DC24V/48V AC Servo Motor Driver
TA8410 (RoHS Directive Compliant)
Instruction Manual

DS'S
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Motortronics®

Tamagawa

DC24V/48V AC Servo Motor
SV-NET Driver
TA8410 Series

Instruction Manual

RoHS Directive Compliant

Tamagawa TAMAGAWA SEIKI CO.,LTD

■ Contents

Memo:

⚠ Safety Precautions

Thank you very much for purchasing the SV-NET Driver. To use the product correctly, please read this document and all supplied documents carefully before installing, operating, maintaining, and inspecting the product. Incorrect usage may lead to improper operation, and, at worst, can lead to damage to the product or the equipment connected to it. Store this manual with the supplied documents in a safe place so that you can refer to it when you have a question.

We exercise the greatest caution to ensure the product quality. However, please give due consideration to safety because unanticipated operation may occur due to unexpected noises, static electricity, accidental part failure, wiring failure, or other problems.

■ Items to Check After Unpacking

After you receive and unpack the product, please check it to see if it is the model you have ordered and for any damage that may have occurred during transportation.

Should your product have any problems, please contact your local dealer or retailer.

■ Precautions for Transportation and Handling

- Do not drop the product by mistake or subject it to excessive impact.
- During transportation, handle the product carefully to avoid breakage.
- Do not handle the product in a way that may allow excessive force to be applied to its parts.
- Do not allow conductive foreign materials such as screws and metal pieces or flammable foreign materials such as paper to get onto the circuit boards or enter the inside of the product.

■ Precautions for Wiring and Installation

- Store and use the product under the following environmental conditions unless otherwise specified:

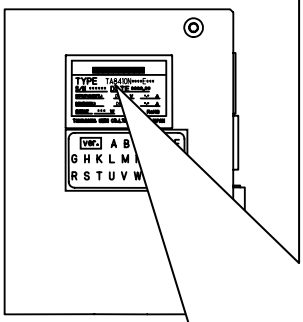
Environmental condition	SV-NET Driver TA8410
Operating temperature range	0°C to +40°C
Operating humidity	90% or less (no condensation)
Storage temperature	-10°C to +85°C (no freezing)
Storage humidity	90% or less (no condensation)
Environment	Indoor (no direct sunlight) Avoid dirt, dust, and corrosive and flammable gasses 1,000 m or less above sea level
Vibration/shock	4.9 m/s^2 or less / 19.6 m/s^2 or less

- Continuously running the motor around the ratings results in more heat. In such cases, take appropriate measures to cool the product such as using a cooling fan so that the ambient temperature does not exceed 40°C.
- Install the driver at a specified spacing from the servo amplifier, the inside of the control panel, and other equipment.
- Do not apply a voltage to the terminals other than that specified in the specifications. Doing so could result in product breakdowns or damage.
- Recheck the wiring and the polarity of the connections before turning on the product.
- The vibration/shock values are short-time ratings.

Safety Precautions

■ Model check

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



Model designation

TA8410	N	7	3	0	0	E	100
(1)		(2)	(3)	(4)	(5)		(6)

(1) Model base

TA8410 Series

(2) Sensor specifications

1: Encoder 2048C/T wiring-saving incremental (*1)
3: Encoder 17-bit INC/ABS (*1)
7: Brushless resolver (Synglsyn/Smartsyn)
(*1) 1 and 3 are only selectable for the SVD-DW type.

(3) Rated continuous output current specs

3: 4 Arms (Up to 12 Arms)
5: 8 Arms (Up to 24 Arms)

(4) Casing and related specs

0: Open frame
1: Covered type (black) Standard
2: Covered type (red)
3: Covered type (silver)
4: Covered type (green)
5: Covered type (blue)
6: Covered type (white)
Note: The color of the cover is shown in parentheses.

(5) I/O and related specs

0: Without I/O IF (network connection only) Standard
1: With I/O IF (right angle type, with a lock)
2: With I/O IF (straight type, with a lock) (*2)
3: With I/O IF (right angle, without a lock)
4: Expansion board with open collector output & without I/O IF (*3)
5: Expansion board with open collector output & with I/O IF (right angle type, with a lock) (*3)
6: Expansion board with open collector output & with I/O IF (right angle type, without a lock) (*3)
7: Expansion board with line driver output & without I/O IF (*3)
8: Expansion board with line driver output & with I/O IF (right angle type, with a lock) (*3)
9: Expansion board with line driver output & with I/O IF (right angle type, without a lock) (*3)
(*2) 2 can only be installed in the open frame type.
(*3) SVD-DW type for 4 to 9.

(6) Software specs

Depend on the combined motor.
100 or higher: Standard specifications
1** Brushless resolver Singlsyn
2** Brushless resolver Smartsyn
5** Encoder 2048C/T wiring-saving INC
6** Encoder 17-bit ABS
7** Encoder 17-bit INC
900 or higher: Specifications of software customized for specific users

Safety Precautions

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

Use the lists below to check if the model of the driver is compatible with the motor you use:

○ List of Combinations of TBL-V Series Motors and Compatible Driver Models

24 V DC type & 48 V DC type	
Motor model	Compatible driver model
TS4742 (50W/50W-□42)	TA8410N75**E111
TS4746 (96W/100W-□56.4)	TA8410N75**E112
TS4747 (132W/200W-□56.4)	TA8410N75**E113
■ Sensor type: Brushless resolver Singlsyn only	

○ List of Combinations of TBL-i **II** Series Motors and Compatible Driver Models

24 V DC type		48 V DC type	
Motor model	Compatible driver model	Motor model	Compatible driver model
TS4601 (30W-□40)	TA8410N△3**E△41	TS4601 (30W-□40)	TA8410N△3**E△81
TS4602 (50W-□40)	TA8410N△3**E△42	TS4602 (50W-□40)	TA8410N△3**E△82
TS4603 (100W-□40)	TA8410N△5**E△43	TS4603 (100W-□40)	TA8410N△3**E△83
TS4606 (100W-□60)	TA8410N△5**E△56	TS4606 (100W-□60)	TA8410N△3**E△96
TS4607 (100W-□60)	TA8410N△5**E△57	TS4607 (200W-□60)	TA8410N△5**E△97
		TS4609 (200W-□60)	TA8410N△5**E△99

■ Note: The number for the symbol "△" is determined by the type of the sensor built into the motor.

N7***E2**: Brushless resolver Smartsyn

N1***E5**: Encoder 2048C/T wiring-saving incremental

N3***E6**: Encoder 17-bit ABS

N3***E7**: Encoder 17-bit INC

Caution!

Running the equipment with a driver whose model is incompatible with the motor may result in damage to the driver and motor as well as to the installed equipment. Be sure to use a driver compatible with the motor.

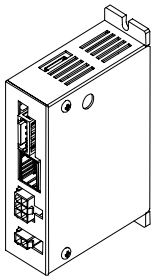
1. Before You Begin

Overview of the Product

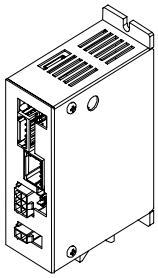
The SV-NET Driver TA8410 Series is a network driver for servo motors with a 24 V or 48 V DC power supply developed to downsize the motion control system and reduce the cost as much as possible. It adopts our original fieldbus SV-NET for the network. The combination of the fieldbus and the SV-NET controller (TA8440) allows for multi-axis interpolation. In spite of its compactness, the driver supports I/O control with pulse and analog commands in addition to communication commands by SV-NET.

The TA8410 Series comes in three product types: the SVD-DL type used exclusively for brushless resolvers, the SVD-DW type with additional functions such as encoder selection, and the open frame type which is the SVD-DL type without a cover.

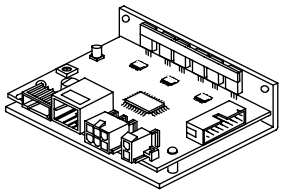
SVD-DL type



SVD-DW type



Open frame type



Standard Functions

Control mode		Position, speed, and current control
Position command input	Communication command input	Position command by SV-NET
	Pulse command input	Pulse form selected by parameters (pulse resolution variable) Forward/reverse pulse. • Pulse/rotation direction.
Analog command input	Speed command input Current command input	Command scale and polarity settable with parameters Factory settings: 6,000 rpm/10 V, 18 Arms/10 V
Parameter setting		Set with SV-NET communication • Control mode • Analog command scale • Position loop gain • Encoder output resolution setting • Speed loop gain • Electronic gear ratio • Speed loop integral time • Acceleration limit • Amount of feed forward • Resonance control filter etc.
Regeneration function		n/a
Sensor		Brushless resolver (Singlsyn/Smartsyn)
Dynamic brake function		n/a
Mechanical brake drive output		0.4 A or less at 24 DC (electromagnetic power off brake (holding))
Protective functions	Hardware errors	Sensor error, drive power error, EEPROM error, overheat error, etc.
	Software errors	Overspeed, overload, excessive deviation, etc.
	Warning	Drive power shutoff
Status indication		LED indication: Servo on, servo off, warning, and alarm are indicated by LED colors and how they light up.
Others		Alarm history, gain-switch function, acceleration limit function for speed control

Additional SVD-DW Functions

Sensor	Brushless resolver (Singlsyn/Smartsyn) Encoder 2048C/T wiring-saving incremental Encoder 17-bit INC/ABS A sensor selectable from the above
Sensor signal output	LEAD, LAG, and Z outputs
Monitor output	Monitor outputs such as motor current and speed feedback

Overview of SV-NET

SV-NET is a medium-speed field network that uses the controller area network (CAN) physical layer. It adopts a simple protocol, with unnecessary functions eliminated, designed solely for motion control 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) that are unique on the network must be set for slaves.

Setting overlapped identifiers causes data collision, leading to incorrect communication.

■ Host controller (master) MAC-ID

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

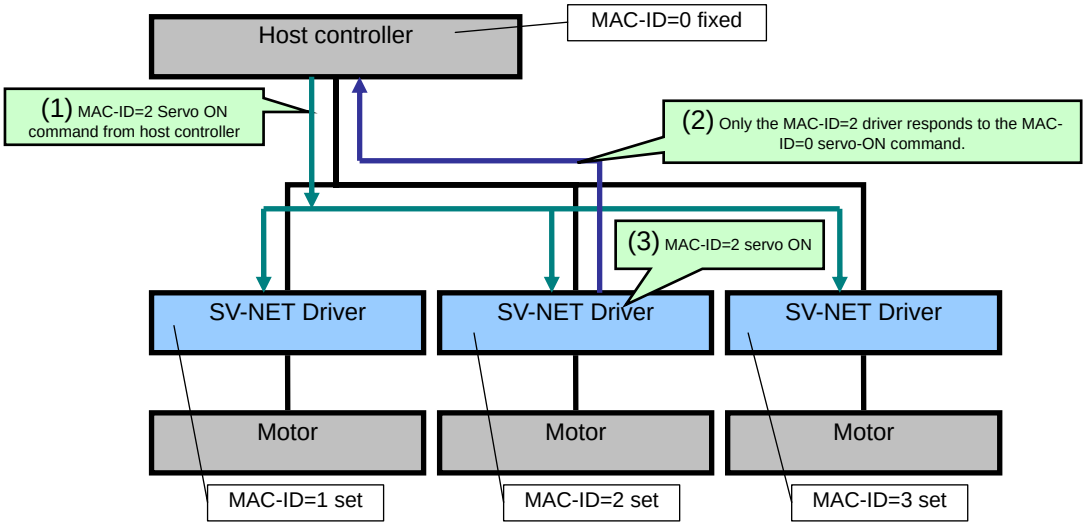
■ Driver (slave) MAC-ID

The MAC-ID of a driver can be set to a value from 1 to 31.

Any numbers can be set as long as they do not overlap.

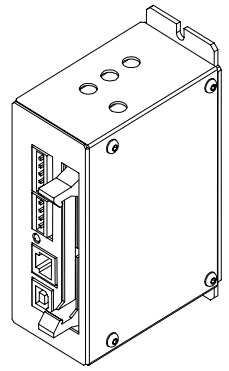
■ Configuration of the SV-NET Motion Control System

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



SV-NET Motion Controller

■ **SV-NET Controller TA8440**



The SV-NET controller is the host 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.

Other Controllers

In addition to the SV-NET motion controller, the following equipment can also control the SV-NET drive.

■ Communication conversion unit

Units that convert SV-NET communication into other interfaces include the following: the communication unit (TA8433) and the regeneration and communication unit (TA8413). They are equipped with a function which mutually converts serial data between SV-NET and interfaces such as RS232C. This function makes the SV-NET driver controllable from a PC or other equipment. "Master of SV-NETⅡ," an application used on a PC, is available free of charge. This is an extremely convenient tool for combining tasks such as performance evaluation, trial runs, and parameter control.

■ Pendant (tentative name)

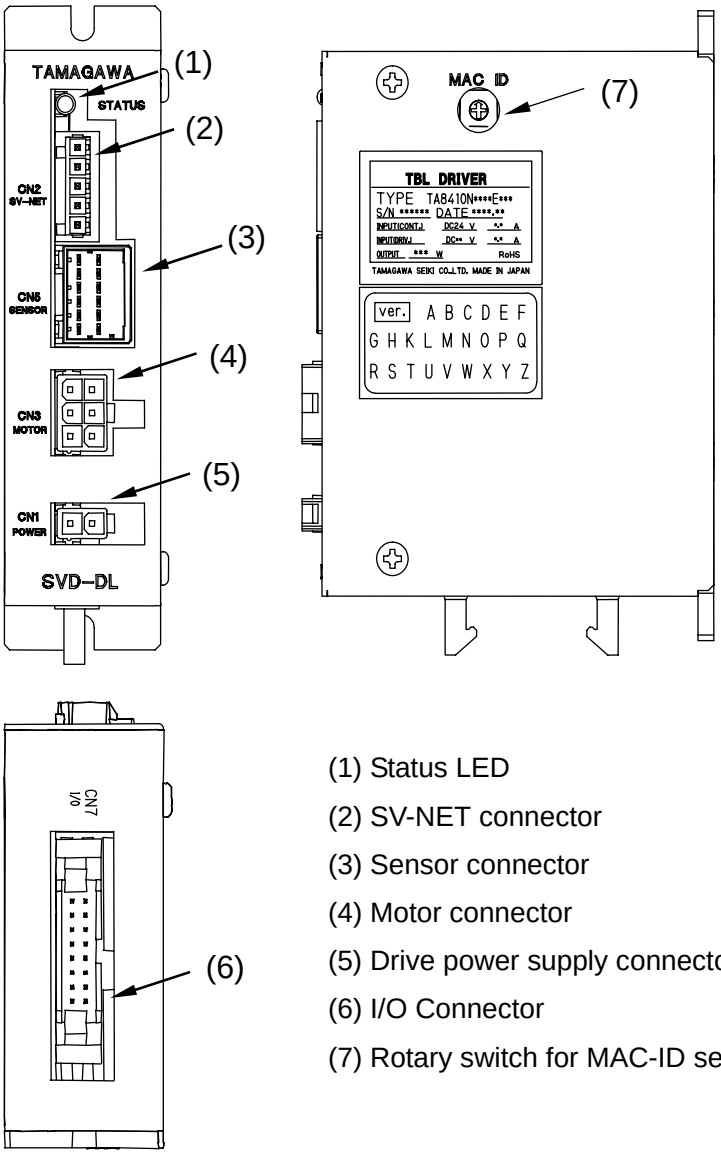
This compact equipment is an MMI (Man-Machine Interface) used also as the controller. (under development)

I/O Unit (Under Development)

The I/O unit, an expansion I/O controllable by SV-NET, can be connected to SV-NET in the same way as the SV-NET driver to facilitate I/O expansion. A switch, sensor, and other such items can be connected to the I/O.

2. Names and Functions of Parts

SVD-DL Part Names



(1) Status LED
(2) SV-NET connector
(3) Sensor connector
(4) Motor connector
(5) Drive power supply connector
(6) I/O Connector
(7) Rotary switch for MAC-ID setting

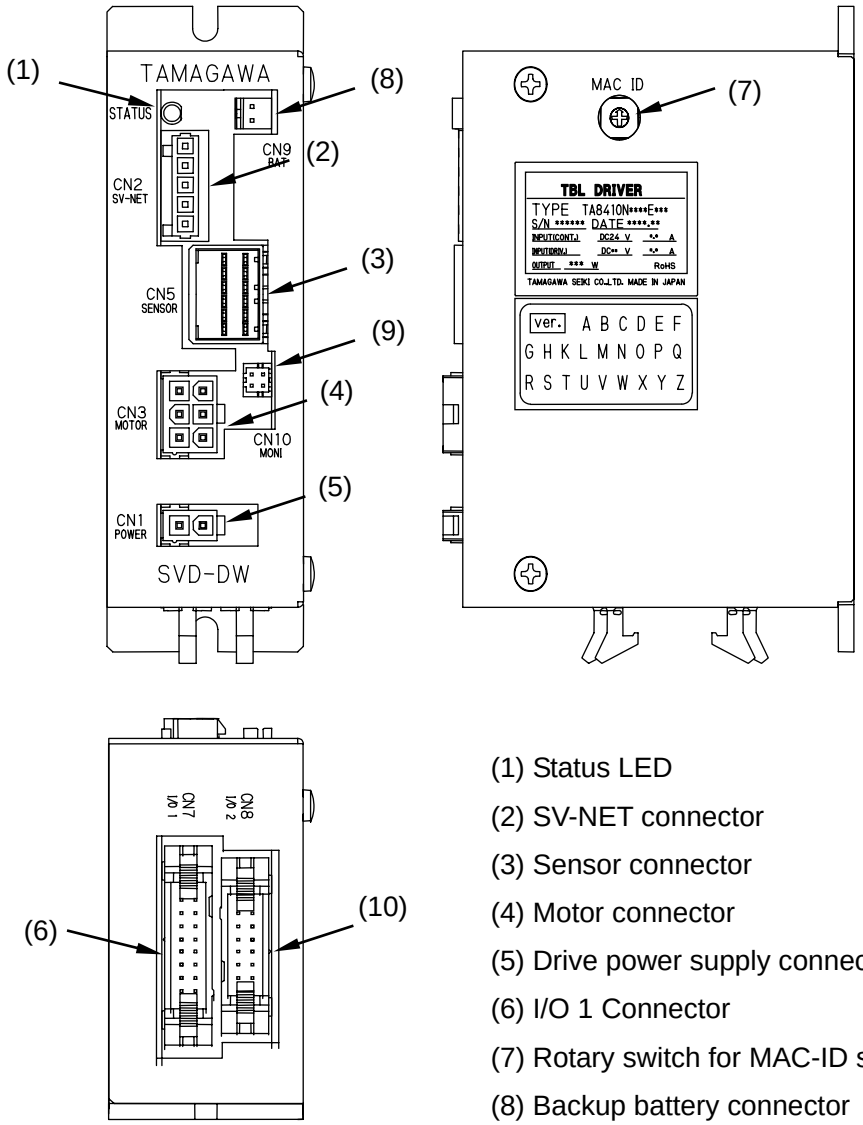
■ (6) I/O Connector

The shape of the connector and whether or not it is provided varies according to the model's N code.
N code: TA8410 N7*** E***

N7**0: No connector
N7**1: Right angle type, with connector lock
N7**3: Right angle type, without connector lock

The type shown in the figure is the TA8410 N7**1 E***.

SVD-DW Part Names



(1) Status LED
(2) SV-NET connector
(3) Sensor connector
(4) Motor connector
(5) Drive power supply connector
(6) I/O 1 Connector
(7) Rotary switch for MAC-ID setting
(8) Backup battery connector
(9) Analog monitor output connector
(10) I/O 2 Connector

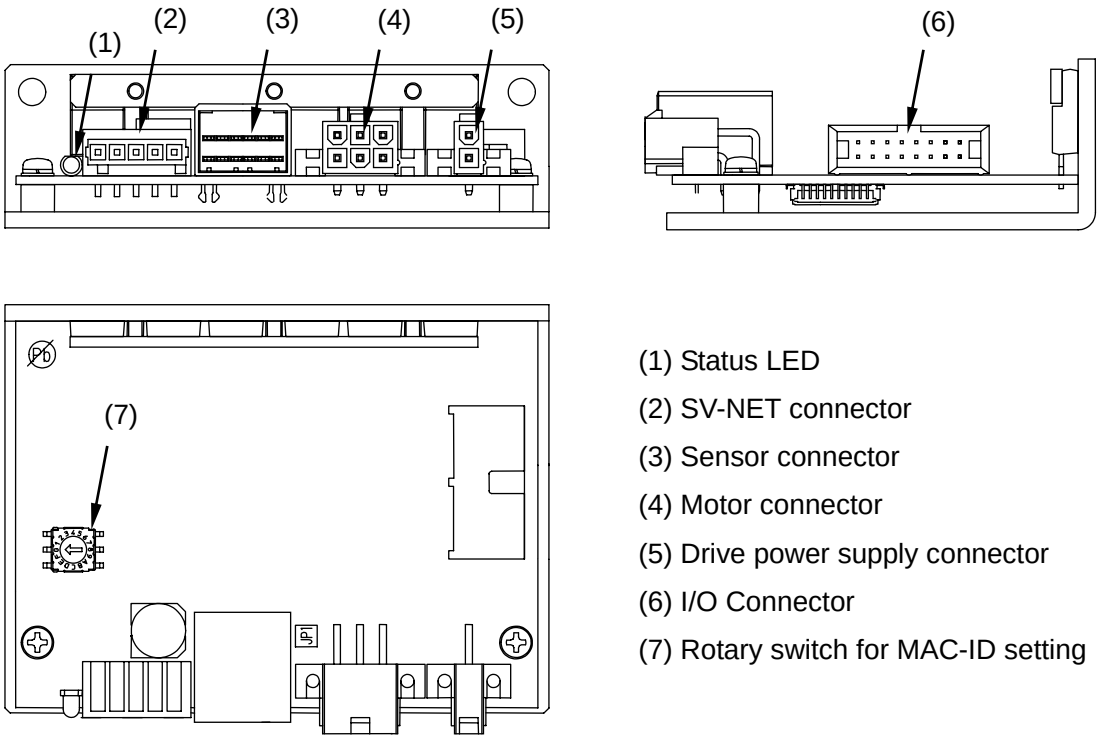
■ (6) I/O 1 Connector and ⑩ I/O 2 Connector

The shape of the connector and whether or not it is provided varies according to the model's N code.
N code: TA8410 N***: E***

N***4/N***6: No connector
N***5/N***7: Right angle type, with connector lock
N***6/N***8: Right angle type, without connector lock

The type shown in the figure is the TA8410 N***5 E***/TA8410 N***7 E***.

Open Frame Part Names



(1) Status LED
(2) SV-NET connector
(3) Sensor connector
(4) Motor connector
(5) Drive power supply connector
(6) I/O Connector
(7) Rotary switch for MAC-ID setting

■ (6) I/O Connector

The shape of the connector and whether or not it is provided varies according to the model's N code.
N code: TA8410 N***4 E***

N7*00: No connector
N7*01: Right angle type, with connector lock
N7*02: Straight type, with connector lock
N7*03: Right angle type, without connector lock

The type shown in the figure is the TA8410 N7*03 E***.

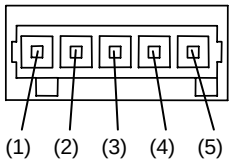
(1) Status LED

The driver status is indicated by three colors.

Color of light	Status
Green	Servo OFF
Flashing green	Servo ON The light flashes green for a number of times equivalent to the Control Mode number. (The light remains lit a little longer for the last flash.) "Control Mode" ⇒ ▣ ID31 "Control Mode" P. 42
Orange	Warning: Drive power supply OFF
Flashes red and green	Alarm Detection The first digit of the alarm code (left) flashes red. The second digit of the alarm code (right) flashes green. "Alarm code" ⇒ ▣"Alarm Code List" P. 92

(2) SV-NET Connector

This connector connects the control power supply input and the SV-NET connection line.



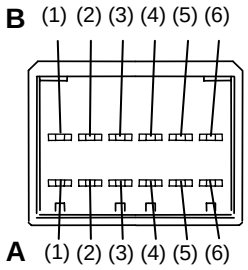
Header 734-165 (WAGO)

PIN No.	Function
1	GND (control power supply)
2	CAN L (-)
3	GND (shield)
4	CAN H (+)
5	DC 24 V (control power supply)

■ Opposite connector
Connector plug 734-105 (made by WAGO)

(3) Sensor Connector

This connector connects the sensor cable of the motor. Note that the installation orientation of the connector differs for SVD-DL and SVD-DW.



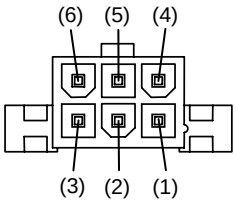
Tab header
1376020-1
(made by Tyco Electronics AMP)

PIN No.	Function		
	SVD-DL/SVD-DW/Open Frame	SVD-DW	
	Brushless resolver Singlsyn/Smartsyn	Encoder 17Bit INC/ABS	Encoder 2048C/T wiring-saving INC
A1	S2 (Resolver output)	—	A
B1	S4 (Resolver output)	—	A/
A2	S1 (Resolver output)	—	B
B2	S3 (Resolver output)	—	B/
A3	R1 (Resolver excitation)	SD	Z
B3	R2 (Resolver excitation)	SD/	Z/
A4	—	VB	—
B4	—	GND-VB	—
A5	—	Vcc	Vcc
B5	GND	GND	GND
A6	VCC	—	NC
B6	GND (shield)	GND (shield)	GND (shield)

■ Opposite connector
Receptacle housing 1-1318118-6 (made by Tyco Electronics AMP)
Terminal 1318108-1 (made by Tyco Electronics AMP)

(4) Motor Connector

This connector connects the motor cable of the motor.



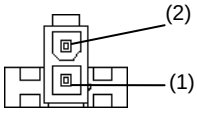
Tab header
5569-06A1
(made by MOLEX)

PIN No.	Function
1	U phase
2	V phase
3	W phase
4	Frame ground
5	(BK) For brake-equipped type only
6	(BK) For brake-equipped type only

■ Opposite connector
Receptacle housing 5557-06R (made by MOLEX)
Terminal 5556TL (made by MOLEX)

(5) Drive Power Supply Connector

This connector inputs the drive power supply.



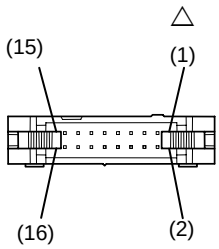
Header 5569-02A1
(made by MOLEX)

PIN No.	Function
1	GND (drive power supply)
2	DC 24 to 48 V (drive power supply)

■ Opposite connector
Receptacle housing 5557-02R (made by MOLEX)
Terminal 5556TL (made by MOLEX)

(6) I/O Connector (SVD-DL/Open Frame) or I/O 1 Connector (SVD-DW)

Establish this connection to control by analog and pulse commands. It is also used to connect other input/output signals.



Header (made by HIROSE)
The shape of the connector header and whether or not it is provided varies according to the N code.

N***0/N***4/N***7:
Without connector

N***1/N***5/N***8:
HIF3BA-16PA-2.54DS
With right angle lock

N***3/N***6/N***9:
HIF3F-16PA-2.54DS
Without right angle lock

N***2:
HIF3BA-16PA-2.54DSA
With straight lock

PIN No.	Function (factory settings)		I/O
1	GND	COM-	
2	AIN	Analog command input	Analog input
3	Reverse-PLS+	Reverse-direction command input pulse + (*1)	Digital input
4	Reverse-PLS-	Reverse-direction command input pulse - (*1)	Digital input
5	Forward-PLS+	Forward-direction command input pulse + (*1)	Digital input
6	Forward-PLS-	Forward-direction command input pulse - (*1)	Digital input
7	GND	COM-	
8	AUX	Profile Start (*2)	Digital input
9	C-RST	Counter reset input (*2)	Digital input
10	ALM-RST	Alarm reset input (*2)	Digital input
11	Reverse-LMT	Reverse-rotation drive disable input (*2)	Digital input
12	Forward -LMT	Forward-rotation drive disable input (*2)	Digital input
13	SV-ON	Servo ON input (*2)	Digital input
14	INP	In-position signal output (*2)	Digital output
15	ALM	Alarm signal output (*2)	Digital output
16	+24V	COM+	

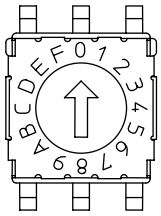
■ Opposite connector
Socket HIF3BA-16D-2.54R (made by HIROSE)

(*1) Command pulse input types can be selected. ⇒ ▣ “Pulse Input Signal Types” P. 74

(*2) Functions can be selected by setting parameters. ⇒ ▣ “Digital Input: Pins 8 to 13” P. 33

(7) MAC-ID Setting Rotary Switch

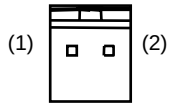
Use this switch to manually change a MAC-ID. The MAC-ID can be manually set to a value from 1 to 15. The factory setting is “0.”



Setting	Function
0	The MAC-ID is the value set by the parameter. The factory setting is “31.”
1	MAC-ID is “1.”
2	MAC-ID is “2.”
3	MAC-ID is “3.”
4	MAC-ID is “4.”
5	MAC-ID is “5.”
6	MAC-ID is “6.”
7	MAC-ID is “7.”
8	MAC-ID is “8.”
9	MAC-ID is “9.”
A	MAC-ID is “10.”
B	MAC-ID is “11.”
C	MAC-ID is “12.”
D	MAC-ID is “13.”
E	MAC-ID is “14.”
F	MAC-ID is “15.”

(8) Backup Battery Connector (SVD-DW only)

This connector is used for a 17-Bit ABS encoder only.



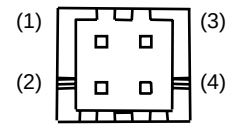
Connector IL-2P-S3FP2-1
(made by JAE)

PIN No.	Function
1	GND (-)
2	VB (+)

■ Backup battery
ER17500VC (made by Toshiba Battery)

(9) Analog Monitor Output Connector (SVD-DW only)

This connector is shared with the monitor output in I/O 2.



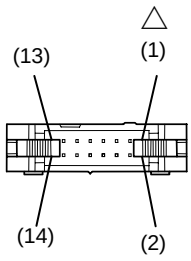
Header DF11-4DP-2DF
(made by HIROSE)

PIN No.	Function
1	Monitor output 1
2	Monitor output 2
3	GND
4	GND

■ Opposite connector
Socket DF11-4DS-2C (made by HIROSE)
Terminal DF11-2428SC (made by HIROSE) AWG24-28

(10) I/O 2 Connector (SVD-DW only)

This connector connects the sensor signal LEAD/LAG/Z signal output and the monitor output.



Header
HIF3BAF-14PA-2.54DS
(Made by HIROSE)

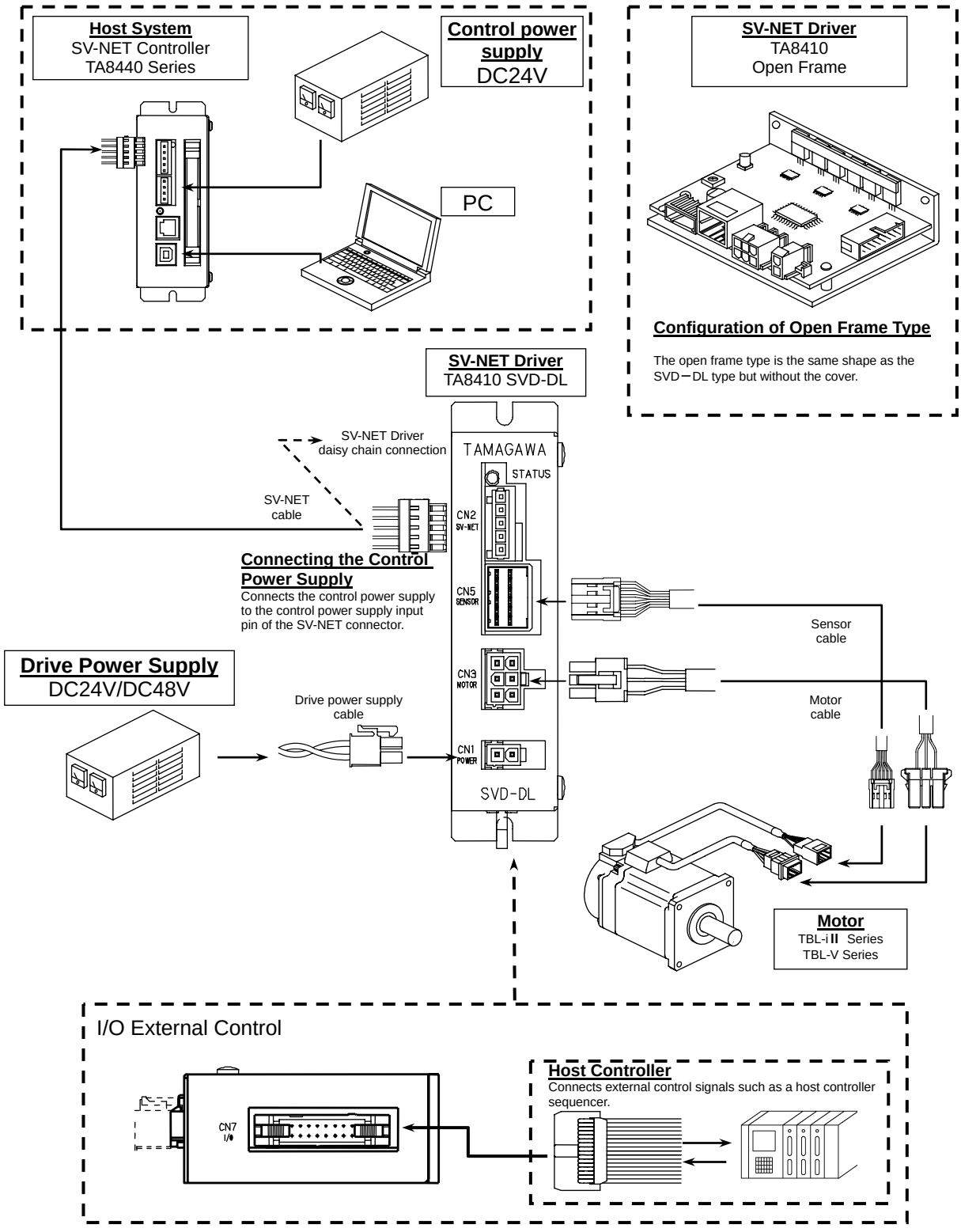
PIN No.	Function (factory settings)		I/O
	Open collector	Line driver	
1	LEAD	LEAD+	Digital output
2	NC	LEAD-	Digital output
3	LAG	LAG+	Digital output
4	NC	LAG-	Digital output
5	Z	Z+	Digital output
6	NC	Z-	Digital output
7	GND		
8	GND		
9	Monitor output 1	Motor current (*1)	Analog output
10	Monitor output 2	Speed feedback (*1)	Analog output
11	GND		
12	GND		
13	NC		
14	NC		

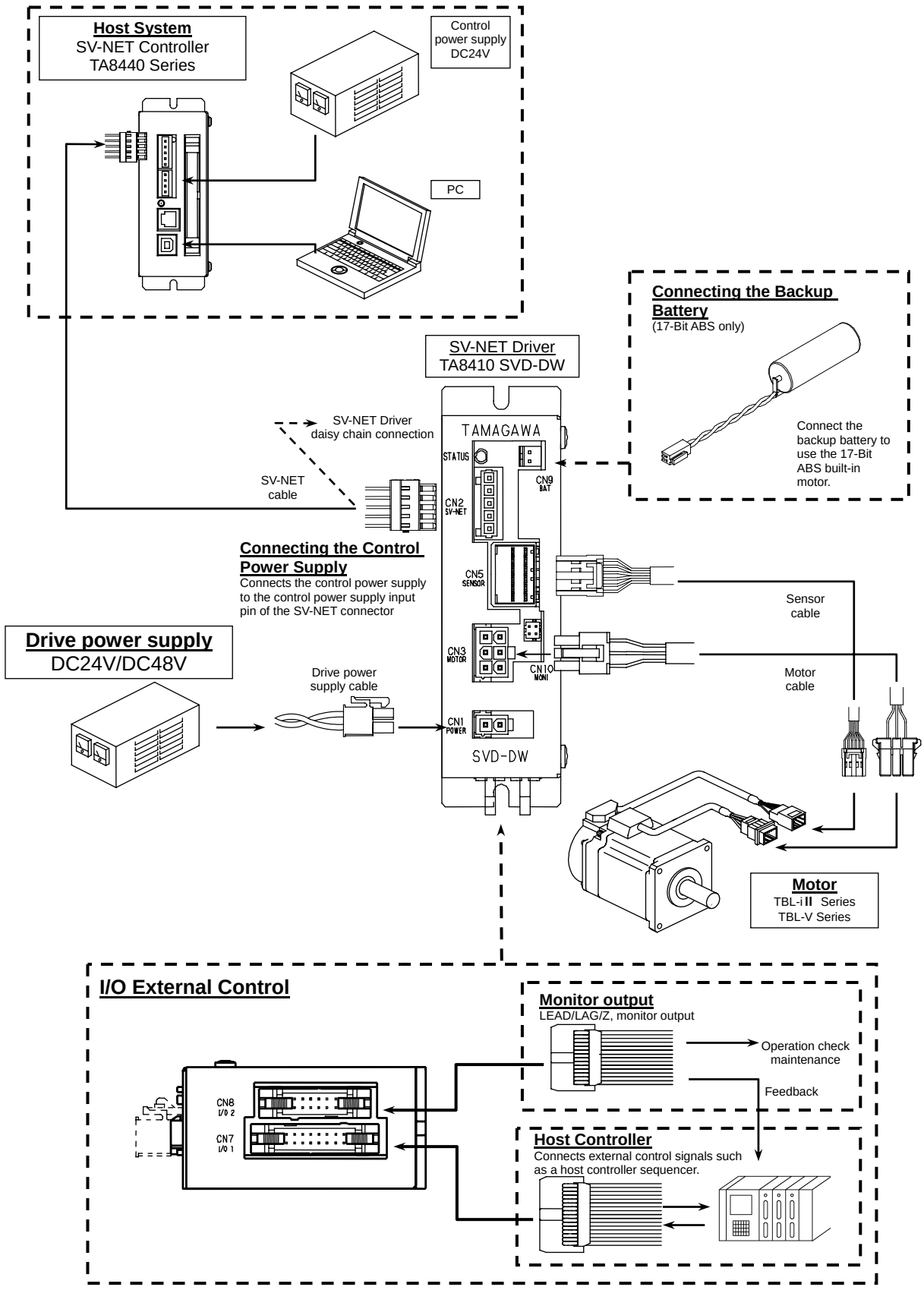
■ Opposite connector
Socket HIF3BA-14D-2.54R (made by HIROSE)

(*1) In monitor output 1 and 2, output content can be changed with parameters.
⇒ ▣ “Parameters for Setting Analog Monitor” P. 49

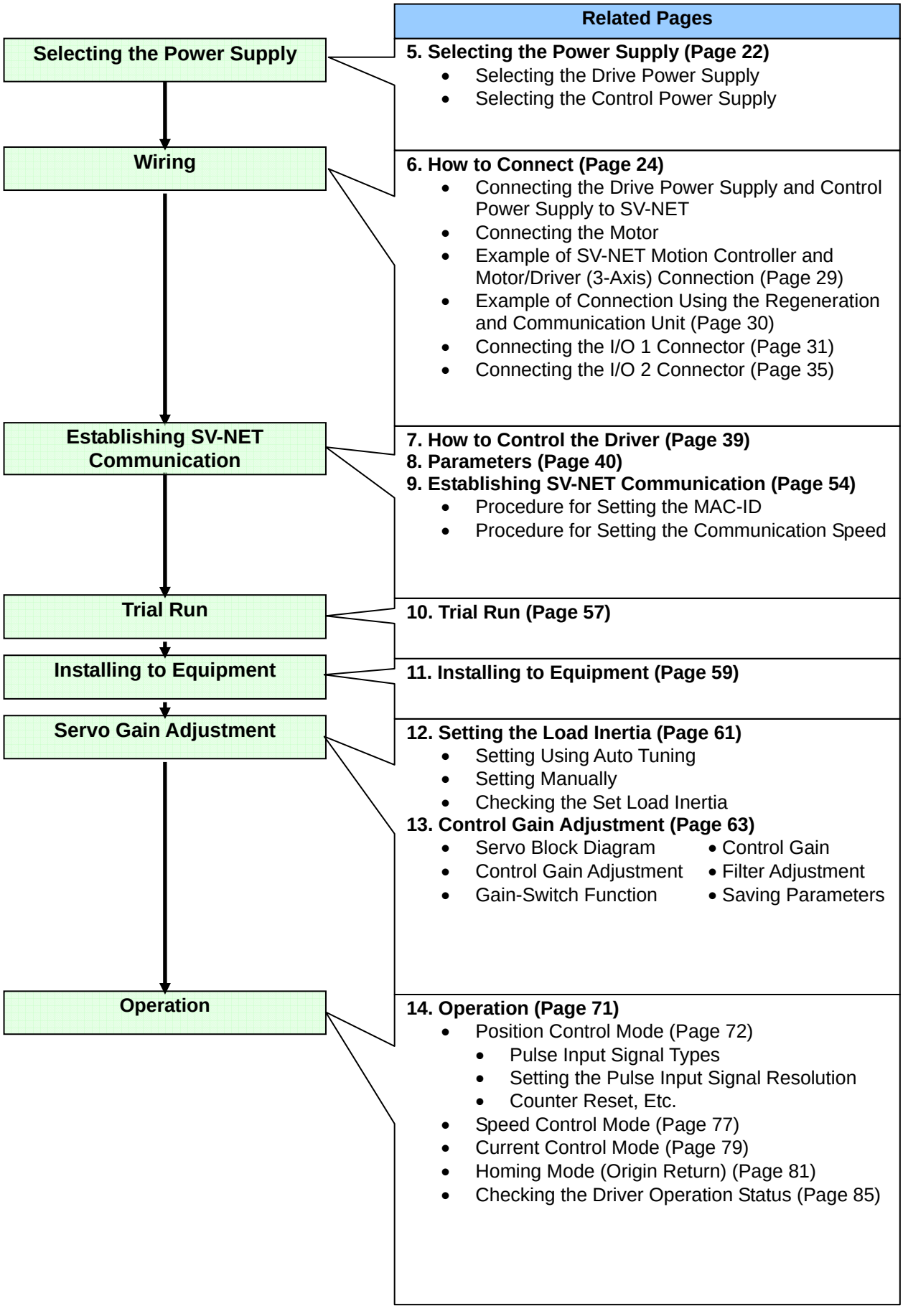
3. Configuration

SVD-DL / Open Frame




Host System
SV-NET Controller
TA8440 Series
Control power supply DC24V
PC
Connecting the Backup Battery
(17-Bit ABS only)
Connect the backup battery to use the 17-Bit ABS built-in motor.
SV-NET Driver
TA8410 SVD-DW
SV-NET Driver daisy chain connection
SV-NET cable
TAMAGAWA
STATUS
CN9 BAT
CN2 SV-NET
Connecting the Control Power Supply
Connects the control power supply to the control power supply input pin of the SV-NET connector
CN5 SENSOR
Sensor cable
Drive power supply
DC24V/DC48V
Drive power supply cable
CN3 MOTOR
CN10 MONI
Motor cable
CN1 POWER
SVD-DW
Motor
TBL-i II Series
TBL-V Series
I/O External Control
Monitor output
LEAD/LAG/Z, monitor output
Operation check maintenance
Feedback
CN8 I/O 2
CN7 I/O 1
Host Controller
Connects external control signals such as a host controller sequencer.

4. Process Flow



5. Selecting the Power Supply

The SV-NET Driver requires one power supply each for the drive power supply and the control power supply, even if the voltage is the same. Particulary when voltage rises as a result of the regeneration effects or when a capacity shortage occurs, the drive power supply may be incapable of performing at full potential due to problems such as a reduction in outputs and torques. Make sure you understand the information provided in this section before selecting your power supplies.

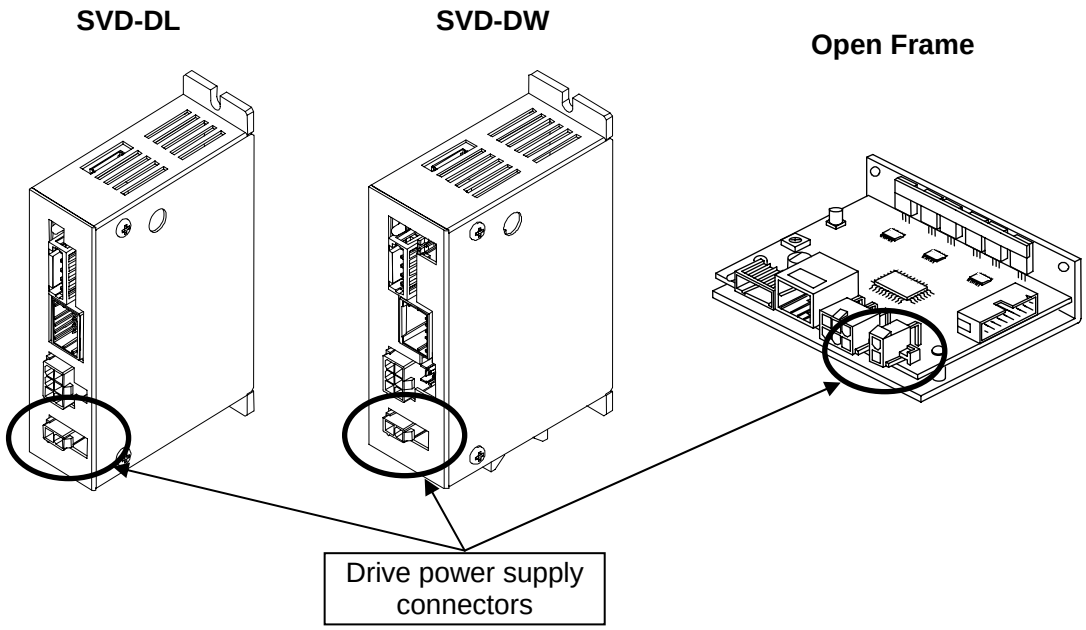
Caution!

GND is shared between the control power supply and the drive power supply.
Use a power supply with the same GND level to avoid GND potential difference.

■ Regeneration effects

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

Selecting the Drive Power Supply



The drive power supply capacity required for operation varies according to the motors being driven, as well as the operation pattern and mechanism (load) conditions. The AC servo motor momentarily outputs a torque approximately three times the rating. With this is mind, select a power supply that can support the capacity. Use the following equation to determine the maximum value for the power supply capacity.

Power supply capacity [A] = (Motor's rated output [W] × 3) ÷ Drive voltage [V]

If connecting more than one drive power supply to one power supply, a power supply capacity equivalent to the sum of the power supply capacities determined is required. However, if the connected motors do not operate at the same time, the power supply capacity can be reduced depending on operation patterns. If selecting a switching power supply as the drive power supply, countermeasures to prevent the regeneration operation from causing a voltage increase are required.

Selecting the Drive Power Supply

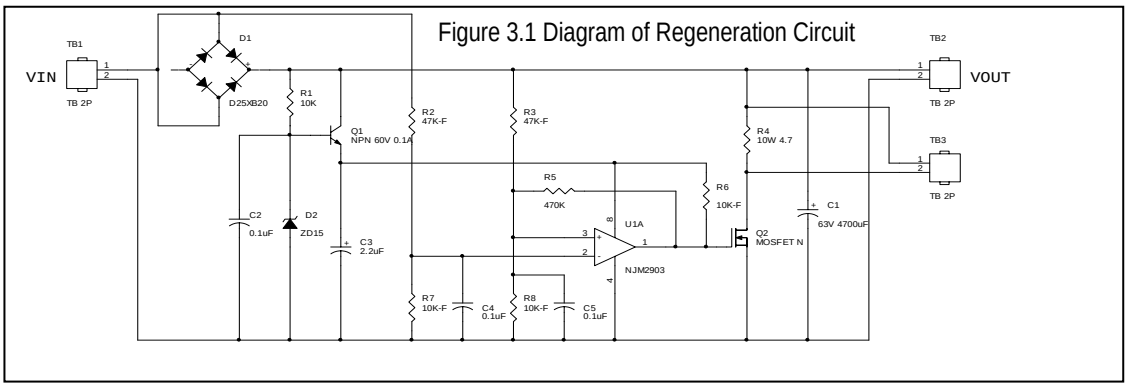
■ Using a switching power supply as the drive power supply

Braking when operating at a high load/speed or applying a high load to the rotation axis downward in the direction of the gravitation force may subject the motor to a counter electromotive force due to regeneration effects, resulting in a rise in drive voltage. With a general-use switching power supply, reaching the specified or higher voltage triggers the protective function, which discontinues operation and causes the required voltage not to be supplied. In such cases, take appropriate measures to restore operation such as turning off the switching power supply for a while.

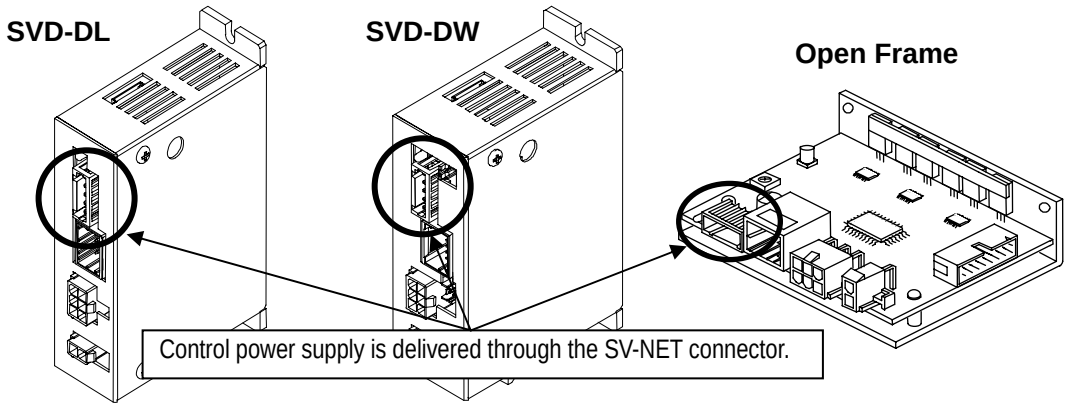
Should such a problem occur during actual operation, the following methods may resolve it.

- Connect a capacitor with an appropriate capacitance to the drive power supply.
  Increasing the capacitance of the capacitor can reduce voltage rise depending on the operating conditions, though it has limitations.
- Insert the regeneration circuit (Figure 3.1) into the power supply line. (Recommended)
- Use regeneration and communication unit TA8413. (Recommended)

Figure 3.1 Diagram of Regeneration Circuit



Selecting the Control Power Supply



Caution!

The control power supply of 24 V DC needs to be connected to a stabilized power supply separate from that of the drive power supply. A voltage ripple caused by motor operation or heat generated in the electrolytic capacitor of the control power supply circuit by charge/discharge may result in damage to the drive power supply.

The power supply capacity required for the control power supply is 0.1 A. To connect more than one TA8410 driver, ensure a power supply capacity of [0.1 A × the number of connected drivers]. The allowable voltage range for the control power supply is 24 V DC ±10%.

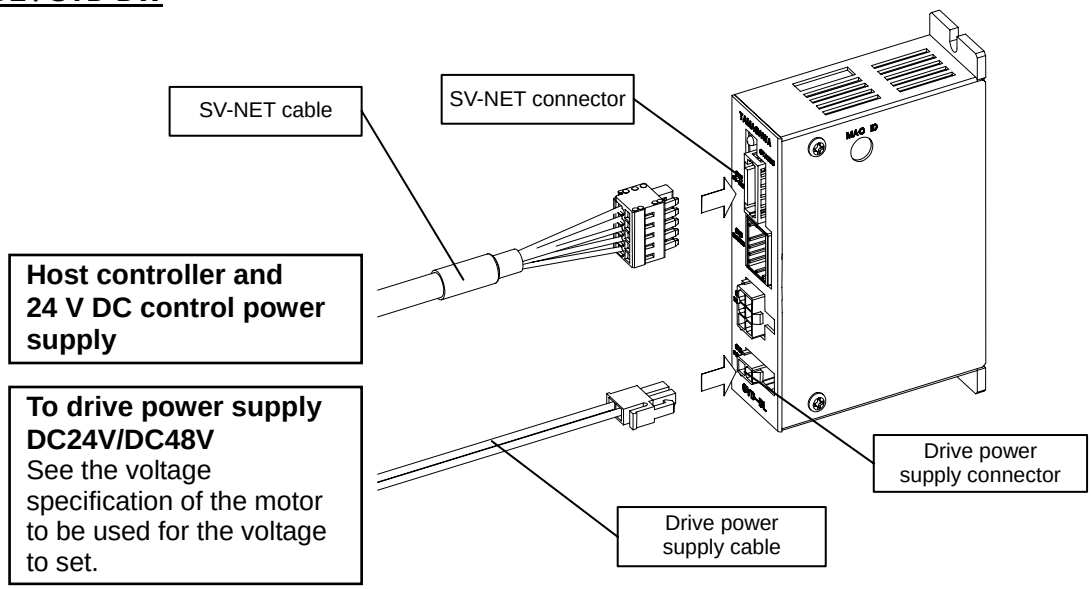
6. How to Connect

Caution!

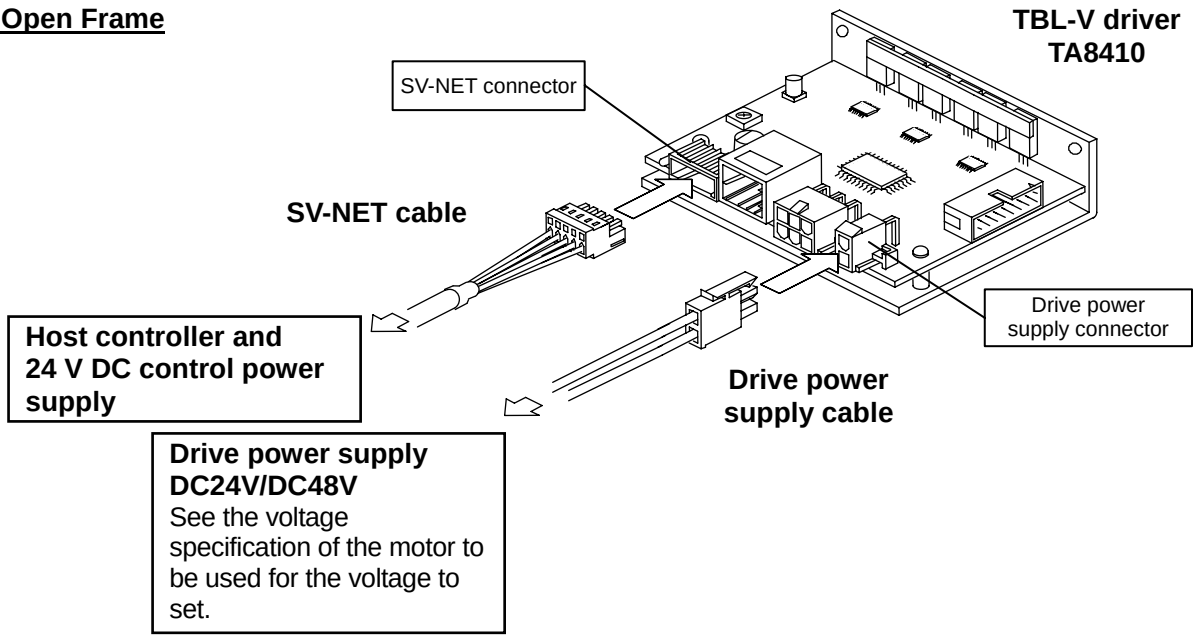
Turn off the power before performing a connection operation.

Connecting the Drive Power Supply and Control Power Supply to SV-NET

■ SVD-DL / SVD-DW



■ Open Frame



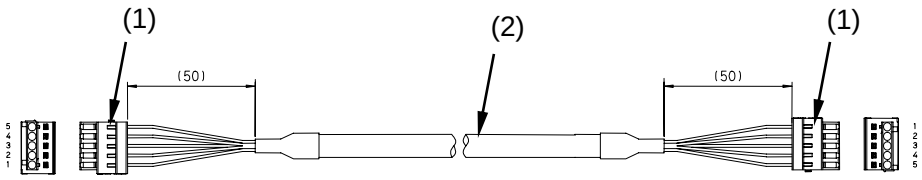
Caution!

Even when using pulse and analog commands, connect the power to SV-NET connector pin 1 “GND” and pin 5 “24 V DC.”

■ Cable specifications

○ SV-NET Cable

Model: EU9610 N****



■ Connection example

(1) GND	Power supply line (black/AWG22)	(1) GND
(2) CAN L	Signal line (blue/AWG24)	(2) CAN L
(3) GND	Shield (drain wire)	(3) GND
(4) CAN H	Signal line (white/AWG24)	(4) CAN H
(5) DC24V	Power supply line (red/AWG22)	(5) DC24V

Wiring using recommended cable NADNR24 (made by MISUMI) is shown in parentheses. (Twist-pair cable, each with signal and power supply lines)

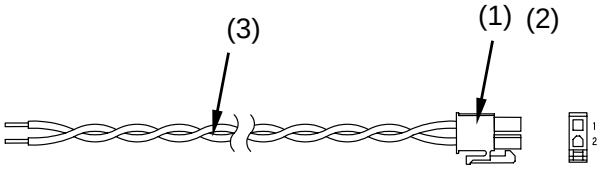
■ Parts for SV-NET cable

Part name	Model or spec	Maker	Remarks
(1) Connector	734-105	WAGO	
(2) Twist pair shield cable	NADNR24	MISUMI	

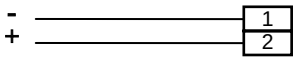
▣ Option parts ⇒ “SV-NET Cable” P. 100

○ Drive Power Supply Cable

Model: EU9613 N0***



■ Connection example

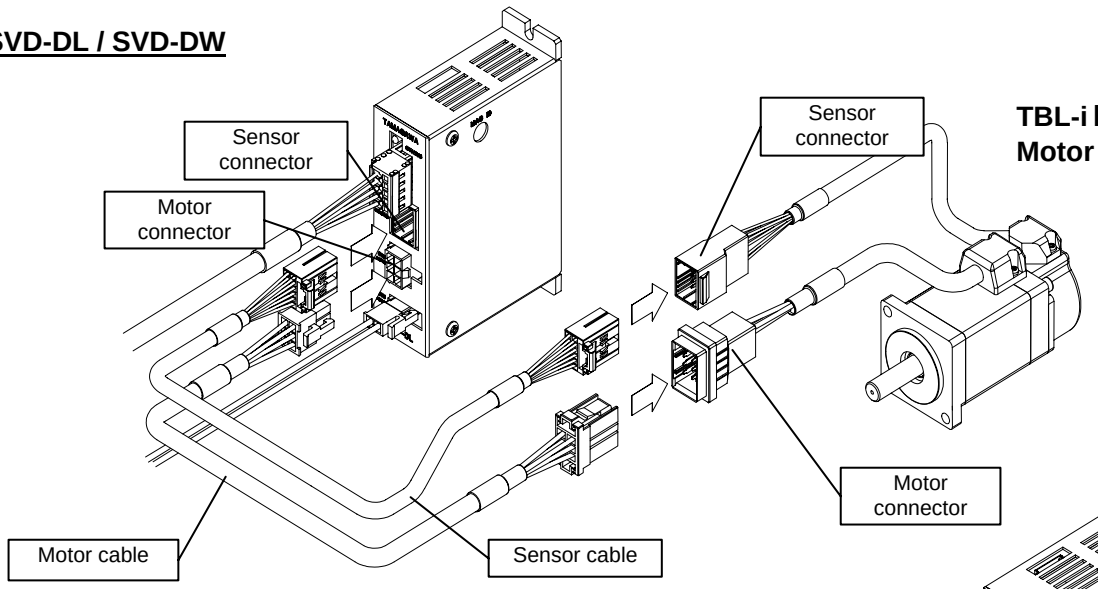


■ Parts for drive power supply cable

Part name	Model or spec	Maker	Remarks
(1) Housing	5557-02R	MOLEX	
(2) Terminal	5556TL	MOLEX	
(3) Cable	AWG18 or equivalent	-	

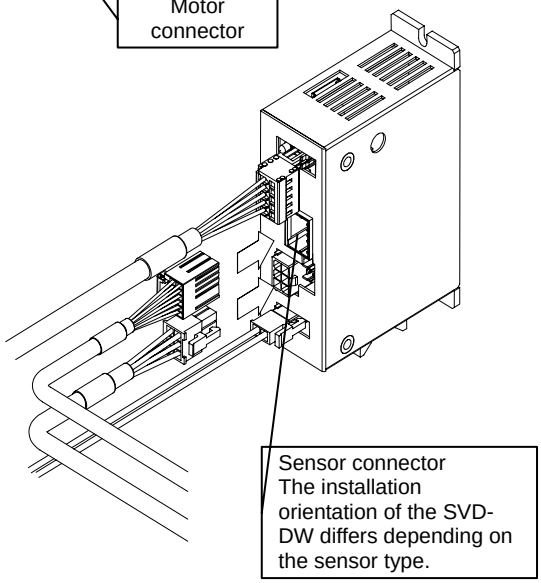
▣ Option parts ⇒ “Drive Power Supply Cable” P. 100

■ SVD-DL / SVD-DW

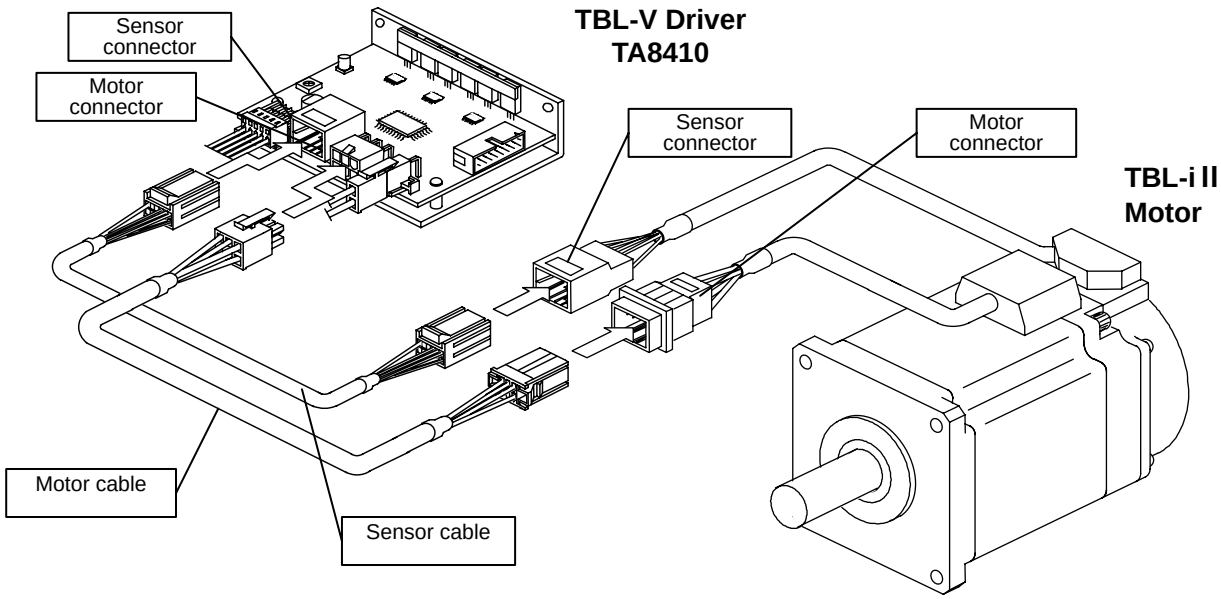


Difference in installation orientation of the SVD-DW sensor connector

If the SVD-DW sensor specification is 17-bit INC/ABS and wiring-saving INC, the installation orientation of the sensor connector differs from that for SVD-DL. Be careful when establishing connections.



■ Open Frame



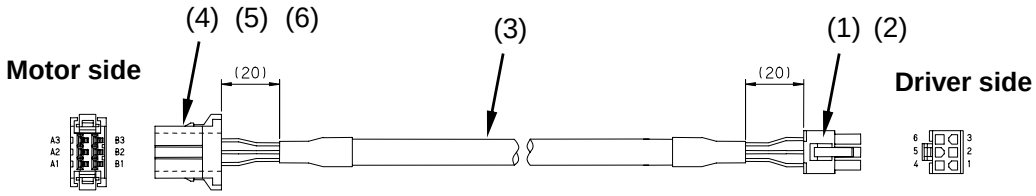
Motor cables and sensor cables differ depending on the motor with which they are combined. The information given in this section uses the TBL-i II Series AC Servo Motor as an example.

■ Cable specifications

TBL-iIISeries AC Servo Motor Cable

○ Motor Cable

Model: EU9614 N****



■ Connection example

Motor side		Driver side	
A1	Red (AWG20)	1	U
A2	White (AWG20)	2	V
A3	Black (AWG20)	3	W
B1	Green/Yellow (AWG20)	4	FG
B2	Yellow (AWG24)	5	BK
B3	Blue (AWG24)	6	BK

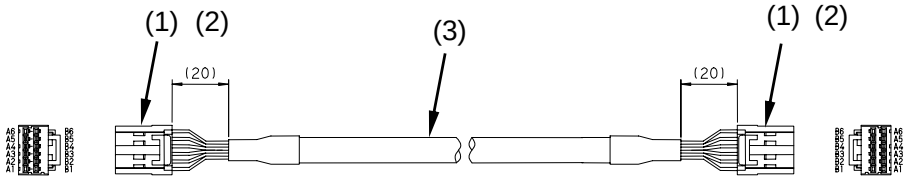
■ Parts for motor cable

Part name	Model or spec	Maker	Remarks
(1) Housing	5557-06R	MOLEX	
(2) Terminal	5556TL	MOLEX	
(3) PVC cable	654101955N40	-	
(4) Housing	178289-3	AMP	
(5) Terminal	175218-2	AMP	For AWG20
(6) Terminal	175217-2	AMP	For AWG24

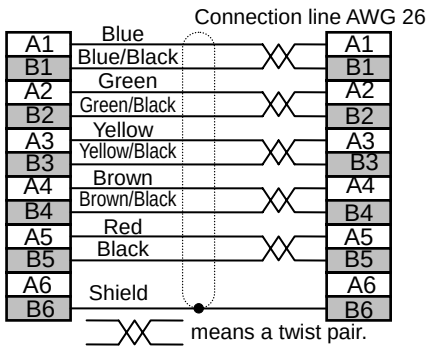
❏ Option parts ⇒ “Motor Cable” P. 100

○ Sensor Cable

Model: EU9615 N****



■ Connection example



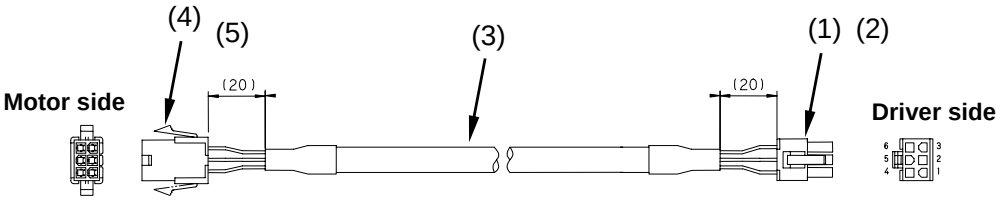
■ Parts for sensor cable

Part name	Model or spec	Maker	Remarks
(1) Housing	1-1318118-6	AMP	
(2) Terminal	1318108-1	AMP	
(3) PVC cable	654101953N40	-	

❏ Option parts ⇒ “Sensor Cable” P. 101

○ Motor Cable

Model: EU9621 N****



■ Connection example

Motor side		Driver side	
1	Red (AWG20)	1	U
2	White (AWG20)	2	V
3	Black (AWG20)	3	W
4	Green/Yellow (AWG20)	4	FG
5	Yellow (AWG24)	5	BK
6	Blue (AWG24)	6	BK

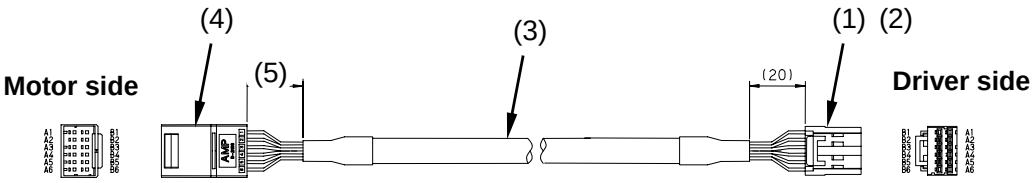
■ Parts for motor cable

Part name	Model or spec	Maker	Remarks
(1) Housing	5557-06R	MOLEX	
(2) Terminal	5556TL	MOLEX	
(3) PVC cable	654101955N40	-	
(4) Housing	5559-06P	MOLEX	
(5) Terminal	5558TL	MOLEX	

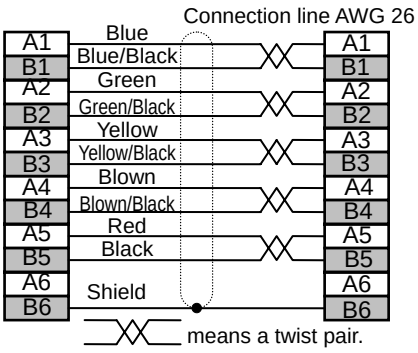
▣ Option parts ⇒ “Motor Cable” P. 100

○ Sensor Cable

Model: EU9622 N****



■ Connection example

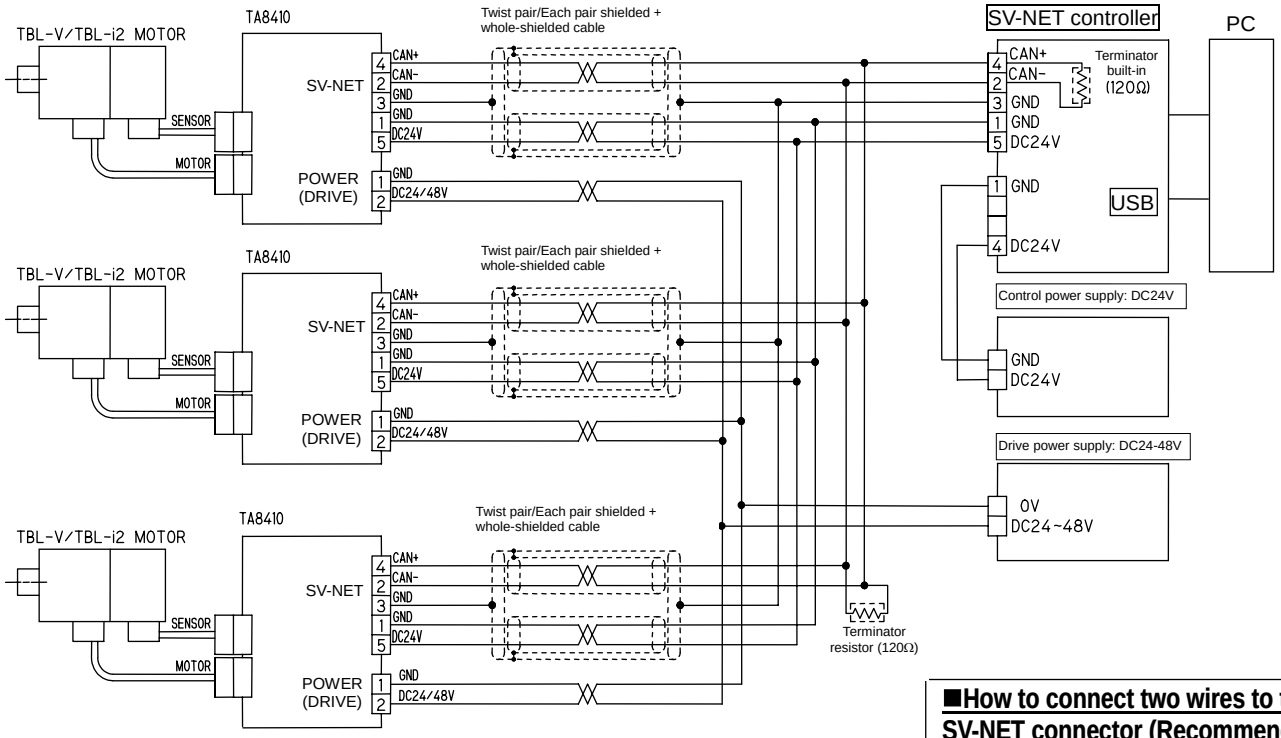


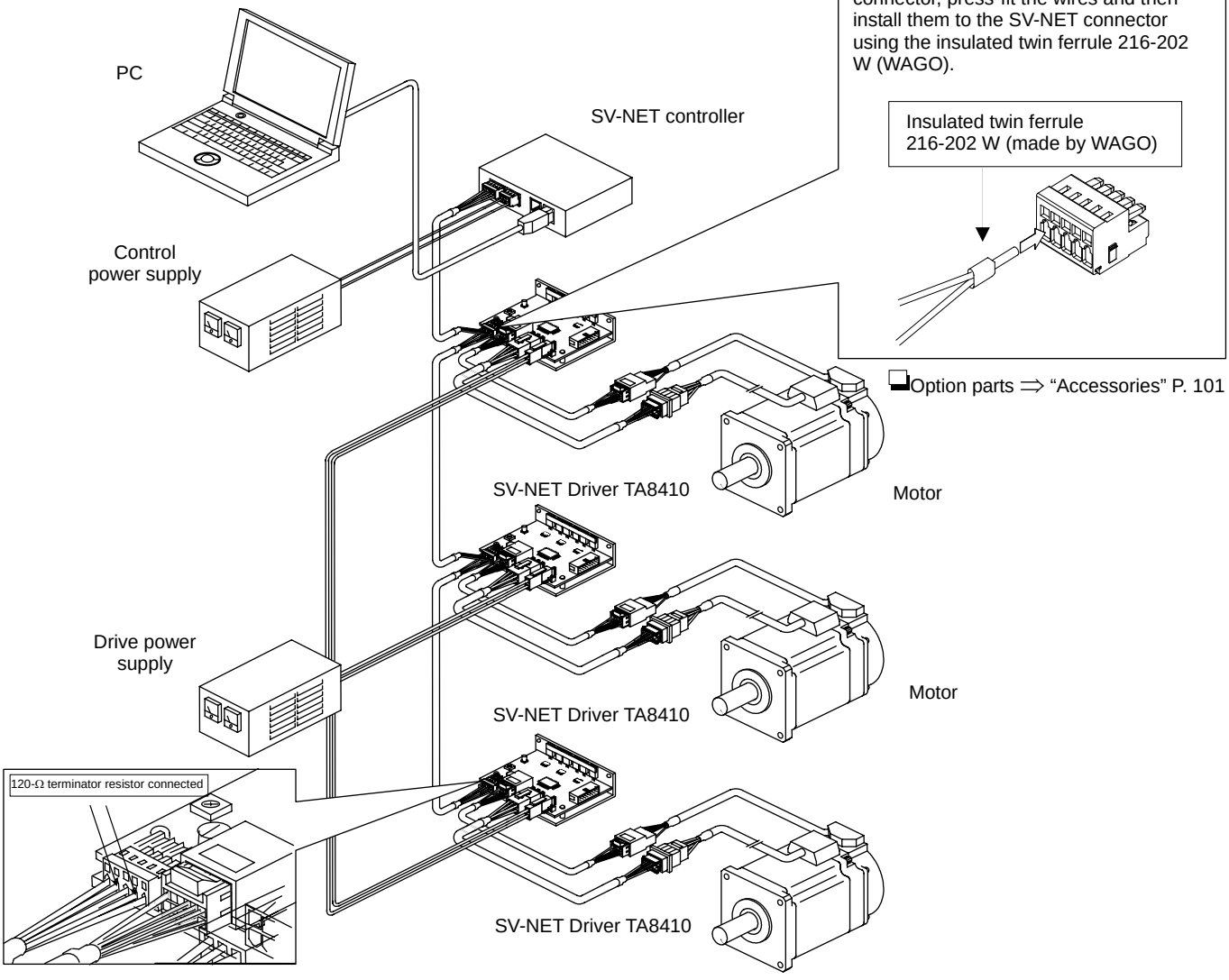
■ Parts for sensor cable

Part name	Model or spec	Maker	Remarks
(1) Housing	1-1318118-6	AMP	
(2) Terminal	1318108-1	AMP	
(3) PVC cable	654101953N40	-	
(4) Housing	1-1318115-6	AMP	
(5) Terminal	1318112-1	AMP	

▣ Option parts ⇒ “Sensor Cable” P. 101

Example SV-NET Controller and Motor/Driver (3-Axis) Connection





■How to connect two wires to the SV-NET connector (Recommended)

To install two wires to the SV-NET connector, press-fit the wires and then install them to the SV-NET connector using the insulated twin ferrule 216-202 W (WAGO).

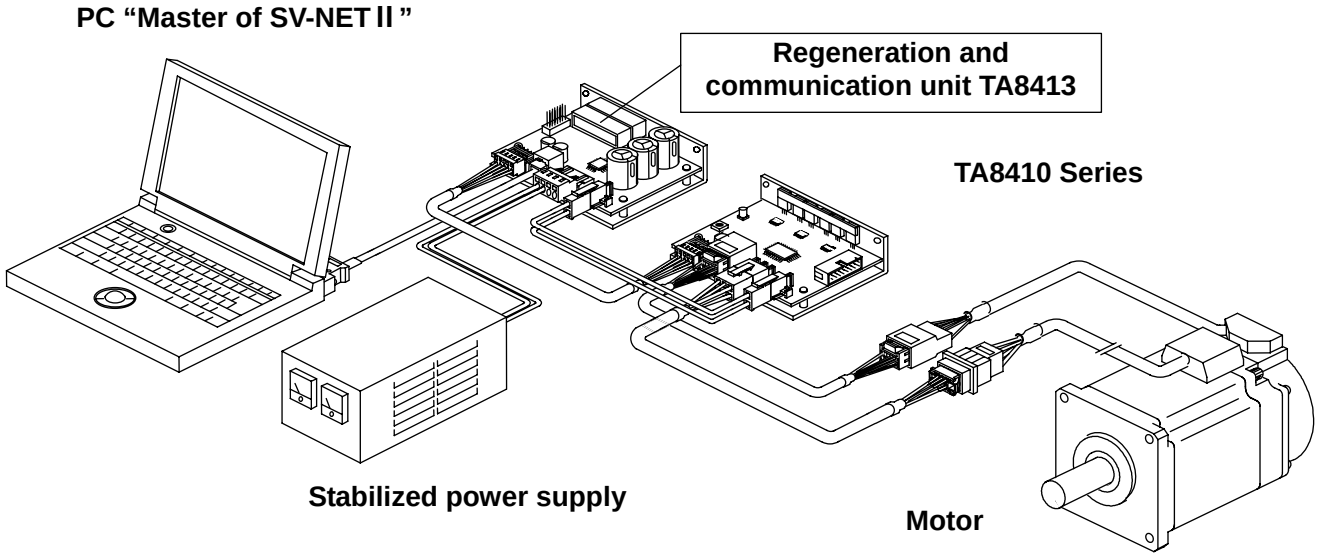
Insulated twin ferrule
216-202 W (made by WAGO)

❑Option parts ⇒ "Accessories" P. 101

Example of Connection Using the Regeneration and Communication Unit

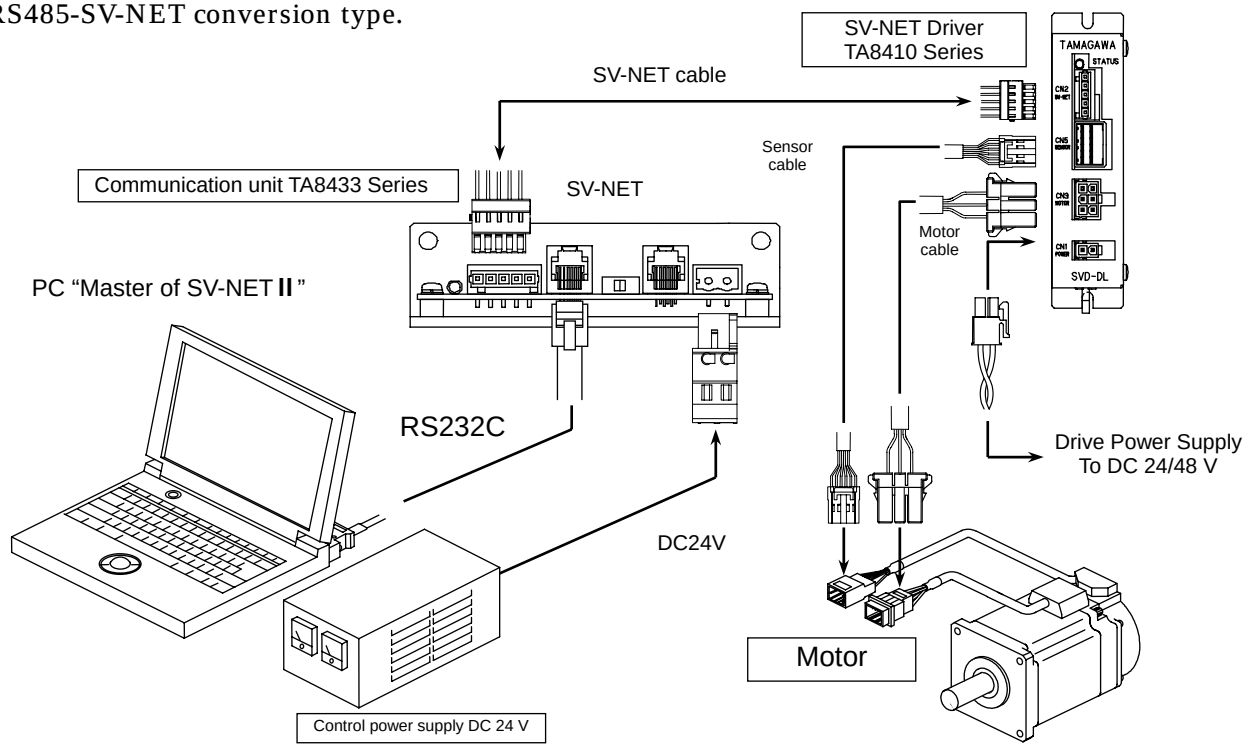
■ Example of regeneration and communication unit TA8413 connection

The regeneration and communication unit TA8413 is equipped with a regeneration protection function that safely processes the excess regeneration energy generated during motor operation. The control power supply circuit is also built in, which eliminates the need for a stabilized power supply as the power supply (control power supply), simplifying the peripheral circuitry. In addition to the regeneration protection function, it is also equipped with a communication function which mutually converts between SV-NET and an RS232C interface. Using the PC application software "Master of SV-NETⅡ" (free of charge) allows you to perform parameter control and operation tests easily.



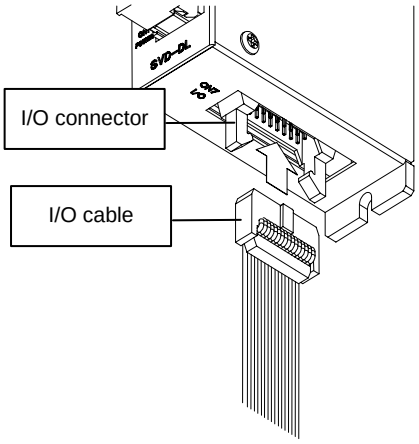
■ Example of communication unit TA8433 connection

Communication unit TA8433 is equipped with a communication function which mutually converts between SV-NET and general-use serial interfaces such as RS232C, allowing a PC to be connected to the SV-NET driver. Using the PC application software "Master of SV-NETⅡ" (free of charge) allows you to perform parameter control and operation tests easily. The communication unit TA8433 has the following lineup: RS232C- or RS422-SV-NET conversion type as well as RS232C- or RS485-SV-NET conversion type.

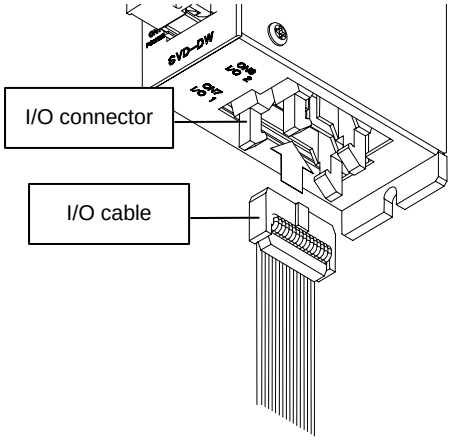


Connecting the I/O (SVD-DL) and I/O 1 (SVD-DW) Connectors

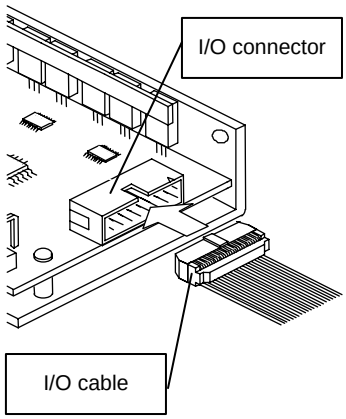
■ SVD-DL



■ SVD-DW

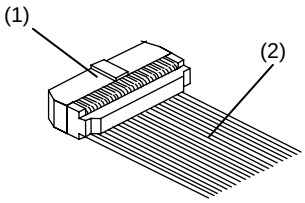


■ Open Frame



■ Cable specifications

■ I/O cable

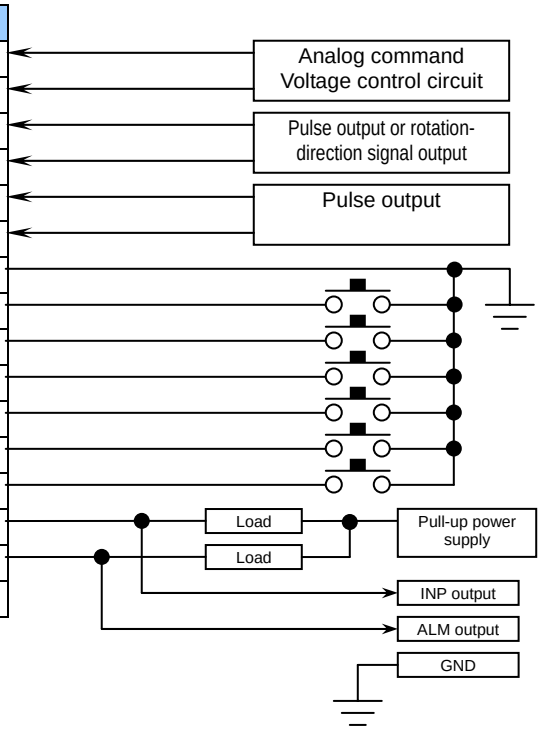


■ Parts for I/O cable

Part name	Model or spec	Maker	Remarks
(1) Socket	HIF3BA-16D-2.54R	HIROSE	
(2) Flat cable	<UL2651> AWG28 flat cable	-	

Wiring the I/O(SVD-DL) and I/O 1 (SVD-DW) Connectors

Pin No.	Pin name	Input/output
1	GND	Shared
2	AIN	Analog input
3	Reverse-PLS+	Digital input
4	Reverse-PLS-	Digital input
5	Forward-PLS+	Digital input
6	Forward-PLS-	Digital input
7	GND	Shared
8	AUX	Digital input
9	C-RST	Digital input
10	ALM-RST	Digital input
11	Reverse-LMT	Digital input
12	Forward-LMT	Digital input
13	SV-ON	Digital input
14	INP	Digital output
15	ALM	Digital output
16	+24V	Output

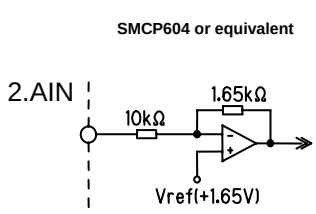


■ Analog input: Pin 2 (analog command input)

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

- Input voltage: Max. DC +10 V; Min. DC -10 V
- Connect the GND for the input signal to the No. 1 or No. 7 GND pin.
- Input is enabled by setting parameter ID 75 “speed command select” or ID 76 “current command select” to analog input.
  ⇒ ▣ “Parameters for Setting Control Functions” P. 45

■ Internal circuit



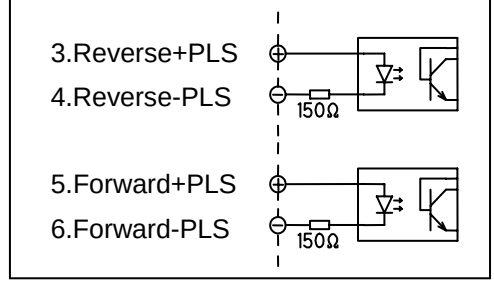
- Analog input setting parameters and analog input offsets need to be adjusted.
  ⇒ ▣ “Run with an Analog Signal from the I/O Connector” in “Speed Control Mode” P. 78
  ⇒ ▣ “Run with an Analog Signal from the I/O Connector” in “Current Control Mode” P. 80

■ Digital input: Pins 3 to 6 (pulse command input)

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

- The input pulse to be used must be 500 kHz or less.
- Input is enabled by setting parameter ID 74 “position command select” to pulse input.
  ⇒ ▣ “Parameters for Setting Control Functions” P. 45
- Command pulse types can be selected.
  ⇒ ▣ “Pulse Input Signal Types” P. 74

■ Internal circuit

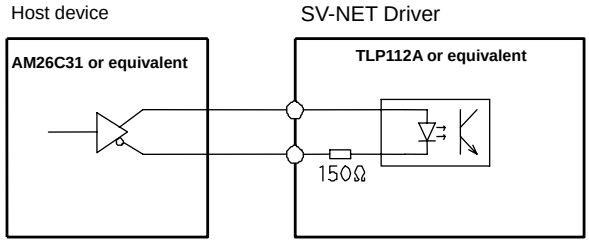


List of Digital Input Pin Functions

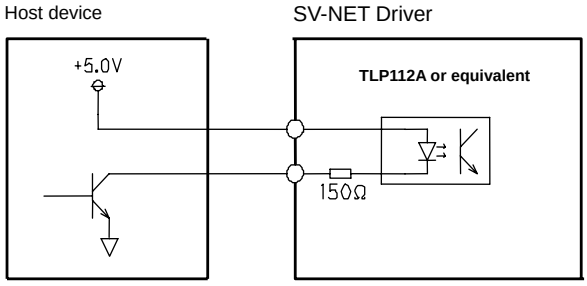
Pin No.	Pin name	Function		
		Factory set pulse input type	User settable pulse input type	
		Forward/reverse pulse	Pulse/direction	
3	Reverse-PLS+	Reverse-rotation command pulse +	Rotation direction +	
4	Reverse-PLS-	Reverse-rotation command pulse -	Rotation direction -	
5	Forward-PLS+	Forward-rotation command pulse +	Command pulse +	
6	Forward-PLS-	Forward-rotation command pulse -	Command pulse -	

Connection example

■ Line driver output



■ Open collector output

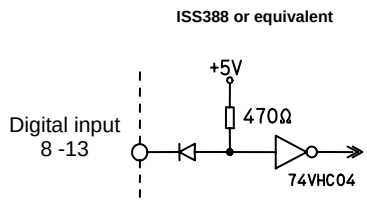


■ Digital input: Pins 8 to 13

These pins input various kinds of digital signals. The function of each pin can be customized.

- Input voltage: DC 5 to 24 V
- H level input voltage: Min. DC 3.5 V
- L level input voltage: Max. DC 1.0 V
- Diode normal-direction withstand voltage: DC 40 V (CMOS)
- Factory settings are ON at L level, and OFF at H level or open. The logic can be reversed with parameters.
- The function selection of each pin can be set with parameter IDs 100 to 105. See the table below for settable functions.

■ Internal circuit

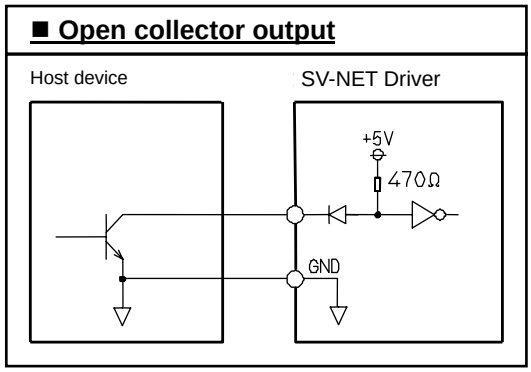


Parameters for Setting Digital Input Pin Functions

Pin No.	Pin name	Parameter		
		ID	Name	Page
8	AUX	105	IN6 setting	P. 48
9	C-RST	104	IN5 setting	
10	ALM-RST	103	IN4 setting	
11	Reverse-LMT	102	IN3 setting	
12	Forward-LMT	101	IN2 setting	P. 47
13	SV-ON	100	IN1 setting	

Connection example

■ Open collector output



List of Digital Input Pin Functions

Pin No.	Pin name	Function				
		Factory setting	Settable function			
8	AUX	Profile start	Home sensor	External fault	Gain-switch	0 command
9	C-RST	Counter reset	Home sensor	External fault	Gain-switch	0 command
10	ALM-RST	Alarm reset	Home sensor	External fault	Gain-switch	0 command
11	Reverse-LMT	Reverse-rotation drive disable	Home sensor	External fault	Gain-switch	0 command
12	Forward-LMT	Forward-rotation drive disable	Home sensor	External fault	Gain-switch	0 command
13	SV-ON	Servo ON	Home sensor	External fault	Gain-switch	0 command

Overview of Digital Input Pin Functions

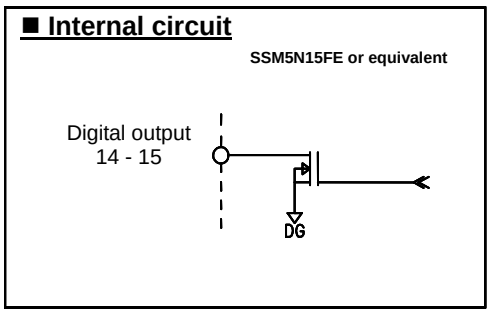
Function name	Description
Servo ON	Sets the servo to ON.
Forward-rotation drive disable	Disables forward-direction rotation.
Reverse-rotation drive disable	Disables reverse-direction rotation.
Alarm reset	Clears driver alarms.
Counter reset	Sets the position information counter to “0” to clear a position deviation. ⇒ ▣ “Counter Reset” P. 76
Profile start	Starts the profile operation to move to a target position for position control.
Home sensor	Detects an origin signal. ⇒ ▣ “Homing Mode” P. 81
External fault	If set to ON, the servo is set to OFF if the driver detects an alarm.
Gain-switch	Switches between gain 1 and gain 2. ⇒ ▣ “Switching Control Gain” P. 68
0 (zero) command	Stops motor rotation.

■ Digital output: Pins 14 to 15

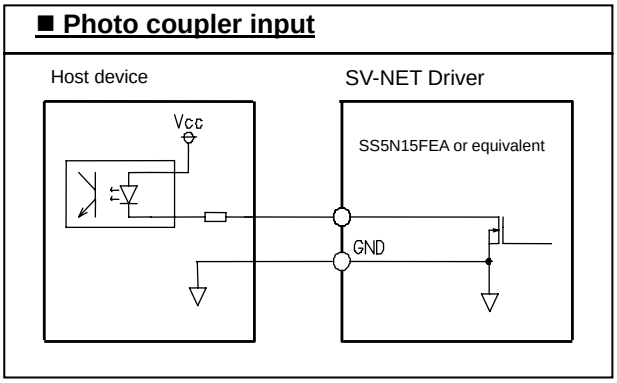
These pins output various kinds of digital signals.

- Collector current: Max. 100 mA
- Max voltage: 30 V
- Use parameter IDs 110 to 111 to set the functions of each pin.

■ Internal circuit



Connection example



Parameters for Setting Digital Input Functions

Pin No.	Pin name	Parameter		
		ID	Name	Page
14	IMP	111	OUT2 setting	P. 48
15	ALM	110	OUT1 setting	

List of Digital Output Pin Functions

Pin No.	Pin name	Function	
		Factory setting	Settable function
14	INP	In-position	Status check
15	ALM	Alarm	Status check

Overview of Digital Output Functions

Function name	Description
In-position	ON if the stop position range in profile operation is entered. ⇒ ▣ ID77 “In-Position Signal ON Range” P. 45
Alarm	Is set to ON if an alarm is detected.
Status check	Outputs the bit information specified for ID20 “Servo Status.” If more than one bit is specified, information is output with OR operation. ⇒ ▣ “Status Check Function” P. 48

■ +24 V: Pin 16 (control signal power supply output)

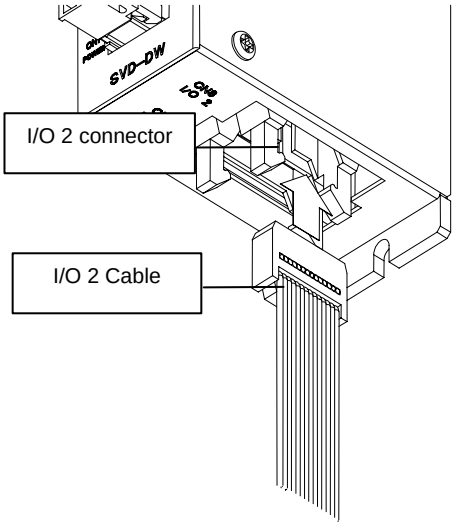
This pin can be used as the power supply for each control signal.

- Output voltage: Rated as 24 V ±10%. Internally connected to the SV-NET connector control power supply for common use.
- Max current: 400 mA

■ GND: Pins 1 and 7

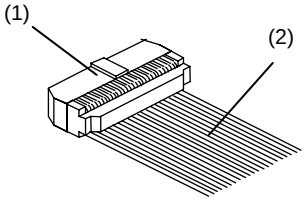
This GND is shared between each control signal.

Connecting the I/O 2 Connector (SVD-DW only)



■ Cable specifications

■ I/O 2 Cable



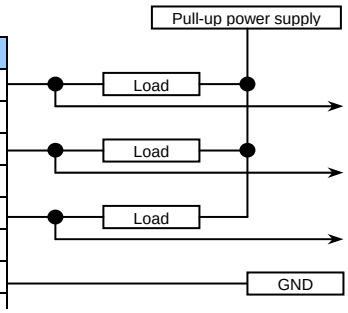
■ Parts for I/O cable

Part name	Model or spec	Maker	Remarks
(1) Socket	HIF3BA-14D-2.54R	HIROSE	
(2) Flat cable	<UL2651> AWG28 flat cable	-	

Wiring the I/O 2 Connector

■ Pins 1 to 7: Open collector output

Pin No.	Pin name	Input/output
1	LEAD	Digital output
2	NC	-
3	LAG	Digital output
4	NC	-
5	Z	Digital output
6	NC	-
7	GND	Shared



■ Checking the Internal Circuit

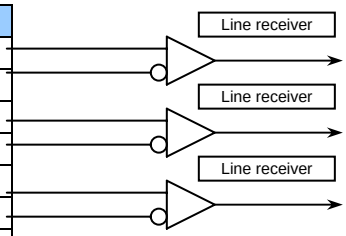
The internal circuits of Pins 1 to 6 of I/O 2 can be checked with the model N code.

TA8410N***□E***

Open collector output	4 - 6
Line driver output	7 - 8

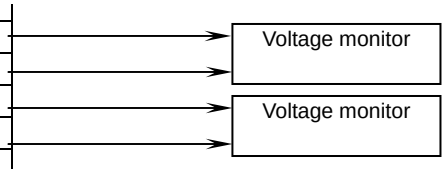
■ Pins 1 to 7: Line driver output

Pin No.	Pin name	Input/output
1	LEAD+	Digital output
2	LEAD-	Digital output
3	LAG+	Digital output
4	LAG-	Digital output
5	Z+	Digital output
6	Z-	Digital output
7	GND	Shared



■ Pins 8 to 14

Pin No.	Pin name	Input/output
8	GND	Shared
9	Monitor output 1	Analog output
10	Monitor output 2	Analog output
11	GND	Shared
12	GND	Shared
13	NC	-
14	NC	-



■ LEAD/LAG/Z output: Pins 1 to 6

The internal circuit varies according to the model. The internal circuits of Pins 1 to 6 of I/O 2 can be checked with the model N code.

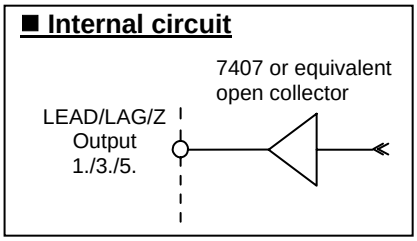
TA8410N***□E***

Open collector output	4 - 6
Line driver output	7 - 8

Open collector output

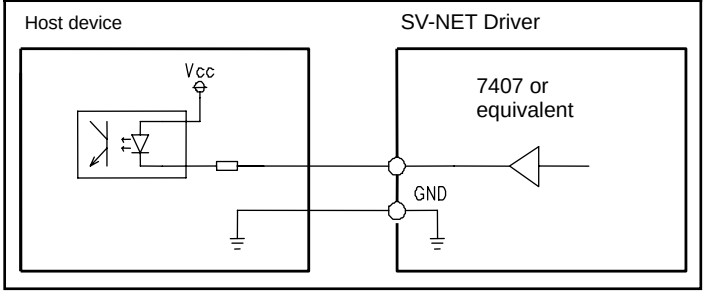
- Open collector: 7407 or equivalent
- Collector current: DC 24 V; up to 30 mA

■ Internal circuit



Connection example

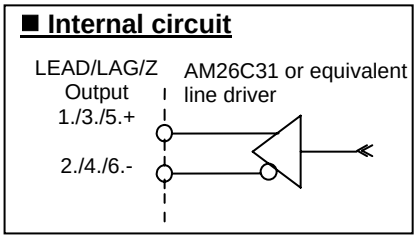
■ Connecting the photo coupler input



Line driver output

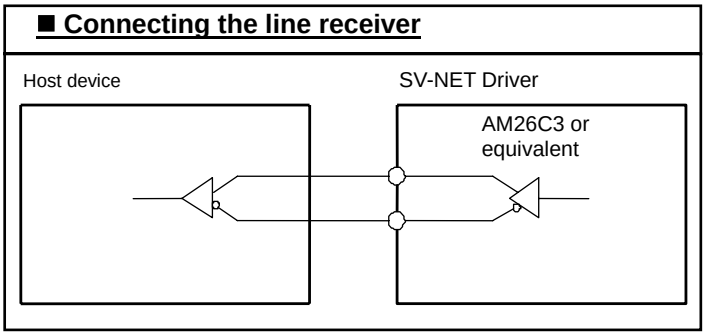
- Line driver: AM26C31 or equivalent

■ Internal circuit



Connection example

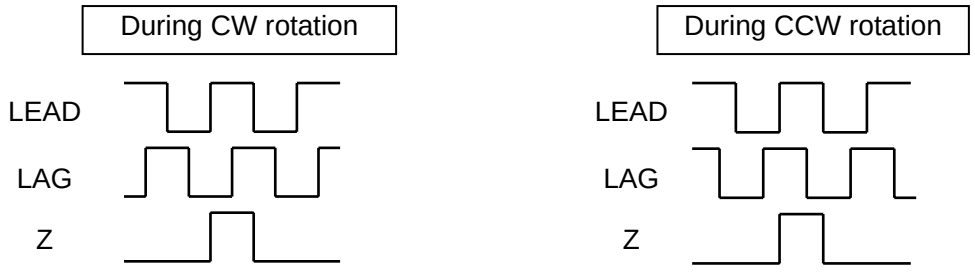
■ Connecting the line receiver



LEAD/LAG/Z output function

Pin name	Function
LEAD	**○ Brushless resolver Smartsyn/Singlsyn** 1X (one Z signal per rotation): Outputs a sensor signal by dividing the frequency (N/8192). (N: 1 - 2048) 2X (two Z signals per rotation): Outputs a sensor signal by dividing the frequency (N/4096). (N: 1 - 2048) **○ Encoder 2048C/T wiring-saving INC** Outputs a sensor signal by dividing the frequency (N/8192). (N: 1 to 8192)
LAG	**○ Encoder 17-bit INC/ABS** Outputs any resolution generated from the sensor signal. (set resolution: 2 to 8192C/T)
Z	**○ Brushless resolver Smartsyn/Singlsyn** Outputs the Z signal generated by R/D conversion. **○ Encoder 2048C/T wiring-saving INC** Outputs the sensor Z signal. **○ Outputs the Z signal generated from the sensor signal.** Outputs the Z signal generated from the sensor signal.

LEAD/LAG/Z output waveform

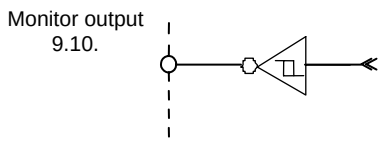


■ Monitor output 1 to 2: Pins 9 to 10

Various parameter values are output in analog signal form.

- They are output within ±2.5, with 2.5 V as standard.
- The parameter IDs targeted for monitor output can be selected with parameters.

■ Internal block diagram



Parameters for Setting Monitor Output

Pin No.	Pin name	Parameter		
		ID	Name	Page
9	Monitor output 1	118	Monitor 1 setting	P. 49
10	Monitor output 2	119	Monitor 2 setting	

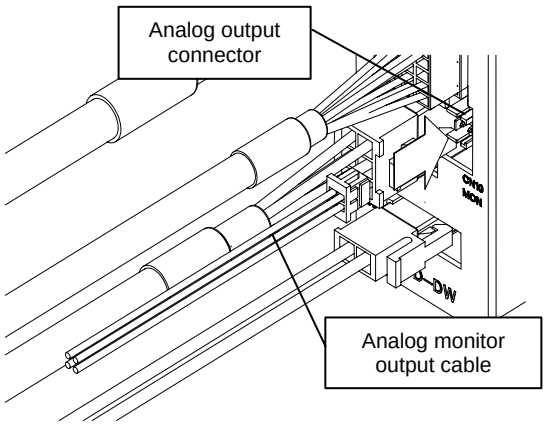
Factory settings

- Monitor output 1: Motor Q-axis current
- Monitor output 2: Motor speed

■ GND: Pins 7 to 8, 11 to 12

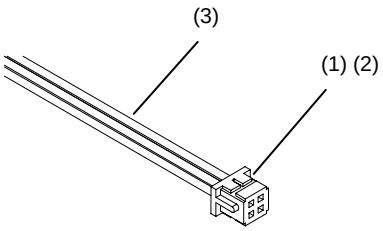
This GND is shared between each signal.

Connecting the Analog Monitor Output Connector



■ Cable specifications

■ Analog monitor output cable



■ Parts for I/O cable

Part name	Model or spec	Maker	Remarks
① Socket	DF11-4DS-2C	HIROSE	
② Terminal	DF-2428SC	HIROSE	
③ Cable	AWG24-28 or equivalent	—	

■ Monitor output 1 to 2: Pins 1 to 2

These are shared with monitor output 1 and 2 (pins 9 and 10) of the I/O 2 connector.

Refer to “Monitor Output” in “I/O 2 Connector” described above.

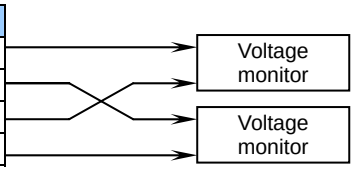
These pins can be used for connecting measuring equipment.

■ GND: Pins 3 to 4

This GND is shared.

Wiring the Analog Monitor Output Connector

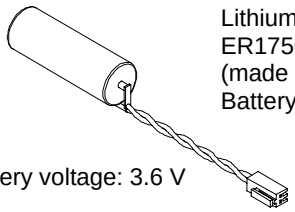
Pin No.	Pin name	Input/output
1	Monitor output 1	Analog output
2	Monitor output 2	Analog output
3	GND	Shared
4	GND	Shared



Connecting the Backup Battery Connector (for SVD-DW only)

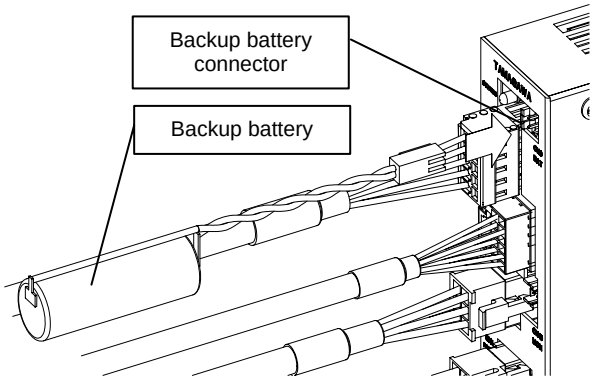
This connector is used to connect the backup battery for encoders. Connect the backup battery to use a 17-bit ABS built-in motor.

■ Backup battery

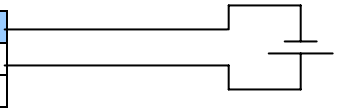


Lithium battery
ER175000VC
(made by Toshiba Battery)

Battery voltage: 3.6 V



Pin No.	Pin name
1	GND (-)
2	VB (+)



7. How to Control the Driver

How to Control the Driver and Setting Control Parameters

The driver is controlled mainly by SV-NET communication. SV-NET communication is performed on the basis of the communication of writing and reading values to the driver parameters. There are many types of parameters and corresponding functions. The host controller controls the driver while reading and writing these parameter values.

This section provides a broad overview of the parameters. For the details on parameters, refer to 8. “Parameters” on P. 40.

Parameter type	Basic description
Communication parameters	Sets MAC-IDs, communication speed, and such other parameters.
Parameters for initializing and saving parameters	Mainly saves parameters.
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 origin return.
Parameters for setting I/O (input, output)	Used to set I/O functions.
Parameters for setting the analog monitor	Sets the SVD-DW analog monitor output.
Parameters for setting pulses	Sets input/output pulses and related settings.
Analog input parameters	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 analog monitor	Parameters for SVD-DW-type analog monitor output.

Most parameters are not changed once they have been set at the beginning. Some parameters, however, 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.

To get started, first use the communication parameters to set MAC-IDs, communication speed, and such other settings so as to establish an environment that allows SV-NET communication. After that, set the speed control and position control values to the control command parameters and then perform a trial run of the motor to check its operation.

8. Parameter

Parameters are defined on the basis of data ID (hereafter referred to as “ID”) numbers. The data length, whether writable from the host controller, and whether savable to nonvolatile memory with a save operation is predetermined for each parameter. Below is a list of the parameters along with a description of their details.

Symbol	Meaning
ID	Data ID number
L	Data length (byte)
W	Write
M	Save to nonvolatile memory

Caution! Setting a value that exceeds the setting range for the parameter impedes operation. Be sure to set values within the setting range.

Communication Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
1	Device Code	2	×	×	1:Servo Motor Driver	1	-	DEC
2	Product Code	2	×	×	Driver model	8410	-	DEC
3	Revision	2	×	×	Driver software revision	-	-	DEC
4	Serial Number	4	×	×	Serial number	-	-	-
5	MAC-ID	1	○	○	Media access control number (Enabled when the rotary DIP switch for MAC-ID setting is set to “0”)	31	1 - 31	DEC
6	Baud Rate	1	○	○	SV-NET communication speed 0:125kHz 1:250kHz 2:500kHz 4:1MHz	4	0 - 2 or 4	DEC

Parameters for Initializing and Saving Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
16	Parameters init.	2	○	×	Setting to 1 initializes all parameters to their initial factory settings. (Do not use in non-standard models.)	0	0 - 1	DEC
17	Parameters save	1	○	×	Setting to 1 saves parameters to nonvolatile memory.	0	0 - 1	DEC
18	Program Code	2	×	×	Built-in software identification code	-	-	HEX

Status parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
20	Servo Status	2	×	×	B0:Servo ON B1:During profile operation B2:In Position B3:Fault state B4:Forward Limit B5:Reverse Limit B6:Torque limit B7:Speed limit B8:Position excessive deviation B10:During homing B11:Gain select B12:Backup battery voltage low B15: During Abs-Encoder reset	-	-	-
21	I/O Status	2	×	×	B0-B5:IN1-IN6 status B8-B10:OUT1-OUT3 status	-	-	-
22	Alarm Code	1	×	×	Returns the current alarm code.	-	-	-
23	Alarm History-1	4	×	○	Returns Alarm-1 to Alarm-4.	-	-	-
24	Alarm History-2	4	×	○	Returns Alarm-5 to Alarm-8.	-	-	-
25	Alarm History-3	4	×	○	Returns Alarm-9 to Alarm-12.	-	-	-
26	Alarm History-4	4	×	○	Returns Alarm-13 to Alarm-16.	-	-	-

Control Command Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
30	Servo Command	2	○	×	B0:Servo ON B1:Start Profile B2:Clear Position error B3:Clear Alarm B4:Hard Stop B5:Smooth Stop B6:direction B7:Acceleration limit ON B8:Analog input offset adjustment ON B11:Gain change B13:Home Sensor Arm B14:Position Reset B15:17-bit sensor alarm & multi-rotation reset	00	0000 ~ FFFF Caution	HEX

Caution: **Set “0” for a bit with no function assigned.**

Symbol	Meaning
ID	Data ID number
L	Data length (byte)
W	Write
M	Save to nonvolatile memory

Control Command Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
31	Control Mode	1	○	○	0:Servo OFF 1:Position Control 2:Velocity Control 3:Torque Control 4:Homing 5:Auto-tuning 15:Demo	0	0 - 5 or 15	DEC
32	Target Position	4	○	○	Profile operation target position [pulse]	0	00000000 ~ FFFFFFFF	HEX
33	Target Velocity	2	○	○	Profile operation target speed [rpm]	1000	0 - 10000	DEC
34	Acceleration	2	○	○	Acceleration during speed control. Also sets acceleration and deceleration for profile operation. [10 rpm/sec]	10000	0 - 32767	DEC
35	Deceleration	2	○	○	Deceleration during speed control. Also sets deceleration [10 rpm/sec] for “Smoothing Stop” (ID 30 Bit5 ON).	10000	0 - 32767	DEC
36	Command Position	4	○	○	Real-time position command [pulse]	0	00000000 ~ FFFFFFFF	HEX
37	Command Velocity	2	○	○	Real-time speed command [rpm]	0	-10000 ~ 10000	DEC
38	Command Current	2	○	○	Real-time current command [0.01 A]	0	-Motor Max. current ~ +Motor Max. current	DEC
39	Reset Position	4	○	○	Position data is reset to this value when Servo Command B14 is 1.	0	00000000 ~ FFFFFFFF	HEX

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Servo Feedback Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
40	Actual Position	4	×	×	Current position [pulse] Outputs the current position used for position control. This value is derived from position data captured from the sensor that is processed using parameters such as ID 140 “Abs Mode” and ID72 “Reference Direction.”	-	-	-
41	Actual Velocity	2	×	×	Current speed [rpm]	-	-	-
42	Actual Current	2	×	×	Current feedback [0.01 A]	-	-	-
43	Actual PVC	6	×	×	The lower-order 16 bits of Actual Position [pulse], Actual Velocity [rpm], and Actual Current [0.01 A] are output in six bytes.	-	-	-
44	Actual SVC	6	×	×	The lower-order 16 bits of Sensor Position [pulse], Actual Velocity [rpm], and Actual Current [0.01 A] are output in six bytes.	-	-	-
45	Sensor Position1	4	×	×	Outputs the position data captured from the sensor. Brushless resolver Smartsyn/Singlsyn: The position is output in absolute position when ID:140 (Abs Mode) is 1 and in relative position (Position 0 when power is on) when it is 0. Encoder wiring-saving INC: The incremental one-rotation position data captured from the sensor is output with no change made to it. Encoder 17-bit ABS/INC: The 17-bit one-rotation absolute value position data captured from the sensor is output with no change made to it.	-	-	-

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Servo Feedback Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
46	Sensor Position2	4	×	×	Outputs the position data captured from the sensor. Brushless resolver Smartsyn/Singlsyn: Outputs position data for one resolver signal cycle (1x) at a resolution multiplying it to 8192 ct/Rev. Encoder wiring-saving INC: Outputs the same value as Sensor Position 1. Encoder 17-bit ABS: The 17-bit multi-rotation data captured from the sensor is output with no change made to it. Encoder 17-bit ABS: The 17-bit one-rotation incremental data captured from the sensor is output with no change made to it.	-	-	-

Servo Gain Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
50	Kp1	2	○	○	Position loop proportional gain 1 [1/s] (Caution 1)	100	0 - 799	DEC
51	Kv1	2	○	○	Speed loop proportional gain 1 [1/s] (Caution 1)	200	0 - 2000	DEC
52	Ki1	2	○	○	Speed loop integral gain 1 [1/s] (Caution 1)	125	0 - 2000	DEC
53	LPF-f	2	○	○	Low-pass filter cutoff frequency [Hz]	1000	0 - 1000	DEC
54	NF-f	2	○	○	Notch filter center frequency [Hz]	1000	0 - 1000	DEC
55	NF-d	2	○	○	Notch filter attenuation [0–32767]	0	0 - 32767	DEC
56	Kcp1	2	○	○	Current loop proportional gain [rad/sec] (Caution 2)	5000	0 - 10000	DEC
57	Kci1	2	○	○	Current loop integral gain [rad/sec] Caution 2)	100	0 - 10000	DEC
58	Phase-advance Gain	2	○	○	(Caution 2)	34	0 - 512	DEC
59	Load Inertia	2	○	○	[gcm^2]	0	0 - 3000	DEC
60	Kp2	2	○	○	Position loop proportional gain 2 [1/s] (Caution 1)	50	0 - 799	DEC
61	Kv2	2	○	○	Speed loop proportional gain 2 [1/s] (Caution 1)	175	0 - 2000	DEC
62	Ki2	2	○	○	Speed loop integral gain 2 [1/s] (Caution 1)	100	0 - 2000	DEC

Caution 1: The unit [1/s] used in Kp, Kv, and Ki is the one used when the load inertia is properly set.

Caution 2: Do not change under normal circumstances.

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting Control Functions

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
70	Position Data Resolution: Numerator (n)	4	○	○	Sets the sensor resolution. Factory setting: [Brushless resolver Smartsyn/Singlsyn] ⇒ 2048 [Encoder wiring-saving INC] ⇒ 8192 [Encoder 17-bit ABS/INC] ⇒ 131072	2048/ 8192/ 131072	-	DEC
71	Position Data Resolution: Denominator (m)	2	○	○	Caution: Do not change from the factory setting.	1	-	DEC
72	Reference Direction	1	○	○	Sets the forward rotation direction. 0:CW, 1:CCW	0	0 - 1	DEC
73	Position FB Select	1	○	○	Selects the feedback signal to be used for position control. 0: Motor encoder Position control unlimited rotation enabled when Bit7 is 1.	00	00 or 80	HEX
74	Position Command Select	1	○	○	Selects a command signal in position control mode. 1: Pulse input 0: Position command by SV-NET	00	00 - 01	HEX
75	Speed Command Select	1	○	○	Selects a command signal in speed control mode. 1: Analog signal input 0: Speed command by SV-NET Reverses the analog signal polarity when B7 is 1.	00	00 - 01 or 80 - 81	HEX
76	Torque Command Select	1	○	○	Selects a command signal in torque control mode. 1: Analog signal input 0: Torque command by SV-NET Reverses the analog signal polarity when B7 is 1.	00	00 - 01 or 80 - 81	HEX
77	Range of In-Position Signal ON	2	○	○	[Pulse]	4	1 - 32767	DEC
78	Smoothing Function Select	1	○	○	Selects smoothing enable/disable for position commands. 0: No smoothing 1: With smoothing	0	0 - 1	DEC
79	Smoothing time	2	○	○	Smoothing time for position commands [msec] Max. 102 ms	50	0 - 102	DEC

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting Control Functions

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
80	Gain-Switch Method Select	1	○	○	0: No switching (fixed to Gain 1) 1: Switch automatically by speed command 2: Switch automatically by motor speed 3: Switch automatically by position deviation 4: Switch by I/O input command (Set the gain-switch function on any one of I/O or I/O 1 connectors 8 to 13. Gain 1 when OFF; Gain 2 when ON.) 5: Switch by ServoCommand Bit11 (Gain 1 when 0; Gain 2 when 1) 9: No switching (fixed to Gain 2)	0	0 - 5 or 9	DEC
81	GainChangePoint_H	2	○	○	Gain-switch point H/L0 to 5 [rpm] or[pulse] Enabled when ID 80 is 1 to 3. Gain 1 if greater than GainChangePoint_H; Gain 2 if smaller than GainChangePoint_L; interpolate between Gain 1 and 2 if between GainChangePoint_L and GainChangePoint_H.	50	0 - 32767	DEC
82	GainChangePoint_L	2	○	○		4	0 - 32767	DEC
83	Soft Limit Select	1	○	○	0: Soft limit disabled 1: Soft limit enabled	0	0 - 1	DEC
84	Positive-side Soft Limit	4	○	○	[Pulse]	40000000	00000000 ~ FFFFFFFF	HEX
85	Negative-side Soft Limit	4	○	○	[Pulse]	C0000000	00000000 ~ FFFFFFFF	HEX
86	Forward-Rotation Current Limit	2	○	○	[0.01A]	Motor max. current	0 ~ Motor max. current	DEC
87	Negative-Rotation Current Limit	2	○	○	[0.01A]	Motor max. current	0 ~ Motor max. current	DEC
88	Speed Limit	2	○	○	[rpm]	Motor max. velocity	0 - 10000	DEC

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting Homing Operation

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
90	Homing Type	1	O	O	Selects homing method Position preset by origin signal & motor point 0 1: Origin return by mechanical stopper 2: Position preset by immediate stop with origin signal 3: Homing position preset until input origin signal is cancelled.	0	0 - 3	DEC
91	Preset Value	4	O	O	Position data set by homing [pulse]	0	00000000 ~ FFFFFFFF	HEX
92	Homing Start Direction	1	O	O	Homing rotation direction 0: Forward direction; 1: Negative direction	0	0 - 1	DEC
93	Homing Speed	2	O	O	Homing start speed [rpm]	500	0 - 10000	DEC
94	Creep Speed	2	O	O	Origin detection speed [rpm]	50	0 - 10000	DEC
95	Thrust Time	2	O	O	Thrust time in thrust-type homing [msec]	200	0 - 10000	DEC
96	Thrust Torque	2	O	O	Thrust torque in thrust-type homing [0.01 Arms]	600	0 ~ Motor max. current	DEC

Parameters for Setting I/O (Input)

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
100	IN1 Setting	1	O	O	0: Servo On 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic) 00 - 04	00	00 - 04 or 80 - 84	HEX
101	IN2 Setting	1	O	O	0: Forward Limit 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic)	00	00 - 04 or 80 - 84	HEX

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting I/O (Input)

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
102	IN3 Setting	1	○	○	0: Reverse Limit 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic)	00	00 - 04 or 80 - 84	HEX
103	IN4 Setting	1	○	○	0: Alarm Reset 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic)	00	00 - 04 or 80 - 84	HEX
104	IN5 Setting	1	○	○	0: Differential counter reset 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic)	00	00 - 04 or 80 - 84	HEX
105	IN6 Setting	1	○	○	0: Profile start 1: Home sensor 2: External Fault 3: Gain-switch command 4: Zero (0) command input (enabled when analog command) Normally ON when B7=1 (negative logic)	00	00 - 04 or 80 - 84	HEX

Caution: When the same function is set in more than one input, priority is given to the input with the largest number.

Parameters for Setting I/O (Output)

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
110	OUT1 Setting	2	○	○	00: Alarm output 0001 to FFFF: Status check	0000	0000 ~ FFFF	HEX
111	OUT2 Setting	2	○	○	00: In-position output 0001 to FFFF: Status check	0000	0000 ~ FFFF	HEX

Status check function:
The bit using a setting value of 0001 to FFFF (HEX) to specify the ID 20 “Servo Status” value is extracted to output the result.
If the extracted bit is greater than one bit, the result that is output is ORed.

Symbol	Meaning
ID	Data ID number
L	Data length (byte)
W	Write
M	Save to nonvolatile memory

Parameters for Setting Analog Monitor (for SVD-DW only)

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
110	Monitor 1 Setting	2	○	○	Sets analog monitor output 1. Outputs specified parameter values to the monitor. Factory setting: ID 42 “Actual current”	202A	0000 ~ E0CE	HEX
111	Monitor 2 Setting	2	○	○	Sets analog monitor output 2. Outputs specified parameter values to the monitor. Factory setting: ID 41 “Actual velocity”	2029	0000 ~ E0CE	HEX

Analog monitor output setting:
Lower-order 12 bits: Sets the parameter ID to be monitored. [Setting value 001 to 0CE (HEX)]
Upper-order 4 bits: Sets the gain (display magnification). [Setting value 0 to E (HEX)]

Calculation of analog monitor voltage output value:
Analog monitor voltage = 2.5 (V) + 2^[Gain] × [Parameter value to be monitored] × 2.5 (V)/32768

Example of analog monitor setting:
Example: Output ID 41 “Actual Velocity” to monitor output 1 under x8 magnification.
Set “3029 (HEX)” to ID 118 “Monitor 1 setting.”

3 029 (HEX)
- 029: Parameter ID to be monitored: 41 (DEC) ⇒ 029 (HEX)
- 3: Gain (display magnification 2^[Gain]): 3 (display magnification 2^3 ⇒ 8 times)

Monitor voltage with the center of 2.5 V displayed with ±2.5 V.
The monitor voltage when ID 41 “Actual Velocity” is 2000 rpm is:
2.5 (V) + 2^3 × 2000 (rpm) × 2.5 (V)/32768 ≅ 3.72 (V)
The monitor voltage when ID 41 “Actual Velocity” is -3000 rpm is:
2.5 (V) + 2^3 × -3000 (rpm) × 2.5 (V)/32768 ≅ 0.67 (V)

Caution: The possible data length for monitor output is 16-bit data. (-32767 to 32767)
If a parameter of 32 bits is set, a value of lower-order 16 bits is output.

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting Pulses

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
120	Pulse Input Signal Mode	1	○	○	0: Forward-pulse and reverse-pulse mode 1: Pulse and direction mode Reverses the polarity when B7 is 1.	00	00 - 01 or 01 - 81	HEX
121	Pulse Input Signal Resolution: Numerator	4	○	○	The pulse resolution is calculated as n/m [pulses/rev], where n is the numerator and m is the denominator. Caution: I Enabled when ID 74 “position command select” is set to pulse input “1.”	2048	1 ~ 1073741825	DEC
122	Pulse Input Signal Resolution: Denominator	2	○	○		1	1 - 255	DEC
126	Sensor Output Frequency-Division Setting	2	○	○	Brushless resolver Smartsyn/Singlsyn: [1X (one Z signal per motor rotation)] Outputs a sensor signal by dividing the frequency (N/8192). (N: 1 to 2048) ⇒ Factory setting: 2048 [2X (two Z signals per motor rotation)] Outputs a sensor signal by dividing the frequency (N/4096). (N: 1 to 2048) ⇒ Factory setting: 2048 Encoder wiring-saving INC: Outputs a sensor signal by dividing the frequency (N/8192). (N: 1 to 8192) ⇒ Factory setting: 8192 Encoder 17-bit ABS/INC: Outputs any resolution generated from the sensor signal. (Set resolution: 1 to 8192C/T)	2048 / 8192	1 - 8192	DEC

Parameters for Setting Analog Input

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
130	Speed Conversion Scale for Analog Input Signal	2	○	○	Speed conversion value for an analog input command of 10 V [rpm]	6000	0 - 10000	DEC
131	Current Conversion Scale for Analog Input Signal	2	○	○	Current conversion value for an analog input command of 10 V [0.01 Arms]	1800	0 - 2400	DEC
132	Analog Input Offset	2	×	○	Set automatically by offset adjustment.	-	0 - 32767	DEC

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Special Servo Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
140	Abs Mode	2	○	○	0: The position where power ON has taken place is controlled as “0” and backup battery related alarms are ignored. 1: The absolute position detection mode using the absolute encoder is used for control. Factory setting: [Brushless resolver Smartsyn/Singlsyn] ⇒ 0 [17Bit ABS] ⇒ 1 [17Bit INC] ⇒ 0 [Wiring-saving INC] ⇒ 0 (1 not allowed)	-	0 - 1	DEC
141	Servo Select	2	○	○	This selection is for special control. Under normal circumstances use it set to 0.	00	00	HEX
142	Reserve					-	-	-
143	Servo Off Delay	2	○	○	Duration until servo OFF is actually achieved following receipt of a servo OFF command (msec). When servo is set from ON to OFF, servo ON continues for a set period of time. 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.	20	0 - 10000	DEC
144	Abs-Offset	4	×	○	Internal data changed by preset, etc., using encoder reset or homing.	-	00000000 ~ FFFFFFFF	HEX
145	Auto Tuning-KV	2	○	○	Speed loop proportional gain during auto tuning. For equipment with a high inertia, set this setting to a high value before performing an auto tuning. Set to one of the following values according to the ratio between the rotor inertia and the approximate inertia of the equipment: x2 or less: 500 x2 to x3: 1000 x3 or more: 1500	500	0 - 2000	DEC
146	Auto Tuning-KI	2	○	○	Speed loop integral gain during auto tuning. Under normal circumstances, use it with the factory setting.	200	0 - 2000	DEC

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Special Servo Parameters

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
147	Brake off Delay	2	○	○	Extends the time that elapses until the brake release output is sent following servo ON. (msec)	0	0 - 10000	DEC
148	Enable Off Time	2	○	○	Servo OFF is automatically achieved if the duration of an SV-NET communication loss exceeds the time set for this parameter. (msec) Unlimited if set to 0.	1000	0 - 6000	DEC
149	Forced Brake Release	2	○	×	Set to 1 to forcefully release the mechanical brake. If set to 0, the brake is released when servo is ON and the brake is on when servo is OFF.	0	0 - 1	DEC
159	Overload Monitor	2	×	×	Overload state detection monitor [0.1%] The internal overload calculation value is displayed as a percentage with reference to the smaller ID 200/211. If this value reaches 100% (1000), an overload alarm (21) results.	-	-	DEC
160	Driver Temperature	2	×	×	Temperature in the driver power amplifier area [0.1°C]	-	-	DEC
161	Drive Power Supply Voltage	2	×	×	Motor drive power supply voltage [0.1 V]	-	-	DEC

Parameters for Setting Error Detection

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
200	Overload Alarm Detection Torque	2	○	○	[0.01A]	Motor rated current	0 - 2400	DEC
201	Over-Speed Alarm Detection Speed	2	○	○	[rpm]	9000	0 - 10000	DEC
202	Nonoperating Position Deviation Error Detection Pulse Count	2	○	○	[Pulse] ([4 x pulse] for 17-bit INC/ABS) [17Bit Encoder] ⇒32767 Caution: Enabled for position control only. Note that the ID 202 value is also used for rotation deviation error detection during pulse input.	2048 / 32767	0 - 32767	DEC
203	Operating Position Deviation Error Detection Pulse Count	2	○	○	Enabled for position control profile operation only. Disabled during pulse input. [17Bit Encoder] ⇒32767 Caution: Enabled for position control profile operation only. Disabled during pulse input.	20480 / 32767	0 - 32767	DEC

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

Parameters for Setting Error Detection

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
204	Overheat Error Detection Temperature	2	○	○	[0.1degreeC]	850	0 - 1000	DEC
205	Overvoltage Error Detection Voltage	2	○	○	[0.1V]	550	0 - 690	DEC
206	Power Supply Shutoff Detection Voltage (low voltage detection)	2	○	○	[0.1V]	180	0 - 690	DEC

Parameters for Analog Monitor

ID	Name	L	W	M	Description	Factory setting	Setting range	Designation
250	Q-Axis Current	2	×	×	Motor Q-axis current calculation value used for driver internal calculation. The unit varies according to the driver model. Model-specific full-scale value: "N*3**": 12Arms/2^{14} "N*5**": 24Arms/2^{14} Example: Value for 5 Arms with "N*3**" (12 Arms) $5/12 \times 2^{14}=6826$	-	-	DEC
251	Velocity	2	×	×	Motor speed used for driver internal calculation. [10000 (rpm)/32767]	-	-	DEC
252	Position Error	2	×	×	Position deviation used for driver internal calculation [pulse].	-	-	DEC
253	Reserve							
254	Reserve							

Symbol	Meaning	ID	Data ID number	L	Data length (byte)	W	Write	M	Save to nonvolatile memory

9. Establishing the SV-NET Communication

To start communications by SV-NET, first set MAC-IDs.

MAC-IDs are set to “31” at the initial setting state, but the MAC-IDs needs to be set to numbers that do not result in an overlap on the network.

To set MAC-IDs, the following two methods are available:

- Set MAC-IDs using the rotary DIP switch.
- Use SV-NET communication to change the ID=5 MAC-ID parameter.

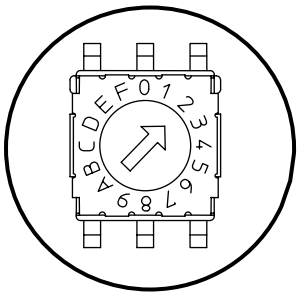
Caution!

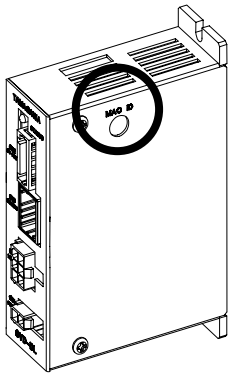
The driver used to operate the rotary switch must be a suitable one. A driver of compatible size has a tip-end width of 2.0 to 2.4 mm and a tip-end thickness of 0.5 to 0.6 mm. A driver with a large grip or an extremely small tip-end width may damage the slots of the rotary switch.

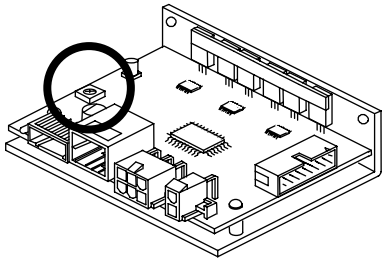
Procedure for Setting a MAC-ID

■ Setting MAC-IDs using the rotary DIP switch

1. Check that the control and drive power supplies are OFF.
2. Turn the rotary DIP switch to select a MAC-ID. The MAC-IDs that can be set using the rotary DIP switch are 1 to 15.
3. The MAC-ID is changed after the power is turned on.







Setting	Description
1	MAC-ID is “1.”
2	MAC-ID is “2.”
3	MAC-ID is “3.”
4	MAC-ID is “4.”
5	MAC-ID is “5.”
6	MAC-ID is “6.”
7	MAC-ID is “7.”
8	MAC-ID is “8.”

Setting	Description
9	MAC-ID is “9.”
A	MAC-ID is “10.”
B	MAC-ID is “11.”
C	MAC-ID is “12.”
D	MAC-ID is “13.”
E	MAC-ID is “14.”
F	MAC-ID is “15.”

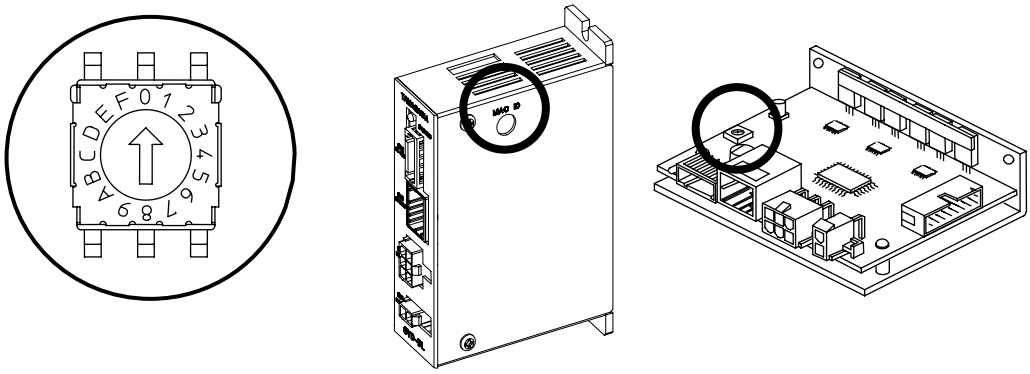
Caution!

- When setting MAC-IDs, make sure there is no overlap with other equipment.
- After the power has been turned on, wait for at least two seconds before starting SV-NET communication.

Procedure for Setting a MAC-ID

■ Setting MAC-IDs using SV-NET communication

1. Check that the control and drive power supplies are OFF.
2. Connect only the driver on which you wish to set a MAC-ID to the host controller using the SV-NET cable. Disconnect the SV-NET cable from other equipment.
3. Set the rotary DIP switch to "0."



4. After the control power has been turned on, wait for at least two seconds before starting the next operation. The drive power supply does not need to be turned ON if only MAC-IDs are being changed.
5. Follow the steps below to set parameters by SV-NET communication using the SV-NET motion controller or a host controller such as "Master of SV-NETⅡ." ID 5 "MAC-ID" can be set to a value from 1 to 31. When a setting is changed, the change must always be saved by setting "1" in ID 17 "parameter save." Communicate at a communication speed of 1 MHz as set at the factory.

Step	ID	Parameter name	Setting value
(1)	5	MAC-ID	1 - 31
(2)	17	Parameter save	1

7. Turn OFF the control power supply.
8. Turn ON the control power supply again and then wait for at least two seconds.
9. Check that the MAC-ID has been changed using the SV-NET motion controller or a host controller such as "Master of SV-NETⅡ."
10. Repeating the same steps, connect the SV-NET cable to drivers one by one to set MAC-IDs, making sure that no number that has already been allocated to a driver connected to the network is re-used.

Caution!

If parameter values are changed, save the parameters.
Turning OFF the control power supply without saving will return the parameter values to their original settings.
⇒ ▣ "Saving Parameters" P. 86

Caution!

- 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.

Procedure for Setting the Communication Speed

When changing communication speed, it is recommended that you use a communication speed of 1 Mbps as set at the factory without changing it. However, if communication becomes unstable because the SV-NET cable is long, setting a slower communication speed may improve stability.

When changing communication speed, be careful not to forget the communication speed you have set. Changing the setting without due care and attention could lead to a problem in communication. Set and save communication speed properly.

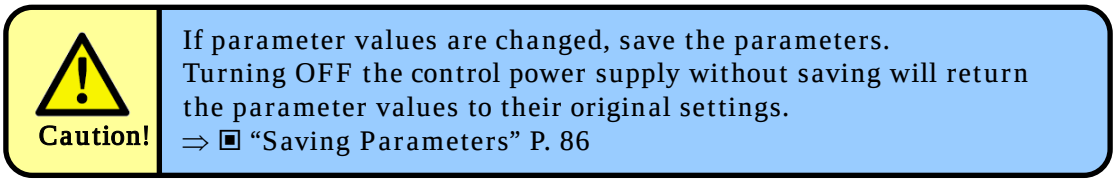
The following describes the steps for changing communication speed.

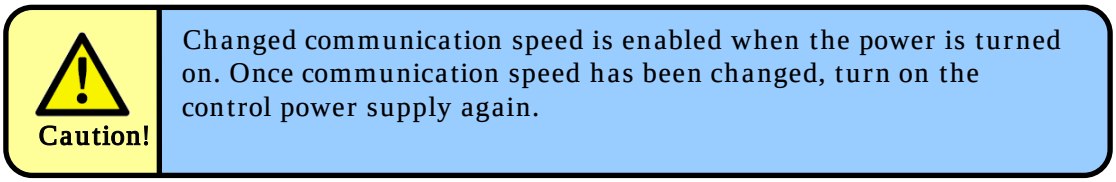
1. Turn ON the control power supply.
2. Follow the steps below to set parameters by SV-NET communication using the SV-NET motion controller or a host controller such as "Master of SV-NETⅡ." For the time being, communicate at 1 MHz, as set at the factory. In ID 6 "Baud Rate," set a number corresponding to the communication speed. When a setting is changed, the change must always be saved by setting "1" in ID 17 "parameter save."

Step	ID	Parameter name	Setting value	Communication speed
(1)	6	Baud Rate	0	125 kHz
			1	250 kHz
			2	500 kHz
			4	1 MHz
(2)	17	Parameter save	1	

The factory setting for communication speed is "4," a speed of 1 MHz.

3. Turn OFF the control power supply.
4. Turn ON the control power supply again and then wait for at least two seconds.
5. Adjust the communication speed of the SV-NET motion controller or a host controller such as "Master of SV-NETⅡ" to the communication speed set on the driver to check if communication can be successfully established.





10. Trial Run

After communication has been established, return the cable to its original place and then perform a trial run on each set of driver and motor one by one. Check if the motor can rotate correctly in a no-load state. To avoid an unexpected accident, perform a trial run without a load; that is, with nothing attached to the motor shaft.

First perform a trial run of speed control and then of position control.

Caution!

When repeating a trial run after the driver has been used with pulse and analog signal inputs, operate with commands sent from SV-NET by setting ID 75 “Speed Command Select” and ID 74 “Position Command Select” to 0.

Speed Control Trial Run

1. Turn ON both the drive and control power supplies and then wait for at least two seconds.
2. If the driver LED lights up green, the driver is in a normal state. If it flashes red and green, an alarm has been detected. Refer to the section “Alarm Detection” on page 92 to reset an alarm after eliminating the cause.
3. If no alarm is detected, start the trial run.
4. Perform the following steps to set parameter values.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to speed control.																	
	31	Control Mode	2															
(2)	Servo ON. Servo ON locks the motor shaft.																	
	30	Servo Command	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	Command Velocity	500															
(4)	Change the rotation speed. (Example: 1000 rpm). After this has been set, the rotation speed will change.																	
	37	Command Velocity	1000															
(5)	Rotation stop. Stop the rotation using servo OFF.																	
	30	Servo Command	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 the trial run for position control.

Position Control Trial Run

6. Proceed to the trial run for position control. Perform the following steps to set parameter values.

Step	Operation																	
	ID	Parameter name	Setting value															
(1)	Set the control mode to position control.																	
	31	Control Mode	1															
(2)	Reset the position. Set the current position to “0.”																	
	30	Servo Command	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	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: Forward direction (CW) 100 rotations, sensor position resolution 2048 (1/rev))																	
	32	Target Position	204800															
(4)	Set the target speed. (Example: 1000 rpm)																	
	33	Target Velocity	1000															
(5)	Set the acceleration. (Example: One unit is 10 rpm/sec, so set the value to “10000” for 100000 rpm/sec.)																	
	34	Acceleration	10000															
(6)	Profile ON. Once set, the motor will rotate to the position set in (3).																	
	30	Servo Command	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	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

7. Check that control can be performed as set and that the motor rotates smoothly. During a trial run, use all of connected drivers and motors to check operation.

11. Installing to Equipment

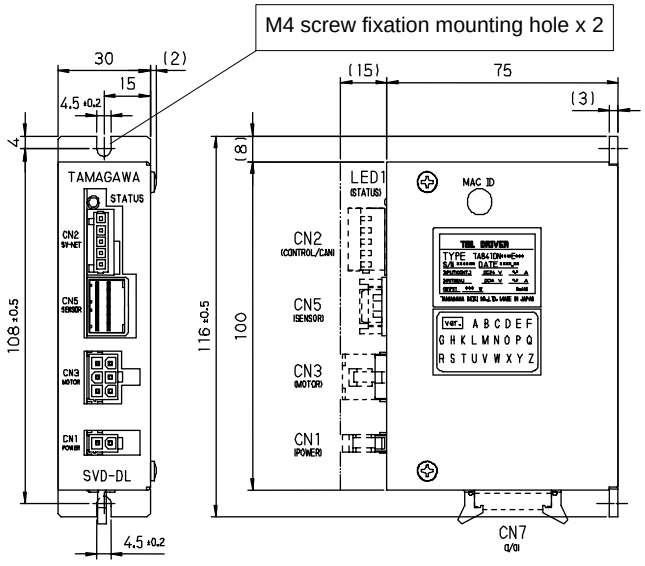
Installing the Driver

To install the driver, use the M4 screw mounting holes located on the base chassis.

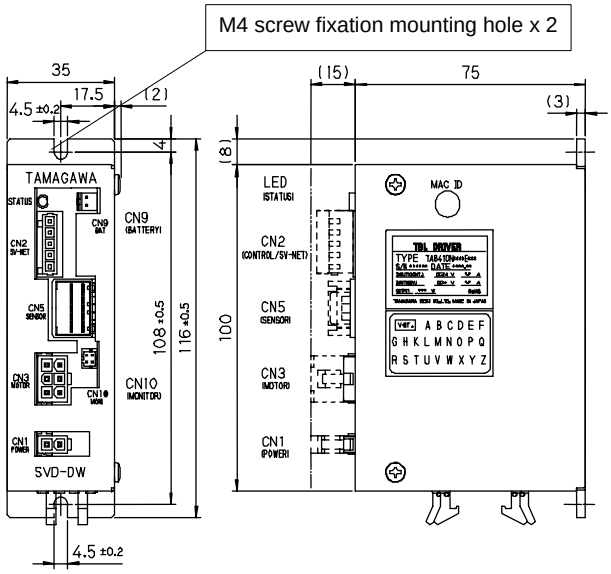
No particular installation orientation is specified.

Note: Installing it on a circuit board metal surface provides greater heat dissipation.

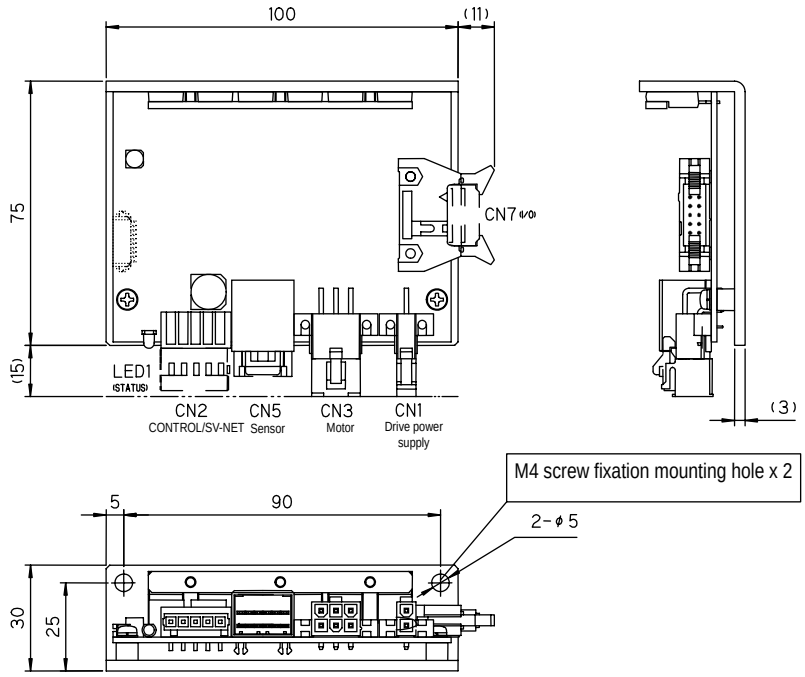
■ SVD-DL



■SVD-DW

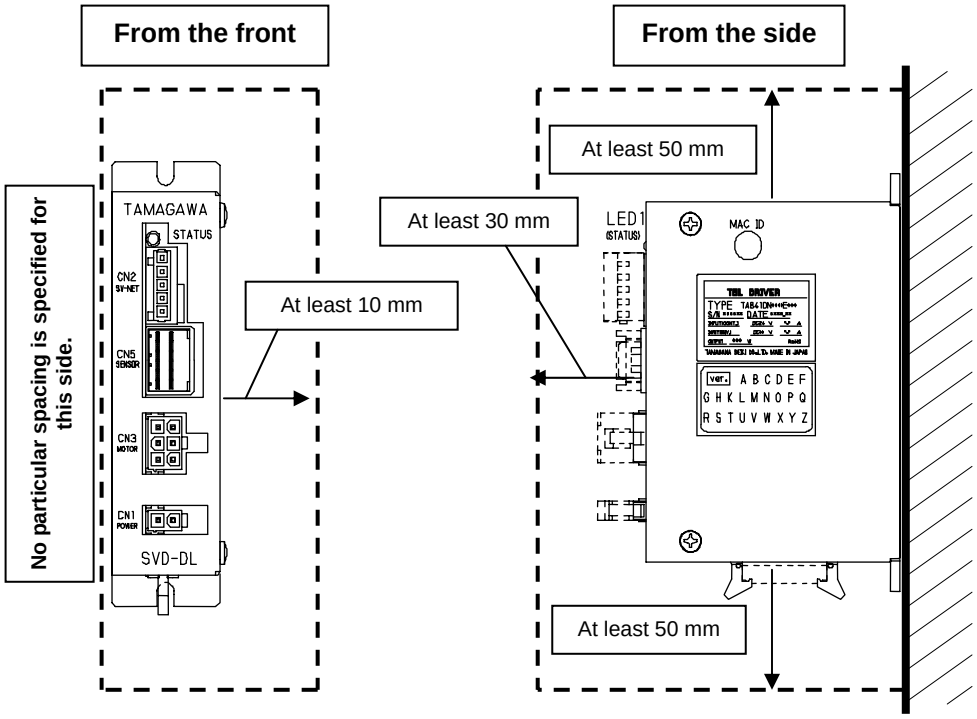


■ Open Frame



■ Installation spacing from other equipment

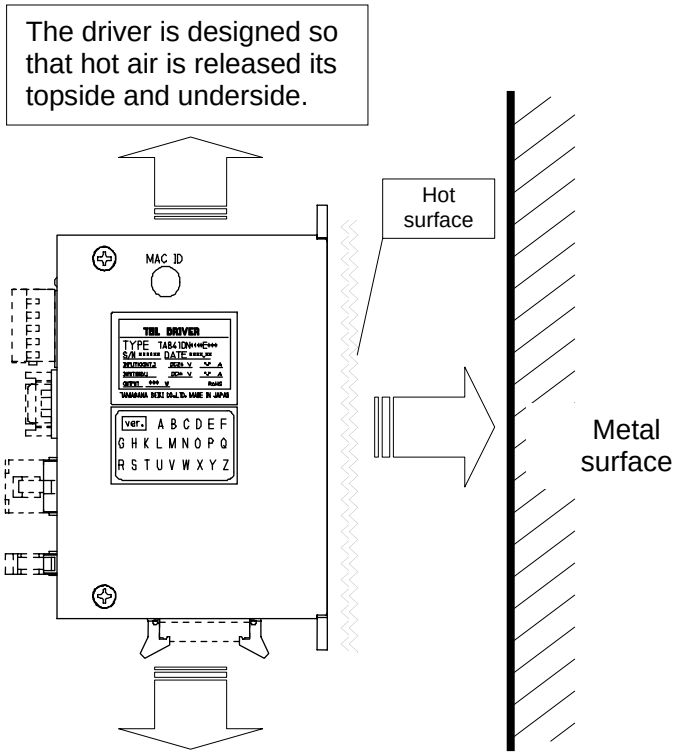
Unless otherwise specified, install the driver at the spacings from other equipment specified here.



■ Measures to cool the driver

Repeatedly running the driver close to its ratings results in more heat being generated. In such cases, appropriate measures to cool the driver need to be taken because, in environments in which heat is easily accumulated such as a closed space, a temperature error may be detected.

- Install a cooling fan or ventilation opening.
- Install the driver on a metal surface, which provides greater heat dissipation.



12. Setting the Load Inertia

Set the load inertia with the motor installed on the load (equipment). Load inertia can be set either manually or by using auto tuning. Auto tuning is effective for a load with high rigidity. Manual setting is recommended for loads of low rigidity.

Caution! In load inertia auto tuning, it may not be possible to estimate the load inertia correctly depending on how the installed equipment is driven.

Caution! When performing this setting after the driver has been used with pulse and analog signal inputs, operate with commands sent from SV-NET by setting ID 75 “Speed Command Select” and ID 74 “Position Command Select” to 0.

Setting with Auto Tuning

For a load with high rigidity, good servo performance can only be obtained by estimating the load inertia using auto tuning. In auto tuning, the motor alternates rotation between the forward (CW) and negative (CCW) directions.

If performing an adjustment using auto tuning, it is recommended that you start with all parameters set to their factory settings. Follow the steps below:

Step	Operation																
	ID	Parameter name	Setting value														
(1)	Set the control mode to auto tuning.																
	31	Control Mode	5														
(2)	Set the speed loop proportional gain for auto tuning. For a high load, however, the setting will need to be changed. ▣ ID 145 “Tuning-KV” Details ⇒ P. 51																
	145	Auto Tuning-KV	500 (factory setting)														
(3)	Servo ON. Servo ON starts auto tuning.																
	30	Servo Command	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 auto 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 ID 59 the “Load Inertia” parameter.

Caution! In auto tuning, servo ON sets the motor to alternate between rotating in a forward (CW) and negative (CCW) direction.
Before operating, check the environment surrounding the motor is safe and then set the servo ON.

Setting Manually

To set the load inertia manually, set it directly in the ID 59 “Load Inertia” parameter.

ID	Parameter name	Description	Factory setting	Setting range
59	Load Inertia	[gcm^2]	0	0 - 3000

Note: If the load inertia cannot be estimated

For efficient adjustment, perform auto tuning and then increase/decrease the setting based on the estimated value.

Checking the Set Load Inertia

Perform the following steps to check the set value. To check, 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	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	Command Velocity	3000														
(4)	Set the rotation speed to 0 rpm. Monitor the state of the load after rotation has stopped.																
	37	Command Velocity	0														

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

If there is no overshoot (stop after 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 after the load inertia has been set to a value at which less overshoot and vibration occur, adjust the control gain as described in the next chapter.

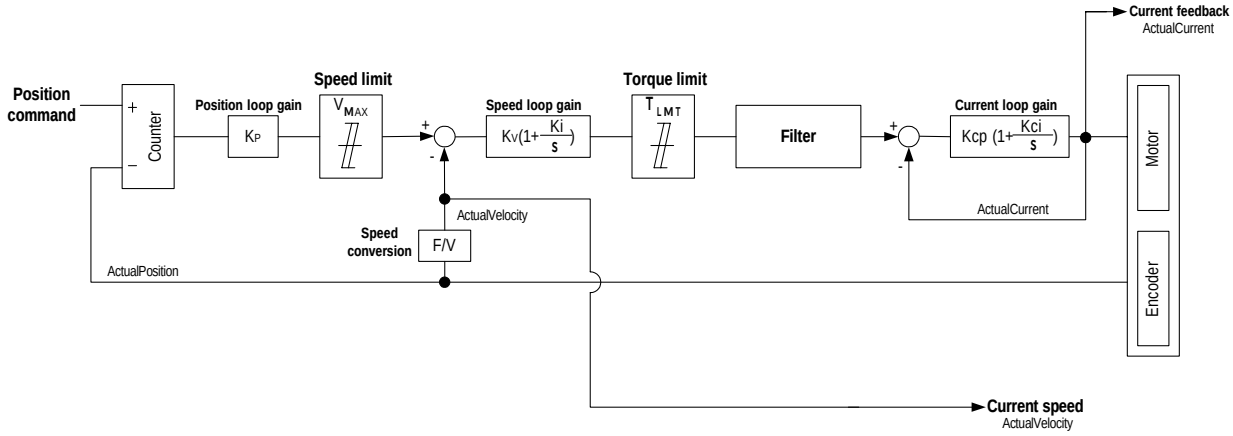
13. Control Gain Adjustment

After the motor has been installed on equipment, various kinds of gains need to be adjusted for the TBL-V Driver to be used under optimal conditions. The control gains set at the factory are set with the focus on ensuring safe operation. Adjust control 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 (stop after target has been passed) or vibration.

Caution!

When re-adjusting gains, operate with commands sent from SV-NET by setting ID 75 “Speed Command Select” and ID 74 “Position Command Select” to 0.

Servo Block Diagram



■ List of corresponding parameters to be set

Name	Symbol	Corresponding parameters to be set	
		ID	Name
Position loop gain	Kp	50/60	Kp1/Kp2 *
Speed loop gain	Kv	51/61	Kv1/Kv2 *
	Ki	52/62	Ki1/Ki2 *
Current loop gain	Kcp	56	Kcp1
	Kci	57	Kci1
Speed limit	VMAX	88	Speed limit
Torque limit	TLMT	86	Forward-rotation current limit
		87	Negative-rotation current limit
Filter	-	53	LPF-f
		54	NF-f
		55	NF-d

* Kp, Kv, and Ki can be automatically switched to Gain 2 Kp2, Kv2, and Ki2 by the setting value of “Gain-Switch Method Select” (ID 80).

Control Gain

Adjust each of the basic control gains: speed loop proportional gain, speed loop integral gain, and position loop proportional 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 to approximately 80% of the limit value, keeping in mind variations between equipment.

■ Speed loop integral gain (Ki*)

This gain also 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, if increased by too much, the response results in vibration.

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 you wish to reduce the positioning time. Set to the highest value within the range that causes no vibration.

■ Position loop proportional gain (Kp*)

The position loop proportional gain cannot be increased more than the speed loop response. Therefore, before adjusting the position loop proportional gain, adjust the speed loop gain using the speed control mode.

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

■ Optimal control gain adjustment

Achieving optimal servo gains has the benefit of the motor stopping without an overshoot or any vibration when it is stopped during high-speed rotation. Also, the three basic gains are adjusted to their highest possible values.

Cautions for control gain adjustment

(1) The optimal servo gain value varies greatly according to the state of the load. Re-adjustment is required if the load conditions change.
(2) The equipment may vibrate intensely during gain adjustment. Perform adjustment only if the servo or the power can be turned off immediately.

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

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

Follow the steps below to rotate the motor and check its state after rotation stops.

Note: The steps shown in the following table should be performed when ID 30 "Servo Command" Bit 7 "Acceleration limit ON" has been set to OFF. If it is set to ON, set "30000" in ID 35 "Deceleration."

Step	Operation																
	ID	Parameter name	Setting/read value														
(1)	Set the control mode to speed control.																
	31	Control Mode	2														
(2)	Servo ON.																
	30	Servo Command	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	Command Velocity	3000 (rpm)														
(4)	Set the rotation speed to 0 rpm. Monitor the state of the load after rotation has stopped.																
	37	Command Velocity	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 causes a vibration to start, which may enable you to increase the speed loop proportional gain (Kv1). Also refer to "Filter Adjustment" on page 67.

Note: More reliable gain adjustment can be achieved by adjusting gains while checking servo rigidity, such as by adding a force to the load when the motor is not operating.

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	125	0 - 2000
53	LPF-f	Low-pass filter cutoff frequency (Hz)	1000	0 - 1000

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

After optimal gains have been set in speed control mode, use position control mode to check there is no vibration after rotation stops. Follow the steps below to rotate the motor and check its state after rotation stops.

Step	Operation																
	ID	Parameter name	Setting value														
(1)	Set the control mode to position control.																
	31	Control Mode	1														
(2)	Reset the position. Set the current position to "0."																
	30	Servo Command	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 locks the motor shaft.																
	30	Servo Command	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: Forward direction (CW) 100 rotations, sensor position resolution 2048 (1/rev))																
	32	Target Position	204800														
(5)	Set the target speed. Set to 3000 rpm.																
	33	Target Velocity	3000 (rpm)														
(6)	Set acceleration and deceleration. Set to 300000 rpm/sec.																
	34	Acceleration	30000 (10 rpm/sec)														
(7)	Profile ON. Start rotation. The motor stops at the set position. Monitor the state.																
	30	Servo Command	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	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

Note: In profile operation, acceleration and deceleration are based on the value set in ID 34 "Acceleration."

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
53	Kp1	Speed loop proportional gain 1	1000	0 - 799

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 this filter properly can further improve servo gains. The setting range for the cutoff frequency is usually approximately 100 to 300 (Hz). Setting this value to "0" shuts off current command outputs and disables the motor.

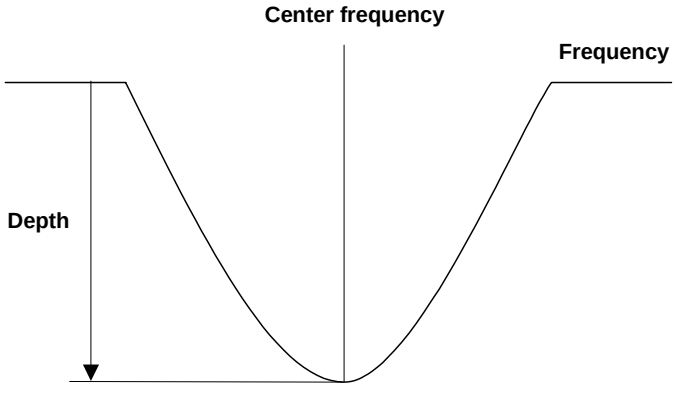
ID	Parameter name	Description	Factory setting	Setting range
53	LPF-f	Low-pass filter cutoff frequency (Hz)	1000	0 - 1000

■ Adjusting the notch filter

When increasing the control gains for the equipment resonance system is difficult, using the notch filter has the effect of attenuating specific resonance frequencies, suppressing resonance without losing system response.

- The center frequency and attenuation of the notch filter can both be adjusted.
- Setting the values of ID 55 to "0" disables each notch filter.
- An attenuation level of 32767 corresponds to an attenuation of –3 dB.

ID	Parameter name	Description	Factory setting	Setting range
54	NF-f	Notch filter 1 center frequency (Hz)	1000	0 - 1000
55	NF-d	Notch filter 1 attenuation	0	0 - 32767



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. Switching between Gain 1 Kp1, Kv1, and Ki1 and Gain 2 Kp2, Kv2, and Ki2 by using the setting value conditions set in ID 80 "Gain-Switch Method Select" can improve control performance.

■ 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 2

■ 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

■ Selecting the gain-switch method

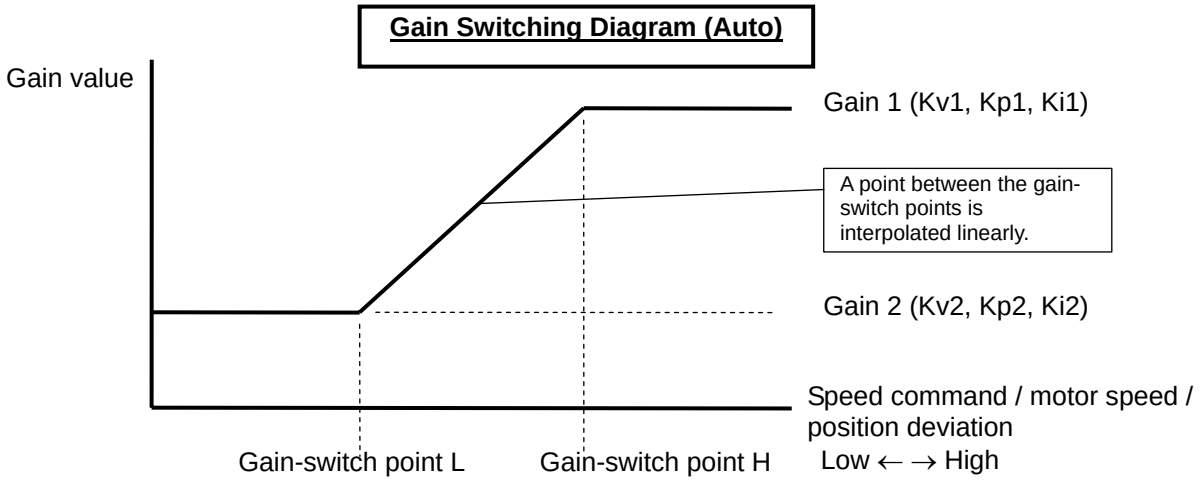
ID	Parameter name	Setting value	Description
80	Gain-switch method select	0	No switching (fixed to gain 1)
		1	Automatically switched by speed command
		2	Automatically switched by motor speed
		3	Automatically switched by position deviation
		4	Switched by I/O input command
		5	Switched by ServoCommand Bit 11
		9	No switching (fixed to gain 2)

* The factory setting is 0: no switching (fixed to gain 1).

■ Gain-switch point

The gain-switch point is enabled when ID 80 "Gain-Switch Method Select" is set to a value from 1 to 3. The gain is switched to gain 1 if greater than gain-switch point H and switched to gain 2 if smaller than gain-switch point L. For an in-between point, switching takes place smoothly while interpolating between gain 1 and 2.

ID	Parameter name	Description	Factory setting	Setting range
81	GainChangePoint_H	Gain-switch point H [rpm] or [pulse] The input is in [rpm] if ID 80 "Gain-Switch Method Select" is set to 1 or 2 and [pulse] if it is set to 3.	50	0 - 32767
82	GainChangePoint_L	Gain-switch point H [rpm] or [pulse] The input is in [rpm] if ID 80 "Gain-Switch Method Select" is set to 1 or 2 and [pulse] if it is set to 3.	4	0 - 32767



ID 80 setting value	ID switching point	Gain used
1: Speed command base 2: Motor speed base 3: Position deviation base	Gain-switch point H	Gain 1
	Between gain-switch points H and L	Value linearly interpolated
	Gain-switch point L	Gain 2

■ Switching the gain of "Servo Command"

To switch the gain using Bit 11 "Gain Change" of ID 30 "Servo Command," set "5" in ID 80 "Gain-Switch Method Select."

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

ON (1): Gain 2

OFF (0): Gain 1

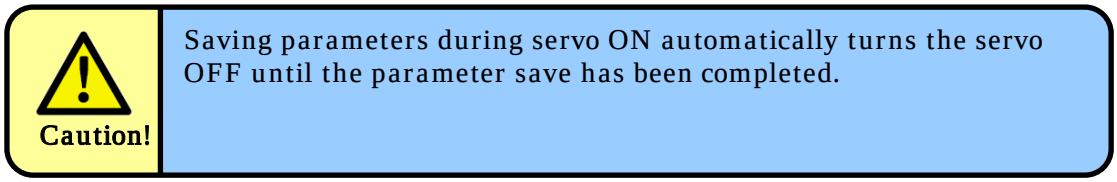
Saving Parameters

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 by position, speed, and torque command selection, use the ID 74 “Position Command Select,” ID 75 “Speed Command Select,” and ID 76 “Torque Command Select” parameters to pre-set the control method.
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

This operation saves parameters with ○ displayed in the “M” column of the parameter list to nonvolatile memory. Usually save parameters with the servo OFF. After the parameter save has been completed, the value returns to “0.”



14. Operation

Position Control Mode

The control operations available in position control mode are divided into three types.

1. Profile Operation

In this operation type, the driver calculates trapezoidal-path movement patterns by setting the target position, target speed, acceleration, deceleration, and other values. This method makes operation easy because the host controller does not need to calculate operation patterns. However, complex movements other than trapezoid-path movement patterns cannot be supported.

2. Real-Time Position Command

In this operation type, the host controller constantly sends position commands so that the driver can operate following those position commands. The host controller controls the driver by continuously sending a position command at specified time intervals. The motor operates at a constant speed if the change amount for the command is set to be constant; the motor accelerates and decelerates if it is set to be variable. Therefore, the host controller controls speed, acceleration, and deceleration. The real-time position command is capable of fast and complex movements, but to control the motor steplessly and smoothly, the host controller needs to perform somewhat advanced calculations.

3. 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 for the host controller to control by means of a pulse signal sent from the sequencer.

This chapter describes the general operational procedures for each operation type.

■ To run in profile operation

Step	Description																
	ID	Parameter name	Setting/read value														
(1)	Set the control mode to position control.																
	31	Control Mode	1														
(2)	Set to servo ON (ID 30; Bit 0: ON). Servo ON fixes the motor shaft.																
	30	Servo Command	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)	Read the current position.																
	40	Actual Position	(pulse)														
(4)	Set the target position.																
	32	Target Position	Value in which the move distance is added to the read current position (pulse)														
	Set the target speed.																
	33	Target Velocity	(rpm)														
	Set acceleration and deceleration.																
	34	Acceleration	(10 rpm/sec)														
(5)	Set to profile ON (ID 30; Bit 1: ON). Move starts.																
	30	Servo Command	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
(6)	Monitor “In profile operation” (ID 20, Bit: 1) in “Servo Status” during operation.																
	20	Servo Status	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)	Move ends. ID 20 “Profile operation in progress” (Bit 1) changes to “0.” To perform another move, input ID 32 “Target Position” after ID 20 “Profile operation in progress” (Bit 1) changes to “0.” Entering the stop position range sets ID 20 “In Position” (Bit 2) to ON.																
	20	Servo Status	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	1	0	1

Note: In profile operation, acceleration and deceleration are based on the value set in ID 34 “Acceleration.”

■ To run with a real-time position command

Step	Description																
	ID	Parameter name	Setting/read value														
(1)	Set the control mode to position control.																
	31	Control Mode	1														
(2)	Set to servo ON (ID 30; Bit 0: ON). Servo ON fixes the motor shaft.																
	30	Servo Command	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)	Check the current position.																
	40	Actual Position	(pulse)														
(4)	Set the real-time position command.																
	36	Command Position	(pulse)														
(5)	Repeatedly input ID 36 “Command Position.” In such a case, the host 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	1														
(2)	Set the pulse input type (refer to page 74 for pulse input signal types).																
	120	Pulse Input Signal Mode Select	0: F-Pulse and R-Pulse mode 1: Pulse and Direction mode *: The polarity is reversed when Bit 7 is 1.														
(3)	Set the control mode to position control.																
	31	Control Mode	1														
(4)	Parameter save. Save the pulse input setting.																
	17	Parameters save	1														
(5)	Set to servo ON (ID 30; Bit 0: ON). Servo ON fixes the motor shaft.																
	30	Servo Command	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
(6)	Inputting the pulse selected in ID 120 “Pulse Input Signal Mode Select” through the I/O connector starts rotation. In such a case, the host system generating the pulse controls speed, acceleration, and deceleration.																

Other related items

ID 121, ID 122 “Setting the pulse input signal resolution,” ID 78 “Smoothing function select,” ID 79 “Smoothing time constant,” counter reset, etc.

Pulse Input Signal Types

ID	Parameter name	Setting value
120	Pulse Input Signal Mode Select	0: Forward-pulse and reverse-pulse mode 1: Pulse and Direction mode *: The polarity is reversed when Bit 7 is 1.

When operating the motor with the pulse that is input from the I/O connector as the position command signal, setting "Pulse Input Signal Mode Select" makes it possible to select from two types of pulse input signal.

This section describes the pulse input signal based on the assumption that the ID 72 "Reference Direction" setting has been set to its factory setting of "0" (forward direction [CW]).

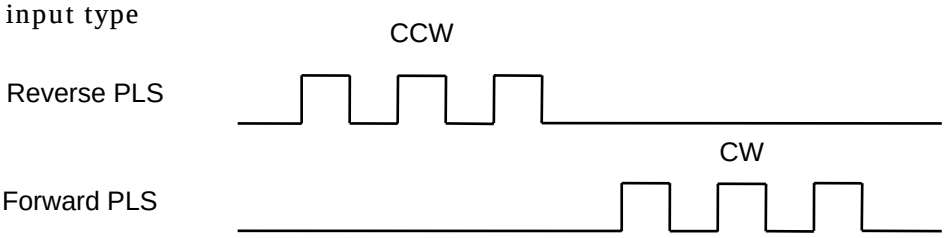
Note: The driver determines the timing by counting the pulse falls.

■ Forward-pulse and reverse-pulse mode

○ I/O connector input pin

PIN No.	Function	
3	Reverse-PLS+	Reverse-direction command input pulse +
4	Reverse-PLS-	Reverse-direction command input pulse -
5	Forward-PLS+	Forward-direction command input pulse +
6	Forward-PLS-	Forward-direction command input pulse -

○ Pulse input type

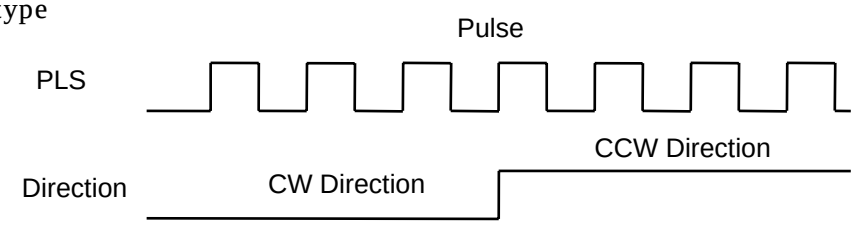


■ Pulse and Direction mode

○ I/O connector input pin

PIN No.	Function	
3	Direction+	Rotation-direction signal +
4	Direction-	Rotation-direction signal -
5	PLS+	Input pulse +
6	PLS-	Input pulse -

○ Pulse input type



Setting the Pulse Input Signal Resolution

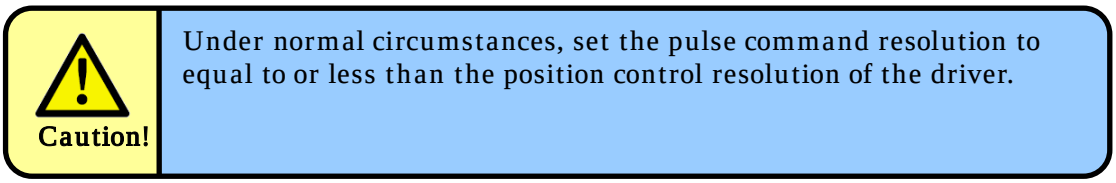
ID	Parameter name	Factory setting	Setting range
121	Pulse Input Signal Resolution: numerator (pulse)	2048	1 - 32767
122	Pulse Input Signal Resolution: denominator (pulse)	1	1 - 255

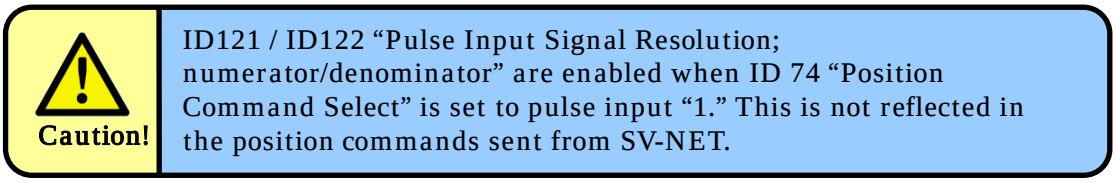
* Factory setting: 2048 (pulse/rev.)

When operating with position control pulse inputs, changing the data in “Pulse Input Signal Resolution: numerator” and “Pulse Input Signal Resolution: denominator” can change the pulse input signal resolution. The pulse command resolution per rotation (pulse/rev.) can be determined with the following equation:

Pulse command resolution per rotation (pulse/rev.) =

(Pulse input signal resolution: numerator) ÷ (Pulse input signal resolution: denominator)





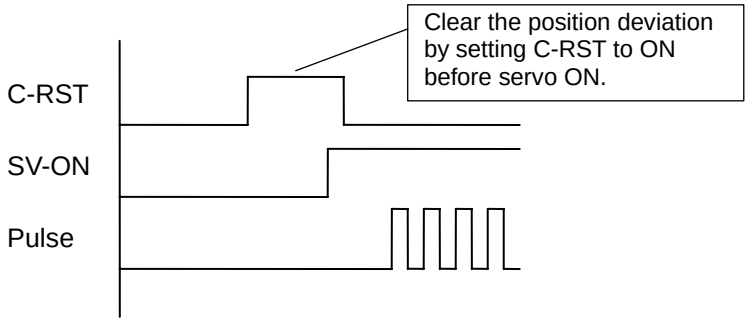
Counter Reset

I/O connector

PIN No.	Function	
10	C-RST	Counter reset

Used mainly to operate using position control pulse inputs. Setting Counter Reset to ON sets the position information counter to "0." Setting Counter Reset to ON during pulse input stops motor rotation. Until set to OFF, the position information remains fixed at 0. Before starting operation using position control pulse inputs, it is recommended that the servo be turned on after the Counter Reset has been set to ON in order to avoid a position deviation error.

■ Example of counter reset use



Position Control Pulse Input Unlimited Rotation Function

ID	Parameter name	Setting							
		B7	B6	B5	B4	B3	B2	B1	B0
73	Position FB Select	1	0	0	0	0	0	0	0

Setting Bit 7 of ID 73 "Position FB Select" to ON enables the unlimited rotation function. If Bit 7 of ID 73 is set to OFF and the motor is continuosly rotated in one direction by position control pulse inputs, overflowing of the position data results in a multi-rotation error, stopping rotation.

Speed Control Mode

Speed control operation has two control types.

1. Running by setting real-time speed commands

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

2. Running with a speed command analog signal that is input from the I/O connector

■ To run with a real-time speed command

Step	Operation																
	ID	Parameter name	Setting/read value														
(1)	Set the control mode to speed control.																
	31	Control Mode	2														
(2)	Set ID 30 Bit7 “Acceleration limit ON” to ON. Enable ID 34 and ID 35.																
	30	Servo Command	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
(3)	Servo ON. Servo ON fixes the motor shaft. (*1)																
	30	Servo Command	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
(4)	Set the acceleration.																
	34	Acceleration	(10rpm/sec)														
(5)	Set the deceleration.																
	35	Deceleration	(10rpm/sec)														
(6)	Set the real-time speed command. Rotation starts.																
	37	Command Velocity	(rpm)														
(7)	To stop, set the rotation speed to 0 rpm.																
	37	Command Velocity	0														

(*1) Turning the servo ON automatically sets ID 37 “Command Velocity” to “0.”

Note: For smooth acceleration/deceleration with real-time speed commands, setting ID 30 “Servo Command” Bit 7 “Acceleration limit ON” to ON enables the setting of ID 34 “Acceleration” and ID 35 “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 in which the analog input is converted into speed. (factory setting: 6000 rpm) The value to be set is the speed (rpm) at 10 V (full scale) where 0 V is standard. Example: 3000 rpm at 5 V if "6000" is set.		
	130	Analog input speed conversion scale value	(rpm)
(2)	Input the analog input signal targeted to be 0 speed (standard) to the I/O connector (PIN No. 2). Example: 3000 rpm at 5 V if ID 130 is set to "6000" where 0 V is standard. Example: 3000 rpm and -3000 rpm at 10 V and 0 V, respectively, where 5 V is standard, if ID 130 is set to "6000."		
(3)	Start measuring the analog input offset value. Set "Analog input offset adjustment" (ID 30, Bit 8) to ON.		

30	Servo Command	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 ID 132 "Analog Input Offset."		
(5)	Save the set speed conversion scale value and offset.		
	17	Parameters save	1

2. Running by inputting an analog signal

Step	Description		
	ID	Parameter name	Setting/read value
(1)	Set speed command select to analog signal input.		
	75	Speed command select	1 (Analog signal polarity is reversed when Bit 7 is 1.)
(2)	Set the control mode to speed control.		
	31	Control Mode	2
(3)	Parameter save. Save the set values. After power has been restored, the motor can be operated by performing operations (4) to (6).		
	17	Parameters save	1
(4)	Input an analog signal of 0 speed (standard) from the I/O connector (PIN No. 2).		
(5)	Set to servo ON (ID 30; Bit 0: ON). Servo ON fixes the motor shaft.		

30	Servo Command	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

(6)	Start rotation by changing the voltage. In such a case, the host system generating the analog signal controls speed, acceleration, and deceleration.		

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 torque.

1. Running by setting real-time current commands

   This control type operates the motor with current commands sent from the host controller. When the command current value sent from the host controller is received, the motor starts to rotate and the current is maintained. By continuously changing the speed, the current can be controlled.

2. Running with a current command analog signal that is input from the I/O connector

■ To run with a real-time current command

Step	Operation																
	ID	Parameter name	Setting/read value														
(1)	Set the control mode to current control.																
	31	Control Mode	3														
(2)	Servo ON. In current control mode, the motor shaft is not fixed (*1).																
	30	Servo Command	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 real-time current command. Rotation starts.																
	38	Command Current	(0.01A)														

(*1) Turning the servo ON automatically sets ID 38 “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

Step	Operation		
	ID	Parameter name	Setting/read value
(1)	Set the scale value in which the analog input is converted into current. Factory setting: 1800 (0.01 Arms) The value to be set is the current (Arms) at 10 V (full scale) where 0 V is standard. Example: 9 Arms at 5 V if “1800” is set.		
	131	Analog input current conversion scale value	(0.01Arms)
(2)	Input the analog input signal targeted to be 0 speed (standard) to the I/O connector (PIN No. 2). Example: 9 Arms at 5 V if ID 130 is set to “1800” where 0 V is standard. Example: 9 Arms and -9 Arms at 10 V and 0 V, respectively, where 5 V is standard, if ID 130 is set to “1800.”		
(3)	Start measuring the analog input offset value. Set ID 30 “Analog input offset adjustment” (Bit 8) to ON.		
	30	Servo Command	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 ID 132 “Analog Input Offset.”		
(5)	Save the set current conversion scale value and the offset.		
	17	Parameters save	1

2. Running by inputting an analog signal

Step	Description		
	ID	Parameter name	Setting/read value
(1)	Set torque command select to analog signal input.		
	76	Torque Command Select	1 (Analog signal polarity is reversed when Bit 7 is 1.)
(2)	Set the control mode to torque control.		
	31	Control Mode	3
(3)	Parameter save. Save the set values.		
	17	Parameters save	1
(4)	Input an analog signal of 0 speed (standard) from the I/O connector (PIN No. 2).		
(5)	Set to servo ON (ID 30; Bit 0: ON). In current control mode, the motor shaft is not fixed.		
	30	Servo Command	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
(6)	Start rotation by changing the voltage.		

Homing Mode (Origin Return)

The homing mode performs the origin return operation. The origin return operation has two methods: use of an origin signal and use of the mechanical stopper. The origin return with an origin signal is divided into three operations.

■ Origin return with an origin signal

Position preset by origin signal & motor point 0

After an origin signal is detected, the position is moved to the 0-point position of the closest motor, setting the current position data to the value set in ID 91 “Preset Value.”

For origin signal detection, origin detection by I/O and origin detection by SV-NET communication can be used.

Position preset by immediate stop with origin signal

After an origin signal is detected, operation stops immediately, setting the current position data to the value set in ID 91 “Preset Value.”

For origin signal detection, origin detection by I/O and origin detection by SV-NET can be used.

Position preset by use of homing until the input origin signal is canceled

After an origin signal is detected, rotation is effected in the reverse direction and homing continues until the origin signal is canceled, setting the current position data to the value set in ID 91 “Preset Value.”

For origin signal detection, origin detection by I/O and origin detection by SV-NET can be used.

How to detect the origin

Detecting an origin signal by I/O:

Detect by assigning the home sensor input to any of the ID 100 to 105, the I/O setting parameters.

⇒ ▣ “Parameters for Setting I/O (Input)” P. 47

Detecting an origin signal by host controller:

Detect by the host controller’s setting Bit 13 “Home Sensor Arm” in ID 30 “Servo Command,” the control command parameter. ⇒ ▣ “Control Command Parameters” P. 41

■ Origin return by mechanical stopper

At the far end of the mechanical stopper, set the current position data to the value set in ID 91 “Preset Value.” Thrust time and torque can be set.

■ Origin return with an origin signal (origin detection by I/O)

<table>
<tr><th>Step</th><th colspan="3">Description</th></tr>
<tr><th></th><th>ID</th><th>Parameter name</th><th>Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="3">Select the homing type by setting to origin return with an origin signal.</td></tr>
<tr><td></td><td>90</td><td>Homing Type</td><td>0: Position preset by origin signal & motor point 0
2: Position preset by immediate stop with origin signal
3: Position preset by use of homing until the input origin signal is canceled.</td></tr>
<tr><td>(2)</td><td colspan="3">Set the position set by homing operation.</td></tr>
<tr><td></td><td>91</td><td>Preset Value</td><td>(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 (CW)
1: Negative direction (CCW)</td></tr>
<tr><td>(4)</td><td colspan="3">Set the homing start speed.</td></tr>
<tr><td></td><td>93</td><td>Homing Speed</td><td>(rpm)</td></tr>
<tr><td>(5)</td><td colspan="3">Set the origin detection speed.</td></tr>
<tr><td></td><td>94</td><td>Creep Speed</td><td>(rpm)</td></tr>
<tr><td>(6)</td><td colspan="3">Use the I/O setting (input) to assign Home Sensor to any of IN1 to IN6.</td></tr>
<tr><td></td><td>100 ~ 105</td><td>Setting IN1 to IN6</td><td>1
Negative logic (usually ON) is set when Bit 7 is 1.</td></tr>
<tr><td>(7)</td><td colspan="3">Set to homing mode.</td></tr>
<tr><td></td><td>31</td><td>Control Mode</td><td>4</td></tr>
<tr><td>(8)</td><td colspan="3">Set to servo ON (ID 30; Bit 0: ON). Homing mode starts.</td></tr>
<tr><td></td><td>30</td><td>Servo Command</td><td>
<table>
<tr><th>B15</th><th>B14</th><th>B13</th><th>B12</th><th>B11</th><th>B10</th><th>B9</th><th>B8</th><th>B7</th><th>B6</th><th>B5</th><th>B4</th><th>B3</th><th>B2</th><th>B1</th><th>B0</th></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>
</table>
</td></tr>
<tr><td>(9)</td><td colspan="3">[Selecting the position preset by origin signal & motor point 0]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin point is detected, the position returns to the 0-point position (origin position) of the closest motor at the speed set in ID 94 “Creep Speed.” The position is set to the value set in ID 91 “Preset Value” at the motor 0-point position.
[Selecting the position preset by immediate stop at origin position]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin signal is detected, the move stops immediately. The position is to with the value set in ID 91 “Preset Value.”
[Selecting the position preset by use of homing until the input origin signal is canceled]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin signal is detected, rotation is effected in the reverse direction and homing continues at the speed set in ID 94 “Creep Speed” until the origin signal is canceled. Then, the position is set to the value set in ID 91 “Preset Value.”
[Finishing an origin return and saving the setting]
After homing finishes, ID 30 “Control Mode” is set to position control “1.” To save the homing setting, refer to “Saving Parameters” on page 86 to save the parameters.</td></tr>
</table>

■ **Origin return with an origin signal (origin detection by SV-NET)**

<table>
<tr><th>Step</th><th colspan="3">Description</th></tr>
<tr><th></th><th>ID</th><th>Parameter name</th><th>Setting/read value</th></tr>
<tr><td>(1)</td><td colspan="3">Select the homing type by setting to origin return with an origin signal.</td></tr>
<tr><td></td><td>90</td><td>Homing Type</td><td>0: Position preset by origin signal & motor point 0
2: Position preset by immediate stop with origin signal
3: Position preset by use of homing until the input origin signal is canceled.</td></tr>
<tr><td>(2)</td><td colspan="3">Set the position set by homing operation.</td></tr>
<tr><td></td><td>91</td><td>Preset Value</td><td>(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 (CW)
1: Negative direction (CCW)</td></tr>
<tr><td>(4)</td><td colspan="3">Set the homing start speed.</td></tr>
<tr><td></td><td>93</td><td>Homing Speed</td><td>(rpm)</td></tr>
<tr><td>(5)</td><td colspan="3">Set the origin detection speed.</td></tr>
<tr><td></td><td>94</td><td>Creep Speed</td><td>(rpm)</td></tr>
<tr><td>(6)</td><td colspan="3">Set to homing mode.</td></tr>
<tr><td></td><td>31</td><td>Control Mode</td><td>4</td></tr>
<tr><td>(7)</td><td colspan="3">Set to servo ON (ID 30; Bit 0: ON). Homing mode starts.</td></tr>
<tr><td></td><td rowspan="2">30</td><td rowspan="2">Servo Command</td><td>B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0</td></tr>
<tr><td>0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1</td></tr>
<tr><td>(8)</td><td colspan="3">Setting “Home Sensor Arm” (ID 30; Bit 13: ON) detects the origin position.</td></tr>
<tr><td></td><td rowspan="2">30</td><td rowspan="2">Servo Command</td><td>B15 B14 B13 B12 B11 B10 B9 B8 B7 B6 B5 B4 B3 B2 B1 B0</td></tr>
<tr><td>0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 1</td></tr>
<tr><td>(9)</td><td colspan="3">[Selecting the position preset by origin signal & motor point 0]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin point is detected, the position returns to the 0-point position (origin position) of the closest motor at the speed set in ID 94 “Creep Speed.” The position is set to the value set in ID 91 “Preset Value” at the motor 0-point position.
[Selecting the position preset by immediate stop at origin position]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin signal is detected, the move stops immediately. The position is to with the value set in ID 91 “Preset Value.”
[Selecting the position preset by use of homing until the input origin signal is canceled]
The move starts at the speed set in ID 93 “Homing Speed.” After an origin signal is detected, rotation is effected in the reverse direction and homing continues at the speed set in ID 94 “Creep Speed” until the origin signal is canceled. Then, the position is set to the value set in ID 91 “Preset Value.”
[Finishing an origin return and saving the setting]
After homing finishes, ID 30 “Control Mode” is set to position control “1.” To save the homing setting, refer to “Saving Parameters” on page 86 to save the parameters.</td></tr>
</table>

■ Origin return by mechanical stopper

Step	Description		
	ID	Parameter name	Setting/read value
(1)	Select the homing type by setting to origin return by the mechanical stopper.		
	90	Homing Type	1: Mechanical stopper origin return
(2)	Set the position set by homing operation.		
	91	Preset Value	(pulse)
(3)	Set the homing start direction.		
	92	Homing Start Direction	0: Forward direction (CW) 1: Negative direction (CCW)
(4)	Set the homing start speed.		
	93	Homing Speed	(rpm)
(5)	Set the thrust time.		
	95	Thrust Time	(msec)
(6)	Set the thrust torque.		
	96	Thrust Torque	(0.01A)
(7)	Set to homing mode.		
	31	Control Mode	4
(8)	Set to servo ON (ID 30; Bit 0: ON). Homing mode starts.		

30	Servo Command	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

(9)	After origin return by the mechanical stopper starts, the move starts at the speed set in ID 93 “Homing Speed.” The location is thrust by the mechanical stopper according to the setting in ID 95 “Thrust Time” and ID 96 “Thrust Torque,” and then operation stops. The stopped position is set for the value in ID 91 “Preset Value.” After origin return finishes, ID 30 “Control Mode” is set to “0,” servo OFF. To save the setting after checking the homing operation, refer to “Saving Parameters” on page 86 to save the parameters.

Checking 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	B0: Servo ON B1: Profile operation in progress B2: In Position B3: Fault state B4: Forward Limit B5: Reverse Limit B6: Torque limit B7: Speed limit B8: Position excessive deviation B10 : Homing operation in progress B11: Gain select	ON when servo ON ON during profile operation ON at the stop position in profile operation ON if stopped by detection of an alarm ON if exceeding the forward-direction move limit position ON if exceeding the negative-direction move limit position ON if the current exceeds the limit value ON if the speed exceeds the limit value ON if the position deviation exceeds the limit value ON if during homing ON if switched to gain 2
	It is recommended that you always monitor these parameters, which can detect an alarm by monitoring the fault status, even during operation.		
21	I/O Status	B0 - B5 B8 - B10	IN1 - IN6 OUT1 - OUT3
	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 “Alarm Detection” on page 92.		
40	Actual Position	Current position [pulse]	
	Can be read at anytime to check the in-operation position.		
41	Actual Velocity	Current speed [rpm]	
	Can be read at anytime to check the in-operation speed.		
42	Actual Current	Feedback current [0.01 A]	
	Can be read at anytime to check the in-operation current.		

■ Special servo feedback parameters

ID	Parameter name	Description					
		Byte5	Byte4	Byte3	Byte2	Byte1	Byte0
43	Actual PVC	ID40 “Actual Position” Lower-order 2 bytes [pulse]		ID41 “Actual Velocity” [rpm]		ID42 “Actual Current” [0.01A]	
44	Actual SVC	ID45 “Sensor Position1” Lower-order 2 bytes [pulse]		ID41 “Actual Velocity” [rpm]		ID42 “Actual Current” [0.01A]	

15. Parameter Functions

Saving Parameters

ID	Parameter name	Setting value
17	Parameters save	1

Save parameters to nonvolatile memory. Savable parameters are marked with ○ in the "M" column in 8. "Parameters" on page 40. Usually save parameters with the servo OFF. After the parameter save has been completed, the value in ID 17 returns to "0."

Caution!

- Note that if the control power supply is turned OFF without this operation having been performed, the changed parameter settings will be lost.
- Saving parameters during servo ON automatically turns the servo OFF until the parameter save has been completed.

Initializing Parameters

ID	Parameter name	Setting value
16	Parameters init	1

Initializes all parameters to their initial factory settings. Do not use this in non-standard models.

Initializing parameters does not save them to nonvolatile memory.

Caution!

Saving parameters using this operation overwrites all parameters. As a result, all settings that existed before initialization will be lost.

Servo ON <<"Servo Command" Bit 0>>

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

Setting ID 30 Bit 0 "Servo ON" to ON turns the servo ON. In position and speed control, the motor shaft is fixed. The servo ON signal can also be input from the I/O connector pin 13 (page 33).

Caution!

To set the servo ON, wait for at least two seconds after power has been turned on.

Profile Start <<"Servo Command" Bit 1>>

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

Use this parameter to operate by setting the target position for position control. After the servo has been turned ON by setting the target position, target speed, acceleration, and deceleration by SV-NET, setting ID 30 Bit 1 "Start Profile" to ON starts the profile operation.

Clearing a Position Error <<"Servo Command" Bit 2>>

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

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 ID 30 Bit 2 "Clear Position error" to ON maintains the current position by clearing the deviation from the command position. Setting "Clear Position error" 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.

Clearing an Alarm <<"Servo Command" Bit 3>>

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

Setting ID 30 Bit 3 "Clear Alarm" to ON clears an alarm. Set Alarm Clear after eliminating the cause of the problem. For details, refer to "Alarm Detection" on page 92.

Hard Stop <<"Servo Command" Bit 4>>

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

Set this parameter to stop the motor immediately during position control profile operation and SV-NET speed control operation.

When Hard Stop is ON, the motor does not rotate even when an operation command is given. Hard Stop is stopped using speed control.

Smooth Stop <<"Servo Command" Bit 5>>

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

Deceleration set in ID 35 "Deceleration" is used to stop the motor during position control profile operation and SV-NET speed control operation.

When Smooth Stop is ON, the motor does not rotate even when an operation command is given. Executing Smooth Stop, which is done using speed control, immediately before the completion of profile operation may overshoot the target position depending on the setting in ID 35 "Deceleration."

Selecting the Rotation Direction <<"Servo Command" Bit 6>>

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

Select the rotation direction using ID 30 Bit 6 "Direction."

ON (1): Negative direction

OFF (0): Forward direction

Acceleration/Deceleration Control during Speed Control <<"Servo Command" Bit 7>>

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

ID	Parameter name	Setting value	Factory setting	Setting range
34	Acceleration	[10 rpm/sec]	10000	0 - 32767 DEC
35	Deceleration	[10 rpm/sec]	10000	0 - 32767 DEC

Setting ID30 Bit 7 "Acceleration limit ON" to ON during speed control by SV-NET enables speed control acceleration and deceleration. Set acceleration in ID 34 "Acceleration" and deceleration in ID 35 "Deceleration."

Setting an Analog Command Signal Offset <<"Servo Command" Bit 8>>

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

Setting ID 30 Bit 8 "Analog Offset Adjust" to ON samples analog command signals for approximately 0.1 second. The average of these values is then set to ID 132 "Analog Input Offset." To set an analog command signal offset, set ID 30 Bit 8 "Analog Offset Adjust" to "ON" by inputting an analog signal equivalent to 0 speed.

Switching Control Gain <<"Servo Command" Bit 11>>

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

Setting ID 30 Bit 11 "Gain change" to ON switches gain to Gain 2. To switch the gain using "Gain Change," set "5" in ID 80 "Gain-Switch Method Select." For details on gain switching, also refer to "Gain-Switch Function" on page 66.

ON (1): : Gain 2

OFF (0): : Gain 1

Origin Detection <<"Servo Command" Bit 13>>

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

Use this parameter to use the host controller to detect an origin during an origin return in homing mode. When ID 30 Bit 13 "Home Sensor Arm" is set to ON, the signal is recognized as the origin signal. For details on origin return, refer to "Homing Mode" on page 79.

Current Position Reset《"Servo Command" Bit 14》

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

ID	Parameter name	Setting value	Factory setting	Setting range
39	Reset Position	(pulse)	0	00000000 - FFFFFFFF HEX

To reset the current position, set ID 30 Bit 14 "Position Reset" to ON, which sets the current position to the value for ID 39 the "Reset Position."

Servo OFF Delay Function

ID	Parameter name	Setting value	Factory setting	Setting range
143	Servo OFF Delay	Delay time (msec) before servo OFF	20	0 - 10000 DEC

When switching from servo ON to OFF, the time that elapses between when a servo OFF command is set to when the servo is actually turned OFF can be adjusted. When using the mechanical brake, the release time setting for the brake can be extended so that servo OFF is performed after the mechanical brake is released.

Setting the Smoothing Operation

ID	Parameter name	Setting value
78	Smoothing Function Select	1: With smoothing 0: No smoothing

ID	Parameter name	Setting value	Factory setting	Setting range
79	Smoothing time	Smoothing time (msec)	50	0 - 102 DEC

Set this parameter for smooth operation in position control. To enable this function, set "1" in ID 78 "Smoothing Function Select" and set the time (msec) in ID 79 "Smoothing Time Constant." Position commands over a set period of time are averaged to perform an operation close to an S-shape curve.

Defining the Forward Rotation Direction

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

The forward rotation direction can be changed to CCW by setting ID 72 “Reference Direction” to “1.”

Note that changing the “Reference Direction” also changes the position data.

Setting the Soft Limit Position

■ Positive-side position soft limit

ID	Parameter name	Setting value	Setting range
84	Positive-side soft limit	(pulse)	00000000 - FFFFFFFF HEX

■ Negative-side position soft limit

ID	Parameter name	Setting value	Setting range
85	Negative-side soft limit	(pulse)	00000000 - FFFFFFFF HEX

■ Setting soft limit enable/disable

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

A limit position can also be set by software so that the motor does not overshoot the specified position.

Servo OFF using SV-NET Communication Stop

The driver has a function which, for safety reasons, voluntarily turns the servo OFF if 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.

Set “0” to cancel this function. If canceled, the servo is not turned OFF even if communication ceases.

ID	Parameter name	Setting value	Setting range
148	Enable Off Time	(msec)	0 - 6000 DEC 0: Cancel

16. Alarm Detection

If an alarm is detected, the driver enters the fault state, turning 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.

How to Detect an Alarm

■ Checking using the LED

An alarm is displayed with the LED flashing red and/or green depending on the alarm status.

■ Detecting using the ID 20 “Servo Status” parameter

An alarm can be detected by monitoring ID 20 “Servo Status” Bit 3 “Fault state.” If an alarm is detected which results in a fault state, Bit 3 “Fault state” is set to ON.

ID	Parameter name	Setting															
		B15	B14	B13	B12	B11	B10	B9	B8	B7	B6	B5	B4	B3	B2	B1	B0
20	Servo Status	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0

■ Detecting with an alarm signal output using the I/O connector

An alarm can be detected using the ALM alarm signal output from the I/O2 connector pin 15, I/O (SVD-DL/Open Frame). ⇒ ▣ “Connecting the I/O 2 Connector, I/O (SVD-DL/Open Frame)” P. 31

Checking the Alarm Code

An alarm code can be checked using ID 22, the “Alarm Code” parameter, and the LED.

■ Checking using ID 22, the “Alarm Code” parameter

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

■ Checking using the LED

If an alarm is detected, an alarm code flashing red and green is displayed on the LED. To check the alarm code using the LED, count the number of times it flashes green and the number of times it flashes green.

Number of red flashes	The tens digit of the alarm code
Number of green flashes	The ones digit of the alarm code

List of Alarm Codes

Alarm code	Name	Description	Situation	Main cause	Corrective action
11	Over Current	Power drive area error, overcurrent	Occurs only when powering on.	Driver failure	Replace the driver.
			Occurs when servo is turned ON.	Motor wiring short	Check the motor wiring.
				Motor winding short	Replace the motor.
				Driver malfunction	Replace the driver.
			Occurs during acceleration/ deceleration.	Driver adjustment failure	Reduce the gain.
				Driver malfunction	Replace the driver.
21	Over Load	Overload alarm	The motor vibrates when servo ON or operation.	Adjustment failure	Re-adjust the gain.
			Occurs during acceleration/decelerati on.	High acceleration/deceleration	Reduce acceleration/ deceleration.
			Occurs during constant-speed rotation.	High load torque	Check installed equipment. Increase the motor size.
			Occurs when servo ON.	Motor wiring	Check the motor wiring.
31	Over Speed	Speed alarm	Occurs during operation.	Speed overshoot	Re-adjust the gain.
41	Counter Overflow	Multi-rotation error	Occurs during rotation.	The in-driver position counter has exceeded the specifications.	Allow the move distance from the origin to be within 7000000 hex counts. Initialize the sensor. Enable unlimited rotation.
42	Position excessive deviation	The deviation counter value has exceeded the set value	Occurs during pulse command input.	Pulse input without servo ON.	Check the servo ON signal.
				The Forward-LMT and Reverse-LMT signals have not been input or set.	Check the wiring and settings.
			Occurs during acceleration/ deceleration.	High acceleration/deceleration	Set to a lower acceleration/ deceleration.
51	Over heat	Error temperature detected in power drive area.	Occurs during operation.	Use under frequent overload conditions	Relax operation conditions.
				Ambient temperature high	Improve heat dissipation conditions by installing a fan, for example.
61 | 69	Sensor error	Alarm codes in the sixties are sensor alarms. Details vary according to the sensor type. See the alarm code list for each sensor. ⇒ ▣ “List of Sensor Alarm Codes” P. 95			

List of Alarm Codes

Alarm code	Name	Description	Situation	Main cause	Corrective action
71	Over Voltage	Drive voltage too high	Occurs during operation.	Inadequate degeneration capability	Insufficient power supply capacity Add a regeneration protective circuit to the power supply. Inadequate regeneration protection capability Reduce deceleration.
			Occurs when power is turned on.	Wrong voltage specification is used if detected when power is turned on.	Change the driver.
				Driver malfunction	Replace the driver.
			Sometimes detected when using regeneration and communication unit TA8413 with 48-V power supply specification.	The regeneration protection voltage is detected by the driver.	Increase the value set in ID 205 “Overvoltage Error Detection Voltage” (Max. 65 V).
72	Voltage Down	Drive voltage low	In operation	Insuffucient power supply capacity	Add a regeneration protective circuit to the power supply.
				Drive power supply line disconnection	
			When power turned on	Drive power supply line disconnection	Check the wiring.
91	Flash Memory Error	Nonvolatile memory read error	When power turned on	IC nonvolatile memory or CPU malfunction	Replace the driver.
92		Nonvolatile memory write error	During parameter save		
98	Hardware Error	CPU error	Occurs during operation.	Malfunction resulting from noise	Install noise filter.
			When power turned on	Driver failure	Replace the driver.
99	Parameters Error	Parameter error	During parameter save	Parameter values written in nonvolatile memory were incorrect. (No write executed).	Check changed parameter values.

Clearing an Alarm

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

Set Alarm Clear after eliminating the cause of the alarm problem.

List of Sensor Alarm Codes

■ Brushless resolver Smartsyn/Singlsyn

Alarm code	Name	Description	Situation	Main cause	Corrective action
61	Sensor Error	Sensor error	When power turned on	Detected when the resolver signal amplitude is low or line is disconnected.	Increase the sensor excitation voltage by one. Check the connection.
62				Detected when the resolver signal amplitude is too high.	Reduce the sensor excitation voltage by one.

■ Encoder wiring-saving INC 2048CT

Alarm code	Name	Description	Situation	Main cause	Corrective action
62	Sensor not Connect Error	Sensor line disconnection	When power turned on	No sensor cable connected	Check the connection.
63 | 65	Sensor Error	Correct receipt of wiring-saving INC signal failed.	Occurs after rotating for a short while.	Sensor cable disconnection	Check the connection.
				Sensor signal failure	Replace the Motor.
			Occurs when power is turned on.	The control power supply was immediately restored after being turned off.	Wait for at least 1 minute after the power has been turned off before restoring the control power supply.

■ Encoder 17-bit ABS / 17-bit INC

Alarm code	Name	Description	Situation	Main cause	Corrective action
61	Sensor Battery Error	Sensor battery error	When power turned on	The battery of the 17-bit ABS sensor was removed.	Clear the sensor alarm by setting ID 30 “Servo Command” Bit 15 “Sensor alarm & multi-rotation reset.” Use it after setting ID 140 “Abs Mode” to 0.
62	Sensor not Connect Error	Sensor line disconnection	When power turned on	No sensor cable connected	Check the connection.
63	Counter Overflow Error	Sensor counter Overflow	When motor is rotating	The multi-rotation counter of the 17-bit ABS sensor overflowed.	Reduce the distance moved from the motor origin. Clear the sensor alarm. Use it after setting ID 140 “Abs Mode” to 0.
64	1rev Count Error	Sensor one-rotation counter error	When power turned on When motor is rotating	Error detected in the one-rotation counter of the 17-bit sensor.	Clear the sensor alarm.
66	Over Speed Error	Sensor over-speed error	When power turned on	The sensor rotated at a speed exceeding the specification during battery drive.	Clear the sensor alarm. Use it after setting ID 140 “Abs Mode” to 0.

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	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

When the sensor is 17-bit ABS/INC, the alarms recorded on the encoder side are alarm codes 61, 63, 64, and 66. They are not cleared unless the sensor alarm is cleared.

Setting ID 30 “Servo Command” B15 “17-bit sensor alarm & multi-rotation reset” causes the driver to send a reset signal to the encoder to clear the sensor alarm.

After clearing the sensor alarm, execute the regular alarm clear to reset the alarm. ⇒ ▣ “Clearing an Alarm” P. 94

Checking the Alarm History

Refer to “Alarm History-1” to “Alarm History-4” to see the past 16 alarms records.

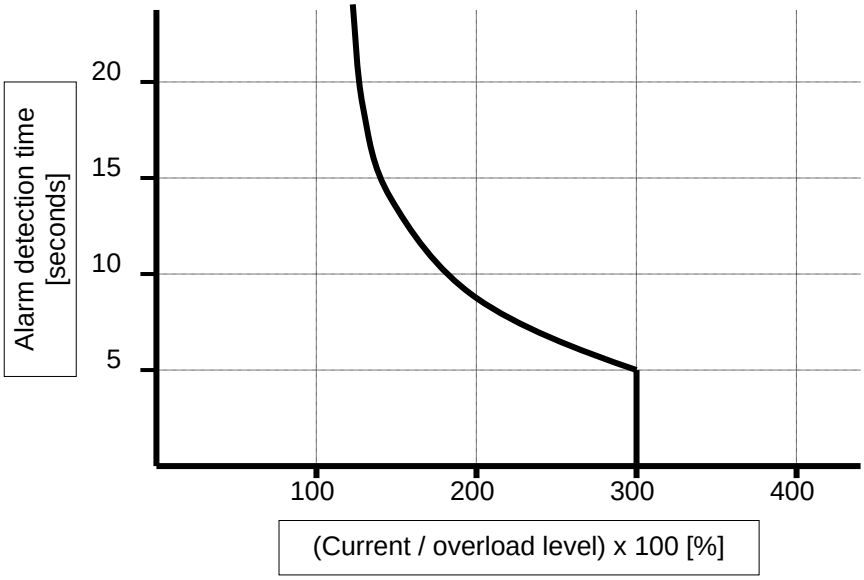
ID	Parameter name	Read value	Description			
			Byte3	Byte2	Byte1	Byte0
23	Alarm History-1	Alarm code records 1 to 4	Record 4	Record 3	Record 2	Record 1
24	Alarm History-2	Alarm code records 5 to 8	Record 8	Record 7	Record 6	Record 5
25	Alarm History-3	Alarm code records 9 to 12	Record 12	Record 11	Record 10	Record 9
26	Alarm History-4	Alarm code records 13 to 16	Record 16	Record 15	Record 14	Record 13
■ Records 1 to 16 are in decimal.						

New alarm record is set in Record 1, with the numbering of all earlier records adjusted accordingly.

When a new record is set, the oldest exisiting record, Record 16, is deleted.

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:



17. Specifications

Item	SV-NET Driver TA8410				
Type	**SVD-DL / Open Frame**		**SVD-DW**		
Drive voltage	DC 24V - 48V ±10%				
Model	N*3**	N*5**	N*3**	N*5**	
Rated continuous output current	4Arms max	8Arms max	4Arms max	8Arms max	
Maximum momentary output current	12Arms max	24Arms max	12Arms max	24Arms max	
Control power supply	DC24V ±10%				
Control power supply current	0.1 A				
Communication specifications	Communication protocol: Physical layer: Maximum number of connected drivers:		SV-NET CAN 31		
Sensor	Brushless resolver (Singlsyn/Smartsyn)		Brushless resolver (Singlsyn/ Smartsyn)	Encoder 17Bit-ABS 17Bit-INC	Encoder wiring-saving INC
Position resolution	2048 (1/rev)		2048 (1/rev)	2^{17}(1/rev)	8192 (1/rev)
LEAD/LAG/Z output	No		Yes		
Monitor output	No		Yes		
Combined motor	TBL-I II Series TBL-V Series				
Maximum output of combined motor	200 W				
Mechanical brake control output	Yes				
Dynamic brake circuit	No				
Regeneration circuit	No				
Number of control rotations	8000 rpm max (*1)				
Operating temperature range	0~+40°C				
Storage temperature range	-10~+85°C				
Operating humidity	90% or less (no condensation)				
Rotation direction definition	A CW rotation as seen from the motor shaft end is the forward direction. (*2)				
Recommended load inertia	Within 30 times or less the motor inertia				
Outer dimensions (mm)	SVD-DL: 116 x 30 x 75 (height x width x depth) Open Frame: 100 x 30 x 75 (height x width x depth) (Excluding connector and LED dimensions)		SVD-DW: 116 x 35 x 75 (height x width x depth) (Excluding connector and LED dimensions)		
Mass	Approximately 0.15 kg		Approximately 0.30 kg		
RoHS Directive compliance	RoHS Directive compliant product				

(*1) The maximum number of rotations varies according to the combined motor.
(*2) The rotation direction definition can be changed by the parameters.

18. After-Sales Service

Repair and Inquiry

- For repair or inquiry, please contact the dealer from whom you purchased the product.
- We offer a service that enables you to upgrade your software version. Please consult us about this (chargeable).

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 manufacture date) of the product being delivered from our plant.

■ Failure Range

Failure diagnosis

We kindly request that, as a rule, you perform the first diagnose of the failure.

However, this diagnosis can be performed instead by us or our service network if you so request. In such a case, following discussions with you, repair is free if the failure is attributed to us.

Failure repair

Repair, substitute replacement, and on-site visits for the occurrence of a failure is chargeable in cases 1 to 4 that follow, and 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 attributed to modifications and changes you have made to our products without our approval.
3. If the failure is attributed to use of our products out of the operating range.
4. Other failures that you acknowledge as being out of our responsibility.

Exemption from Responsibility for Compensation for Equipment Loss and the like

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 equipment you or your customers may suffer, any damage to a product other than our own as well as those attributable to another's responsibility.

Period of Repair after Production Discontinuation

We repair discontinued products for seven years following the date on which their production was discontinued. For some products, substitutes may be recommended.

Delivery Condition

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 and trial runs.

Appropriate Use of This Product

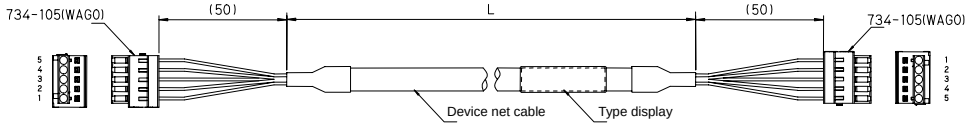
- This product is not designed or manufactured for use with equipment and systems used under in situations where there is a risk to life.
- If you are considering using this product with medical, aerospace, nuclear power, electric power, marine, manned transportation, or other special systems, please consult us at our sales office.
- This product is manufactured under strict quality control. However, if the application is such that 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.

19. Appendices

Option Parts

■ Cable

SV-NET cable

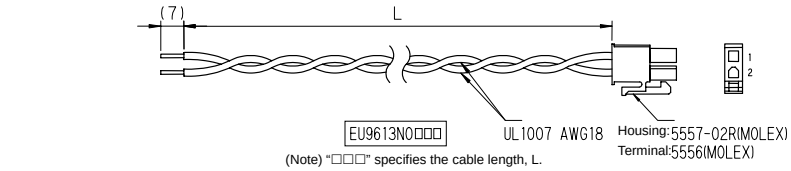


Type	Length (L)
EU9610 N*010	1m
N*030	3m
N*050	5m
N*100	10m

***=2: With both-side connector, *=1: With one-side connector, *=0: Without both-side connector**

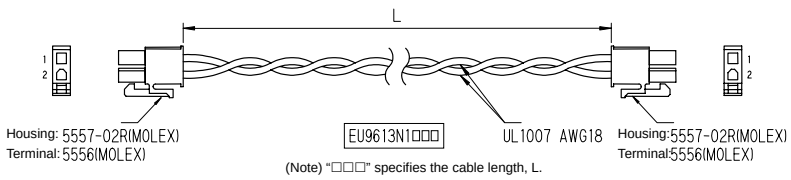
- For multi-axis daisy chain connection, can be used together with E9610N1*** (one-side connector cable). You can also order the assembled finished product. Please contact us if you wish to request this.

Drive power supply cable



(Note) "□□□" specifies the cable length, L.

Type	Length (L)
EU9613 N0010	1m
N0030	3m
N0050	5m
N0100	10m

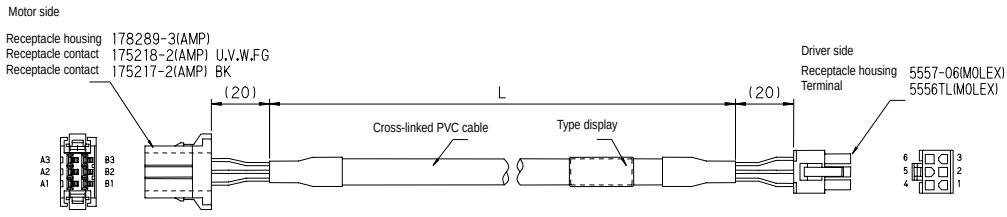


(Note) "□□□" specifies the cable length, L.

Type	Length (L)
EU9613 N1010	1m
N1030	3m
N1050	5m
N1100	10m

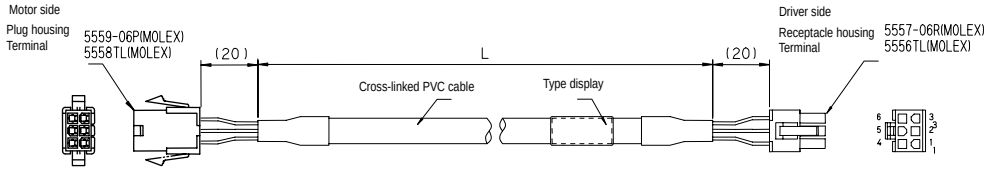
EU9613N1* is the cable used to connect the regeneration and communication unit (TA8413).**

Motor cable



Type	Length (L)
EU9614 N0010	1m
N0030	3m
N0050	5m

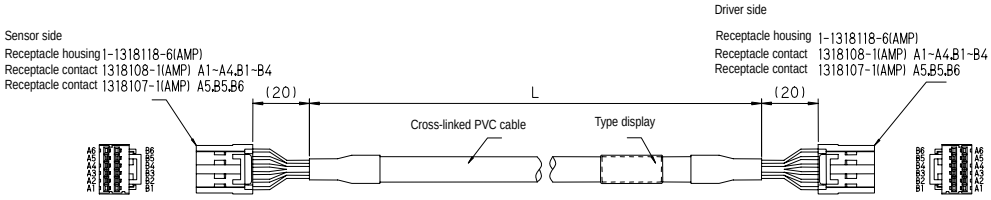
EU9614 is for use with TBL-I II Series motors.



Type	Length (L)
EU9621 N0010	1m
N0030	3m
N0050	5m

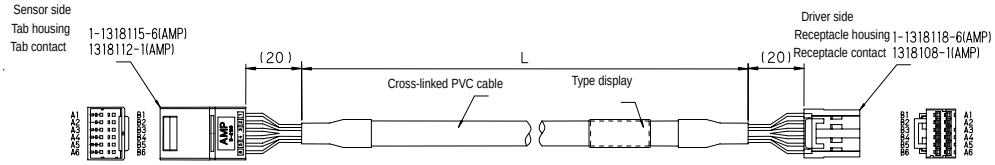
EU9621 is for use with TBL-V Series motors.

Sensor cable



Type	Length (L)
EU9615 N0010	**1m**
N0030	**3m**
N0050	**5m**

EU9615 is for use with TBL-I II motors.



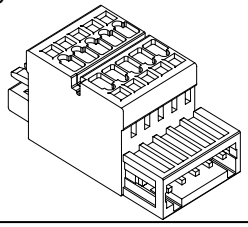
Type	Length (L)
EU9622 N0010	**1m**
N0030	**3m**
N0050	**5m**

EU9622 is for use with TBL-V Series motors.

Accessories

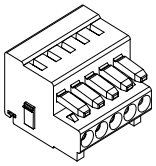
■ SV-NET cable branch connector

Model: 734-365 (made by WAGO)
Using this connector on one side of the SV-NET cable allows you to establish a daisy chain connection easily.



■ SV-NET cable connector

Model: 734-105 (made by WAGO)
This connector is for the SV-NET cable.



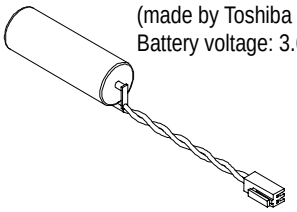
■ Insulated twin ferrule

Model: 216-202W (made by WAGO)
This part is used to press-fit two wires for a daisy chain connection using the SV-NET cable connector (734-105).

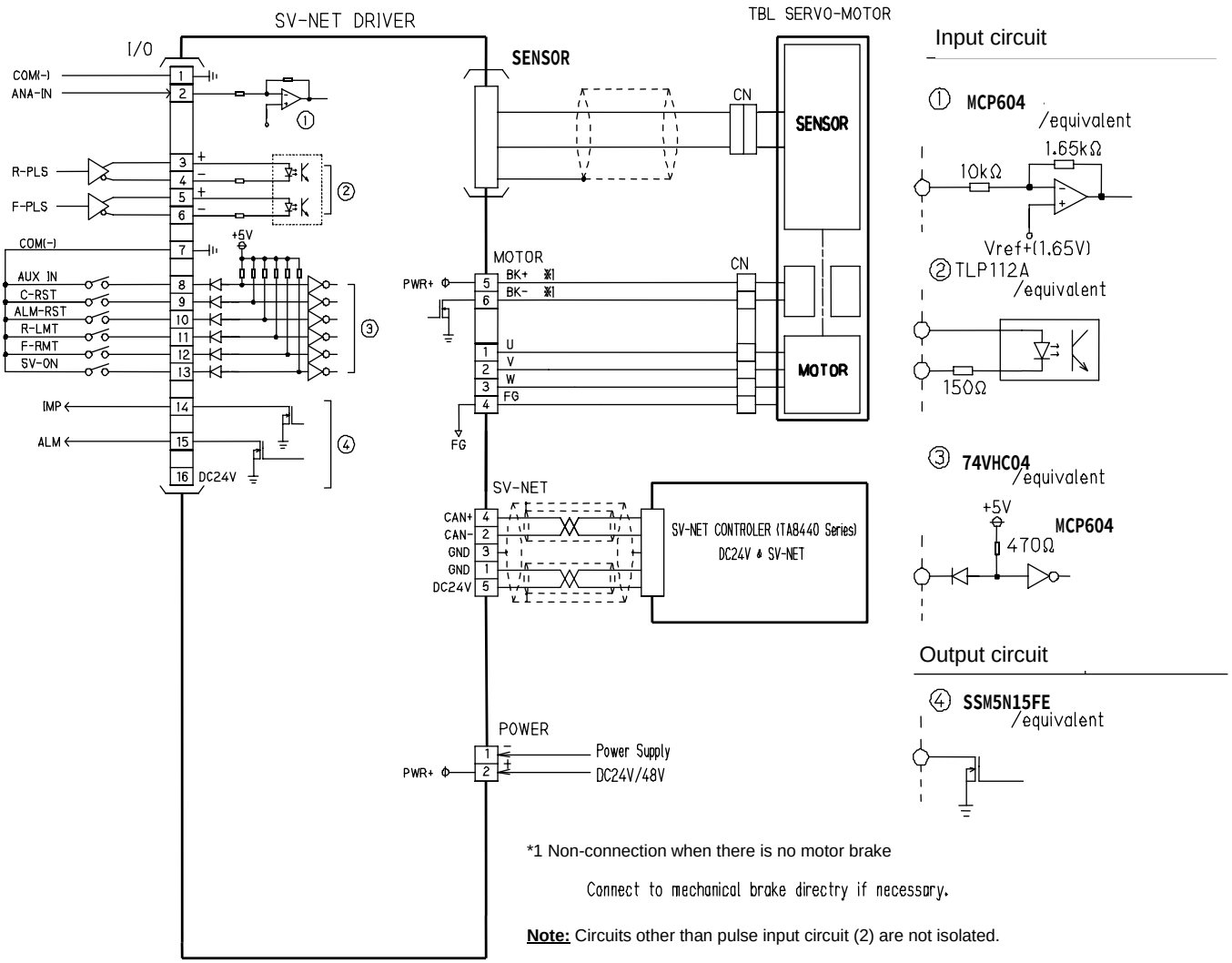
■ Backup battery

Model: ER175000VC (made by Toshiba Battery)
Use this to connect an encoder 17-bit ABS built-in motor.

Lithium battery
ER175000VC
(made by Toshiba Battery)
Battery voltage: 3.6 V



■ External connection diagram: TA8410 Series SVD-DL / Open Frame

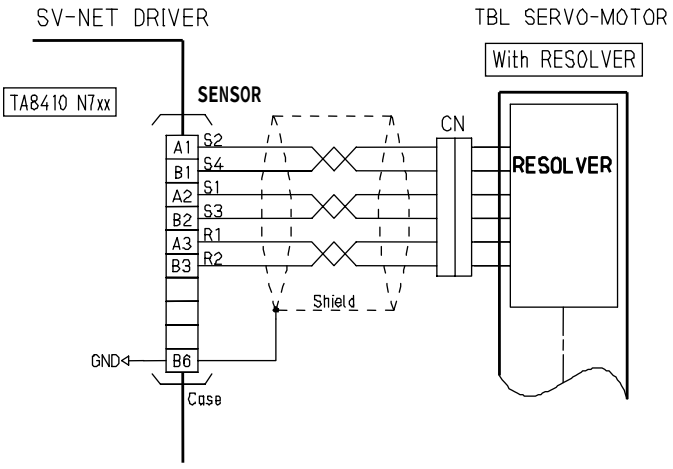


*1 Non-connection when there is no motor brake

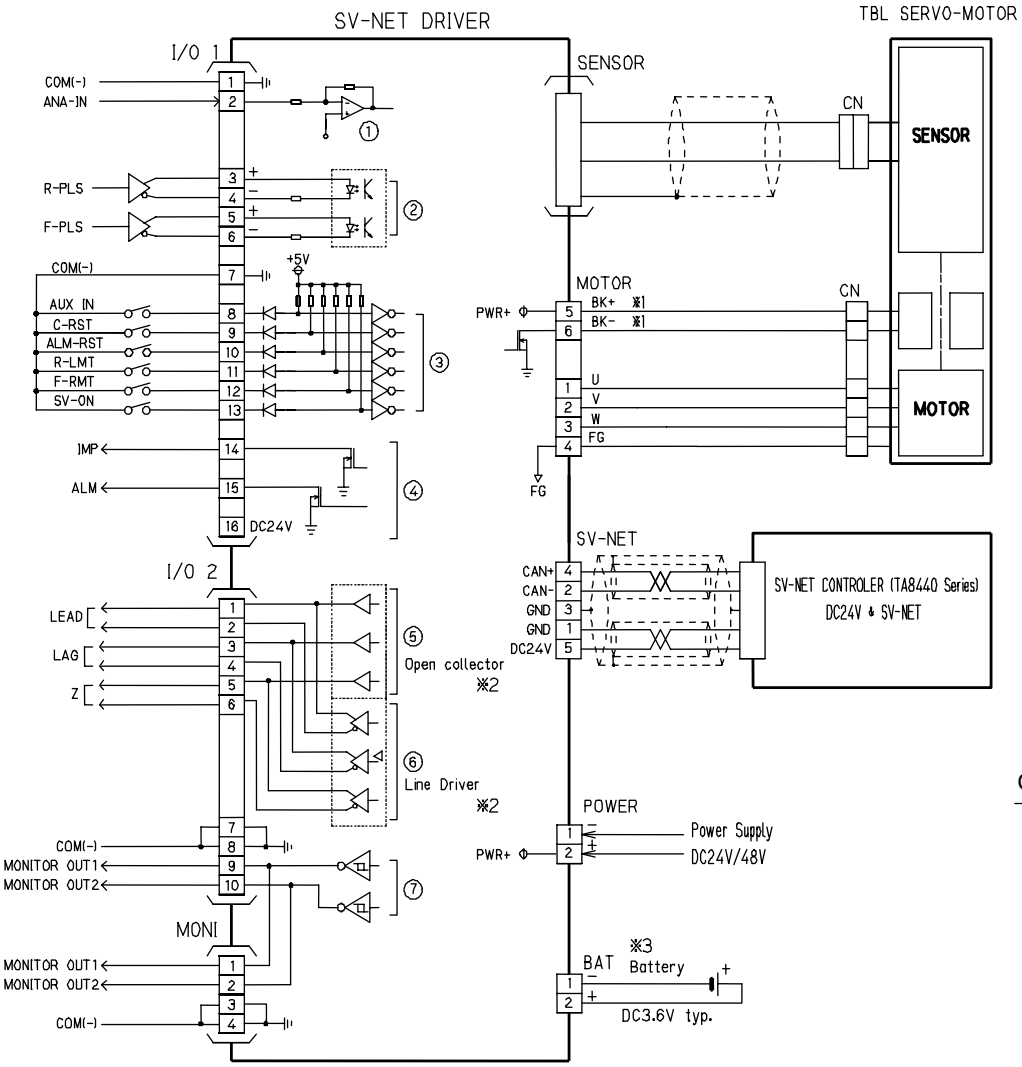
Connect to mechanical brake directry if necessary.

Note: Circuits other than pulse input circuit (2) are not isolated.

Sensor Connection Diagram



■ External connection diagram: TA8410 Series SVD-DW



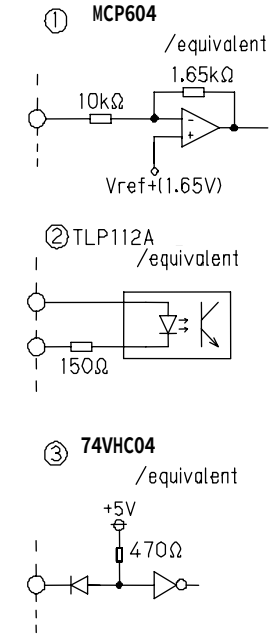
*1 Non-connection when there is no motor brake

Connect to mechanical brake directry if necessary.

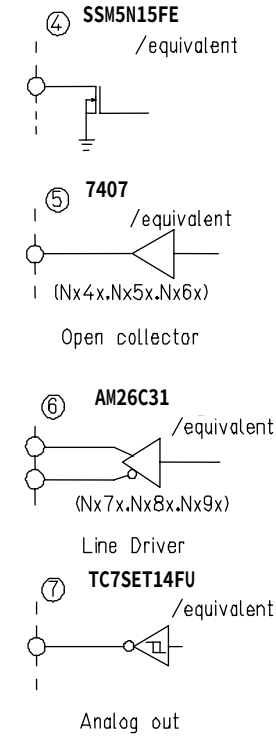
*2 Select either open collector output or line driver output.

*3 Battery is for backing up 17-bit absolute encoder data.

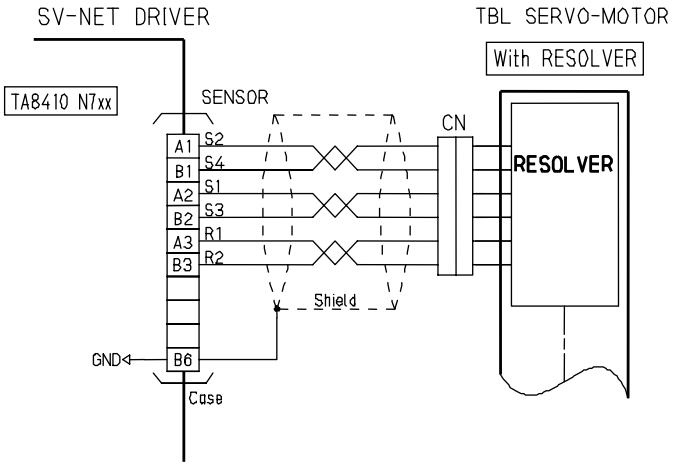
Input circuit

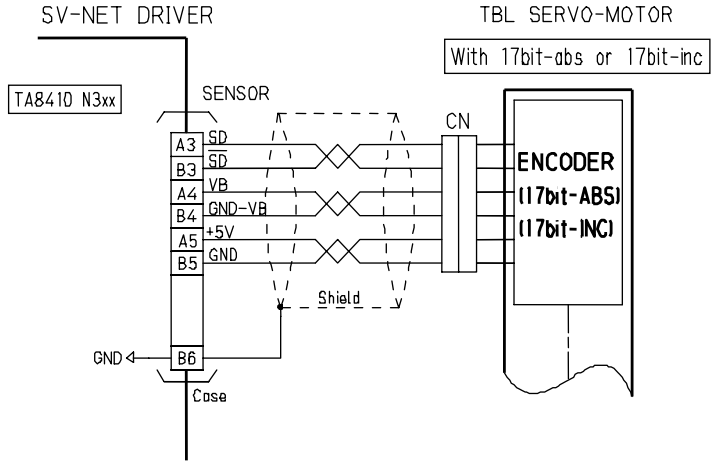


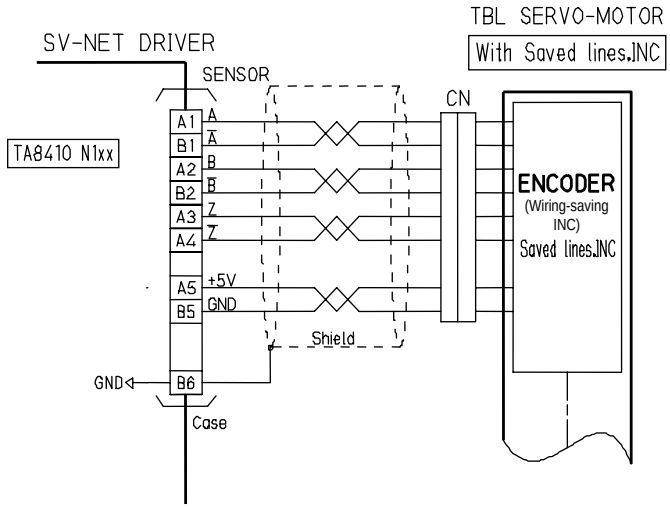
Output circuit



Sensor Connection Diagram







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. The software installed varies according to the type of sensor used. Check which sensor is compatible before referring to the table.

Brushless resolver (Smartsyn/Singlsyn)

ID	Parameter name	Read value
3	Revision	DEC

Example: The number “440” means the Revision is “4.40.”

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
1	Device Code		○	○	○	○				
2	Product Code		○	○	○	○				
3	Revision		○	○	○	○				
4	Serial Number		○	○	○	○				
5	MAC-ID		○	○	○	○				
6	Baud Rate		○	○	○	○				
7	Device Group ID		○	○	○	○				
8	Interrupt Data ID-1									
9	Interrupt Data ID-2									
10	Interrupt Data ID-3									
11	Interrupt Data ID-4									
12	Indirect Data ID									
13	Indirect Data									
14	Indirect Data+									
15	Indirect Data-									
16	Parameters init.		○	○	○	○				
17	Parameters save		○	○	○	○				
18	Program Code		○	○	○	○				
20	Servo Status	Bit0	○	○	○	○				
		Bit1	○	○	○	○				
		Bit2	○	○	○	○				
		Bit3	○	○	○	○				
		Bit4	○	○	○	○				
		Bit5	○	○	○	○				
		Bit6	○	○	○	○				

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
20	Servo Status	Bit7		○	○	○				
		Bit8	○	○	○	○				
		Bit9								
		Bit10		○	○	○				
		Bit11		○	○	○				
		Bit12				○				
		Bit13								
		Bit14								
		Bit15								
21	I/O Status		○	○	○	○				
22	Alarm Code		○	○	○	○				
23	Alarm History-1		○	○	○	○				
24	Alarm History-2		○	○	○	○				
25	Alarm History-3		○	○	○	○				
26	Alarm History-4		○	○	○	○				
30	Servo Command	Bit0	○	○	○	○				
		Bit1	○	○	○	○				
		Bit2	○	○	○	○				
		Bit3	○	○	○	○				
		Bit4	○	○	○	○				
		Bit5	○	○	○	○				
		Bit6	○	○	○	○				
		Bit7	○	○	○	○				
		Bit8	○	○	○	○				
		Bit9								
		Bit10								
		Bit11	○	○	○	○				
		Bit12								
		Bit13	○	○	○	○				
		Bit14	○	○	○	○				
		Bit15								
31	Control Mode	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
31	Control Mode	4	○	○	○	○				
		5	○	○	○	○				
		15	○	○	○	○				
		16	○	○	○	○				
32	Target Position		○	○	○	○				
33	Target Velocity		○	○	○	○				
34	Acceleration		○	○	○	○				
35	Deceleration		○	○	○	○				
36	Command Position		○	○	○	○				
37	Command Velocity		○	○	○	○				
38	Command Current		○	○	○	○				
39	Reset Position		○	○	○	○				
40	Actual Position		○	○	○	○				
41	Actual Velocity		○	○	○	○				
42	Actual Current		○	○	○	○				
43	Actual PVC		○	○	○	○				
44	Actual SVC		○	○	○	○				
45	Sensor Position1		○	○	○	○				
46	Sensor Position2					○				
47										
48										
49										
50	Kp1		○	○	○	○				
51	Kv1		○	○	○	○				
52	Ki1		○	○	○	○				
53	LPF-f		○	○	○	○				
54	NF-f		○	○	○	○				
55	NF-d		○	○	○	○				
56	Kcp1		○	○	○	○				
57	Kci1		○	○	○	○				
58	Phase-advance Gain		○	○	○	○				
59	Load Inertia		○	○	○	○				
60	Kp2		○	○	○	○				
61	Kv2		○	○	○	○				

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
62	Ki2		○	○	○	○				
63	NF-f2					○				
64	NF-d2					○				
65										
66										
67										
68										
69										
70	Position Data Resolution: Numerator									
71	Position Data Resolution: Denominator									
72	Reference Direction		○	○	○	○				
73	Position FB Select	Bit0	○	○	○	◯				
		Bit7	○	○	○	◯				
74	Position Command Select		○	○	○	○				
75	Speed Command Select		○	○	○	○				
76	Torque Command Select		○	○	○	○				
77	Range of In-Position Signal ON		○	○	○	○				
78	Smoothing Function Select		○	○	○	○				
79	Smoothing time		○	○	○	○				
80	Gain-Switch Method Select		○	○	○	○				
81	GainChangePoint_H		○	○	○	○				
82	GainChangePoint_L		○	○	○	○				
83	Soft Limit Select		○	○	○	○				
84	Positive-side Soft Limit		○	○	○	○				
85	Negative-side Soft Limit		○	○	○	○				
86	Forward-Rotation Current Limit		○	○	○	○				
87	Negative-Rotation Current Limit		○	○	○	○				
88	Speed Limit		○	○	○	○				
89										
90	Homing Type	0	○	○	○	○				
		1	○	○	○	○				
		2		○	○	○				
		3		○	○	○				
91	Preset Value		○	○	○	○				
92	Homing Start Direction		○	○	○	○				
93	Homing Speed		○	○	○	○				

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
94	Creep Speed		○	○	○	○				
95	Thrust Time		○	○	○	○				
96	Thrust Torque		○	○	○	○				
97										
98										
99										
100	IN1 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				
		4	○	○	○	○				
101	IN2 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				
		4	○	○	○	○				
102	IN3 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				
		4	○	○	○	○				
103	IN4 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				
		4	○	○	○	○				
104	IN5 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3	○	○	○	○				
		4	○	○	○	○				
105	IN6 Setting	0	○	○	○	○				
		1	○	○	○	○				
		2	○	○	○	○				
		3								

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
105	IN6 Setting	4	○	○	○	○				
106										
107										
108										
109										
110	OUT1 Setting	0	○	○	○	○				
		1-FFFF				○				
111	OUT2 Setting	0	○	○	○	○				
		1-FFFF				○				
112										
113										
114										
115										
116										
117										
118	Monitor 1 Setting					○				
119	Monitor 2 Setting					○				
120	Pulse Input Signal Mode	0	○	○	○	○				
		1	○	○	○	○				
		2								
		3								
		4								
121	Pulse Input Signal Resolution: Numerator		○	○	○	○				
122	Pulse Input Signal Resolution: Denominator		○	○	○	○				
123										
124										
125										
126	Sensor Output Frequency-Division Setting					○				
127										
128										
129										
130	Speed Conversion Scale for Analog Input Signal		○	○	○	○				
131	Current Conversion Scale for Analog Input Signal		○	○	○	○				
132	Analog Input Offset		○	○	○	○				
133										
134										

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol		Revision							
			4.40	4.51	4.60	6.30				
135										
136										
137										
138										
139										
140	Abs Mode		○	○	○	○				
141	Servo Select	Bit0	○	○	○	○				
		Bit1								
		Bit2								
		Bit3	○	○	○	○				
		Bit4	○	○	○	○				
		Bit5								
		Bit6								
		Bit7	○	○	○	○				
142										
143	Servo Off Delay		○	○	○	○				
144	Abs-Offset		○	○	○	○				
145	Auto Tuning-KV		○	○	○	○				
146	Auto Tuning-KI		○	○	○	○				
147	Brake off Delay					○				
148	Enable Off Time					○				
149	Forced Brake Release					○				
153	Servo Message Processing Time									
154										
155										
159	Overload Monitor		○	○	○	○				
160	Driver Temperature		○	○	○	○				
161	Drive Power Supply Voltage		○	○	○	○				
200	Overload Alarm Detection Torque		○	○	○	○				
201	Over-Speed Alarm Detection Speed		○	○	○	○				
202	Nonoperating Position Deviation Error Detection Pulse Count		○	○	○	○				
203	Operating Position Deviation Error Detection Pulse Count		○	○	○	○				
204	Overheat Error Detection Temperature		○	○	○	○				
205	Overvoltage Error Detection Voltage		○	○	○	○				
206	Power Supply Shutoff Detection Voltage (low voltage detection)		○	○	○	○				

Usable Parameters by Software Revision [Brushless Resolver]

ID	Parameter symbol	Revision							
		4.40	4.51	4.60	6.30				
250	Q-Axis Current				○				
251	Velocity				○				
252	Position Error				○				
253	Reserve								
254	Reserve								

Encoder 17-bit INC/ABS

ID	Parameter name	Read value
3	Revision	DEC

Example: The number “440” means the Revision is “4.40.”

ID	Parameter symbol		Revision							
			2.10							
1	Device Code		○							
2	Product Code		○							
3	Revision		○							
4	Serial Number		○							
5	MAC-ID		○							
6	Baud Rate		○							
7	Device Group ID		○							
8	Interrupt Data ID-1									
9	Interrupt Data ID-2									
10	Interrupt Data ID-3									
11	Interrupt Data ID-4									
12	Indirect Data ID									
13	Indirect Data									
14	Indirect Data+									
15	Indirect Data-									
16	Parameters init.		○							
17	Parameters save		○							
18	Program Code		○							
20	Servo Status	Bit0	○							
		Bit1	○							
		Bit2	○							
		Bit3	○							
		Bit4	○							
		Bit5	○							
		Bit6	○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
20	Servo Status	Bit7	○							
		Bit8	○							
		Bit9								
		Bit10	○							
		Bit11	○							
		Bit12	○							
		Bit13								
		Bit14								
		Bit15								
21	I/O Status		○							
22	Alarm Code		○							
23	Alarm History-1		○							
24	Alarm History-2		○							
25	Alarm History-3		○							
26	Alarm History-4		○							
30	Servo Command	Bit0	○							
		Bit1	○							
		Bit2	○							
		Bit3	○							
		Bit4	○							
		Bit5	○							
		Bit6	○							
		Bit7	○							
		Bit8	○							
		Bit9								
		Bit10								
		Bit11	○							
		Bit12								
		Bit13	○							
		Bit14	○							
		Bit15	○							
31	Control Mode	0	○							
		1	○							
		2	○							
		3	○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
31	Control Mode	4	○							
		5	○							
		15	○							
		16	○							
32	Target Position		○							
33	Target Velocity		○							
34	Acceleration		○							
35	Deceleration		○							
36	Command Position		○							
37	Command Velocity		○							
38	Command Current		○							
39	Reset Position		○							
40	Actual Position		○							
41	Actual Velocity		○							
42	Actual Current		○							
43	Actual PVC		○							
44	Actual SVC		○							
45	Sensor Position1		○							
46	Sensor Position2		○							
47										
48										
49										
50	Kp1		○							
51	Kv1		○							
52	Ki1		○							
53	LPF-f		○							
54	NF-f		○							
55	NF-d		○							
56	Kcp1		○							
57	Kci1		○							
58	Phase-advance Gain		○							
59	Load Inertia		○							
60	Kp2		○							
61	Kv2		○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
62	Ki2		○							
63	NF-f2		○							
64	NF-d2		○							
65										
66										
67										
68										
69										
70	Position Data Resolution: Numerator									
71	Position Data Resolution: Denominator									
72	Reference Direction		○							
73	Position FB Select	Bit0	○							
		Bit7	○							
74	Position Command Select		○							
75	Speed Command Select		○							
76	Torque Command Select		○							
77	Range of In-Position Signal ON		○							
78	Smoothing Function Select		○							
79	Smoothing time		○							
80	Gain-Switch Method Select		○							
81	GainChangePoint_H		○							
82	GainChangePoint_L		○							
83	Soft Limit Select		○							
84	Positive-side Soft Limit		○							
85	Negative-side Soft Limit		○							
86	Forward-Rotation Current Limit		○							
87	Negative-Rotation Current Limit		○							
88	Speed Limit		○							
89										
90	Homing Type	0	○							
		1	○							
		2	○							
		3	○							
91	Preset Value		○							
92	Homing Start Direction		○							
93	Homing Speed		○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
94	Creep Speed		○							
95	Thrust Time		○							
96	Thrust Torque		○							
97										
98										
99										
100	IN1 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
101	IN2 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
102	IN3 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
103	IN4 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
104	IN5 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
105	IN6 Setting	0	○							
		1	○							
		2	○							
		3	○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
105	IN6 Setting	4	○							
106										
107										
108										
109										
110	OUT1 Setting	0	○							
		1-FFFF	○							
111	OUT2 Setting	0	○							
		1-FFFF	○							
112										
113										
114										
115										
116										
117										
118	Monitor 1 Setting		○							
119	Monitor 2 Setting		○							
120	Pulse Input Signal Mode	0	○							
		1	○							
		2								
		3								
		4								
121	Pulse Input Signal Resolution: Numerator		○							
122	Pulse Input Signal Resolution: Denominator		○							
123										
124										
125										
126	Sensor Output Frequency-Division Setting		○							
127										
128										
129										
130	Speed Conversion Scale for Analog Input Signal		○							
131	Current Conversion Scale for Analog Input Signal		○							
132	Analog Input Offset		○							
133										
134										

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol		Revision							
			2.10							
135										
136										
137										
138										
139										
140	Abs Mode		○							
141	Servo Select	Bit0	○							
		Bit1								
		Bit2								
		Bit3	○							
		Bit4	○							
		Bit5								
		Bit6								
		Bit7	○							
142										
143	Servo Off Delay		○							
144	Abs-Offset		○							
145	Auto Tuning-KV		○							
146	Auto Tuning-KI		○							
147	Brake off Delay		○							
148	Enable Off Time		○							
149	Forced Brake Release		○							
153	Servo Message Processing Time									
154										
155										
159	Overload Monitor		○							
160	Driver Temperature		○							
161	Drive Power Supply Voltage		○							
200	Overload Alarm Detection Torque		○							
201	Over-Speed Alarm Detection Speed		○							
202	Nonoperating Position Deviation Error Detection Pulse Count		○							
203	Operating Position Deviation Error Detection Pulse Count		○							
204	Overheat Error Detection Temperature		○							
205	Overvoltage Error Detection Voltage		○							
206	Power Supply Shutoff Detection Voltage (low voltage detection)		○							

Usable Parameters by Software Revision [Encoder 17-bit INC/ABS]

ID	Parameter symbol	Revision							
		2.10							
250	Q-Axis Current	○							
251	Velocity	○							
252	Position Error	○							
253	Reserve								
254	Reserve								

Encoder 2048C/T wiring-saving INC

ID	Parameter name	Read value
3	Revision	DEC

Example: The number “440” means the Revision is “4.40.”

ID	Parameter symbol		Revision							
			1.00							
1	Device Code		○							
2	Product Code		○							
3	Revision		○							
4	Serial Number		○							
5	MAC-ID		○							
6	Baud Rate		○							
7	Device Group ID		○							
8	Interrupt Data ID-1									
9	Interrupt Data ID-2									
10	Interrupt Data ID-3									
11	Interrupt Data ID-4									
12	Indirect Data ID									
13	Indirect Data									
14	Indirect Data+									
15	Indirect Data-									
16	Parameters init.		○							
17	Parameters save		○							
18	Program Code		○							
20	Servo Status	Bit0	○							
		Bit1	○							
		Bit2	○							
		Bit3	○							
		Bit4	○							
		Bit5	○							
		Bit6	○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
20	Servo Status	Bit7	○							
		Bit8	○							
		Bit9								
		Bit10	○							
		Bit11	○							
		Bit12	○							
		Bit13								
		Bit14								
		Bit15								
21	I/O Status		○							
22	Alarm Code		○							
23	Alarm History-1		○							
24	Alarm History-2		○							
25	Alarm History-3		○							
26	Alarm History-4		○							
30	Servo Command	Bit0	○							
		Bit1	○							
		Bit2	○							
		Bit3	○							
		Bit4	○							
		Bit5	○							
		Bit6	○							
		Bit7	○							
		Bit8	○							
		Bit9								
		Bit10								
		Bit11	○							
		Bit12								
		Bit13	○							
		Bit14	○							
		Bit15	○							
31	Control Mode	0	○							
		1	○							
		2	○							
		3	○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
31	Control Mode	4	○							
		5	○							
		15	○							
		16	○							
32	Target Position		○							
33	Target Velocity		○							
34	Acceleration		○							
35	Deceleration		○							
36	Command Position		○							
37	Command Velocity		○							
38	Command Current		○							
39	Reset Position		○							
40	Actual Position		○							
41	Actual Velocity		○							
42	Actual Current		○							
43	Actual PVC		○							
44	Actual SVC		○							
45	Sensor Position1		○							
46	Sensor Position2		○							
47										
48										
49										
50	Kp1		○							
51	Kv1		○							
52	Ki1		○							
53	LPF-f		○							
54	NF-f		○							
55	NF-d		○							
56	Kcp1		○							
57	Kci1		○							
58	Phase-advance Gain		○							
59	Load Inertia		○							
60	Kp2		○							
61	Kv2		○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
62	Ki2		○							
63	NF-f2		○							
64	NF-d2		○							
65										
66										
67										
68										
69										
70	Position Data Resolution: Numerator									
71	Position Data Resolution: Denominator									
72	Reference Direction		○							
73	Position FB Select	Bit0	○							
		Bit7	○							
74	Position Command Select		○							
75	Speed Command Select		○							
76	Torque Command Select		○							
77	Range of In-Position Signal ON		○							
78	Smoothing Function Select		○							
79	Smoothing time		○							
80	Gain-Switch Method Select		○							
81	GainChangePoint_H		○							
82	GainChangePoint_L		○							
83	Soft Limit Select		○							
84	Positive-side Soft Limit		○							
85	Negative-side Soft Limit		○							
86	Forward-Rotation Current Limit		○							
87	Negative-Rotation Current Limit		○							
88	Speed Limit		○							
89										
90	Homing Type	0	○							
		1	○							
		2	○							
		3	○							
91	Preset Value		○							
92	Homing Start Direction		○							
93	Homing Speed		○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
94	Creep Speed		○							
95	Thrust Time		○							
96	Thrust Torque		○							
97										
98										
99										
100	IN1 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
101	IN2 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
102	IN3 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
103	IN4 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
104	IN5 Setting	0	○							
		1	○							
		2	○							
		3	○							
		4	○							
105	IN6 Setting	0	○							
		1	○							
		2	○							
		3	○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
105	IN6 Setting	4	○							
106										
107										
108										
109										
110	OUT1 Setting	0	○							
		1-FFFF	○							
111	OUT2 Setting	0	○							
		1-FFFF	○							
112										
113										
114										
115										
116										
117										
118	Monitor 1 Setting		○							
119	Monitor 2 Setting		○							
120	Pulse Input Signal Mode	0	○							
		1	○							
		2								
		3								
		4								
121	Pulse Input Signal Resolution: Numerator		○							
122	Pulse Input Signal Resolution: Denominator		○							
123										
124										
125										
126	Sensor Output Frequency-Division Setting		○							
127										
128										
129										
130	Speed Conversion Scale for Analog Input Signal		○							
131	Current Conversion Scale for Analog Input Signal		○							
132	Analog Input Offset		○							
133										
134										

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol		Revision							
			1.00							
135										
136										
137										
138										
139										
140	Abs Mode		○							
141	Servo Select	Bit0	○							
		Bit1								
		Bit2								
		Bit3	○							
		Bit4	○							
		Bit5								
		Bit6								
		Bit7	○							
142										
143	Servo Off Delay		○							
144	Abs-Offset		○							
145	Auto Tuning-KV		○							
146	Auto Tuning-KI		○							
147	Brake off Delay		○							
148	Enable Off Time		○							
149	Forced Brake Release		○							
153	Servo Message Processing Time									
154										
155										
159	Overload Monitor		○							
160	Driver Temperature		○							
161	Drive Power Supply Voltage		○							
200	Overload Alarm Detection Torque		○							
201	Over-Speed Alarm Detection Speed		○							
202	Nonoperating Position Deviation Error Detection Pulse Count		○							
203	Operating Position Deviation Error Detection Pulse Count		○							
204	Overheat Error Detection Temperature		○							
205	Overvoltage Error Detection Voltage		○							
206	Power Supply Shutoff Detection Voltage (low voltage detection)		○							

Usable Parameters by Software Revision [Encoder 2048C/T wiring-saving INC]

ID	Parameter symbol	Revision							
		1.00							
250	Q-Axis Current	○							
251	Velocity	○							
252	Position Error	○							
253	Reserve								
254	Reserve								

Revision History

Date of revision	Rev. No.	Page / chapter / section	Description / reason	Stamp
07/03/12	0000	First version		
07/11/20	0100	All pages	Added SVD-DL and SVD-DW Types, and information related to them. Added configuration diagrams and external connection diagrams. Added I/O connection diagrams.	