or replace it with a larger capacity driver or servo motor.
	Wrong types of sensors are used.	Check the correct combination.	Use the correct combination of sensors.
	The servo ON input of CN1 (I/O) is not turned on.	Check the command from the higher-level device. Check ID 21 "I/O Status Display."	Check the wiring of the servo ON input.
	Forward-rotation drive disable input or reverse-rotation drive disable input of CN1 (I/O) is turned on.	Check ID 21 "I/O Status Display."	Turn off the forward-rotation drive disable input/reverse-rotation drive disable input signals.
	Deviation reset input of CN1 (I/O) is turned on.	Check ID 21 "I/O Status Display."	Turn off the deviation reset input.
	Driver malfunction	Compare with a correctly operating driver.	Replace the driver.
	Pulse input disable command of CN1 (I/O) is turned on.	Check ID 21 "I/O Status Display."	Pulse input disable command signal is turned off.
	Drive power supply is shut off.	Check if the CHARGE lamp is lit.	Check the wiring and voltage of the power supply of the driver.
	The motor shaft drags. The motor does not rotate.	Check that you can turn the motor shaft by hand, after turning off the power of the driver and separating it from the machine. In the case of a motor with an electromagnetic brake, check that you can turn the motor shaft by hand while applying voltage to the brake.	If you cannot turn the motor shaft, replace the motor.

Classification/Trouble	Cause	Check method	Corrective action
Servo Motor Does Not Rotate **<Parameter>**	The control mode and command selection are wrong.	In the monitor mode of the settings panel, check whether the current control mode is wrong.	Again set the parameters related to operation. ・ ID 31 "Control Mode" ・ ID 74 "Select Position Command" ・ ID 75 "Select Speed Command" ・ ID 76 "Select Torque Command"
	The settings for I/O inputs are wrong.	Check if there are any errors or superimposed items on the I/O input setting.	Set parameters related to operation again. ・ ID 100-107 "I/O Input 1 (IN1)-8 (IN8) Setting"
	Command pulse input setting is wrong. (for position control)	Pulse output setting of a higher-level device and check the setting of ID 120 "Pulse Input Mode."	Check if the command pulse is properly input with a method selected in ID 120 "Pulse Input Mode."
	Speed command is invalid. (for speed control)	Check that the speed command input method is correct.	・ Using external analog command Assign "1" to ID 75 "Select Speed Command" and once again check ID 130 "Analog Input Signal Speed Conversion Scale" and ID 132 "Analog Input Offset." ・ Using command signal with SV-NET Assign "0" to ID 75 "Select Speed Command" and set ID 37 "Real-time Command Speed."
	The command pulse input resolution is wrong. (for position control)	Check that the motor moves the expected distance in response to the input command pulse.	Set parameters related to operation again. ・ ID 74 "Select Position Command" ・ ID 120 "Pulse Input Mode" ・ ID 121 "Command Pulse Input Signal Resolution Numerator" ・ ID 122 "Command Pulse Input Signal Resolution Denominator"
	The current command is invalid (for current control).	Check whether the current command input method is wrong.	・ Using external analog input Assign "1" to ID 76 "Select Torque Command" and once again check ID 131 "Analog Input Current Speed Conversion Scale" and ID 132 "Analog Input Offset." ・ Using command signal with SV-NET Set the ID 76 "Select Torque Command" to "0" and set the ID 38 "Real-time Command Current."
The Motor Rotates Momentarily but Will Not Rotate after That	The servo motor wiring is not correct.	Check the wiring.	Correct the wiring.
	The sensor wiring is not correct.	Check the wiring.	Correct the wiring.
The Motor Rotation Is Unstable	Wiring connection to the servo motor is defective.	The connection between the motor cable (U, V, and W phases) and the sensor connector may be unstable. Check the wiring.	Correct the wiring by tightening loose terminal blocks and connectors.
The Motor Rotates without a Command	Driver malfunction	Compare with a normal drive.	Replace the driver.

Classification/Trouble	Cause	Check method	Corrective action
Dynamic Brake (DB) Does Not Operate	Wrong setting for ID 154 "Dynamic Brake Drive Conditions"	Check the setting for ID 154 "Dynamic Brake Drive Conditions."	Correctly set ID 154 "Dynamic Brake Drive Conditions."
	DB actuation circuit failure	-	Replace the driver.
Abnormal Noise from Servo Motor	Strong motor vibration.	Check the feedback speed waveform of the monitor.	Reduce the load or re-adjust the gain.
	Mechanical mounting failure.	Check if the servo motor is mounted securely.	Tighten the mounting screws.
		Check if there is misalignment of couplings.	Align the couplings.
		Check if there are unbalanced couplings.	Balance the couplings.
	There is an abnormality in the bearings.	Check the noise and vibration around the bearings.	Replace the servo motor.
	The vibration is generated from another machine.	Check if there is any foreign matter, damage, or deformation in the moving parts of the machine.	Consult the machine maker.
	Noise is superimposed on the sensor cable.	Check the sensor cable specifications. Review the cable specifications. Use a twisted pair cable or twisted pair common shield cable (core wire: 0.12 mm^2 or more, tinned annealed copper twisted wire).	Review the cable specifications.
		Check whether there is any pinching of sensor cable or breakage in the shield.	Replace the sensor cable and alter the sensor cable layout environment.
		Check if a ground is used as both the control power supply ground (safety voltage GND) and the frame ground (FG) by a host system.	Separate the control power supply ground and the frame ground (FG).
		Check the termination of the sensor cable shield.	Change the termination to the control power supply ground when the shield is terminated to the frame ground (FG).
	Noise is superimposed because the sensor cable is too long.	Check the length of the sensor cable.	Use a sensor cable of 10 m or less.

Classification/Trouble	Cause	Check method	Corrective action
Abnormal Noise from Servo Motor	There is excessive noise interference on the sensor cable.	Check to make sure that the sensor cable is not bundled together with a power line or arranged closed to the line.	Improve the installation environment to avoid application of a surge from a power line.
	The FG (frame ground) potential varies because of influence from machines on the servo motor side, such as a welder.	Check the grounding state (non-grounding, incomplete grounding, etc.) of the motor-side machines.	Correctly ground the machines on the motor side.
	Failure due to excessive vibration or shocks applied to the sensor	Check that no vibration is generated from the machine. Also check the mounting conditions of the servo motor (mounting surface accuracy, fixing state, core dislocation).	Reduce vibration from the machine. Improve the mounting conditions of the servo motor.
	Sensor malfunction	-	Replace the servo motor.
Servo Motor Vibrates at a Frequency of Approx. 400 Hz or Less	The servo gain balance is not appropriate.	Check if the servo gain is adjusted.	Re-adjust the servo gain.
	The setting value of ID 51 "Speed Loop Proportional Gain 1" is excessively high.	Check the setting value of ID 51 "Speed Loop Proportional Gain 1." Factory setting: Kv = 200	Lower the setting value of ID 51 "Speed Loop Proportional Gain 1" until the servo motor does not vibrate.
	The setting value of ID 50 "Position Loop Proportional Gain 1" is excessively high.	Check the setting value of ID 50 "Position Loop Proportional Gain 1." Factory setting: Kp = 50	Configure the setting value of ID 50 "Position Loop Proportional Gain 1" until the servo motor does not vibrate.
	The setting value of ID 52 "Speed Loop Integral Gain 1" is incorrect.	Check the setting value of ID 52 "Speed Loop Integral Gain 1." Factory setting: Ki = 50	Configure the setting value of ID 52 "Speed Loop Integral Gain 1" correctly.
	The setting value of ID 59 "Load Inertia" is incorrect.	Check the setting value of ID 59 "Load Inertia."	Configure the setting value of ID 59 "Load Inertia" correctly.
High Motor Speed Overshoot on Starting and Stopping	The servo gain balance is not appropriate.	Check if the servo gain is adjusted.	Re-adjust the servo gain.
	The setting value of ID 51 "Speed Loop Proportional Gain 1" is excessively high.	Check the setting value of ID 51 "Speed Loop Proportional Gain 1." Factory setting: Kv = 200	Reduce the setting value of ID 51 "Speed Loop Proportional Gain 1" to bring the overshoot to a low level.
	The setting value of ID 50 "Position Loop Proportional Gain 1" is excessively high.	Check the setting value of ID 50 "Position Loop Proportional Gain 1." Factory setting: Kp = 50	Reduce the setting value of ID 50 "Position Loop Proportional Gain 1" to bring the overshoot to a low level.
	The setting value of ID 52 "Speed Loop Integral Gain 1" is incorrect.	Check the setting value of ID 52 "Speed Loop Integral Gain 1." Factory setting: Ki = 50	Configure the setting value of ID 52 "Speed Loop Integral Gain 1" correctly.
	The setting value of ID 59 "Load Inertia" is incorrect.	Check the setting value of ID 59 "Load Inertia."	Configure the setting value of ID 59 "Load Inertia" correctly.

Classification/Trouble	Cause	Check method	Corrective action
Absolute Encoder Position Error (Difference between the position at the time of power-off held by the host equipment and the position at the time of the next power-on)	Noise is superimposed on the sensor cable. .	Check the sensor cable specifications. Review the cable specifications. Use a twisted pair cable or twisted pair common shield cable (core wire: 0.12 mm^2 or more, tinned annealed copper twisted wire).	Review the cable specifications.
		Check whether there is any pinching of sensor cable or breakage in shield.	Replace the sensor cable and alter the sensor cable layout environment.
		Check if a ground is used as both the control power supply ground (safety voltage GND) and the frame ground (FG) by a host system.	Separate the control power supply ground and the frame ground (FG).
		Check the termination of the sensor cable shield.	Change the termination to the control power supply ground when the shield is terminated to the frame ground (FG).
	Noise is superimposed because the sensor cable is too long.	Check the length of the sensor cable.	Use a sensor cable of 10 m or less.
	There is excessive noise interference on the sensor cable.	Check to make sure that the sensor cable is not bundled together with a power line or arranged closed to the line.	Improve the installation environment to avoid application of a surge from a power line.
	The FG (frame ground) potential varies because of influence from machines on the servo motor side, such as a welder.	Check the grounding state (non-grounding, incomplete grounding, etc.) of the motor-side machines.	Correctly ground the machines on the motor side.
	Driver's pulse counting error due to noise interference	Check if there is noise interference on the signal line from the sensor.	Take countermeasures against noise for the sensor wiring.
	Failure due to excessive vibration shocks applied to the sensor	Check that no vibration occurs from the machine. Also check the mounting conditions of the servo motor (mounting surface accuracy, fixing state, core dislocation).	Reduce vibration from the machine. Improve the mounting conditions of the servo motor.
	Sensor malfunction	Compare with a normal one.	Replace the servo motor.
	Driver malfunction (Pulse count does not change.)	Compare with a normal one.	Replace the driver.
	Rotation data read error in the host equipment	Check the error detection part of the host equipment.	Fix the error detection part so that it works properly.
		Check if parity data and other data is checked by the host equipment.	Perform a parity check of rotation data or check other data.
		Check that there is no noise interference in the cable between the driver and host equipment.	Take countermeasures against noise and execute a parity check for rotation data or check the other data again.

Classification/Trouble	Cause	Check method	Corrective action
Overtravel function does not work properly	The forward-rotation drive disable input/reverse-rotation drive disable input signals are malfunctioning.	Check the voltage of common power supply (+COM) for digital input.	Correct the voltage of common power supply for digital input (+COM).
		Make sure that the voltage of common power supply (+COM) for digital input does not fluctuate.	Eliminate fluctuations in the voltage of common power supply for digital input (+COM).
		Make sure that operation of the limit switch for overtravel is not unstable.	Stabilize the limit switch operation for overtravel.
		Check the wiring of the limit switch for overtravel (damaged cable, tightening condition of screws).	Properly connect the limit switch for overtravel.
	Erroneous allocation of forward-rotation drive disable input/reverse-rotation drive disable input signals to I/O inputs IN1 to IN8 (data IDs 100 to 107).	Check whether the forward-rotation drive disable input signals are allocated to I/O inputs IN1 to IN8 (data IDs 100 to 107).	If other signals are already assigned, then allocate the forward-rotation drive disable input signals.
		Check whether the reverse-rotation drive disable input signals are allocated to I/O inputs IN1 to IN8 (data IDs 100 to 107).	If other signals are already assigned, then allocate the reverse-rotation drive disable input signals.
	Inadequate position of the limit switch or dog for overtravel prevention.	-	Install the limit switch or dog for overtravel prevention in an appropriate position.
	Position of the limit switch for overtravel is too limited for coasting distance.	-	Install the limit switch for overtravel prevention in an appropriate position.
Position Error (Without Alarm)	Noise is superimposed on the sensor cable.	Check the sensor cable specifications. Review the cable specifications. Use a twisted pair cable or twisted pair common shield cable (core wire: 0.12 mm^2 or more, tinned annealed copper twisted wire).	Review the cable specifications.
		Check whether there is any pinching of sensor cable or breakage in shield.	Replace the sensor cable and alter the sensor cable layout environment.
		Check if a ground is used as both the control power supply ground (safety voltage GND) and the frame ground (FG) by a host system.	Separate the control power supply ground and the frame ground (FG).
		Check the termination of the sensor cable shield.	Change the termination to the control power supply ground when the shield is terminated to the frame ground (FG).
	Noise is superimposed because the sensor cable is too long.	Check the length of the sensor cable.	Use a sensor cable of 10 m or less.
	The motor FG line and the frame ground are not connected.	Check the motor wiring.	Make the right connection.

Classification/Trouble	Cause	Check method	Corrective action
Position Error. (Without Alarm)	There is excessive noise interference on the sensor cable.	Check to make sure that the sensor cable is not bundled together with a power line or arranged closed to the line.	Improve the installation environment to avoid application of a surge from a power line.
	The FG (frame ground) potential varies because of influence from machines on the servo motor side, such as the welder.	Check the grounding state (non-grounding, incomplete grounding, etc.) of the motor-side machines.	Properly ground the motor-side machines to prevent shunt currents from flowing into the PG and FG sides.
	Driver's pulse counting error due to noise interference	Check if there is noise interference on the signal line from the sensor.	Take countermeasures against noise for the sensor wiring.
	Failure due to excessive vibration shocks applied to the sensor	Check that no vibration occurs from the machine. Also check the mounting conditions of the servo motor (mounting surface accuracy, fixing state, core dislocation).	Reduce vibration from the machine. Improve the mounting conditions of the servo motor.
	Unsecured coupling between the machine and servo motor	Check if a position error occurs at the coupling between the machine and servo motor.	Secure the coupling between the machine and servo motor.
	Noise is superimposed on the I/O cable.	Check the I/O cable specifications. Review the cable specifications. Use a twisted pair cable or twisted pair common shield cable (core wire: 0.12 mm^2 or more, tinned annealed copper twisted wire).	Review the cable specifications.
		Check if a ground is used as both the control power supply ground (safety voltage GND) and the frame ground (FG) by a host system.	Separate the control power supply ground and the frame ground (FG).
		Check the termination of the I/O cable shield.	Change the termination to the control power supply ground when the shield is terminated to the frame ground (FG).
	Noise is superimposed because of the excessive length of I/O cable.	Check the length of the I/O cable.	Use an I/O cable of 3 m or less.
	Encoder malfunction (Pulse count does not change.)	Compare with a normally operating product.	Replace the servo motor.
	Driver malfunction	Compare with a normally operating product.	Replace the driver.
Overheating of Motor	Ambient temperature too high	Measure the ambient temperature of the servo motor.	Reduce the ambient temperature to 50°C or less.
	The servo motor surface is dirty.	Visually check the dirt on the surface.	Clean the dirt, dust, and oil on the surface.
	The servo motor is overloaded.	Check the load status with monitor.	If overloaded, reduce the load or replace it with a larger capacity driver or servo motor.
Motor Runs Slowly Even with Speed Zero at Speed Control Mode. **<Parameter>**	The motor is affected by the offset voltage.	Check the ID 31 "Control Mode" and the ID 75 "Select Speed Command."	Set analog input offset. Use the Analog Input Zero Clamp function.

Classification/Trouble	Cause	Check method	Corrective action
Unstable Rotation **<Adjustment>**	Servo gain adjustment is not proper. (Position control)	Check using the graph display function of the monitor or controller.	Increase the setting value of ID 50 "Position Loop Proportional Gain 1." Decrease the ID 53 "Low-pass Filter Cutoff Frequency." Again, increase the setting value of ID 50 "Position Loop Proportional Gain 1."
	Speed and position command are not stable.	Check using the graph display function of the monitor or controller.	Check the motor movement. Review the wiring, connector contact failure and controller.
Unstable Rotation **<Wiring>**	Input signals to CN1 (I/O) are chattering. (1) Servo-ON input (2) Forward-direction limit/reverse-direction limit input signal (3) Deviation reset input (4) Pulse input disable command, etc.	Check the waveform of the signals from the host controler via the ID 21 "I/O Status" or an oscilloscope.	Correct the wiring and connection so that each signal turns on and off normally. Check the controller's operation.
	Noise is on the speed command.	—	Use a shield cable. Arrange the power line and a signal line in separate ducts at least 30 cm apart.
	Slip of offset. (Analog input)	—	Measure the voltage between the analog command input of CN1 (I/O) and GND using a tester and an oscilloscope.
	Noise is superimposed onto a command pulse.	—	Use a shield cable. Arrange a power line and a signal line in separate ducts at least 30 cm apart.
Positioning Accuracy Is Poor **<System>**	Erroneous position command. Or erroneous count of command pulse. (command pulse amount)	Repeat reciprocal movement with the same distance to count the feedback pulse in the position monitor of the designated application.	When the count values vary, check the wiring of the controller or the wiring for command pulse.
	The in-position signal is captured right at the edge.	-	Make the controller capture the in-position signal not at the edge but with some time allowance.
	Shape or width of the command pulse is not per the specifications. (Erroneous count)	Observe the waveform on an oscilloscope.	If the shape of the command pulse is broken or narrowed, review the pulse generating circuit. Review the noise countermeasures.
	Noise is superimposed onto the deviation reset input. (Erroneous input)	-	Take noise countermeasures for the digital input power supply or check the I/O cable specifications.
Positioning Accuracy Is Poor **<Adjustment>**	Position loop proportional gain is small.	-	Check the position error amount using the analog monitor or application software. Check the loop gain by increasing the setting value of the ID 50 "Position Loop Proportional Gain 1" within the range where oscillation does not occur. Decrease the ID 53 "Low-pass Filter Cutoff Frequency" and increase the ID 50 "Position Loop Proportional Gain 1."
Positioning Accuracy Is Poor **<Parameter>**	The setting of the positioning completion range is too large.	-	Decrease the setting value of the ID 77 "In-Position Signal Range" to a value in the range free from chattering.
	The command pulse frequency exceeded the maximum allowable frequency (500 kHz, 200 kHz).	-	Decrease the command pulse frequency. Change the pulse input resolutions of ID 121 and ID 122.
	Pulse Input Signal Resolution Denominator is incorrect	-	Check whether repeatability is the same.

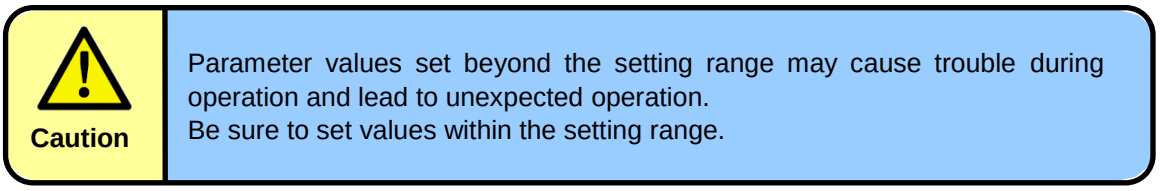
Classification/Trouble	Cause	Check method	Corrective action
Positioning Accuracy Is Poor <Wiring>	Input signals to CN1 (I/O) are chattering. (1) Servo-ON input (2) Positive-/ Negative-rotation drive disable input (3) Deviation reset input (4) Pulse input disable command, etc.	Check the signal waveform via the ID 21 "I/O Status" or an oscilloscope.	Correct the wiring and connection so that each signal turns on and off normally. Reexamine the operation of a higher-level device.
Positioning Accuracy Is Poor <Installation>	Load inertia is large.	Check operating waveforms with the monitor.	Check the overshoot at stopping using observed waveforms. If no improvement is obtained after adjusting servo gains, increase the driver and motor capacity.
Origin Point Slips <System>	The origin return creep rate is high.	-	Reduce the origin return creep rate or extend the detection range of the origin sensor.
Origin Point Slips <Wiring>	Chattering of the limit switch and dog output.	-	Check the input signal of the used sensor with an oscilloscope. Review the wiring around the sensor and take noise reduction measures, etc.
	Noise is superposed on the I/O cable.	-	Take measures including noise reduction (installation of noise filter, insertion of ferrite core), shielding of I/O cable, use of twist-pair line, and separation of a signal line and a power line.
Abnormal Motor Noise or Vibration <Wiring>	Noise is superimposed on the speed command.	-	Using an oscilloscope, measure the noise between the analog command input of CN1 (I/O) and the GND. Take measures including noise reduction (installation of noise filter, insertion of ferrite core), shielding of I/O cable, use of twist-pair line, and separation of a signal line and a power line.
Abnormal Motor Noise or Vibration <Adjustment>	Servo gain is set high.	-	Reduce the servo gain. ・ID 51 "Speed Loop Proportional Gain 1" ・ID 52 "Speed Loop Integral Gain 1"
Abnormal Motor Noise or Vibration <Installation>	Resonance between a machine and the motor	Check with the analog monitor or application software.	Perform readjustment by setting the ID 53 "Low-pass Filter Cutoff Frequency." Check for any machine oscillation on the analog monitor or application software. If there is oscillation, then set the ID 54 "Notch Filter Center Frequency 1" and ID 55 "Notch Filter Attenuation 1."
	Motor bearing	-	Run the motor with no load and check the noise and vibration around the bearing. Replace the motor and check.
	Electromagnetic sound, gear sound, rubbing sound at braking, hub sound, rubbing sound from the encoder	-	Run the motor with no load and check. Replace the motor and check.

Classification/Trouble	Cause	Check method	Corrective action
Overshoot/Undershoot **Overheating of the Motor (Motor Burn-Out)**	Servo gain adjustment is not proper.	Check with the analog monitor or application software.	Re-adjust the servo gain.
	Load inertia is large.	Check with the analog monitor or application software.	Increase the driver and motor and lower the inertia ratio. Use a gear reducer.
	Looseness or slip of the equipment (machine)	-	Review the mounting of the equipment (machine).
	Ambient temperature and environment	-	Install the cooling fan when the operating temperature exceeds a specified value.
	The cooling fan stops. The air intake of the fan is dirty.	-	Inspect the cooling fan of the equipment.
	Mismatch between the driver and motor	-	Check the type of the driver and the motor. Select a correct combination of driver and motor by referring to the instruction manual or catalogue.
	Motor bearing failure	-	Turn the power off and turn the shaft of the motor independently to check if there is any rumbling sound. If there is such a noise, replace the motor.
	The electromagnetic brake stays on.	Check the motor cable.	Check if there is an error in the connection. Replace the driver.
Overshoot/Undershoot **Overheating of the Motor (Motor Burn-Out)**	Motor failure (oil, water, etc.)	-	Avoid high temperature, humidity, oil, dust, and iron powders.
	Motor has been turned by external force while dynamic brake is active.	-	Check the operating pattern, use conditions, and working conditions, and avoid this kind of operation.
Motor Speed Does Not Reach the Set Speed **Motor Rotation Quantity (Move Distance) Is Too Large or Small**	Analog input scale values such as speed command are incorrect. Speed command input gain is not correct. The main circuit drive power supply voltage decreased.	-	Check the related parameters. ・ID 130 "Analog Input Signal Speed Conversion Scale" ・ID 131 "Analog Input Current Speed Conversion Scale"
	Position loop gain is low.	-	Increase the setting value of ID 50 "Position Loop Proportional Gain 1" little by little.
Parameter Returns to the Previous Value	No parameters were saved in nonvolatile memory prior to power-off of the driver.	-	Set "1" to ID 17 "Parameters Save" to save parameters in the nonvolatile memory.

19. List of Parameters

Parameters are defined on the basis of data ID (hereafter referred to as "ID") numbers. The data length and writable data to save on each parameter are predetermined for each parameter when storing data on a nonvolatile memory so that information is described in a list along with the parameter contents.

Symbol	Meaning
ID	Data ID number
L	Data length (bytes)
W	Writable or not writable
M	Save to nonvolatile memory



19.1. Communication Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
1	Device Code	2	×	○	[Do not change.] 1: Servo Motor Driver	1	-	DEC
2	Product Code	2	×	○	[Do not change.] Driver model	8811	-	DEC
3	Software Revision	2	×	○	[Do not change.] Driver software revision	-	-	DEC
4	Serial Number	4	×	○	[Do not change.] Serial number	-	-	-
5	MAC-ID	1	○	○	Media access control ID Used for SV-NET communication. Set unique values within the same network.	63	1–63	DEC
6	Communication Speed	2	○	○	Sets SV-NET/RS232/RS485 communication speed. 1. Bit3-0: SV-NET baud rate 0: 125 kbps 2: 500 kbps 1: 250 kbps 4: 1 Mbps (factory initial value) 2. Bit7-4: RS232 baud rate (Option manufacturers use.) 0: 115200 bps (factory initial value) 1: 9600 bps 4: 56000 bps 2: 19200 bps 5: 57600 bps 3: 38400 bps 6: 115200 bps 3. Bit11-8: RS485(ModbusRTU) baud rate 0: 115200 bps (factory initial value) 1: 9600 bps 4: 56000 bps 2: 19200 bps 5: 57600 bps 3: 38400 bps 6: 115200 bps 4. Bit15-12: Set ModbusRTU character. 0: No parity, Stop bit 1 (factory initial value) 1: No parity, Stop bit 2 2: Even parity, Stop bit 1 3: Even parity, Stop bit 2 4: Odd parity, Stop bit 1 5: Odd parity, Stop bit 2 Example: When setting SV-NET = 1 Mbps, RS232 = 56000 bps, RS485 = 19200 bps, Modbus to even parity, stop bit 1: 0x2244. When communication errors occur frequently due to the environment or the state of the cables, set a low communication speed. Change the setting, save the parameter, and then turn the power off and then on again to enable the parameter.	0x0004	0x0000 – 0x5664	HEX

19.2. Parameters for Initializing and Saving Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
16	Parameters init.	2	○	×	If "1" is set, all parameters are initialized by the initial value table in the driver. And not necessarily set to the factory initial settings. Do not use in non-standard models.	0	0–1	DEC
17	Parameters Save	1	○	×	If "1" is set, all parameters are saved to the nonvolatile memory. Perform this after confirming the servo is OFF.	0	0–1	DEC
18	Program Code	2	×	×	[Do not change.] Built-in software identification code	-	-	HEX

19.3. Status Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
20	Servo Status	4	×	×	Each Bit becomes ON depending on the driver status. Bit 0: During Servo ON Bit 1: During profile operation Bit 2: In-position Bit 3: Alarm occurring Bit 4: Arrival at forward limit Bit 5: Arrival at reverse limit Bit 6: Torque limit Bit 7: Speed limit Bit 8: Position excessive deviation Bit 9: Servo ready Bit 10: During homing Bit 11: During switching to second gain Bit 12: Backup battery voltage low Bit 13: Drive power cutoff Bit 14: Stop speed status Bit 16: Mechanical brake output signal Bit 20: Alarm bit code 0 signal (Ab0) Bit 21: Alarm bit code 1 signal (Ab1) Bit 22: Alarm bit code 2 signal (Ab2) Bit 24: Arrival at profile command target position	-	-	-
21	I/O status display	2	×	×	When driver's I/O input/output is ON, each Bit becomes ON. Bit 0,1,2 - 7 : Input 1,2 - 8 status Bit 8,9,10,11,12: Output 1,2,3,4,5 status	-	-	-
22	Alarm Code	1	×	×	Displays current alarm code. (Decimal numbers)	-	-	-
23	Alarm History-1	4	×	○	Displays alarm history 1 to 4. (Decimal numbers) Bit 0 to 7: History 1 Bit 8 to 15: History 2 Bit 16 to 23: History 3 Bit 24 to 31: History 4	-	-	-
24	Alarm History-2	4	×	○	Displays alarm history 5 to 8. (Decimal numbers) Bit 0 to 7: History 5 Bit 8 to 15: History 6 Bit 16 to 23: History 7 Bit 24 to 31: History 8	-	-	-

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
25	Select Alarm Occurrence Information to be Displayed	2	○	×	Allows checking detailed information from the time the alarm occurred. Setting the history number and information number of the alarm that you want to check will update the content of ID26 "Alarm Occurrence Information." ・Bit 7-0 = Alarm information code 00: Alarm code 01: Month and day of occurrence [BCD] Note * The year is not displayed. 02: Hour and minute of occurrence [BCD] Note * The seconds are not displayed. 03: Total driver power ON time [minutes] 04: Servo Status (ID 20) 05: Feedback current [0.01 A] (ID 42) 06: Feedback speed [rpm] (ID 41) 07: Feedback position [pulse] (ID 40) 08: Drive power supply voltage [0.1 V] (ID 161) 09: Driver temperature [0.1°C] (ID 160) 0A: Overload monitor [0.1%] (ID 159) 0B: Command overload monitor [0.1%] ・Bit 15-8= Alarm history code 00: History 1(Latest), 01: History 2 - 07: History 8 Example: To see the feedback speed when history 4 alarm occurred, set 0x0306. **Supplement** **Set the date (ID240) and time (ID241) in advance.**	-	0x0000 – 0x070B	HEX
26	Alarm Occurrence Information	4	×	×	Displays the data specified with ID 25 "Select Alarm Occurrence Information to be Displayed."	-	-	-
29	Warning Status Display	2	×	×	Bit 0: Drive power supply voltage low warning Bit 1: Backup battery voltage low warning (only for the absolute encoder) Bit 2: (Reserved) Bit 3: Actual current overload warning Bit 4: Command current overload warning Bit 5: Overspeed warning Bit 6: Multi-rotation warning Bit 7: Excess position deviation warning Bit 8: Driver temperature warning Bit 9: External encoder count warning Bit 10: External encoder position error warning Bit 11: Excessive regeneration capacity warning Bit 12 to 15: (Reserved) **! Important** **When an alarm is generated, Bit 3 to Bit 11 for Warning Status Display are fixed at the status they were when the alarm was generated. They are cleared by resetting the alarm.**	-	-	-

19.4. Control Command Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
30	Servo Command	2	○	×	Sends the control command to the driver by setting each Bit to ON. Bit 0: Servo ON Bit 1: Profile Operation Enabled Bit 2: Deviation Reset Bit 3: Reset Alarm Bit 4: Hard Stop Bit 5: Smooth Stop Bit 6: (Reserved) Bit 7: Acceleration/Deceleration Enabled Bit 8: Analog Input 0-point Adjustment Command Bit 9: Switch to second control mode Bit 10: Second Current Limit Switch Bit 11: Second Gain Switch Bit 12: Smart ABS Sensor Alarm Reset Bit 13: Origin Detection Notification Bit 14: Current Position Reset Bit 15: Smart ABS Sensor Alarm & Multi-rotation Reset **Important** **Set reserved Bits to "0."**	0x0000	0x0000 – 0xFFBF	HEX
31	Control Mode	1	○	○	Sets driver's control mode. 0: No Control Mode (Servo OFF) 1: Position Control Mode 2: Velocity Control Mode 3: Current Control Mode 4: Homing Control Mode 5: Inertia Estimation Mode 6: Friction Correction Torque Estimation Mode 14: Simplified Control Mode	0	0 to 6 or 14	DEC
32	Target Position	4	○	○	Sets a target position in profile operation. [pulse]	0	-2147483648 to 2147483647	DEC
33	Target Velocity	2	○	○	Sets a target velocity in profile operation. [rpm]	100	0–10000	DEC
34	Acceleration	2	○	○	Sets acceleration in speed control and profile operation. [10 rpm/sec]	1000	0–65535	DEC
35	Deceleration	2	○	○	Sets deceleration at "Smooth Stop" (ID30 Bit5 ON) in speed control and profile operation. [10 rpm/sec]	1000	0–65535	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
36	Real-time Command Position	4	○	○	Real-time position command [pulse] Use when giving a direct position command when in position control Control Mode (ID 31=1). **Caution** **Updated automatically for position commands generated inside the driver when operating a servo message through profile operation or SV-NET.** **When giving a position command with this parameter, note that there is the possibility that the motor axis may rapidly accelerate if there is a large deviation.**	0	-2147483648 – 2147483647	DEC
37	Real-time Command Speed	2	○	○	Real-time speed command [rpm] Sets the current command in speed control "Control Mode" (ID31 = 2). When ID76 "Select Torque Command" is "3," this setting becomes the speed limit value.When ID76 "Select Torque Command" is "3," this setting becomes the speed limit value.	0	-10000 – 10000	DEC
38	Real-time Command Current	2	○	○	Real-time current command [0.01 A] Sets current command in current control "Control Mode" (ID31 = 3).	0	- (Motor max. current)to + (Motor max. current)	DEC
39	Position Reset Value	4	○	○	When "1" is set to Bit 14 "Current Position Reset" in the ID 30 "Servo Command," the ID 40 "Feedback Position" is reset to this value.	0	-2147483648 – 2147483647	DEC

19.5. Servo Feedback Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
40	Feedback Position	4	×	×	Current position [pulse] Outputs the current position used for position control. This value is derived from position data read from the motor sensor and processed using parameters such as ID 140 "Abs Mode" and ID 72 "Reference Direction." In the control by external encoder(ID 73 "Select Position Feedback" =1), this value is a processed value from position information of external encoder.	-	-	-
41	Feedback Speed	2	×	×	Current speed [rpm] Displays the motor axis speed.	-	-	-
42	Feedback Current	2	×	×	Motor current [0.01 A] Displays the motor current sensing value (q-axis current).	-	-	-
43	Feedback PVC	6	×	×	Displays the lower order 16 bits for feedback position [pulse], feedback speed [rpm], and feedback current [0.01 A] in 6 bytes. Cannot be displayed on the setting panel.	-	-	-
44	Feedback SVC	6	×	×	Displays the lower order 16 bits for feedback position [pulse] (however, for data before processing in ID 72, "Reference Direction"), feedback speed [rpm], and feedback current [0.01 A] in 6 bytes. Cannot be displayed on the setting panel.	-	-	-

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
45	Sensor Position 1	4	×	×	Displays position datacaptured by the sensor. [Pulse] [Brushless resolver 1X-BRX] The position data per double axial angle 1X of the resolver is displayed at a resolution of 8192 pulses. [Incremental encoder wiring-saving INC] Displays the 16-bit counter (counted multiplied by 4 from the sensor resolution) that counts the sensor A/B phases. [Serial encoder 17, 23Bit-ABS/INC] Displays the one-rotation absolute value position data read from the sensor.	-	-	-
46	Sensor Position 2	4	×	×	Displays position data captured by the sensor. [Pulse] [Brushless resolver 1X-BRX] The position data per double axial angle 1X of the resolver is displayed at a resolution of 2048 pulses. (Same as ID47 "Sensor Position 3.") [Incremental encoder wiring-saving INC] Displays the value of the ID 45 "Sensor Position 1" at the moment of detection of sensor Z-phase. [Serial encoder 17, 23Bit-ABS] Displays the multi-rotation data read from the sensor. [Serial encoder 17, 23Bit-INC] Displays the one-rotation incremental data read from the sensor.	-	-	-
47	Sensor Position 3	4	×	×	Motor Sensor Counter [pulse] The value taken from motor sensor is displayed as given in the 32 bit counter. This is the value of ID40 "Feedback Position" before it is processed.	--	--	--
48	External Encoder Position	4	×	×	External encoder counter [pulse] Displays a value captured by external encoder as a 32 bit counter of which "0" is the position when the power is turned on.	--	--	--
49	Position Deviation	4	×	×	Position deviation [pulse] Displays the position deviation during position control. Position deviation = Position command (*1) - Current Position (*2) *1: ID 36 "Real-time Command Position" *2: ID 40 "Feedback Position"	--	--	--

19.6. Servo Gain Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
50	Position Loop Proportional Gain 1	2	○	○	Position loop proportional gain 1 Kp1 [rad/s] *1	50	0-799	DEC
51	Speed Loop Proportional Gain 1	2	○	○	Speed loop proportional gain 1 Kv1 [rad/s] *1	200	0-2000	DEC
52	Speed Loop Integral Gain 1	2	○	○	Speed loop integral gain 1 Ki1 [1/s] *1	50	0-2000	DEC
53	Low-pass Filter Cutoff Frequency	2	○	○	Low-pass Filter Cutoff Frequency [Hz] 0: Low-pass filter disabled 1 to 1000: Cutoff frequency setting	For resolver: 600 Other: 1000	0-1000	DEC
54	Notch Filter Center Frequency 1	2	○	○	Notch filter1 • Center Frequency [Hz] 0, 1000: Notch filter 1 disabled 1 to 999: Center Frequency Setting • Attenuation 0: Notch filter 1 disabled <Attenuation targets> 30: -3 dB, 50: -5 dB, 75: -12 dB, 87: -18 dB **Caution** Oscillation may occur if the center frequency is too low.Normally, use it with a setting of 50 or more. If the attenuation is too great, there may be oscillations. It should normally be set to no more than 30.	0	0-1000	DEC
55	Notch Filter Attenuation 1	2	○	○		0	0-100	DEC
56	Current Loop Proportional Gain	2	○	○	Current loop proportional gain [rad/s] *2	4000	0-13000	DEC
57	Current Loop Integral Gain	2	○	○	Current loop proportional gain [1/s] *2	700	0-10000	DEC
58	Phase-advance Gain	2	○	○	Phase-advance Gain *2	40	0-512	DEC
59	Load Inertia	4	○	○	[g•cm^2] *3	0	0-50000	DEC
60	Position Loop Proportional Gain 2	2	○	○	Position loop proportional gain 2 Kp2 [rad/s] *1	50	0-799	DEC
61	Speed Loop Proportional Gain 2	2	○	○	Speed loop proportional gain 2 Kv1 [rad/s] *1	150	0-2000	DEC
62	Speed Loop Integral Gain 2	2	○	○	Speed loop integral gain 2 Ki2 [1/s] *1	50	0-2000	DEC
63	Notch Filter Center Frequency 2	2	○	○	Notch filter 2 ・Center frequency [Hz] 0, 1000: Notch filter 2 disabled 1 to 999: Center frequency setting ・Attenuation 0: Notch filter 2 disabled <Attenuation targets> 30: -3 dB, 50: -5 dB, 75: -12 dB, 87: -18 dB **Caution** Oscillation may occur if the center frequency is too low.Normally, use it with a setting of 50 or more. If the attenuation is too great, there may be oscillations. It should normally be set to no more than 30.	0	0-1000	DEC
64	Notch Filter Attenuation 2	2	○	○		0	0-100	DEC
65	Forward Current Limit 2	2	○	○	Forward-rotation direction 2nd current limit [0.01 A] Enabled when 2nd current limit is selected by ID 30 Bit 10 or I/O input.	Motor max. current	0 to Motor max. current	DEC
66	Reverse Current Limit 2	2	○	○	Reverse-rotation direction 2nd current limit [0.01 A] Enabled when 2nd current limit is selected by ID 30 Bit 10 or I/O input. Enabled when 2nd current limit is selected by ID30 Bit 10 or I/O input.	Motor max. current	0 to Motor max. current	DEC
68	Position Feed-forward Gain	2	○	○	Position Feed-forward Gain [%]	0	0-100	DEC

***1 Kp, Kv, and Ki units are the units when the load inertia is set correctly.**

***2 These are set automatically by the auto-tuning function of the driver. Normally these should not be changed.**

***3 The setting range is 0 to 3000 on software Ver. 4.30 and older versions.**

19.7. Parameters for Setting Control Functions

ID	Name	L	W	M	Description	Factory setting	Setting range	Display
69	Control Switch	2	○	○	Bit 0 Resets position deviation when servo OFF. 0: Disabled (Maintains position deviation value.) 1: Enabled (The value is cleared to 0 when servo OFF.) Bit 1 Automatically clears the operation permission flag (ID 30 "Servo Command" Bit 1) when profile operation is completed. 0: Disabled 1: Enabled Bit 2 Selects command status when control mode is changed. 0: Resets command value. (Speed/current control = 0, Position control = Current position) 1: Maintains current command value. When control mode is changed soon after servo ON and during servo ON, you can select either resetting the command or maintaining the current value when switching from 2nd control mode to the 1st. Position control is performed only in profile operation. Bit 3 Speed calculation filter settings This setting only supports 17-bit sensors 0: Speed calculation filter 1 (The setting for fast response during low speed) 1: Speed calculation filter 2 (The setting for high stability during low speed) Bit 4 Analog input resolution switch function 0: Enabled (Switches to the high resolution circuit automatically during low voltage input) 1: Disabled Bit 5 Sets the acceleration/deceleration in speed control mode. 0: Disabled (Follows ID 30 Servo Command Bit 7 setting.) 1: Enabled ID 30 "Servo Command" Bit 7 setting is normally reset when power is turned off. Set this setting to Enabled to maintain the acceleration/deceleration setting. Bit 6 Selects Z signal output style. 0: Hi when both LEAD/LAG are low. 1: Hi by synchronizing with LEAD Hi. Do not change during motor control. Bit 7 Sets Z signal I/O output 0: Disabled 1: Z signal output from I/Ooutput 5 (OUT5). When 1 is set, the value of the ID 114 "I/O output (OUT5) setting" is ignored.	0x0001	0x0000 - 0x0000	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Display
69	Control Switch (*Continued)				Bit 8 Output 1 (OUT1) output logic setting 0: Positive logic 1: Negative logic Bit 9 Output 2 (OUT2) output logic setting 0: Positive logic 1: Negative logic Bit 10 Output 3 (OUT3) output logic setting 0: Positive logic 1: Negative logic Bit 11 Output 4 (OUT4) output logic setting 0: Positive logic 1: Negative logic Bit 12 Output 5 (OUT5) output logic setting 0: Positive logic 1: Negative logic Bit 13 Outputs the position pulses of encoder received by driver as they are (unchanged): LEAD/LAG/Z all outputs. 0: Disabled 1: Enabled Enabled only when wiring-saving INC encoder is used. Bit 14 Outputs the position pulses of encoder received by driver as they are (unchanged): Z output only. 0: Disabled 1: Enabled Enabled only when the wiring-saving INC encoder is used. Bit 15 Reverses logic of rotation direction in LEAD/LAG/Z output. 0: Disabled 1: Enabled * Disabled when Bit 13 or 14 is set to 1 (enabled).			

ID	Name	L	W	M	Description	Factory setting	Setting range	Display
72	Reference Direction	1	○	○	Sets the reference direction of the motor axis. 0: CCW, 1: CW	0	0-1	DEC
73	Select Position Feedback	1	○	○	Selects the feedback signal to be used for position control. 0x00: Motor encoder 0x01: External encoder (fully closed control) The external encoder is used as the current position for position control "Control Mode" (ID 31 = 1) (the motor encoder is used when calculating the current speed).	0x00	0x00-0x01	HEX
74	Select Position Command	1	○	○	Selects a command signal in position control mode. 0x00: Position command by communication 0x01: Position command by pulse input	0x00	0x00-0x01	HEX
75	Select Speed Command	1	○	○	Selects the type of command signal in speed control mode. 0x00: Speed command by communication 0x01: Speed command by analog signal input The analog signal polarity is reversed when Bit 7 is "1." 0x02: Use the analog signal input as speed limit during position/speed control(command in speed control mode is speed command via communication).When ID 88 "Speed Limit" is lower than the speed limit set by this function, ID 88 setting supersedes.	0x00	0x00-0x02 or 0x81	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
76	Select Torque Command	1	○	○	Selects the type of command signal in current control mode. 0x00: Torque command by communication 0x01: Torque command by analog signal input The analog signal polarity is reversed when Bit 7 is "1." 0x02: In position/speed/current control, the analog signal input is used as the current limit. (Command during current control is torque command via communication.) The current limit set by this function is common to the forward and reverse directions. Analog input signal accepts voltage for forward-rotation direction only. The reverse rotation direction is handled by setting the limit value to 0. When one of the values of ID 86, 87, 65, 66 is lower than the limit value set by this function, the lower value supersedes other values. 0x03: Analog signal input is used as the torque command with speed limit. This function uses analog signal input as the current limit in speed control. And when the sign of the analog signal input is negative, the sign of the speed control is automatically reversed. In speed control, this function can be used as a pseudo torque control with speed limit. This function can be used only in speed control. Set the speed command to ID 37 (Real-time command speed). When you do not want ID 37 to be cleared to 0 at servo ON, set Bit 2 of ID 69 (Control Switch) to "1." When one of the values of ID 86, 87, 65, 66 is lower than the limit value set by this function, the lower value supersedes the other values.	0x00	0x00-0x03 or 0x81	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
77	In-position (Positioning Completion) Signal Range	2	○	○	[Pulse] Outputs in-position if the position deviation (ID 49) is within this setting value.	By Sensor	1-32767	DEC
78	Smoothing Time 1	2	○	○	Smoothing time for position command [msec] Setting as 0 will disable Smoothing 1 and 2. Do not change the set value when the servo is ON in position control.	0	0-1638	DEC
79	Smoothing Time 2	2	○	○	Smoothing time for position command [msec] Setting as 0 will disable Smoothing 2. Do not change the set value when the servo is ON in position control.	0	0-1638	DEC
80	Select Gain-switch Method	1	○	○	Selects the switching method between 1st gain and 2nd gain of servo gain. ⇒ Refer to ❑13.6 "Gain-switch Function." 0x00: No switching (fixed to Gain 1) 0x01: Switch by speed command value. 0x02: Switch by motor feedback speed. 0x03: Switch by position deviation value. 0x04: Switch by I/O input command. (Set the gain-switch function with I/O input. OFF: 1st Gain, ON: 2nd Gain) 0x05: Switch by ID 30 "Servo Command" Bit 11. ("0" = 1st Gain, "1" = 2nd Gain) 0x06: Switch after a specified time from motor stop command. 0x07: Switch after motor stop command when the current command is not more than the specified range. 0x09: No switching (fixed to Gain 2)	0x00	0x00-0x07 or 0x09	HEX
81	GainChangePoint_H	2	○	○	Gain-switch Point H/L When ID 80 = 1 to 3: When this is equal to or larger than the GainChangePoint_H (*1), Gain 1 is selected, and when this is equal to or lower than GainChangePoint_L (*1), Gain 2 is selected, and when this is in between, the value is interpolated by Gain 1 and Gain 2, and changes smoothly. When ID 80 = 6: When Motor Stop Command (*2) continues for GainSwitchPoint_H [msec], switch to Gain 2, otherwise, Gain 1. When ID 80 = 7: When Motor Stop Command (*2) continues for GainSwitchPoint_H [msec], and Current Command is equal to or lower than GainSwitchPoint_L [0.01 A], switch to Gain 2, otherwise, Gain 1. *1. ID 80 = 1 to 2 … Speed [rpm] ID 80 = 3 ….. Position deviation [pulse] *2. In Position Control … No change in command value In Speed Control … Speed 0 command	100	0 to 32767	DEC
82	GainChangePoint_L	2	○	○		50	0 to 32767	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
83	Select Soft Limit	1	○	○	Selects whether to enable or disable the soft limit. 0: Soft limit disabled 1: Soft limit enabled	0	0-1	DEC
84	Positive-side Soft Limit	4	○	○	[Pulse] When the current position is beyond the set value in the reverse direction, sets the reverse speed command to 0. This function does not use the position control to manage the stop position. The stop position might be a little beyond the limit position depending on the speed and the gain when it reaches there.	1073741824	-2147483648 - 2147483647	DEC
85	Reverse-side Soft Limit	4	○	○	[Pulse] When the current position is beyond the set value in the reverse direction, sets the reverse speed command to 0. This function does not use the position control to manage the stop position. The stop position might be a little beyond the limit position depending on the speed and gain when it reaches there.	-1073741824	-2147483648 - 2147483647	DEC
86	Forward-Rotation Current Limit	2	○	○	[0.01 A] Sets the limit value for the current command for the forward-rotation direction.	Motor max. current	0 to Motor max. current	DEC
87	Reverse-Rotation Current Limit	2	○	○	[0.01 A] Sets the limit value for the current command for the reverse-rotation direction.	Motor max. current	0 to Motor max. current	DEC
88	Speed Limit	2	○	○	[rpm] Sets the limit value for the speed command. Common for both forward and reverse-rotation directions.	Motor maximum rotation speed	0-10000	DEC
89	Speed Limit 2	2	○	○	[rpm] Sets the limit value for the speed command switched by the gain switch function. Common to both forward and reverse-rotation directions. To add a speed limit switch to the gain switch function, set ID 256 (Special Function Switching 2) Bit 11 to "1."	Motor maximum rotation speed	0-10000	DEC

19.8. Parameters for Setting Homing Operation

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
90	Homing Mode	1	○	○	Selects homing method ⇒ Refer to ❑13.4 "Homing Mode." 0: Decelerates to stop when detecting origin signal. Then moves to the Z signal detection position and presets the position. 1: Stops when detecting thrust, and presets the position there. 2: Stops immediately when detecting origin signal, and presets the position there. 3: Decelerates to stop when detecting origin signal. Then moves back until the origin signal is released and presets the position. 4: Stops when detecting thrust. Then moves to the Z signal detection position and presets the position.	0	0-4	DEC
91	Homing Preset Value	4	○	○	Sets position data to be set after homing operation. [pulse] When Bit 3 of ID 209 "Alarm Mask" is not set to 1, set the data to 0x70000000 (1,879,048,192) or smaller by considering the alarm 41 (counter overflow) detection threshold value.	0	-2147483648 - 2147483647	DEC
92	Homing Start Direction	1	○	○	Sets the rotation direction of the homing operation. 0: Forward direction; 1: Reverse direction	0	0-1	DEC
93	Homing Speed	2	○	○	Sets the speed from the start of homing to the detection of origin signal. [rpm]	500	0-10000	DEC
94	Homing Creep Speed	2	○	○	Sets the speed from the detection of origin signal until stopping at the origin position. [rpm]	50	0-10000	DEC
95	Homing Thrust Time	2	○	○	Sets the thrust time in thrust-type homing. [msec]	1000	0-10000	DEC
96	Homing Thrust Torque	2	○	○	Sets the thrust torque in thrust-type homing. [0.01 A]	100	0 to Motor max. current	DEC

19.9. Control Mode Switching Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
99	Second Control Mode	2	○	○	Sets the second control mode in control mode switching. ⇒ Refer to ❑15.6 "Control Mode Switching Function." Bit 3 to 0: second control mode 0: Disable control mode switch 1: Position control 2: Speed control 3: Current control Bit 15 to 12: Selection of command when switched to second control mode 0: Resets command value. (speed and current controls = 0, position control = current position) 1: Maintains command value before switching. Position control is performed only in profile operation. Example: When 0x1002 is set, the second control mode is speed control, and for the speed command at the moment the mode is switched to the second control mode, the command value that is set before the switch is continuously used.	0x0000	0x0000 - 0x1003	HEX

19.10. Parameters for Setting I/O

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
100	I/O Input 1 (IN1) Setting	1	○	○	Sets the function of each I/O input terminal. The factory setting (standard function) varies depending on the input terminal. 0x00: (standard function) - IN1: Servo ON command - IN2: Forward-rotation drive disable command - IN3: Reverse-rotation drive disable command - IN4: Alarm reset command - IN5: Deviation reset command - IN6: External alarm input - IN7: Origin sensor input - IN8: Command pulse count disable command 0x01: Servo ON command 0x02: Forward-rotation drive disable command 0x03: Reverse-rotation drive disable command 0x04: Alarm reset command 0x05: Deviation reset command 0x06: Profile operation permission command 0x07: Origin sensor input 0x08: External alarm input 0x09: Gain-switch command 0x0A (10): Analog input 0-point adjustment command When I/O input changes from ON to OFF, starts 0 point adjustment. 0x0B (11) : Second current limit switch input 0x0C (12): Pulse input disable command 0x0D (13): Homing start command 0x0E (14): Analog input forced-0 command 0x0F (15): Simplified control mode input 1 to 8 0x10 (16): Control mode switch input 0x11 (17): Hard stop 0x12 (18): Smooth stop 0x13 (19): Emergency stop input Normally ON when Bit 7=1 (negative logic) 0x63 (99): Ignore input	0x00	0x00-0x13 or 0x80-0x93 or 0x63	HEX
101	I/O Input 2 (IN2) Setting	1	○	○				
102	I/O Input 3 (IN3) Setting	1	○	○				
103	I/O Input 4 (IN4) Setting	1	○	○				
104	I/O Input 5 (IN5) Setting	1	○	○				
105	I/O Input 6 (IN6) Setting	1	○	○				
106	I/O Input 7 (IN7) Setting	1	○	○				
107	I/O Input 8 (IN8) Setting	1	○	○				

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
110	I/O Output 1 (OUT1) Setting	4	○	○	Sets the function of each I/O output terminal. The output corresponds to each bit of ID 20 "Servo Status." ⇒Refer to ❑19.3 "Status Display Parameters." When there is more than one bit at "1" then it is output as OR. And when this is set to 0xFFFFFFFF, any program in the simplified control mode (ID 31 = 14) can use these I/O outputs.	0x00000008 (Alarm status)	0x00000000 - 0x01717FFF or 0xFFFFFFFF	HEX
111	I/O Output 2 (OUT2) Setting	4	○	○		0x00000004 (In-position)		
112	I/O Output 3 (OUT3) Setting	4	○	○		0x00000200 (Servo ready)		
113	I/O Output 4 (OUT4) Setting	4	○	○		0x00010000 (Mechanical brake output)		
114	I/O Output 5 (OUT5) Setting	4	○	○		0x00004000 (Stop speed status)		
117	I/O filter time	2	○	○	Sets filter time for I/O input (IN1 to IN8). [Setting unit: 200 us] When an input status continues for a specified time or longer, that status will be used. E.g. If the default setting is "5" then the filter time will be 1 ms. **Supplement** This function works to cancel instantaneous noise, but detection of normal signals will also be delayed. In particular, when an immediate stop or similar is made using the origin signal (I/O input) in a homing operation, you will need to check that there are no changes in the origin point following changes to these parameters. There may also be effects on the stop operation due to the limit signal (I/O input).	5	5 - 32767	DEC

19.11. Parameters for Setting Analog Monitor

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
118	Monitor 1 Setting	2	○	○	Analog monitor output 1 setting	42 (Feedback current)	1-511	DEC
119	Monitor 2 Setting	2	○	○	Analog monitor output 2 setting	41 (Feedback speed)	1-511	DEC

Outputs the value of the specified parameter ID.
The digital value of specified parameter ID: +32767 to 0 to -32767 corresponds to the monitor output: +10 V to 0 V to -10 V.
Sets monitor gain (magnification) in ID 185 "Monitor 1 Gain", ID186 "Monitor 2 Gain."

[Analog monitor output settings]
ID 118, ID 119: Sets the parameter ID to be monitored. [Setting value: 1–511]
ID 185, ID 186: Sets the monitor voltage magnification. [Setting value: -32767 to 32767]
1 = 1x, 10 = 10x, -10 = 1/10x, -20 = 1/20x (0, -1 are 1x)
[Analog monitor voltage output value calculation]
Analog monitor voltage = [magnification] × (digital value of the specified parameter ID] /32768) x 10 (V)

[Example of analog monitor settings]
Example: Output ID 41 "Feedback Speed" to Monitor Output 1 with 8x magnification
Set "41" in ID 118 "Monitor 1 Setting" and set "8" in ID 185 "Monitor 1 Gain."

The monitor voltage will be displayed as ±10 V centered around 0 V.
The monitor voltage when ID 41 "Feedback Speed" is 2000 rpm is 8×2000×10 (V) / 32768 ≈ 4.88 (V)
The monitor voltage when ID 41 "Feedback Speed" is -3000 rpm is 8×-3000×10 (V) / 32768 ≈ -7.32 (V)

19.12. Parameters for Setting Pulses

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
120	Pulse Input Mode	2	○	○	Selects an input type of pulse command input. Enabled when ID 74 "Select Position Command" is set to "1" (pulse input). **Important** **To reflect changes, turn the power off and then on again after saving the changed settings and parameters.** Bit 1, Bit 0: Pulse command mode 00: Forward-rotation pulse/Reverse-rotation pulse 01: Pulse/Rotation direction 02: 90°phase difference 2 phase pulse mode (Used by option manufacturers) Bit 5, Bit 4: Pulse command software filter 00: No filter 01: 500 kHz (allowable frequency) 10: 250 kHz (allowable frequency) 11: 125 kHz (allowable frequency) Bit 7: Pulse command polarity 0: Forward direction 1: Reverse direction	0x0000	0x0000-0x0032 or 0x0080-0x00B2	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
121	Command Pulse Input Signal Resolution Numerator	4	○	○	When the numerator is n and the denominator is m, the resolution of the command pulse can be calculated as n/m pulses per motor rotation. Example: When ID 121 = 2000 and ID 122 = 3, the motor rotates 3 times at 2000 pulses. **Important** **To reflect changes, turn the power off and then on again after saving the changed settings and parameters.**	2048	1-1073741824	DEC
122	Command Pulse Input Signal Resolution Denominator	2	○	○	 **Important** **When using a high resolution motor sensor such as a 23 bit encoder, set so that the value of [ID 122 x sensor resolution] is no greater than 0x70000000.** **Supplement** **Enabled when ID 74 "Select Position Command" is set to "1" for pulse input.**	1	1-16384	DEC
123	External Encoder Direction	1	○	○	Sets the count direction for the motor sensor in the external encoder. 0: Forward-rotation (Motor sensor and count are in the same direction.) 1: Reverse-rotation (Motor sensor and count are in the opposite direction.) **Caution** **Operation in a wrong setting may lead to unexpected behavior such as motor runaway.** **Important** **To reflect changes, turn the power off and then on again after saving the changed settings and parameters.**	0	0-1	DEC
124	External Encoder Resolution	4	○	○	Sets the number of the pulse count for the external encoder for each revolution of the motor. [pulse/rev] Sets the resolution for the external encoder LEAD phase to 4x. This parameter will be used to detect if the external encoder is out of position (alarm code = 68) and for calculating the unit of position loop gain. **Important** **Enabled when "0x01" (external encoder) is assigned to ID 73 "Select Position Feedback".** **Important** **To reflect changes, turn the power off and then on again after saving the changed settings and parameters.**	2048	1-131072	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
126	Sensor Output Division Setting	2	○	○	Set the output resolution of the sensor signal output (pins CN1-44 to 49) in the number of pulses per motor rotation (number of rising edges in LEAD phase). (*1) The maximum possible setting value and factory setting vary depending on the sensor. [Brushless resolver] [1X-BRX (Z signal is output once per motor rotation.)] ⇒ Factory setting 512, max. value 512 [Incremental encoder wire-saving INC] ⇒ Maximum value & factory setting, depending on the resolution of the combined sensor. [Serial encoder 17-/23-bit ABS/INC] ⇒ Factory setting 2048, max. value 2048 *1. Note that there may be an unstable pulse output from the sensor output signal at the instant this setting changes. * When Bit 13 or 14 of ID 69 "Control Switch" is set to 1 (enabled), this setting is disabled. **Important** **To reflect changes, turn the power off and then on again after saving the changed settings and parameters.**	See description on the left.	1 to the maximum value of each sensor (See description in the left.)	DEC

19.13. Parameters for Setting Analog Input

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
130	Analog Input Speed Conversion Scale Value	2	○	○	Sets speed conversion scale for an analog input value of +10 V. [rpm] Example: When this is set to 6000, the command speed for analog input of +5 V is 3000 rpm.	6000	0-10000	DEC
131	Analog input signal current conversion scale value	2	○	○	Sets current conversion scale for an analog input value of 10 V. [0.01 A] Example: When this is set to 500, the command current for analog input of +5 V is 2.5 Arms.	500	0-2400	DEC
132	Analog Input Offset	2	○	○	Set automatically by analog input 0 point adjustment command. This should not normally be changed directly.	-	0-32767	DEC
133	Analog Input Zero Clamp	2	○	○	Sets the dead band for analog inputs after zero point adjustment. [0.01 V] Analog input commands within ± of this set value are treated as 0. This setting is effective when analog input signal is unstable due to noise or other factors when the motor stops.	0	0-1000	DEC
134	Analog Input Filter	2	○	○	Sets filter (moving average) for analog input signal. 0: No averaging 3: Eight averagings 1: Two averagings 4: Sixteen averagings 2: Four averagings Analog inputs are read on a 50 µs cycle. This setting is effective when analog input signal is unstable due to noise or other factors.	0	0-4	DEC

19.14. Special Servo Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
140	Abs Mode	2	○	○	Sets the absolute value display mode for using the ABS sensor. 0: Incremental mode The position where the power was turned ON is counted from "0" and backup battery-related alarms are ignored. 1: Absolute mode The ABS sensor controls the absolute position. The current position information is maintained after the power is turned OFF. [Factory settings] [17/23 Bit ABS] ⇒ 1 [Brushless resolver] [17/23 Bit INC] [Wiring-saving INC] ⇒ 0 **Caution** **"1" is not allowed except for the ABS sensor.**	-	0-1	DEC
141	Special Function Switching	2	○	○	Makes special setting of servo functions. Do not change these settings during normal use. Bit 2/Bit 1: Sets the communication protocol for CN5 and CN6. 00: SV-NET enabled 01: RS485 (Tamagawa Format) enabled 10: RS485 (ModbusRTU Format) enabled Example: ModbusRTU Format is enabled, 0x0004 Bit 12: PWM carrier frequency setting 0: 10 kHz 1: 13.3 kHz **Important** **After the setting is changed and parameter is saved, this function is enabled when the driver was turned off and then on.** **Important** **Be sure to set "0" to those bits to which no function is allocated.**	-	0x0000 - 0x1004	HEX
143	Servo OFF Delay	2	○	○	Sets the time delay between receiving a servo off command and the time the servo is turned OFF. [msec] The servo will remain ON for the set period of time when the servo is switched from ON to OFF. Refer to the operation time for the brake to be used when setting this time. This setting has the effect of preventing a drop when operation is stopped using the mechanical brake after a vertical up and down movement, by delaying servo OFF until the brake has been enabled.	0	0-10000	DEC
144	Abs-Offset	4	○	○	Internal data changed by presets, etc., using encoder reset or homing. This should not normally be changed directly.	-	-2147483648 - 2147483647	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
145	Speed Loop Proportional Gain During Inertia Estimate Mode	2	○	○	Sets the speed loop proportional gain during Inertia Estimate Mode. **Important** **When the device inertia is large enough, make temporary setting before starting inertia estimation.** **The temporary setting depends on the ratio of the rough device inertia to the rotor inertia as follows:** **2x or less: 500** **2 to 3x: 1000** **3x or more: 1500**	200	0-2000	DEC
146	Speed Loop Integral Gain During Inertia Estimate Mode	2	○	○	Sets the speed loop integral gain during Inertia Estimate Mode. This should normally be used with the factory settings.	125	0-2000	DEC
147	Brake Release Delay Time	2	○	○	Sets the delay time for brake control signal output when servo is ON. [msec] When a mechanical brake is used on a vertical axis, adjusting the timing of servo ON and brake release can prevent falling. Set this value by referring to the brake start-up time.	0	0-10000	DEC
148	Enable Off Timer	2	○	○	Sets the communication time-out time of USB or SV-NET during servo-ON. [msec] If communication commands are absent for an interval longer than this setting during servo-ON, the servo is automatically turned OFF. **Caution** **Setting this to "0" disables the function; even if communication stops, the servo will not be turned OFF.**	1000	0-10000	DEC
149	Mechanical Brake Setting	2	○	×	Sets the operation for the break control signal. 1: Forced release (Output signal = always 1) 99: Forced brake (Output signal = always 0) 0: Released with servo ON (Output signal = 1) Brake ON with servo OFF (Output signal = 0) **Caution** **When set to 99, take care not to run the motor while the brake is applied.** **Caution** **To operate a brake, you need to separately prepare a brake release circuit.**	0	0,1,99	DEC
154	Dynamic Brake Actuation Conditions	1	○	○	Set the condition(s) for triggering the dynamic brake. 0: Only when the power is shut off 1: When the power is shut off and an alarm is detected 2: When the power is shut off, an alarm is detected and the servo is turned off	0	0-2	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
158	Command Current Overload Factor Monitor	2	×	×	Command current overload factor monitor [0.1%] Displays the overload calculation value calculated from the command current in % with reference to ID 200 (overload alarm detection current). When this value reaches 100% (1000), the Command Current Overload Alarm (22) occurs.	-	-	DEC
159	Actual Current Overload Factor Monitor	2	×	×	Actual current overload factor monitor [0.1%] Displays the overload calculation value calculated from the motor actual current in % with reference to ID 200 (overload alarm detection current). When this value reaches 100% (1000), the Actual Current Overload Alarm (21) occurs.	-	-	DEC
160	Driver Temperature	2	×	×	Displays the board temperature inside the driver. [0.1°C] When this value reaches ID 204 (Overheat Error Detection Temperature) or more, the driver Overheat (51) occurs.	-	-	DEC
161	Drive Power Supply Voltage	2	×	×	Displays the driver power supply (P-N) voltage. [0.1 V] When this value reaches the ID 205 (Overvoltage Error Detection Voltage) setting value or higher, then Over Voltage (71) occurs. When it falls below the setting value of ID 206 "Low Voltage Detection," then Voltage Down (72) occurs.	-	-	DEC
166	Simple Control Execution Step Monitor	2	×	×	When Simple Control is working, the currently-running step number and status can be checked. Bit 7 to 0: Currently running step number Bit 12: "1" finishes the program. (Executes END.)	-	-	-
182	Stop Speed Judgement Speed	2	○	○	Sets the speed threshold value to judge ID 20 Bit 14 (Stop Speed Status). [rpm] **Important** **Set this value to 50 or higher when using a resolver.**	For resolver: 50 Other: 10	0-10000	DEC
185	Monitor 1 Gain	2	○	○	Sets the monitor gain (magnification) for analog monitor output 1. Examples: 1 = 1x, 10 = 10x, -10 = 1/10x, -20 = 1/20x (0, -1 are 1x)	1	-32767 - 32767	DEC
186	Monitor 2 Gain	2	○	○	Sets the monitor gain (magnification) for analog monitor output 2. Examples: 1 = 1x, 10 = 10x, -10 = 1/10x, -20 = 1/20x (0, -1 are 1x)	1	-32767 - 32767	DEC

19.15. Parameters for Setting Error Detection

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
200	Overload Alarm Detection Current	2	○	○	Sets the threshold level for Overload Alarm (21 and 22). [0.01 A] Monitors Overload Alarm by comparing the motor current command with the detection level. ⇒ Refer to ❑17.9 "Characteristics of Overload Alarm Detection."	105% of the motor rating current	Up to 105% of the motor rating current	DEC
201	Over-Speed Alarm Detection Speed	2	○	○	Sets the threshold level for Over-Speed Alarm (31). [rpm] When ID 41 "Feedback Speed" reaches this setting value, the Over-Speed Alarm occurs.	8000	0-10000	DEC
202	Position Deviation Error Detection Pulse Count	4	○	○	Sets the threshold level for the Position Excessive Deviation Alarm (42). [pulse] When ID 49 "Position Deviation" reaches this setting value or higher, a Position Excessive Deviation Alarm occurs. This setting uses no sign. **Caution** If set to 2147483648 or larger, the alarm monitoring is disabled.	Depends on the sensor	0 - 4294967295	DEC
204	Overheat Error Detection Temperature	2	○	○	Sets the threshold level for Overheat Alarm (51). [°C] When ID 160 "Driver Temperature" reaches this setting value or higher, the Overheat Alarm occurs. **Caution** Do not set more than the upper bound value.	850	0-850	DEC
205	Overvoltage Error Detection Voltage	2	○	○	Sets the threshold level for Over Voltage (71). [0.1 V] When ID 161 "Drive Power Supply Voltage" reaches this setting value or higher, the Over Voltage Alarm occurs. **Caution** Do not set more than the upper bound value.	VAC 200: 4100 VAC 100: 2100	0-4100 0-2100	DEC
206	Power Supply Shutoff Detection Voltage (low voltage detection)	2	○	○	Sets the threshold level for Voltage Down (72). [0.1 V] When ID 161 "Drive Power Supply Voltage" reaches this setting value or lower, the Voltage Down Alarm occurs.	VAC 200: 1000 VAC 100: 500	0-1000 0-500	DEC
207	Regeneration Alarm Detection Capacity	2	○	○	Sets the threshold level for Regeneration Alarm (73 and 74). [W] When regeneration protection works continuously and the generated power reaches this setting value or higher, the Regeneration Error Alarm occurs. **Caution** **You need to set ID 208 "Regenerative Resistance Value" correctly according to the regenerative resistor you are using.**	60	0-6000	DEC
208	Regeneration Resistance Value	2	○	○	Set the resistance value of the regenerative resistor you use. [0.01 Ω] **Caution** **Unless the correct value is set the regeneration alarm will not be able to detect it.**	4700	4700	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
209	Alarm Mask	2	○	○	Disables detection of some alarms. Setting the specified bit to "1" disables the issuance of an alarm. Bit 0: 1 = Disable Actual Current Overload Alarm (21) Detection Bit 1: 1 = Disable Command Current Overload Alarm (22) Detection Bit 2: 1 = Disable Overspeed Alarm (31) Detection Bit 3: 1 = Disable Multi-rotation Alarm (41) Detection Bit 4: 1 = Disable Position Excessive Deviation Alarm (42) Detection Bit 5: 1 = Disable Driver Temperature Alarm (51) Detection Bit 6: 1 = Disable External Encoder Count Alarm (67) Detection Bit 7: 1 = Disable External Encoder Position Error Alarm (68) Detection Bit 8: 1 = Disable Regeneration Capacity Over Alarm (74) Detection Bit 9 to 11:(Reserved) Bit 12: 1= Disable Drive Power Low Alarm (72) Detection Bit 13 to 15: (Reserved) Example: Set 0x0030 when disabling Excessive Deviation Alarm (42) and Driver Overheat Alarm (51). **Important** **Set the reserved bit to "0."** **Caution** **Even when the alarm detection is set to disabled, continuing operation when the alarm conditions are met has the risk of damaging the driver or motor. When using the driver with the alarm detection disabled, constantly monitor the ID 29 "Warning Status Display." Take safety measures such as quickly stopping at the safe side upon detecting a warning.**	0x0000	0x0000 - 0x11FF	HEX
240	Current Date	4	○	○	Displays the date registered in the driver in binary coded decimal form. Example 1: November 23, 2013 → 0x00131123 Example 2: To change the current date to March 5, 2014 → 0x881440305 In this setting, data are set and saved at the same time. (No need for parameter saving operation) Year cannot be set to 00. If an abnormality occurs, this set value is registered in the alarm history as its date.	-	0x010101 - 0x991231	HEX
241	Current Time	4	○	○	Displays the present time registered in the driver in binary-coded decimal (BCD). To change the current time, set new values by adding 0x88 to the most significant 1 byte. Example 1: Display of 23h 12m 05sec → 0x00231205 Example 2: To change the current time to 11h 32m 01sec → 0x88113201 In this setting, data are set and saved at the same time. (No need for parameter saving operation) If an abnormality occurs, this set value is registered in the alarm history as its date.	-	0x000000 - 0x235959	HEX
242	Total Power Supply ON Time	4	×	×	Displays the time duration of the driver power being ON up to the present time since the product was shipped. [min] Example: For 130 hours (= 7800 [min]) of operation: 7800 This parameter is saved in non-volatile memory when the power is OFF, but numbers smaller than one minute are not saved. For example, if the power is turned OFF less than a minute after it is turned ON, the total time does not increase.	-	0 - 2000000000	DEC

19.16. Parameters for Internal Monitoring

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
246	Analog Input Monitor	2	×	×	Displays the analog input voltage in the scale and direction that the driver uses for internal control. [no unit] (Values after switching the analog input resolution) ±10 V is displayed as ±32767. Example: +10 V → 32767	-	-	-
247	Real-time Command Current	2	×	×	Displays the current command value in the scale and direction that the driver uses for internal control. [no unit] [Model-specific full-scale value] N**1: ±4.13 A is displayed as ±16384 N**2: ±8.26 A is displayed as ±16384 N**3: ±16.53 A is displayed as ±16384 N**4: ±24.79 A is displayed as ±16384	-	-	-
248	Speed Command	2	×	×	Displays the speed command value in the scale and direction that the driver uses for internal control. [no unit] ±10000 rpm is displayed as ±32767 Example: +10000 rpm → 32767	-	-	-
249	Position Command	4	×	×	Displays the position command value in the scale and direction that the driver uses for internal control. [pulse]	-	-	-
250	q-Axis Current	2	×	×	Displays the current feedback value that the driver uses for internal control. [no unit] [Model-specific full-scale value] N**1: ±4.13 A is displayed as ±16384 N**2: ±8.26 A is displayed as ±16384 N**3: ±16.53 A is displayed as ±16384 N**4: ±24.79 A is displayed as ±16384	-	-	-
251	Driver Internal Speed	2	×	×	Displays the speed feedback value in the scale and direction that the driver uses for internal control. [no unit] ±10000 rpm is displayed as ±32767 Example: +10000 rpm → 32767	-	-	-
252	Driver Internal Position Error	4	×	×	Displays the position deviation in the scale and direction that the driver uses for internal control. [pulse]	-	-	-

19.17. Extension Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
256	Switching Special Functions 2	2	○	○	Makes special settings for the servo functions. Bit 0: Position loop operation method (Only for 17- and 23-bit encoders) 0 = High resolution operation 1 = Standard resolution operation Bit 1: Speed carry operation method (Only for 17- and 23-bit encoders) 0 = Method 1 (Standard) 1 = Method 2 Bit 2: Friction compensation switching 0 = Friction compensation disabled 1 = Friction compensation enabled Bit 3: Weight compensation switching 0 = Weight compensation disabled 1 = Weight compensation enabled Bit 4: Quasi friction control switching 0 = Quasi friction control disabled 1 = Quasi friction control enabled (Friction compensation enabled; when Bit 2 = 1, it is disabled.) Bit 5: Wire-saving INC speed calculation method switching Switches among feedback speed calculation methods for the wire-saving INC. Switching sometimes can reduce vibrations or hunting. 0 = Speed calculation method 1 1 = Speed calculation method 2 Bit 6: Load inertia setting unit switching Switches setting units of ID 59 (Load Inertia) 0 = Absolute unit [g·cm^2] 1 = Relative unit [motor inertia magnification/100] (Example: For 3 times, 300) When this setting is changed, the value for ID 59 is automatically converted. Bit 7: Acceleration/deceleration setting unit switching Switches setting units of ID 34 (acceleration) and ID 35 (deceleration). 0 = [10 × rpm/s] 1 = [100 × rpm/s] Bit 8, Bit 9: Overload Alarm detection time constant switching Making the Overload Alarm (21 and 22) detection time constant smaller than the standard can shorten the alarm detection time. Bit 9/Bit 8 = 0/0: Standard Bit 9/Bit 8 = 0/1: Twice Bit 9/Bit 8 = 1/0: Quadruple Bit 9/Bit 8 = 1/1: Octuple Bit 10: (Reserved) Bit 11: Speed Limit switching 0 = Gain switching does not include Speed Limit switching. 1 = Gain switching includes Speed Limit switching. Bit 12: Tuning-free function response setting automatic switching 0 = When oscillation is detected, response setting automatic setting is enabled. 1 = When oscillation is detected, response setting automatic setting is disabled. Bit 13 to 15: (Reserved) **Important** **Be sure to set reserved Bits to "0."**	0x0000	0x0000 - 0x1BFF	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
257	Switching observer	2	○	○	Sets various observer functions. Bit 0: Disturbance Observer 0 = Disable 1 = Enable ⇒ Refer to ❑14.4 "Disturbance Observer" Bit 1: (Reserved) Bit 2: (Reserved) Bit 3: (Reserved) Bit 4: Speed Stabilizing Control 0 = Disable 1 = Enable ⇒ Refer to ❑14.2 "Speed Stabilizing Control" Bit 5: Disturbance suppression function in Speed Stabilizing Control 0 = Disable 1 = Enable Bit 6 to 15: (Reserved) **Caution** Speed stabilizing control is permitted to be enabled only with the finite rotation axis. **Important** **Be sure to set reserved Bits to "0."**	0x0000	0x0000 - 0x0031	HEX
260	Low-pass Filter cut-off frequency 2	2	○	○	Sets the cut-off frequency of Low-pass Filter 2. [Hz] Low-pass Filter 2 is an IIR-type LP filter that is switchable between first and second order. 0 or less, 5001 or more: Low-pass Filter 2 is disabled. 1 to 5000: Sets the cut-off frequency.	0	0-5000	DEC
261	Order of Low-pass Filter 2	2	○	○	Sets the order of Low-pass Filter 2. 0: Second order 1: First order	0	0-1	DEC
265	Speed Command filter	2	○	○	Set the cut-off frequency of the low-pass filter that applies to Speed Command. [Hz] 0 or less, 2100 or more: Speed command filter is disabled. 1 to 2099: Sets the cut-off frequency.	0	0-2099	DEC
268	Speed Feedback filter	2	○	○	Set the number of points of the moving average filter that applies to Speed Feedback. (Up to 100)	0	0-100	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
270	Center frequency of Notch Filer 3	2	○	○	Notch Filters 3 to 7 ・ Center frequency [Hz] 0 or less, 5001 or more: Notch Filter is disabled. 1 to 5000: Sets Center frequency. ・ Attenuation [dB] The smaller the value, the larger the attenuation ・ Guidelines for attenuation: 100: 0 dB, 70: -3 dB, 40: -8 dB, 20: -15 dB, 10: - 20 db, and 0: -75 dB ・ Bandwidth [Hz] The smaller the value, the narrower the attenuation width and the steeper the attenuation curve Use the default value in normal use. Using a notch filter attenuates particular frequency components to suppress mechanical resonance without disrupting the system response. Note that the method for setting Notch Filters 3 to 7 differs from that for Notch Filters 1 and 2. ⇒ Refer to ❑13.4 "Filter Adjustment" **Caution** Oscillation may occur if the center frequency is too low.Normally, use it with a setting of 50 or more.	0	0-5000	DEC
271	Attenuation of Notch Filer 3	2	○	○		0	0-100	DEC
272	Bandwidth of Notch Filer 3	2	○	○		50	1-100	DEC
273	Center frequency of Notch Filer 4	2	○	○		0	0-5000	DEC
274	Attenuation of Notch Filer 4	2	○	○		0	0-100	DEC
275	Bandwidth of Notch Filer 4	2	○	○		50	1-100	DEC
276	Center frequency of Notch Filer 5	2	○	○		0	0-5000	DEC
277	Attenuation of Notch Filer 5	2	○	○		0	0-100	DEC
278	Bandwidth of Notch Filer 5	2	○	○		50	1-100	DEC
279	Center frequency of Notch Filer 6	2	○	○		0	0-5000	DEC
280	Attenuation of Notch Filer 6	2	○	○		0	0-100	DEC
281	Bandwidth of Notch Filer 6	2	○	○		50	1-100	DEC
282	Center frequency of Notch Filer 7	2	○	○		0	0-5000	DEC
283	Attenuation of Notch Filer 7	2	○	○		0	0-100	DEC
284	Bandwidth of Notch Filer 7	2	○	○		50	1-100	DEC
290	Speed Feedforward Gain	2	○	○	Sets Speed Feedforward Gain. [%] This function applies feedforward to the torque command using the change in speed command value. This reduces speed deviation at the time of acceleration/deceleration. 0 or less: Speed Feedforward is disabled. 1 to 500: Feedforward Gain [%] ⇒ Refer to ❑14.3 "Feed-forward Function"	0	0-500	DEC
291	The number of Speed Feedforward Filters	2	○	○	Sets the number of filters for Speed Feedforward. This setting is effective when there is a large amount of noise at the speed command values in analog speed commands. Bit 3-0: Speed command acceleration calculation cycle 0: Speed control cycle (high speed) 1: Speed control cycle x 2 2: Speed control cycle x 3 3: Speed control cycle x 4 (low speed) Bit 7-4: Averaged number of feedforward commands 0: Not averaged 1: Averaged twice 2: Averaged four times ⇒ Refer to ❑14.3 "Feed-forward Function"	0x0000	0x0000 - 0x0023	HEX

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
300	Friction Compensation Torque in the CW direction	2	○	○	Torque in the CW direction with Friction Compensation [0.01 A] Sets the current value for the static friction torque in the CW direction with Friction Compensation enabled. It can be automatically set with Control Mode (ID 31) = 6. **Caution** **Setting a value that is extremely larger than practical friction torques or weight torques may make the motor uncontrollable or cause large vibrations. When changing the value that was set confirm safety and then increase the value gradually.** **⇒ Refer to ❑14.5 "Correction for Friction and Gravity"**	0	0 to Rated current	DEC
301	Friction Compensation Torque in the CCW direction	2	○	○	Torque in the CCW direction with Friction Compensation [0.01 A] Sets the current value for the static friction torque in the CCW direction with Friction Compensation enabled. It can be automatically set with Control Mode (ID 31) = 6. **Caution** **Setting a value that is extremely larger than practical friction torques or weight torques may make the motor uncontrollable or cause large vibrations. When changing the value that was set confirm safety and then increase the value gradually.** **⇒ Refer to ❑14.5 "Correction for Friction and Gravity"**	0	0 to Rated current	DEC
302	Friction Compensation Viscous friction coefficient	2	○	○	Friction Compensation; Viscous friction coefficient Sets the compensation value for a viscous friction component with Friction Compensation enabled. The larger the value, the larger the compensation at a high speed 0: Viscous friction coefficient is zero **Caution** **Setting a value that is extremely larger than practical friction torques or weight torques may make the motor uncontrollable or cause large vibrations. When changing the value that was set confirm safety and then increase the value gradually.** **⇒ Refer to ❑14.5 "Correction for Friction and Gravity"**	0	0-32767	DEC
303	Weight Compensation Torque	2	○	○	Weight Compensation Torque [0.01 A] Sets the compensation current value for a static weight torque component with Weight Compensation enabled. When the CW direction is the ascending side, the value is positive. It can be automatically set with Control Mode (ID 31) = 6. **Caution** **Setting a value that is extremely larger than practical friction torques or weight torques may make the motor uncontrollable or cause large vibrations. When changing the value that was set confirm safety and then increase the value gradually.** **⇒ Refer to ❑14.5 "Correction for Friction and Gravity"**	0	−Rated current to +Rated current	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
310	Disturbance Observer Gain	2	○	○	Sets Disturbance Observer Gain. [%] 0: Disturbance Observer is disabled. 1 to 500: Disturbance Observer Gain [%] ⇒ Refer to ❑14.4 "Disturbance Observer"	0	0-500	DEC
311	Disturbance Observer LPF cut-off frequency	2	○	○	Sets the LPF cut-off frequency in Disturbance Observer. [Hz] Decreasing the set value reduces the response performance. ⇒ Refer to ❑14.4 "Disturbance Observer"	1000	1-3000	DEC
320	Speed Stabilizing Control Time estimation	2	○	○	Sets the estimated time in Speed Stabilizing Control. [msec] Setting this value to 0 or less disables Speed Stabilizing Control. The large the value, the more the stabilization. **Caution** **Do not use Speed Stabilizing Control in systems where the inertia change is large or the inertia is unknown, or for infinite rotation axes.** ⇒ Refer to ❑14.2 "Speed Stabilizing Control"	0	0-100	DEC
321	Speed Stabilizing Control Gain 1	2	○	○	Sets Gain 1 for Speed Stabilizing Control. **Caution** **Do not use Speed Stabilizing Control in systems where the inertia change is large or the inertia is unknown, or for infinite rotation axes.** ⇒ Refer to ❑14.2 "Speed Stabilizing Control"	0	0-1000	DEC
322	Speed Stabilizing Control Gain 2	2	○	○	Sets Gain 2 for Speed Stabilizing Control. **Caution** **Do not use Speed Stabilizing Control in systems where the inertia change is large or the inertia is unknown, or for infinite rotation axes.** ⇒ Refer to ❑14.2 "Speed Stabilizing Control"	0	0-1000	DEC
330	ModbusRTU latency for return	2	○	○	Sets the delay time it takes for the slave to start returning the response after receiving a query from the master in the ModbusRTU communication. [msec] When this setting value is smaller than the response time (T_res), the response time (T_res) is the latency for return. This is enabled by restarting the power after setting and saving the parameters.	0	0-1000	DEC
331	ModbusRTU communication time-out	2	○	○	In the ModbusRTU communication, and with servo-ON, if the time duration of the absence of query from the master or of absence of broadcast query exceeds the time set by this parameter, the servo is automatically turned OFF. [msec] Setting it to "0" disables this function.	0	0 - 32767	DEC

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
360	Tuning-free Function Mode	2	○	○	Sets Tuning-free Function Mode. 0: Tuning-free Function Mode disabled. 1: Only load inertia is set. Automatically estimates and sets ID59 “load inertia.” 2: Estimates load inertia and friction compensation value. Automatically estimates and sets ID59 “Load Inertia,” ID300 “Friction Compensation Torque in the CW Direction,” ID301 “Friction Compensation Torque in the CCW Direction,” and ID302 “Friction Compensation Viscous Friction Coefficient.” *Parameters for friction compensation (ID300 to 302) are not used in control unless otherwise Bit 2 of ID256 “Special Function Switching 2” is set to “1.”	0	0～2	DEC
361	Tuning-free Function Response Setting	2	○	○	Sets the targeted servo response when Tuning-free function is enabled. The greater the value is, the higher the response tuning becomes, but oscillation could be caused if the set value is too large. Uses it within the range not to cause oscillation.	14	0～29	DEC
390	Position Command Damping Filter 1 Center frequency	2	○	○	Position Command Damping Filter 1 This function suppresses low-frequency vibrations at the mechanical edge when the position is controlled. ・ Center frequency [0.1 Hz] 9 or less, 1001 or more: Damping Filter is disabled. 10 to 1000: Setting the center frequency ・ Attenuation [dB] The smaller the value, the larger the attenuation Guidelines for attenuation: 100: 0 dB, 70: -3 dB, 40: -8 dB, 20: -15 dB, 10: - 20 db, and 0: -75 dB ・ Width [Hz] The smaller the value, the narrower the attenuation width and the steeper the attenuation curve Use the default value in normal use. **Caution** ・ **Do not use the Position Command Damping Filter for infinite rotation axes.**	0	0 or 10-1000	DEC
391	Position Command Damping Filter 1 Attenuation	2	○	○		0	0-100	DEC
392	Position Command Damping Filter 1 Width	2	○	○		50	1-100	DEC
450	Pulse Count Monitor	4	×	×	Displays input pulse count value for Position Command. [pulse]	-	-	-
451	Analog Input Voltage Monitor	2	×	×	Displays Analog Input Voltage monitoring value. (Value before switching Analog Input Resolution) "±12 V" is displayed as" ±2048."	-	-	-
452	External Encoder Input Monitor	2	×	×	Displays the input pulse count of the External Encoder. [pulse]	-	-	-
453	Regeneration Monitor	2	×	×	Displays Regeneration Power. [W] If this value exceeds ID 207 "Regeneration Alarm Detection Capacity," Regeneration Error Alarm (74) occurs.	-	-	-
454	Drive Power Supply Voltage Monitor	2	×	×	Displays the monitoring value of the non-averaged Drive Power Supply Voltage. [0.1 V]	-	-	-
455	Monitor Torque	2	×	×	Displays the theoretical value of motor output torque calculated by the operation: Motor Current x Motor Torque Constant (Kt). [0.01 N·m] This is only a reference value, which differs from the real torque at the motor shaft end.	-	-	-

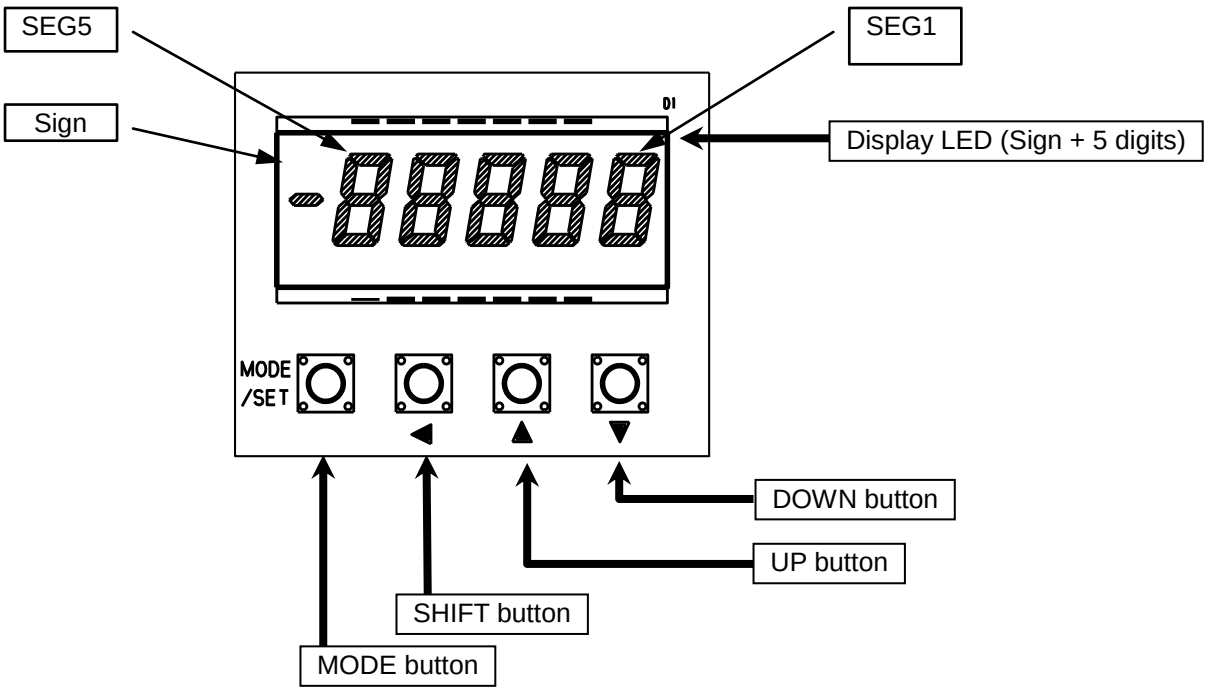
ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
459	Internal Position Command Monitor 1	4	×	×	Displays the Internal Position Command value. [pulse] Monitor 1: Before the smoothing process Monitor 2: After the smoothing process	-	-	-
460	Internal Position Command Monitor 2	4	×	×		-	-	-
461	Internal Speed Command Monitor 1	2	×	×	Displays the Internal Speed Command value. [no unit] Monitor 1: Before Speed Command Filter Monitor 2: After Speed Command Filter ±10000 rpm is displayed as ±32767. Example: +10000 rpm = 32767	-	-	-
462	Internal Speed Command Monitor 2	2	×	×		-	-	-
465	Internal Current Command Monitor 1	2	×	×	Displays the Internal Current Command value. [no unit] Monitor 1: Before the filtering of current command Monitor 2: (Process order 1) After Disturbance Observer Monitor 3: (Process order 2) After the LPF and Notch Filter Monitor 4: (Process order 3) After Speed Feedforward Monitor 5: (Process order 4) After Friction Compensation [Model-specific full-scale value] N**1: ±4.13 A is displayed as ±16384. N**2: ±8.26 A is displayed as ±16384. N**3: ±16.53 A is displayed as ±16384. N**4: ±24.79 A is displayed as ±16384.	-	-	-
466	Internal Current Command Monitor 2	2	×	×		-	-	-
467	Internal Current Command Monitor 3	2	×	×		-	-	-
468	Internal Current Command Monitor 4	2	×	×		-	-	-
469	Internal Current Command Monitor 5	2	×	×		-	-	-
470	Speed Integration Monitor	2	×	×	Displays the integrated value of the Speed Integration Gain within a range of ±32768. [no unit]	-	-	-
471	Current Integration Monitor 1	2	×	×	Displays the integrated value of the Current Integration Gain within a range of ±32768. [no unit]	-	-	-
473	Speed Command Monitor	2	×	×	Displays the Internal Speed Command value before Speed Command Filter. [rpm] ID 461 "Internal Speed Command Monitor 1" is converted into this value in rpm.	-	-	-
474	Current Command Monitor	2	×	×	Displays the Internal Current Command value before all processes. [0.01 A] ID 465 "Internal Current Command Monitor 1" is converted into this value in A.	-	-	-
476	Driver Internal Position Deviation	4	×	×	Displays the Position Deviation in the scale and direction that the driver uses for internal control. [pulse]	-	-	-

20. Settings Panel Operation

The settings panel allows you to change parameters, run Jog, display statuses, and so on.
The following provides explanations of how to operate the settings panel.

20.1. Settings Panel Names and Functions

The names and functions of each display and button are shown below.

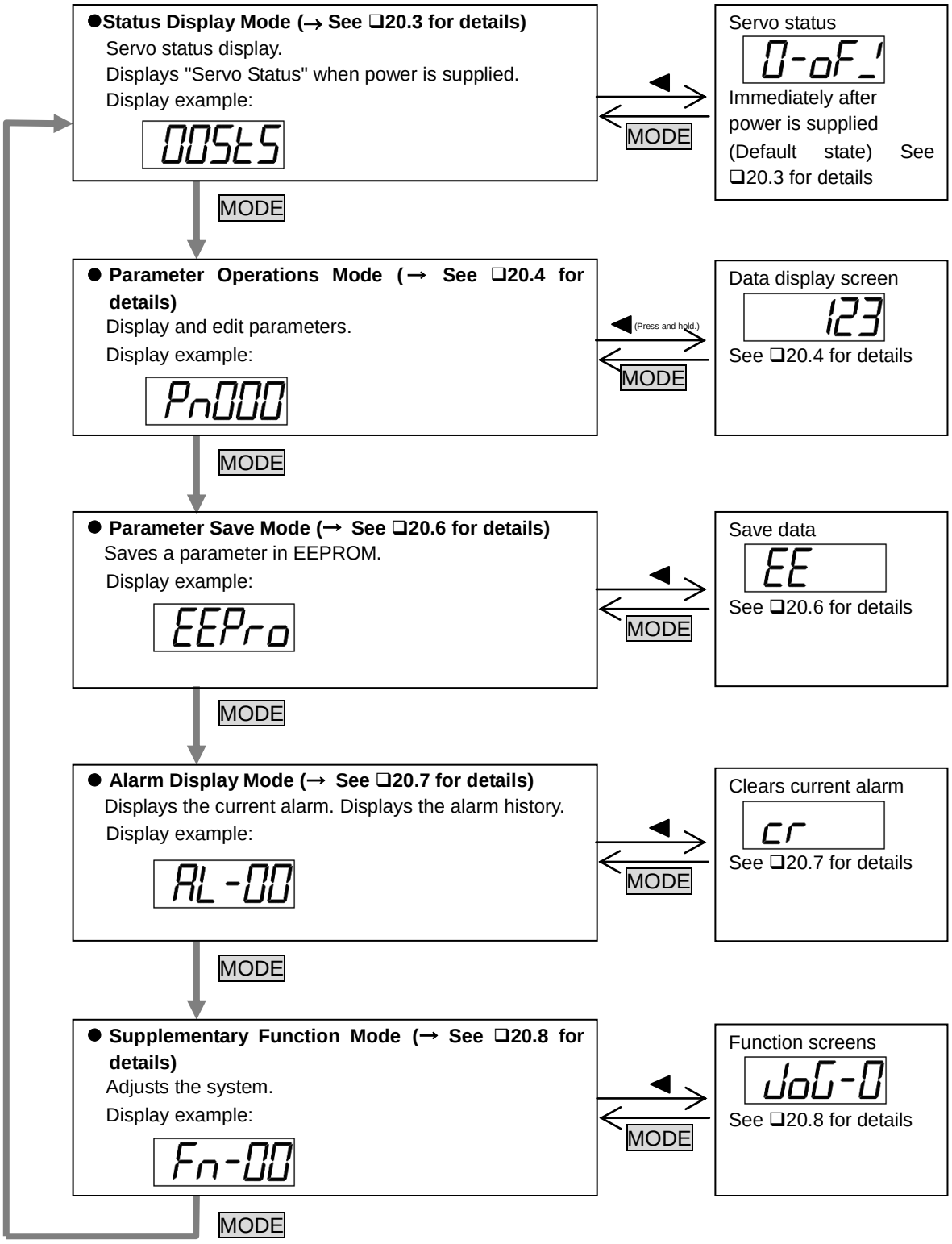


Button	Function
MODE	**MODE button** Switches between the various modes. ・ Status Display → Parameter Operations → Parameter Save → Alarm Display → Supplementary Functions Used when returning from operating in each mode.
◀	**SHIFT button** This lets you select which digits you want to change when changing data. Pressing this button will shift the selected (blinking) row digit to the left. It will also change the mode if pressed and held.
▲	**UP button** Pressing this button increases the setting value of the data. During JOG operation, this becomes the forwards rotation operation (CCW) button.
▼	**DOWN button** Pressing this button decreases the setting value of the data. During JOGoperation, this becomes the reverse rotation operation (CW) button.

Pressing more than one button at the same time can cause the display to become unstable.
Do not press multiple buttons at the same time.

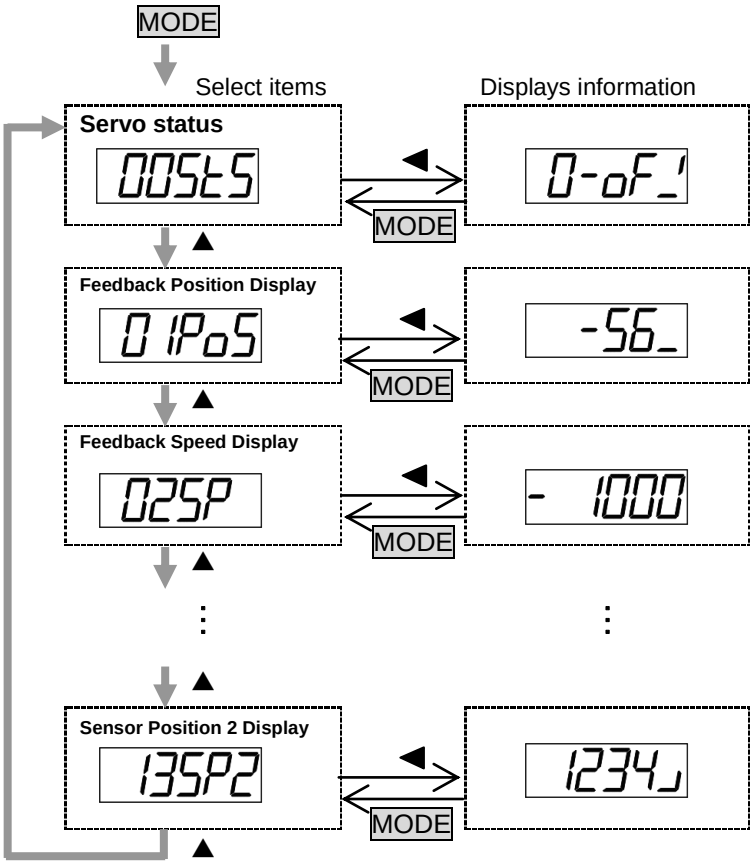
20.2. Display Mode Functions and Selection

Pressing the MODE button switches between Display Modes.
Status Display mode is used immediately after power is supplied. The default setting (factory setting) is "Servo Status" display.



20.3. Operations in Status Display Mode

In Status Display mode, the signals, motor speed, etc. input to the driver are displayed in the LED.
Select the status with the UP button and display the details with the SHIFT button.
While the details are displayed, the MODE button will return you to the selection screen, but you can also use the UP button to return to the selection screen.
If the SHIFT button is not pressed, the details display screen will be selected automatically in about three seconds.
When the power is turned ON, the device starts up with the Status Display mode that was running the last time power was turned OFF. (Ver. 4.65 or later)

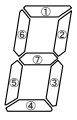


To read the display, refer to Table: How to Read Servo Status Displays.

To read the display, refer to ❑20.5 "Examples of Parameter Value Display."

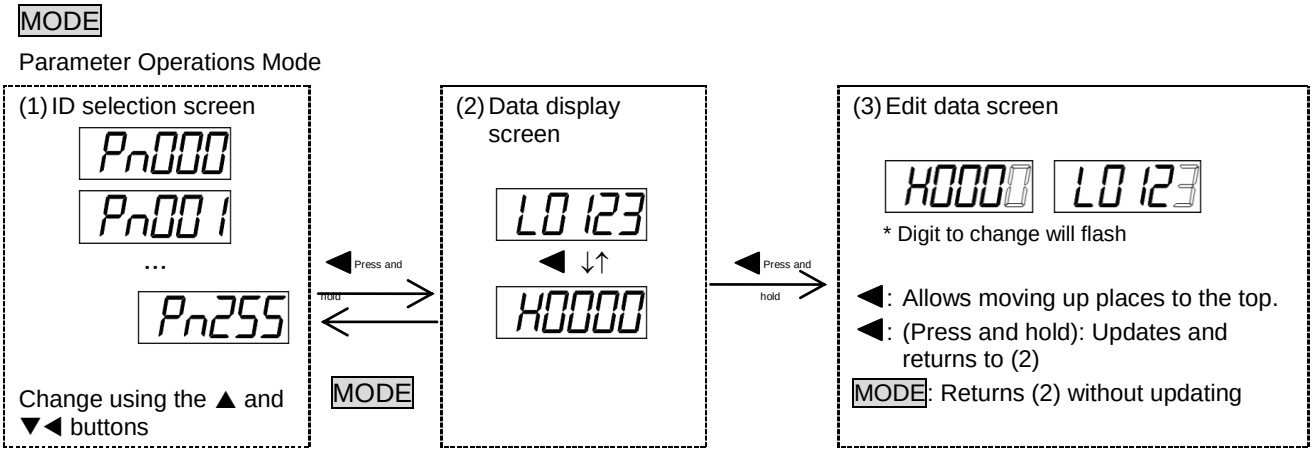
To read the display, refer to ❑20.5 "Examples of Parameter Value Display."

Table. How to Read Servo Status Displays

	Sign	SEG5	SEG4	SEG3	SEG2	SEG1
Normal	(Turned OFF)	Displays the ID 31 "control mode". 0: Servo OFF mode 1: Position control mode 2: Speed control mode 3: Current control mode 4: Zero return control mode 5: Inertia estimation mode 6: Friction correction torque estimation mode E: Simple control	Displays hyphens	Displays servo ON or OFF : Servo OFF : Servo ON		 Input signal status Lit with photocoupler ON (1) IN1 (2) IN2 (3) IN3 (4) IN4 (5) IN5 (6) IN6 (7) IN7 * IN8 cannot be displayed.
Alarm ON		Displays "AL".		Displays Alarm No. (two digits decimal).		

20.4. Operations in Parameter Operations Mode

Display and editing are always available but some data cannot be changed or the values are restricted. (For details, refer to ❑19. "List of Parameters."
Parameters with a notation of DEC are displayed in decimal numbers; those with HEX are displayed in hexadecimal numbers.



(1) ID selection screen.

Select the ID of parameter that is to be displayed and edited.

Change the value using the ▲ or ▼ buttons.

Press the ◀ button once (no more than half a second) to change the digit you can operate (the flashing digit).

When the parameter ID is set, press and hold the ◀ button (for one second or longer) to move to (2) Data display screen.

(2) Data display screen

The data of the selected parameter is displayed. The value cannot be edited.

For a 4-byte parameter, press ◀ to change displayed digits.

To edit values, press and hold the ◀ button (for one second or longer) to move to (3) Data editing screen.

When you do not need to edit anything, press the MODE button to return to (1) ID selection screen.

(3) Edit data screen

Edit the parameter data of selected ID.

Change the value using the ▲ or ▼ buttons.

Press the ◀ button once (no more than half a second) to change the digit you can operate (the flashing digit).

Once you have selected the figure, press and hold the ◀ button (for over one second). The data will be updated and you will be returned to (2) the data display screen.

If editing is possible, the values will be updated and reflected in the results.

To return to the data display screen without updating the values, press the MODE button.

20.5. Parameter Value Display Examples

■ 1-byte data/2-byte data

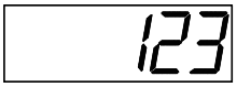
- Hexadecimal notation (HEX)

  Example: "0x0123"

Its first character is displayed as "h."

- Decimal notation (DEC)

  Example 1: "123"



  Example 2: "-1000"

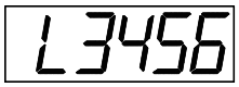
Displays the negative sign (−) at the left end.

■ 4-byte data

- Hexadecimal notation (HEX)

  Example: "0x00123456"

Higher

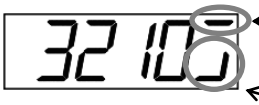


Lower

Displays "H" (higher digits) or "L" (lower digits) at the left.

- Decimal notation (DEC)

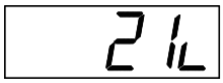
Supplement **This function applies to software revision 4.44 or later.**



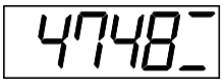
This indicates there are higher digits outside the screen. (Higher order digits exist: ‾)

This indicates the order of digits displayed (High: ⌞; Middle: _; Low:

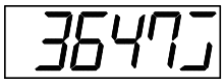
Example 1: "2147483647"



Higher

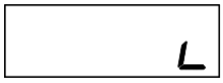


Middle

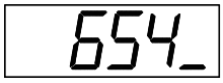


Lower

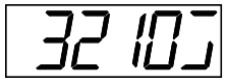
Example 2: "6543210"



Higher

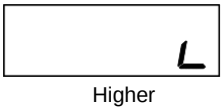


Middle

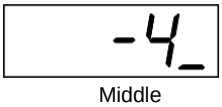


Lower

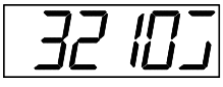
Example 3: "-43210"



Higher



Middle

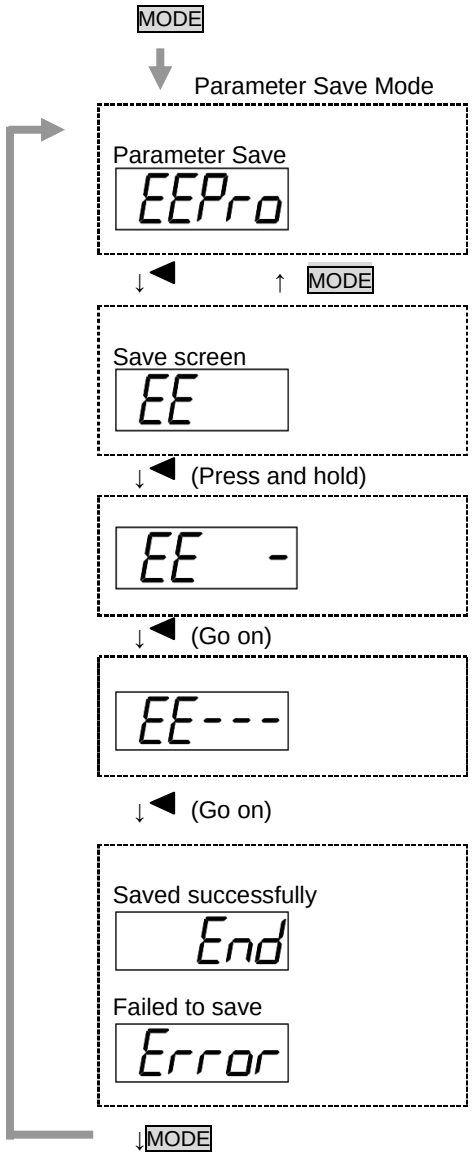


Lower

The negative sign (−) is displayed at the immediate left of the highest digit.

20.6. Operations in Parameter Save Mode

Servo parameters can be edited in Parameter Operations mode, but the changed data is saved in this mode. All parameters are saved in EEPROM.
Parameters should be saved with the servo OFF.



Use the MODE button to select Parameter Save mode (EEPro).

Press the ◀ button.

Once you are on the Parameter Save screen, release the ◀ button.
Next, pressing and holding the ◀ button will increase the "-."

Releasing the button before "- - -" is displayed means that no processing will be done.

When processing is finished, the screen will change to the completion screen.

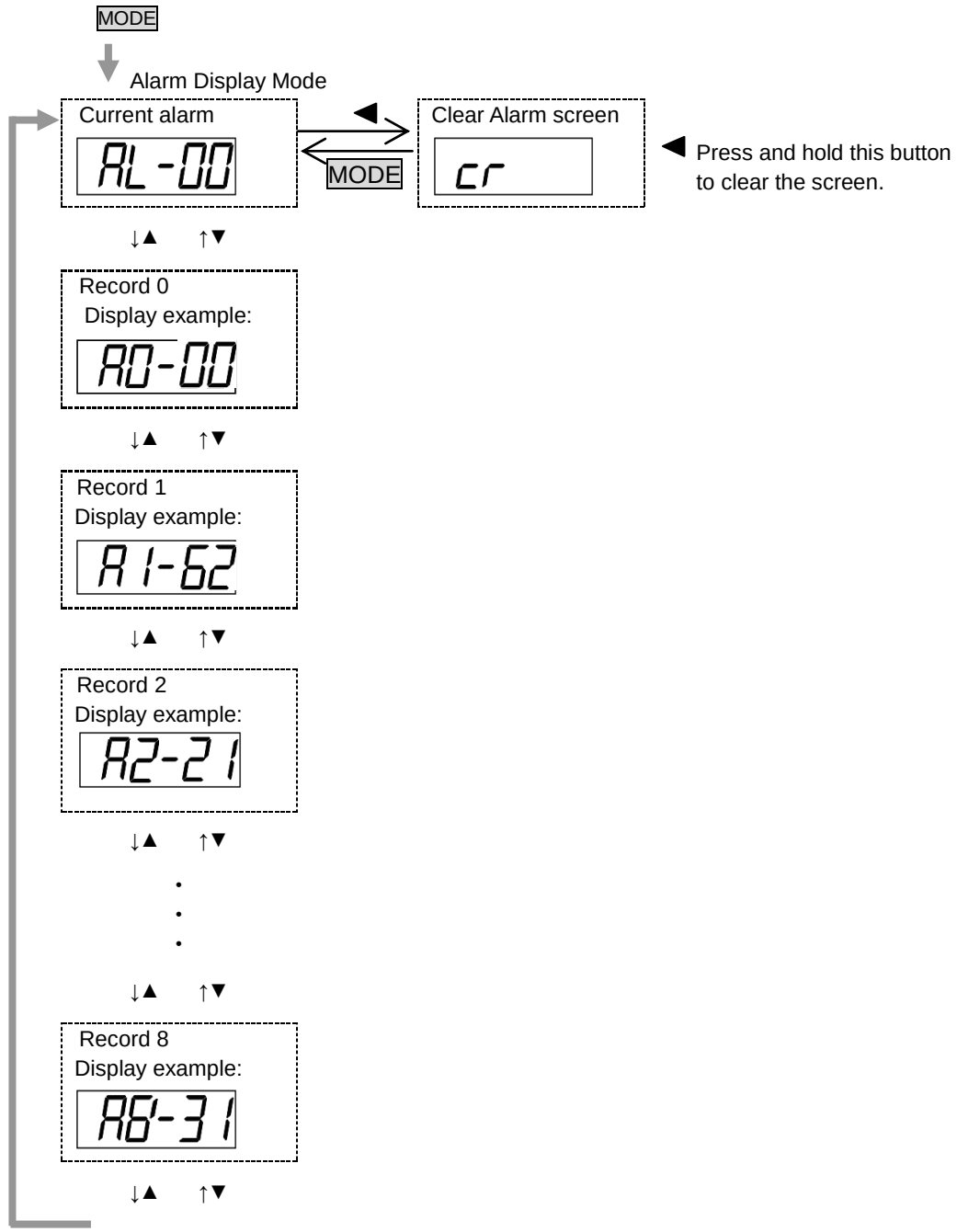
"End": Completed without errors
"Error": Completed with errors (save processing was done when operation cannot be accepted, so it could not be saved)

The "Error" display shows the "Completed with errors" for button operation, and does not affect servo operation.

Press the MODE button in the completion screen to return to the Parameter Save mode screen.

20.7. Operations in Alarm Display Mode

The current alarm and the alarm history are shown on the LED display in Alarm Display mode.
In the alarm history, the larger the number, the older the alarm.
Use the ▲ button to display the next alarm and the ▼ button to display the previous alarm.
With "Current alarms" displayed, pressing the ◄ button will move you to the Clear Alarm screen.
Removing the cause of the alarm and holding and pressing the ◄ button lets you clear the alarm. (Some alarms cannot be cleared.)

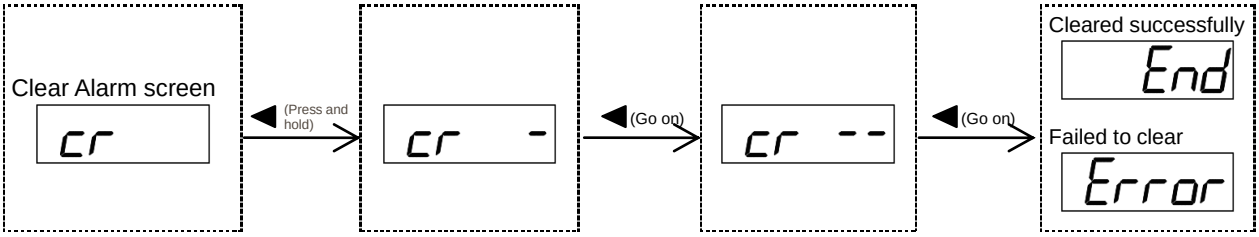


((Clear Alarm screen))

Pressing and holding the ◀ button in the Clear Alarm screen will increase the "-." Releasing the button before "- - -" is displayed means that no processing will be done.

When processing is finished, the screen will change to the completion screen.

Press the MODE button in the completion screen to return to the Alarm Display mode screen.



"End": Cleared successfully

"Error": Failed to clear (reset operation was not performed since there were no alarms or clear operation was performed without eliminating the cause of alarm.)

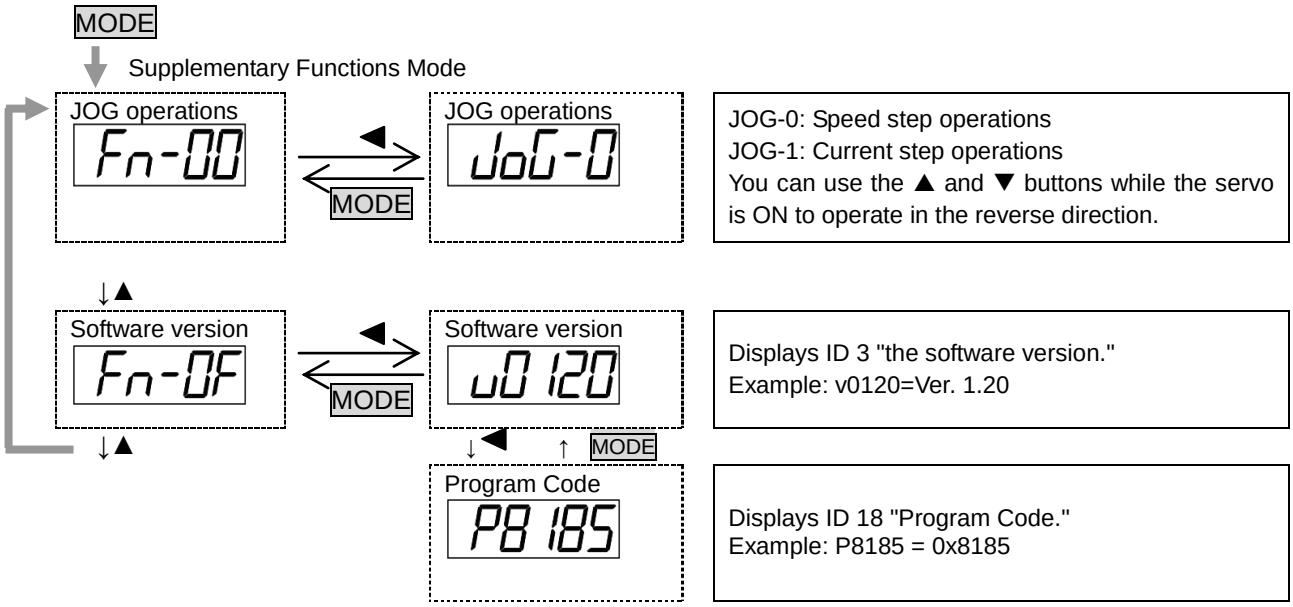
* The "Error" display shows the "Completed with errors" for button operation, and does not affect servo operation.
* When the sensor is a SmartABS sensor, such as 17/23 Bit-ABS, the alarms recorded on the encoder side are alarm codes 61, 63, 64, and 66, and alarms cannot be cleared using the above setting alone.

In this event, first use parameter operations to set B15 " SmartABS sensor alarm & multi-rotation reset" in ID 30, "Servo Commands," then clear the alarm.

⇒ Refer to ❑17.5 "Clearing a Sensor Alarm"

20.8. Operations in Supplementary Functions Mode

In Supplementary Functions mode, you can make various adjustments to the driver. Supplementary mode is made up of a range of function screens, with the operation changing for each function.
Select the function with the ▲ button and move to the execution screen with the ◀ button.

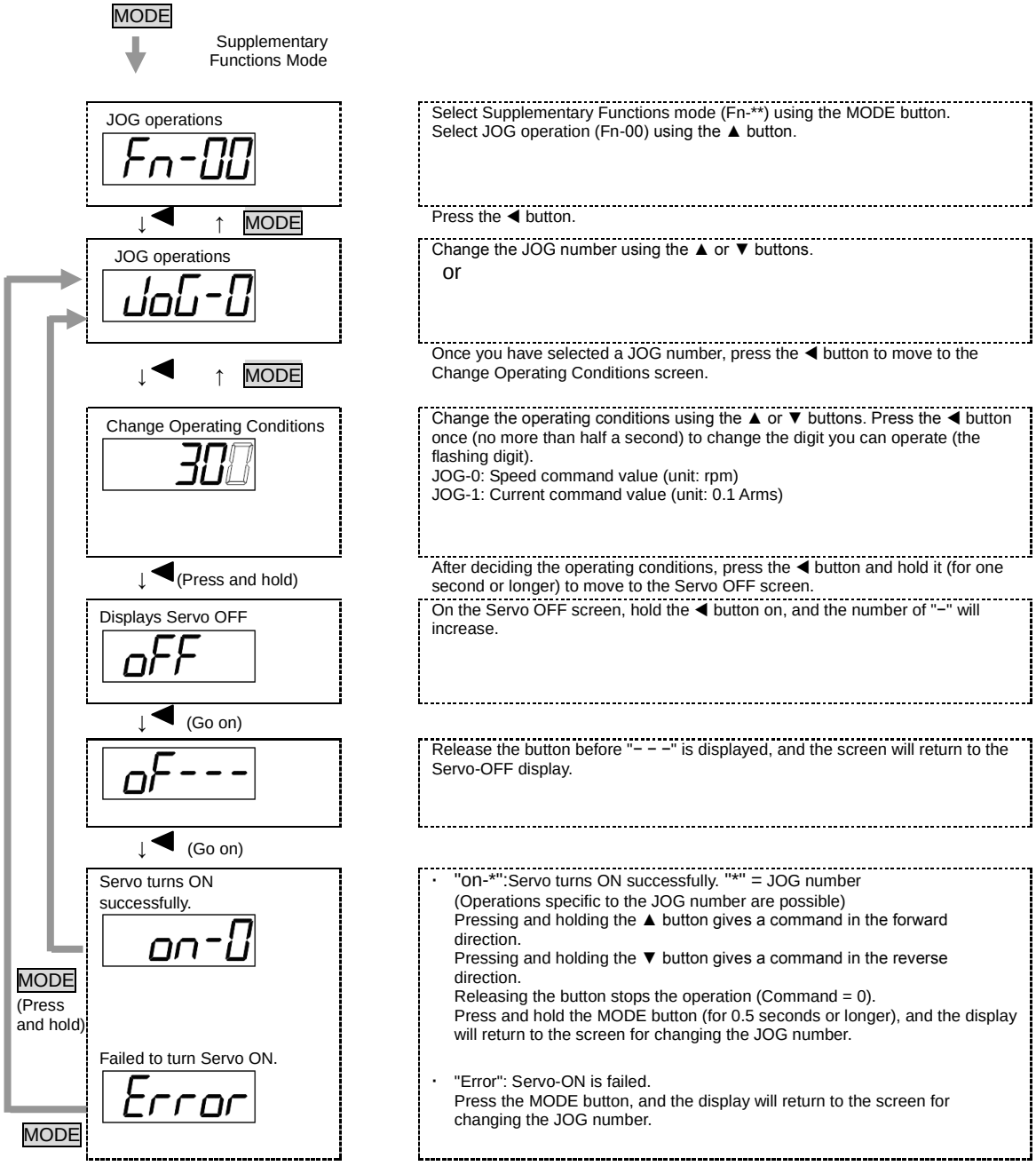


20.9. Operations in JOG Operation Mode

Entering JOG operation in Supplementary Functions mode lets you run the motor in JOG mode from the settings panel.
JOG operation should be done with the servo OFF and alarm reset OFF.

List of JOG Operations

JOG number	Description
JOG-0	Speed step operations You can use the ▲ button while "ON-0" is displayed for forwards direction speed step operation and the ▼ button for reverse direction speed step operation. (Default value: 0 rpm)
JOG-1	Current step operations You can use the ▲ button while "ON-1" is displayed for forwards direction current step operation and the ▼ button for reverse direction current step operation. (Default value: 0 Arms)



20.10. List of Status Display Mode

Item	Example	Description
005t5	0-oF_1	Displays Servo Status. To read, refer to ❑Table "How to Read Servo Status Displays" in 20.3. Display example: Mode 0, Servo OFF, IN2 and IN4 input ON
025P	-56_	Displays the value of ID 40 "Feedback Position." Unit: pulse; Display example: Middle digits of −567890 pulses
01P05	- 1000	Displays the value of ID 41 "Feedback Speed." Unit: rpm; Display example: −1000 rpm
03Crt	- 105	Displays the value of ID 42 "Feedback Current." Unit: 0.01A; Display example: −1.05 A
04tr	213	Displays the value of ID 455 "Monitor Torque." Unit: 0.001 N•m, Display example: 0213 N•m * The Monitor Torque value is calculated by Motor Current x Motor Torque Constant (Kt). This is only a reference value, which differs from the real torque at the motor shaft end.
05PEr	-123_	Displays the value of ID 49 "Position Deviation." Unit: pulse, Display example: Lower order digits of −123 pulse.
06CPL	-234_	Displays the value of ID 459 "Internal Position Command Monitor 1." Unit: pulse, Display example: Middle digits of −2345678 pulse.
07CSP	3000	Displays the value of ID 473 "Speed Command Monitor." Unit: rpm, Display example: 3000 rpm
08CCr	-312	Displays the value of ID 474 "Current Command Monitor." Unit: 0.01 A, Display example: −3.12 A
0ALd	815	Displays the value of ID 159 "Actual Current Overload Factor Monitor." Unit: 0.1%, Display example: 81.5%
0bCLd	501	Displays the value of ID 158 "Command Current Overload Factor Monitor." Unit: 0.1%, Display example: 50.1%
0CPLC	1234_	Displays the value of ID 450 "Pulse Count Monitor." Unit: pulse, Display example: Lower order digits of 1234 pulse
0dEPC	-5555_	Displays the value of ID 452 "External Encoder Input Monitor." Unit: pulse, Display example: Lower order digits of −5555 pulse
0EAnG	512	Displays the value of ID 451 "Analog Input Voltage Monitor." Range: ±2048 (=±12V) Display example: 512 (=3 V)
0FrGn	20	Displays the value of ID 453 "Regeneration Monitor." Unit: W, Display example: 20 W
10Pru	2450	Displays the value of ID 454 "Drive Power Supply Voltage Monitor." Unit: 0.1 V, Display example: 245.0 V
11tPL	456	Displays the value of ID 160 "Driver Temperature." Unit: 0.1°C, Display example: 45.6°C
125P1	1234_	Displays the value of ID 45 "Sensor Position 1." Unit: pulse, Display example: Lower order digits of 1234 pulse
135P2	1234_	Displays the value of ID 46 "Sensor Position 2." Unit: pulse, Display example: Lower order digits of 1234 pulse

21. After-Sales Service

21.1. Repair and Inquiry

For repair or inquiry, please contact the dealer from whom you purchased the product.
We offer a software upgrade service. Please consult with us about this (charges may apply).

21.2. Guarantee

■ Free Guarantee Period

The free guarantee period is valid for the shorter of the following: within one year of the product being installed at your site or your customer's site or within 18 months (from the manufacturing month) of the product being delivered from our plant.

■ Guarantee Scope

Failure diagnosis

We request that, as a rule, your company should perform the initial diagnosis of the failure.

However, this diagnosis can be performed instead by us or our service network if you so request. In this case, following discussions with your company, repairs will be provided free of charge if the failure is attributable to us.

Failure repair

Repair, replacement, and on-site visits for failures incur charges for the four cases below, but are free in other cases.

1. If the failure is due to improper storage or handling, negligence on the part of you or your customer, the nature of your software or hardware design, or any other such reason.
2. If the failure is attributable to modifications and changes you have made to our products without our approval.
3. If the failure is attributable to use of a product beyond the specified range.
4. Other failures that you acknowledge as being outside our responsibility.

21.3. Exemption from Responsibility for Compensation for Opportunity Loss, Etc.

Whether within the free guarantee period or not, our guarantee does not provide compensation for the following items attributable to the failure of our products: any loss of opportunity you or your customers may suffer, any damage to a product other than our own, or damage attributable to another's responsibility.

21.4. Period of Repair after Production Discontinuation

We will repair discontinued products for seven years after the last shipment date. For some products, substitutes may be recommended.

21.5. Delivery Conditions

For standard products which do not include application setting and adjustment, delivery of the product to you is deemed as acceptance of the product, and we assume no responsibility for operations such as on-site adjustment or trial runs.

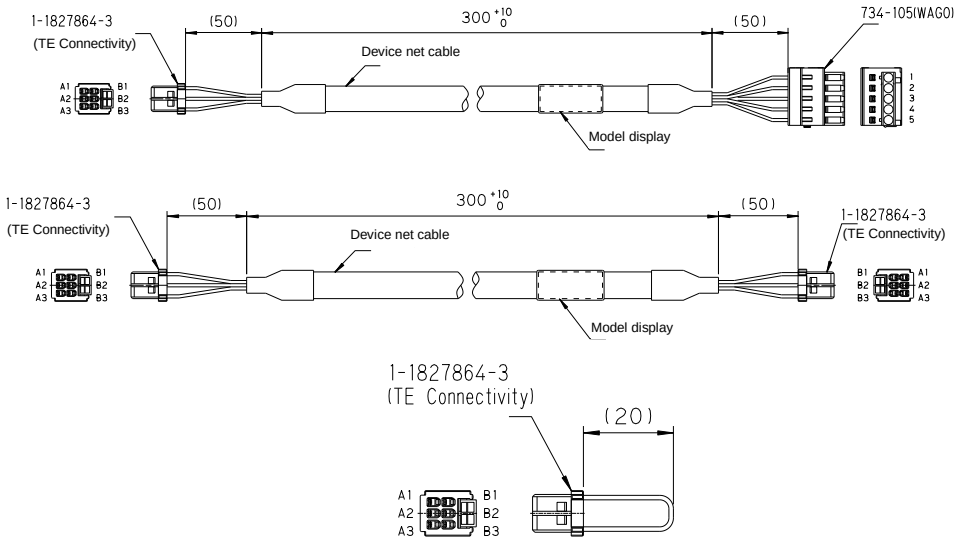
21.6. Appropriate Use of This Product

- This product is not designed or manufactured for use with equipment and systems used in situations where there is a risk to life.
- If you are considering using this product with medical, aerospace, nuclear power, electric power, marine, manned transportation, or other special systems, please consult with our sales office.
- This product is manufactured under strict quality control. However, if failure of the product may result in serious accident or loss, safety devices must be installed on the equipment and systems on which our product is installed.

22. Appendices

22.1. Optional Parts

■ SV-NET Cable



Controller-Driver Connection

Model	Length (L)
EUA1354 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

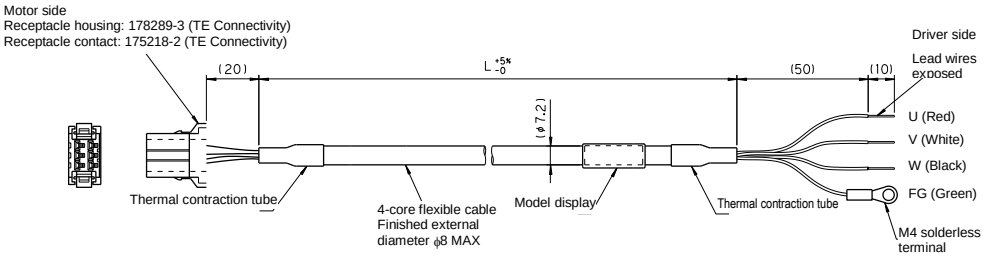
Driver-Driver Connection

Model	Length (L)
EUA1287 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

Termination Connector

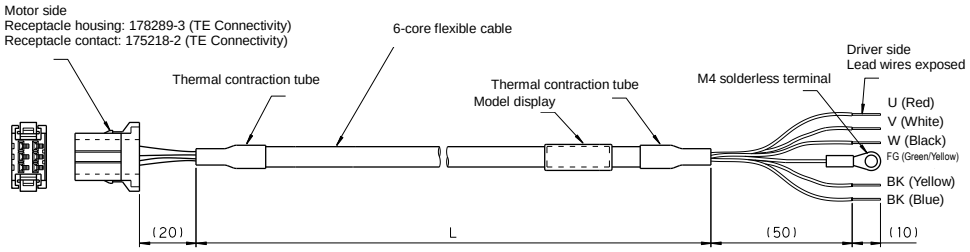
Model	Length (L)
EUA1294 N0000	-

■ Motor Cable (brakeless)



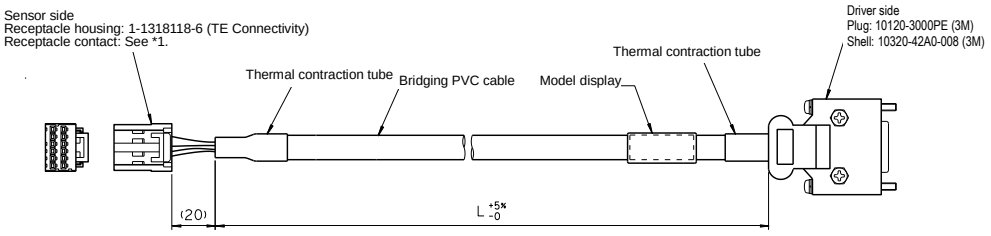
Model	Length (L)
EUA1280 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ Motor Cable (braked)



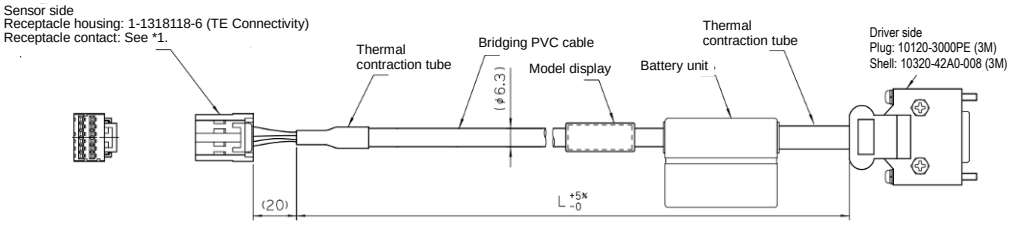
Model	Length (L)
EUA1292 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ Sensor Cable (wire-saving INC, 17bit-INC, 23bit-INC, resolvers)



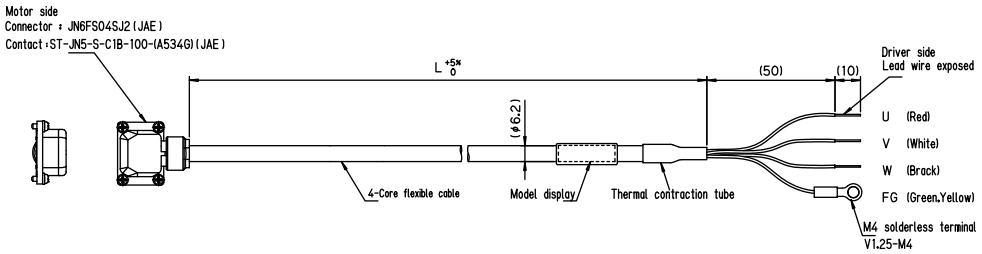
Model	Length (L)
EUA1281 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ Sensor Cable (built-in 17bit-ABS, 23bit-ABS battery)



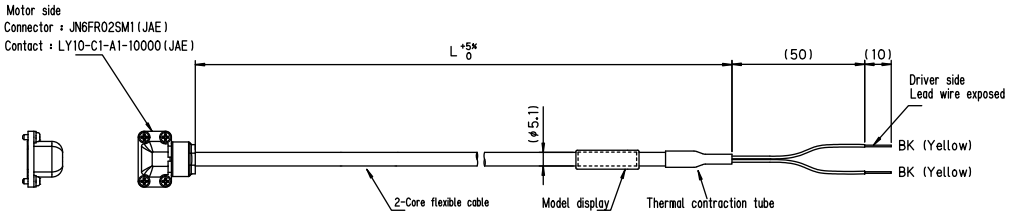
Model	Length (L)
EUA1283 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ i4s Motor Cable



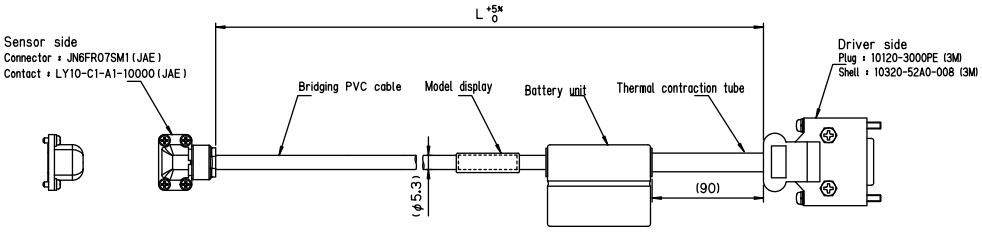
Model	Length (L)
EUA9201 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ i4s Braked Cable



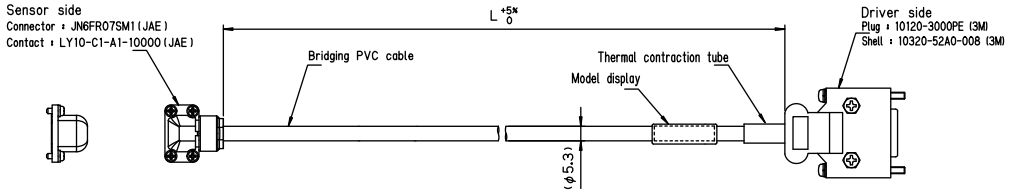
Model	Length (L)
EUA9202 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ i4s Sensor Cable (serial-ABS)



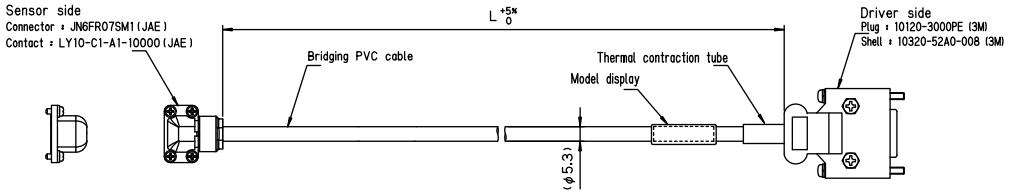
Model	Length (L)
EUA9203 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ i4s Sensor Cable (serial-INC)



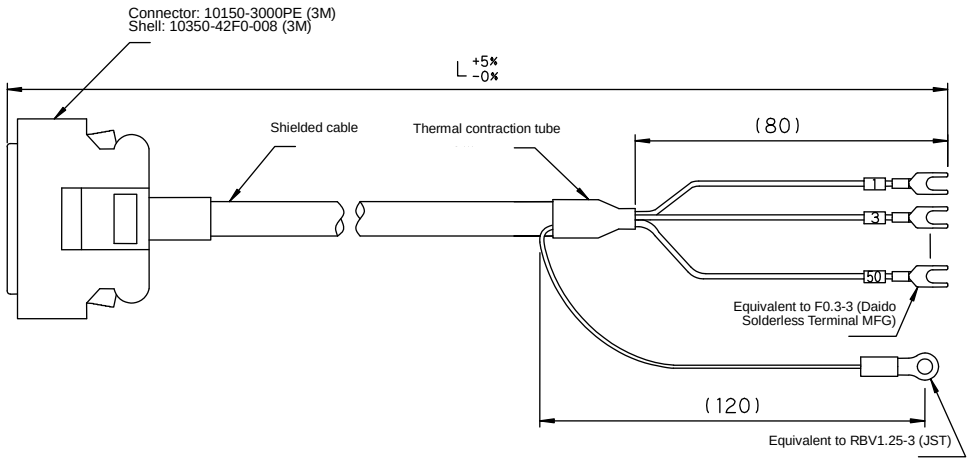
Model	Length (L)
EUA9204 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ i4s Sensor Cable (resolvers)



Model	Length (L)
EUA9205 N0010	1 m
N0030	3 m
N0050	5 m
N0100	10 m

■ I/O Cable



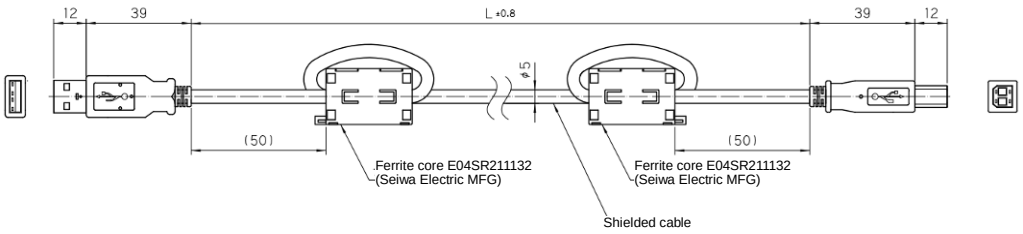
Command pulse input: Line driver

Model	Length (L)
EUA1424 N0003	0.3 m
N0010	1 m
N0030	3 m
N0050	5 m

Command pulse input: Open collector

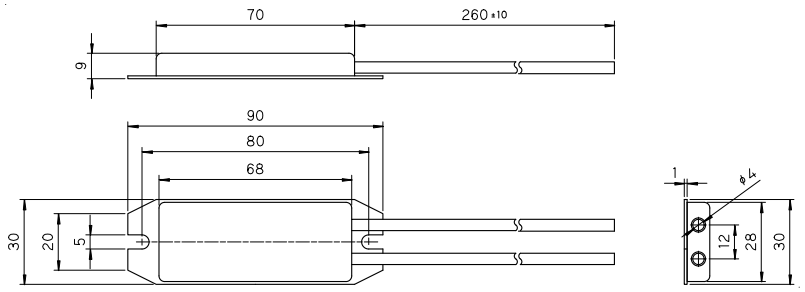
Model	Length (L)
EUA1425 N0003	0.3 m
N0010	1 m
N0030	3 m
N0050	5 m

■ USB Cable



Model	Length (L)
EUA1459 N0010	0.8 m
N0015	1.3 m
N0020	1.8 m
N0030	2.8 m

■ Regenerative Resistor

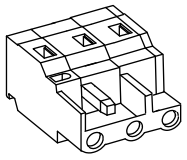


Model	Resistance/Capacity
EUA1290	47 Ω 80 W

■ Accessories

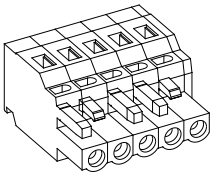
▪ Power supply connector

0134-32-6588-03 (DINKLE)



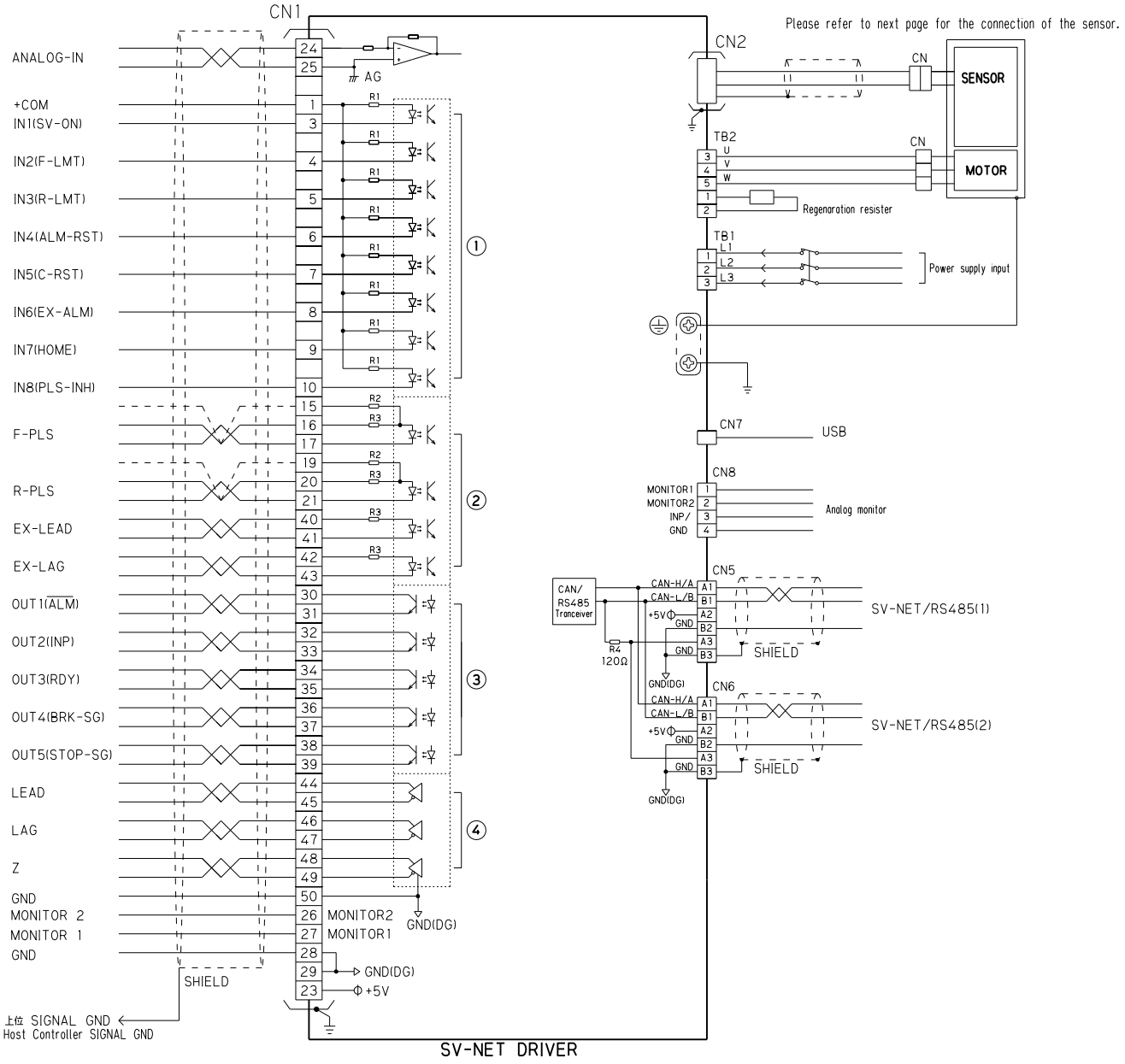
▪ Motor connector

0134-1105 (DINKLE)

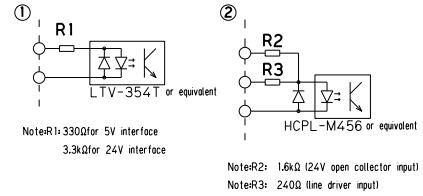


22.2. External Connection Diagram

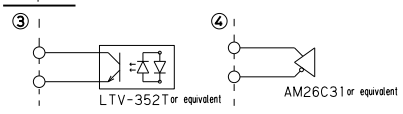
■ **TAD 8811Series**



Input



Output



*1 The power supply can be connected to either single-phase or three-phase.

*2 The power supply voltage and the I/F voltage differ by N-number model.
Combinations are as follows.

TAD8811N□***

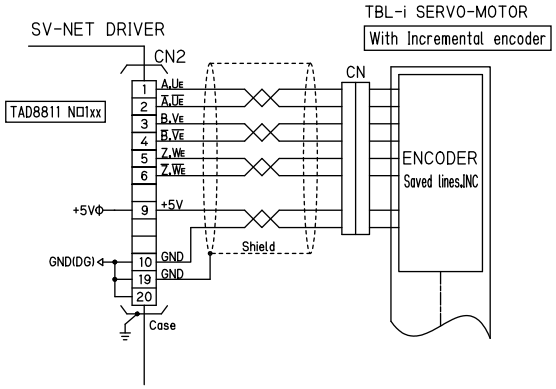
Rated current specification. refer to each specification for details.

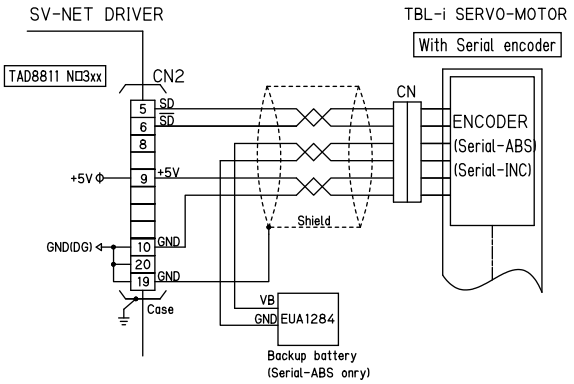
Electrical supply voltage. I/F voltage
1 : I/F voltage 5V Electrical supply voltage AC100V
2 : I/F voltage 5V Electrical supply voltage AC200V
3 : I/F voltage 24V Electrical supply voltage AC100V
4 : I/F voltage 24V Electrical supply voltage AC200V

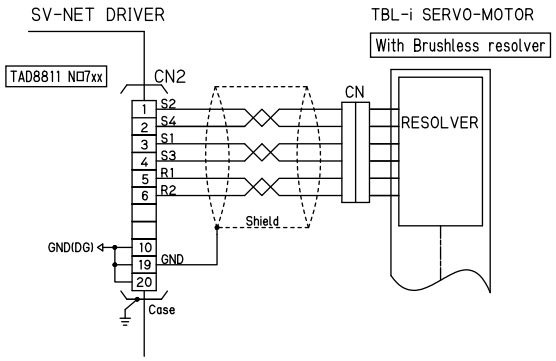
Special machinery specification

*3 We recommend that the sensor shild be connected to DG.
Howevew.connecting to CN2-CASE(⏚)can increase the noise resistance level.

Sensor Connection Diagram







22.3. Usable Parameters by Software Revision

Product refinements may enable parameters to be added. Use the table below to check usable parameters. See ID 3 "Revision" to check software revision details.
EN- and UL-compliant products are equipped with Software Revision 6.00 or later.

ID	Parameter name	Read value
3	Software Revision	DEC

Example: The number "316" means the Revision is "3.16."

ID	Parameter symbol		Revision							
			3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
1	Device Code		○	○	○	○	○	○	○	○
2	Product Code		○	○	○	○	○	○	○	○
3	Software Revision		○	○	○	○	○	○	○	○
4	Serial Number		○	○	○	○	○	○	○	○
5	MAC-ID		○	○	○	○	○	○	○	○
6	Baud Rate		○	○	○	○	○	○	○	○
16	Parameters init.		○	○	○	○	○	○	○	○
17	Parameters Save		○	○	○	○	○	○	○	○
18	Program Code		○	○	○	○	○	○	○	○
20	Servo Status	Bit 0	○	○	○	○	○	○	○	○
		Bit 1	○	○	○	○	○	○	○	○
		Bit 2	○	○	○	○	○	○	○	○
		Bit 3	○	○	○	○	○	○	○	○
		Bit 4	○	○	○	○	○	○	○	○
		Bit 5	○	○	○	○	○	○	○	○
		Bit 6	○	○	○	○	○	○	○	○
		Bit 7	○	○	○	○	○	○	○	○
		Bit 8	○	○	○	○	○	○	○	○
		Bit 9	○	○	○	○	○	○	○	○
		Bit 10	○	○	○	○	○	○	○	○
		Bit 11	○	○	○	○	○	○	○	○
		Bit 12	○	○	○	○	○	○	○	○
		Bit 13	○	○	○	○	○	○	○	○
		Bit 14	○	○	○	○	○	○	○	○
		Bit 16	○	○	○	○	○	○	○	○
		Bit 20	-	-	-	-	-	○	○	○
		Bit 21	-	-	-	-	-	○	○	○
		Bit 22	-	-	-	-	-	○	○	○
		Bit 24	○	○	○	○	○	○	○	○
21	I/O Status		○	○	○	○	○	○	○	○
22	Alarm Code		○	○	○	○	○	○	○	○
23	Alarm History-1		○	○	○	○	○	○	○	○
24	Alarm History-2		○	○	○	○	○	○	○	○
25	Select Alarm Occurrence Information to be Displayed		○	○	○	○	○	○	○	○
26	Alarm Occurrence Information		○	○	○	○	○	○	○	○
29	Warning Status Display		○	○	○	○	○	○	○	○

ID	Parameter symbol		Revision							
			3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
30	Servo Command Control Mode	Bit 0	○	○	○	○	○	○	○	○
		Bit 1	○	○	○	○	○	○	○	○
		Bit 2	○	○	○	○	○	○	○	○
		Bit 3	○	○	○	○	○	○	○	○
		Bit 4	○	○	○	○	○	○	○	○
		Bit 5	○	○	○	○	○	○	○	○
		Bit 7	○	○	○	○	○	○	○	○
		Bit 8	○	○	○	○	○	○	○	○
		Bit 9	○	○	○	○	○	○	○	○
		Bit 10	○	○	○	○	○	○	○	○
		Bit 11	○	○	○	○	○	○	○	○
		Bit 12	○	○	○	○	○	○	○	○
		Bit 13	○	○	○	○	○	○	○	○
		Bit 14	○	○	○	○	○	○	○	○
		Bit 15	○	○	○	○	○	○	○	○
31	Control Mode	0	○	○	○	○	○	○	○	○
		1	○	○	○	○	○	○	○	○
		2	○	○	○	○	○	○	○	○
		3	○	○	○	○	○	○	○	○
		4	○	○	○	○	○	○	○	○
		5	○	○	○	○	○	○	○	○
		14	○	○	○	○	○	○	○	○
32	Target Position		○	○	○	○	○	○	○	○
33	Target Velocity		○	○	○	○	○	○	○	○
34	Acceleration		○	○	○	○	○	○	○	○
35	Deceleration		○	○	○	○	○	○	○	○
36	Real-time Command Position		○	○	○	○	○	○	○	○
37	Real-time Command Speed		○	○	○	○	○	○	○	○
38	Real-time Command Current		○	○	○	○	○	○	○	○
39	Position Reset Value		○	○	○	○	○	○	○	○
40	Feedback Position		○	○	○	○	○	○	○	○
41	Feedback Speed		○	○	○	○	○	○	○	○
42	Feedback Current		○	○	○	○	○	○	○	○
43	Feedback PVC		○	○	○	○	○	○	○	○
44	Feedback SVC		○	○	○	○	○	○	○	○
45	Sensor Position 1		○	○	○	○	○	○	○	○
46	Sensor Position 2		○	○	○	○	○	○	○	○
47	ECD Position		○	○	○	○	○	○	○	○
48	External Encoder Position		○	○	○	○	○	○	○	○
49	Position Deviation		○	○	○	○	○	○	○	○

ID	Parameter symbol		Revision							
			3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
50	Position Loop Proportional Gain 1		○	○	○	○	○	○	○	○
51	Speed Loop Proportional Gain 1		○	○	○	○	○	○	○	○
52	Speed Loop Integral Gain 1		○	○	○	○	○	○	○	○
53	Low-pass Filter Cutoff Frequency		○	○	○	○	○	○	○	○
54	Notch Filter Center Frequency 1		○	○	○	○	○	○	○	○
55	Notch Filter Attenuation 1		○	○	○	○	○	○	○	○
56	Current Loop Proportional Gain		○	○	○	○	○	○	○	○
57	Current Loop Integral Gain		○	○	○	○	○	○	○	○
58	Phase-advance Gain		○	○	○	○	○	○	○	○
59	Load Inertia		○	○	○	○	○	○	○	○
60	Position Loop Proportional Gain 2		○	○	○	○	○	○	○	○
61	Speed Loop Proportional Gain 2		○	○	○	○	○	○	○	○
62	Speed Loop Integral Gain 2		○	○	○	○	○	○	○	○
63	Notch Filter Center Frequency 2		○	○	○	○	○	○	○	○
64	Notch Filter Attenuation 2		○	○	○	○	○	○	○	○
65	Forward Current Limit 2		○	○	○	○	○	○	○	○
66	Reverse Current Limit 2		○	○	○	○	○	○	○	○
68	Position Feedforward Gain		○	○	○	○	○	○	○	○
69	Control Switch	Bit 0 to 4	○	○	○	○	○	○	○	○
		Bit 5	-	-	-	-	-	○	○	○
		Bit 6 to 15	○	○	○	○	○	○	○	○
72	Reference Direction		○	○	○	○	○	○	○	○
73	Select Position Feedback	0	○	○	○	○	○	○	○	○
		1	○	○	○	○	○	○	○	○
74	Select Position Command		○	○	○	○	○	○	○	○
75	Select Speed Command	0, 1, Bit 7	○	○	○	○	○	○	○	○
		2	-	○	○	○	○	○	○	○
76	Select Torque Command	0, 1, Bit 7	○	○	○	○	○	○	○	○
		2	-	○	○	○	○	○	○	○
		3	-	-	-	-	-	○	○	○
77	In-Position Signal Range		○	○	○	○	○	○	○	○
78	Smoothing Time 1		○	○	○	○	○	○	○	○
79	Smoothing Time 2		○	○	○	○	○	○	○	○
80	Select Gain-switch Method		○	○	○	○	○	○	○	○
81	Gain-switch Point H		○	○	○	○	○	○	○	○
82	Gain-switch Point L		○	○	○	○	○	○	○	○
83	Select Soft Limit		○	○	○	○	○	○	○	○
84	Positive-side Soft Limit		○	○	○	○	○	○	○	○
85	Reverse-side Soft Limit		○	○	○	○	○	○	○	○
86	Forward-rotation Current Limit		○	○	○	○	○	○	○	○
87	Reverse-rotation Current Limit		○	○	○	○	○	○	○	○
88	Speed Limit		○	○	○	○	○	○	○	○
89	In-Position Signal Range		-	-	-	-	-	○	○	○
90	Homing Mode	0	○	○	○	○	○	○	○	○
		1	○	○	○	○	○	○	○	○
		2	○	○	○	○	○	○	○	○
		3	○	○	○	○	○	○	○	○
		4	○	○	○	○	○	○	○	○
91	Homing Preset Value		○	○	○	○	○	○	○	○
92	Homing Start Direction		○	○	○	○	○	○	○	○
93	Homing Speed		○	○	○	○	○	○	○	○
94	Homing Creep Speed		○	○	○	○	○	○	○	○
95	Homing Thrust Time		○	○	○	○	○	○	○	○
96	Homing Thrust Torque		○	○	○	○	○	○	○	○

ID	Parameter symbol		Revision							
			3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
99	Control Mode 2		○	○	○	○	○	○	○	○
100 to 107	I/O Setting Parameter Input 1 (IN1) – Input 8 (IN8) Setting	0	○	○	○	○	○	○	○	○
		1	○	○	○	○	○	○	○	○
		2	○	○	○	○	○	○	○	○
		3	○	○	○	○	○	○	○	○
		4	○	○	○	○	○	○	○	○
		5	○	○	○	○	○	○	○	○
		6	○	○	○	○	○	○	○	○
		7	○	○	○	○	○	○	○	○
		8	○	○	○	○	○	○	○	○
		9	○	○	○	○	○	○	○	○
		10	○	○	○	○	○	○	○	○
		11	○	○	○	○	○	○	○	○
		12	○	○	○	○	○	○	○	○
		13	○	○	○	○	○	○	○	○
		14	○	○	○	○	○	○	○	○
		15	○	○	○	○	○	○	○	○
		16	○	○	○	○	○	○	○	○
		17	○	○	○	○	○	○	○	○
		18	○	○	○	○	○	○	○	○
		99	○	○	○	○	○	○	○	○
110 to 114	I/O Setting Parameter Output 1 (OUT1) – Output 5 (OUT5) Setting		○	○	○	○	○	○	○	○
117	I/O filter time		○	○	○	○	○	○	○	○
118	Monitor 1 Setting		○	○	○	○	○	○	○	○
119	Monitor 2 Setting		○	○	○	○	○	○	○	○
120	Pulse Input Mode	0	○	○	○	○	○	○	○	○
		1	○	○	○	○	○	○	○	○
		2	-	-	○	○	○	○	○	○
121	Command Pulse Input Signal Resolution Numerator		○	○	○	○	○	○	○	○
122	Command Pulse Input Signal Resolution Denominator		○	○	○	○	○	○	○	○
123	External Encoder Direction		○	○	○	○	○	○	○	○
124	External Encoder Resolution		○	○	○	○	○	○	○	○
126	Sensor Output Division Setting		○	○	○	○	○	○	○	○
130	Analog Input Signal Speed Conversion Scale		○	○	○	○	○	○	○	○
131	Analog Input Current Speed Conversion Scale		○	○	○	○	○	○	○	○
132	Analog Input Offset		○	○	○	○	○	○	○	○
133	Analog Input Zero Clamp		○	○	○	○	○	○	○	○
134	Analog Input Filter		○	○	○	○	○	○	○	○

ID	Parameter symbol	Revision							
		3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
140	Abs Mode	○	○	○	○	○	○	○	○
141	Special Function Switching	○	○	○	○	○	○	○	○
143	Servo OFF Delay	○	○	○	○	○	○	○	○
144	Abs-Offset	○	○	○	○	○	○	○	○
145	Speed Loop Proportional Gain in Inertia Estimate Mode	○	○	○	○	○	○	○	○
146	Speed Loop Integral Gain in Inertia Estimate Mode	○	○	○	○	○	○	○	○
147	Brake Release Delay Time	○	○	○	○	○	○	○	○
148	Enabled Time for Servo During Communication Shutoff	○	○	○	○	○	○	○	○
149	Input Brake Setting	○	○	○	○	○	○	○	○
154	Dynamic Brake Actuation Conditions	○	○	○	○	○	○	○	○
158	Command Current Overload Factor Monitor	-	○	○	○	○	○	○	○
159	Actual Current Overload Factor Monitor	○	○	○	○	○	○	○	○
160	Driver Temperature	○	○	○	○	○	○	○	○
161	Drive Power Supply Voltage	○	○	○	○	○	○	○	○
166	Simple Control Execution Step Monitor	○	○	○	○	○	○	○	○
182	Stop Speed Judgment Speed	○	○	○	○	○	○	○	○
185	Monitor 1 Gain	○	○	○	○	○	○	○	○
186	Monitor 2 Gain	○	○	○	○	○	○	○	○
200	Overload Alarm Detection Current	○	○	○	○	○	○	○	○
201	Over-Speed Alarm Detection Speed	○	○	○	○	○	○	○	○
202	Position Deviation Error Detection Pulse Count	○	○	○	○	○	○	○	○
204	Overheat Error Detection Temperature	○	○	○	○	○	○	○	○
205	Overvoltage Error Detection Voltage	○	○	○	○	○	○	○	○
206	Power Shutoff Detection Voltage (low voltage detection)	○	○	○	○	○	○	○	○
207	Regeneration Alarm Detection Capacity	○	○	○	○	○	○	○	○
208	Regeneration Resistance Value	○	○	○	○	○	○	○	○
209	Alarm Mask	○	○	○	○	○	○	○	○
240	Current Date	○	○	○	○	○	○	○	○
241	Current Time	○	○	○	○	○	○	○	○
242	Total Power Supply ON Time	○	○	○	○	○	○	○	○
246	Analog Input Monitor	○	○	○	○	○	○	○	○
247	Real-time Command Current	○	○	○	○	○	○	○	○
248	Speed Command	○	○	○	○	○	○	○	○
249	Position Command	○	○	○	○	○	○	○	○
250	Q-Axis Current	○	○	○	○	○	○	○	○
251	Driver Internal Speed	○	○	○	○	○	○	○	○
252	Driver Internal Position Error	○	○	○	○	○	○	○	○

ID	Parameter symbol		Revision							
			3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
256	Special Function Switching 2	Bit 0 to 6	-	-	-	○	○	○	○	○
		Bit 7	-	-	-	-	-	○	○	○
		Bit 8, 9	-	-	-	○	○	○	○	○
		Bit 11	-	-	-	-	-	○	○	○
		Bit 12	-	-	-	-	-	-	○	○
257	Observer Switching		-	-	-	○	○	○	○	○
260	Low-pass Filter Cutoff Frequency 2		-	-	-	○	○	○	○	○
261	Low-pass Filter Order 2		-	-	-	○	○	○	○	○
265	Speed Command Filter		-	-	-	○	○	○	○	○
268	Speed Feedback Filter		-	-	-	○	○	○	○	○
270	Notch Filter Center Frequency 3		-	-	-	○	○	○	○	○
271	Notch Filter Attenuation 3		-	-	-	○	○	○	○	○
272	Notch Filter Bandwidth 3		-	-	-	○	○	○	○	○
273	Notch Filter Center Frequency 4		-	-	-	○	○	○	○	○
274	Notch Filter Attenuation 4		-	-	-	○	○	○	○	○
275	Notch Filter Bandwidth 4		-	-	-	○	○	○	○	○
276	Notch Filter Center Frequency 5		-	-	-	○	○	○	○	○
277	Notch Filter Attenuation 5		-	-	-	○	○	○	○	○
278	Notch Filter Bandwidth 5		-	-	-	○	○	○	○	○
279	Notch Filter Center Frequency 6		-	-	-	○	○	○	○	○
280	Notch Filter Attenuation 6		-	-	-	○	○	○	○	○
281	Notch Filter Bandwidth 6		-	-	-	○	○	○	○	○
282	Notch Filter Center Frequency 7		-	-	-	○	○	○	○	○
283	Notch Filter Attenuation 7		-	-	-	○	○	○	○	○
284	Notch Filter Bandwidth 7		-	-	-	○	○	○	○	○
290	Speed Feedforward Gain		-	-	-	○	○	○	○	○
291	Number of Speed Feedforward Filters		-	-	-	○	○	○	○	○
300	Friction Compensation Torque in the CW Direction		-	-	-	○	○	○	○	○
301	Friction Compensation Torque in the CCW Direction		-	-	-	○	○	○	○	○
302	Friction Compensation Viscous Friction Coefficient		-	-	-	○	○	○	○	○
303	Weight Compensation Torque		-	-	-	○	○	○	○	○
310	Disturbance Observer Gain		-	-	-	○	○	○	○	○
311	Disturbance Observer LPF Frequency		-	-	-	○	○	○	○	○
320	Speed Stabilizing Control Time Estimation		-	-	-	○	○	○	○	○
321	Speed Stabilizing Control Gain 1		-	-	-	○	○	○	○	○
322	Speed Stabilizing Control Gain 2		-	-	-	○	○	○	○	○
330	ModbusRTU Latency for Return		-	-	-	○	○	○	○	○
331	ModbusRTU Communication Time-out		-	-	-	○	○	○	○	○
360	Tuning-free Function Mode		-	-	-	-	-	-	○	○
361	Tuning-free Function Response Setting		-	-	-	-	-	-	○	○

ID	Parameter symbol	Revision							
		3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
390	Position Command Damping Filter 1 Center Frequency	-	-	-	-	-	○	○	○
391	Position Command Damping Filter 1 Attenuation	-	-	-	-	-	○	○	○
392	Position Command Damping Filter 1 Width	-	-	-	-	-	○	○	○
450	Pulse Count Monitor	-	-	-	-	-	○	○	○
451	Analog Input Voltage Monitor	-	-	-	-	-	○	○	○
452	External Encoder Input Monitor	-	-	-	-	-	○	○	○
453	Regeneration Monitor	-	-	-	-	-	○	○	○
454	Drive Power Supply Voltage Monitor	-	-	-	-	-	○	○	○
455	Monitor Torque	-	-	-	-	-	○	○	○
459	Internal Position Command Monitor 1	-	-	-	-	-	○	○	○
460	Internal Position Command Monitor 2	-	-	-	-	-	○	○	○
461	Internal Speed Command Monitor 1	-	-	-	-	-	○	○	○
462	Internal Speed Command Monitor 2	-	-	-	-	-	○	○	○
465	Internal Current Command Monitor 1	-	-	-	-	-	○	○	○
466	Internal Current Command Monitor 2	-	-	-	-	-	○	○	○
467	Internal Current Command Monitor 3	-	-	-	-	-	○	○	○
468	Internal Current Command Monitor 4	-	-	-	-	-	○	○	○
469	Internal Current Command Monitor 5	-	-	-	-	-	○	○	○
470	Speed Integration Monitor	-	-	-	-	-	○	○	○
471	Current Integration Monitor 1	-	-	-	-	-	○	○	○
473	Speed Command Monitor	-	-	-	-	-	○	○	○
474	Current Command Monitor	-	-	-	-	-	○	○	○
476	Driver Internal Position Error	-	-	-	-	-	○	○	○

To use the parameters that have been newly added to the driver side, you also need to update the dedicated applications. Use applications of the latest available revisions.

Software Revision	3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
Motion Adjuster	○	1.5.0.5	1.5.0.5	1.6.0.0	1.6.0.0	×	×	×
Motion Designer Drive	○	○	○	○	0.30	1.00	1.00	1.10

22.4. Settings Panel Function Extension

Since the products are continually improved, settings panel functions are sometimes extended. When using an old driver, please be aware of this.

Software Revision	3.16	3.22	4.11	4.31	4.44	4.77	6.00	6.20
4-byte parameter in the decimal notation	-	-	-	-	○	○	○	○
Status Display Monitor additional items	-	-	-	-	-	○	○	○

Revision History

Date of revision	Rev. No.	Description/reason
17/03/06	0000	First version
17/06/15	0001	Addition of a new combination motor type (TBL-i4s series) Revision of descriptions in 9. Establishing Communication with Host Equipment, 11. Servo Gain Adjustment, and 15.4 Homing Mode Update of the software revision (revision of the homing mode and enhancement of the gain adjustment function)