CONTROL™
TECHNIQUES

Instruction Manual

AC SERVO MOTOR and SERVO DRIVE
Series Digitax-SF

Nidec
All for dreams

Part Number: 0478-0606-01
Issue: 1

Thank you for your purchase of the Digitax SF products. This Instruction Manual includes precautions for the product use.

- ■ Please study this manual first and use the product properly and safely.
- ■ Before using the product, be sure to carefully read the Safety Instructions.
- ■ After reading this manual, please keep it for future reference.
- ■ Product specifications are subject to change without notice in the course of product improvement.

Apr. 2019

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MEMO

1 Before Use

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1. Important Safety Instructions

1. Safety Precautions

This manual uses the signs below to indicate serious but avoidable problems caused by misuse of the product. One is for death or serious bodily harm. The other is for bodily injury or product or equipment damage.

⚠ **DANGER**	Identifies information about imminent hazards that will result in death or serious injury.
⚠ **CAUTION**	Identifies information about hazards that could result in injury or equipment damage.

Throughout this document, the safety precautions that users must follow are marked as follows.

🚫	Safety Precaution - **Prohibited** Action
❗	Safety Precaution - **Mandatory** Action

The possible hazardous events are marked as follows.

⚠	Cautions and Dangers Causes unexpected, unstable, or uncontrolled motion. Compromises the performance or reliability of the product. Shortens the service life of the product.
⚡	Electric shock hazard
♨	Burn hazard
🔥	Fire hazard
⚠	Injury hazard
⚠	Failure and damage hazard

Important safety information. Hazards. Competence of designers and installers

This guide applies to products which control electric motors either directly (drives) or indirectly (controllers, option modules and other auxiliary equipment and accessories). In all cases the hazards associated with powerful electrical drives are present, and all safety information relating to drives and associated equipment must be observed.

Specific warnings are given at the relevant places in this guide.

1. Important Safety Instructions

Drives and controllers are intended as components for professional incorporation into complete systems. If installed incorrectly they may present a safety hazard. The drive uses high voltages and currents, carries a high level of stored electrical energy, and is used to control equipment which can cause injury. Close attention is required to the electrical installation and the system design to avoid hazards either in normal operation or in the event of equipment malfunction. System design, installation, commissioning/start-up and maintenance must be carried out by personnel who have the necessary training and competence. They must read this safety information and this guide carefully.

Responsibility

It is the responsibility of the installer to ensure that the equipment is installed correctly with regard to all instructions given in this guide. They must give due consideration to the safety of the complete system, so as to avoid the risk of injury both in normal operation and in the event of a fault or of reasonably foreseeable misuse.

The manufacturer accepts no liability for any consequences resulting from inappropriate, negligent or incorrect installation of the equipment.

Compliance with regulations

The installer is responsible for complying with all relevant regulations, such as national wiring regulations, accident prevention regulations and electromagnetic compatibility (EMC) regulations. Particular attention must be given to the cross-sectional areas of conductors, the selection of fuses or other protection, and protective ground (earth) connections.

This guide contains instructions for achieving compliance with specific EMC standards.

All machinery to be supplied within the European Union in which this product is used must comply with the following directives:

2006/42/EC Safety of machinery.

2014/30/EU: Electromagnetic Compatibility.

Electrical Hazards

The voltages used in the drive can cause severe electrical shock and/or burns, and could be lethal. Extreme care is necessary at all times when working with or adjacent to the drive. Hazardous voltage may be present in any of the following locations:

- AC and DC supply cables and connections
- Output cables and connections
- Many internal parts of the drive, and external option units

Unless otherwise indicated, control terminals are single insulated and must not be touched.

The supply must be disconnected by an approved electrical isolation device before gaining access to the electrical connections.

The control terminal functions of the drive do not isolate dangerous voltages from the output of the drive or from any external option unit.

The drive must be installed in accordance with the instructions given in this guide. Failure to observe the instructions could result in a fire hazard.

1. Important Safety Instructions

Stored Electrical Charge

The drive contains capacitors that remain charged to a potentially lethal voltage after the AC supply has been disconnected. If the drive has been energized, the AC supply must be isolated at least ten minutes before work may continue.

Mechanical Hazards

Careful consideration must be given to the functions of the drive or controller which might result in a hazard, either through their intended behaviour or through incorrect operation due to a fault. In any application where a malfunction of the drive or its control system could lead to or allow damage, loss or injury, a risk analysis must be carried out, and where necessary, further measures taken to reduce the risk – forexample, an over-speed protection device in case of failure of the speed control, or a fail-safe mechanical brake in case of loss of motor braking.

None of the drive functions must be used to ensure safety of personnel, i.e. they must not be used for safety-related functions.The system designer is responsible for ensuring that the complete system is safe and designed correctly according to the relevant safety standards

Access to equipment

Access must be restricted to authorized personnel only. Safety regulations which apply at the place of use must be complied with.

Environmental limits

Instructions in this guide regarding transport, storage, installation and use of the equipment must be complied with, including the specified environmental limits. This includes temperature, humidity, contamination, shock and vibration. Equipment must not be subjected to excessive physical force.

Hazardous environments

The equipment must not be installed in a hazardous environment (i.e. a potentially explosive environment).

Motor

The safety of the motor under variable speed conditions must be ensured.

To avoid the risk of physical injury, do not exceed the maximum specified speed of the motor.

Mechanical brake control

Any brake control functions are provided to allow well co-ordinated operation of an external brake with the drive. While both hardware and software are designed to high standards of quality and robustness, they are not intended for use as safety functions, i.e. where a fault or failure would result in a risk of injury. In any application where the incorrect operation of the brake release mechanism could result in injury, independent protection devices of proven integrity must also be incorporated.

1. Important Safety Instructions

Adjusting parameters

Some parameters have a profound effect on the operation of the drive. They must not be altered without careful consideration of the impact on the controlled system. Measures must be taken to prevent unwanted changes due to error or tampering.

Electromagnetic compatibility (EMC)

Installation instructions for a range of EMC environments are provided in an EMC datasheet. If the installation is poorly designed or other equipment does not comply with suitable standards for EMC, the product might cause or suffer from disturbance due to electromagnetic interaction with other equipment. It is the responsibility of the installer to ensure that the equipment or system into which the product is incorporated complies with the relevant EMC legislation in the place of use.

1. Important Safety Instructions

⚠ DANGER

Sign	Precautionary Measures	If Not Observed
Installation and Wiring		
🚫	Never connect the motor directly to the AC mains power supply.	🔥 ⚠
	Do not place any flammable items near the motor or drive.	🔥
❗	Protect the drive with a protective enclosure and ensure the clearance between the drive, the enclosure and other devices is as specified in this manual	⚡ 🔥 ⚠
	Install the product in a place free from dust, water or oil splash.	⚡ 🔥 ⚠
	Mount the motors and drives on metallic or other noncombustible materials.	🔥
	All wiring work must be performed by certified electricians.	⚡
	Ground the F G terminals of motor and drives.	⚡
	Isolate the drive from the power supplies before attempting any wiring. Wiring must be performed correctly	⚡ ✋ ⚠
	Ensure that cable connections are tight. The current-carrying conductors must be insulated.	⚡ 🔥 ⚠
Operations		
🚫	Never touch the inside of the drive.	♨ ⚡
	Be careful not to damage the cables. Do not apply excessive force to them or place heavy objects on top of them. Do not let any part of cables become pinched or twisted.	⚡ ⚠
	Never touch the rotating component of the motor during operation.	✋
	Do not use the product where it may be subjected to water, corrosive atmosphere, flammable gas, or combustible materials.	🔥
	Do not use the product where excessive vibration or impact load is present.	⚡ ✋ 🔥
	Do not use cables soaked in water or oil.	⚡ ⚠
	Do not handle wiring nor operate the motor with wet hands.	⚡ ✋ 🔥
	Do not touch the keyway if you are using a motor with a shaft-end keyway.	✋
	Do not touch the motor or drive heat sink. It becomes very hot.	🔥 ⚠
	Do not connect the motor directly to the AC mains supply.	🔥

1. Important Safety Instructions

⚠ DANGER

Sign	Precautionary Measures	If Not Observed
Additional Precautions		
❗	Install external emergency stop circuitry so that the operation can be stopped and the power supply can be shut down immediately in case of emergency.	⚠ ⚠ ⚠ ⚠
Maintenance and Inspection		
🚫	Never attempt to disassemble the product.	⚠ ⚠ ⚠
❗	Hazardous voltages are present in the drive. Before performing any wiring or inspection of the terminal connections, allow more than 5 minutes after the power shuts off for the internal voltage to completely discharge.	⚠

1. Important Safety Instructions

⚠ CAUTION

Sign	Precautionary Measures	If Not Observed
Installation and Wiring		
🚫	Do not directly touch the terminal parts of any connectors	⚡ 🔥
	Do not block the air vents. Do not allow ingress of any foreign objects to the product.	⚡ 🔥
❗	Keep the motor-drive pairing as specified.	🔥 💥
	Before a test run, confirm that the motor is fixed in place, check the motion while the motor is isolated from the machinery first, then install the motor in the machinery.	✋
	Observe the mounting method and orientation as specified.	✋ 💥
	Install the product in an appropriate way suitable for its main body mass and the rated output of the product.	✋ 💥
Operations		
🚫	Do not step on the product or place any heavy object on it.	⚡ ✋ 💥
	Never make drastic changes during tuning, which if not observed, will result in unstable motion.	💥
	Do not come close to the machinery right after power restoration following a power outage. The machinery may restart unexpectedly at any moment. Take appropriate measures to ensure safety against an unexpected restart.	✋
	Do not use the product where it may be exposed to direct sunlight.	💥
	Do not apply impact load.	💥
	Never use the AC contactor installed on the main power supply-side to operate or stop the motor.	💥
	Do not use the built-in brake of the motor for regular braking purposes. It is a holding brake.	✋ 💥
	Do not use faulty, damaged motors or drives	✋ ⚡
❗	Confirm that the power supplies are within specification.	💥
	The holding brake is not a stopping device to secure the safety of the machine. The machine requires a separate stopping device to secure safety.	✋
	Upon occurrence of an alarm, remove the cause and ensure the safe condition of the equipment before resetting the alarm and restarting the machine.	✋
	Connect the brake control relay and the emergency stop relay in series.	✋ 💥

1. Important Safety Instructions

⚠ CAUTION

Sign	Precautionary Measures	If Not Observed
Transportation and Storage		
🚫	Do not store the product at a location subject to water or moisture, or where toxic gases or liquids are present.	⚠
	Do not hold the cables or motor shafts during transportation.	⚠ ⚠
	When transporting the drive and motor, do not drop them or let them fall.	⚠ ⚠
!	When the product has been stored for greater than 1.5 years, contact the supplier.	⚠
	Store the product in suitable storage environment as specified in the instruction manual.	⚠
Additional Precautions		
!	Prior to disposal of the batteries, insulate them with tape or other material. Dispose of them following the local laws and regulations.	
	When disposing of the product, treat it as industrial waste.	
Maintenance and Inspection		
🚫	Never attempt to repair the product. In the event of a failure, return the product to the supplier	⚠
	The motor, heat sink of the drive, and braking resistor may become dangerously hot. Do not touch any of them with hands when power is on or for a while after power shutdown.	⚠ ⚠
!	If the drive or motor fails, shut down both the control power supply and the main circuit power supply.	⚠

1. Important Safety Instructions

2. Other Considerations and Precautions

Export of this product or its applications

If the end user or application is involved in military activities or weapons, its export may be subject to export restrictions.
Ensure adequate trade compliance and legal reviews are completed and follow any required export procedures.
Follow the laws and regulations of the destination country.

Use of the product – suitable applications

This product is designed and manufactured to be used for general industrial products.
Medical applications are not allowed.

Applications for special environments or purposes such as nuclear power, aerospace and transportation

Please contact the supplier in advance of use if the product is to be used in one of these environments.

Applications that could cause serious accidents or damage due to product failure

Be sure to have safety device or protection device installed before using your equipment.

Applying voltage beyond the rated voltage of the product

Doing so could result in a fire or smoke hazard. Be sure to check and confirm correct power supply levels before turning the power on. Be particularly careful in a location such as a clean room.

Operations with the motor shaft not electrically grounded

Depending on the device or installation environment, bearing noise might be increased by galvanic corrosion of the motor bearings. Perform careful check on grounding.

Operations in environment under significant influence of external noise and static electricity

This product has been designed and manufactured to pass extensive noise tests. However, there is a possibility of unexpected behavior depending on user's environment
Practice a fail-safe design and take adequate measures to ensure safety within the range of machine motion.

Use of the product in a manner not rated by the manufacturer

Such use shall void the manufacturer's warranty. Do not attempt to do so.

3. Safety Standards

Rating		Motor	Drive
EU/EC Directives	Low Voltage Directive (*1)	EN60034-1 EN60034-5	EN61800-5-1
	EMC Directive (*2)	EN61000-6-2 EN55011 Class A, Group1	
	Machinery Directive	(N/A)	(N/A)
UL Standards (*1)		1004-1 1004-6 (File No.E470950)	508C (File No.E471456)
CSA Standards		C22.2 No.100	C22.2 No.14
South Korea Radio Law (KC)		(N/A)	KN11 KN61000-6-2
China Compulsory Product Certification System (CCC)		(N/A)	

*1) Install the product in the environment that meets the following requirements:
- Overvoltage Category II
- Class I
- Pollution Degree 2 (Circuitry)

*2) The test conditions for the machinery and equipment with this product installed may be different from our test conditions. Such machinery or equipment must meet the safety standards for their final configurations.

EU Declaration of Conformity

This declaration is issued under the sole responsibility of the manufacturer

1. Name and address of the manufacturer

Nidec Control Techniques Ltd
The Gro
Newtown
Powys
SY16 3BE
UK

Registered in England and Wales. Company Reg. No. 01236886
Telephone: 00 44 1686 612300
E mail: marketing.control techniques@mail.nidec.com
Web: www.controltechniques.com

2. Object of the declaration

Digitax SF variable speed AC servo motors and motor drives

Servo Motors
MY500, MY101, MX201, MZ201, MX401, MZ401, MX751, MZ751, MM102, MH102, MM152, MH152, MM202
Motor Drives
DA2YZ23, DA2Z123, DA21223, DA22423, DA23823, DA24A23, DA26B23, DA28C23

The model numbers may be followed by other characters that do not affect the ratings.

3. The object of the declaration is in conformity with the relevant European Union harmonisation legislation.

Restriction of Hazardous Substances Directive (2011/65/EU)
Low Voltage Directive (2014/35/EU)
Electromagnetic Compatibility Directive (2014/30/EU).

4. References to the relevant harmonised standards used

The servo motor and drive products listed above have been designed and manufactured in accordance with the following European harmonised standards:

EN 61800-5-1:2007+ A1:2017	Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
EN 60034-1:2010	Rotating electrical machines - Part 1: Rating and performance
EN 60034-5:2001	Rotating electrical machines - Part 5: Degrees of protection provided by the integral design of rotating electrical machines (IP code) - Classification
EN 60034-11:2004	Rotating electrical machines - Part 11: Thermal protection
EN 55011:2009+A1:2010	Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics – Limits and methods of measurement
EN 61000-6-2: 2005	Electromagnetic compatibility (EMC) - Part 6-2: Generic standards - Immunity for industrial environments

7. Signed for and on behalf of:

Jon Holman-White
Vice President of Research and Development
Nidec Control Techniques Ltd
Date: 13th June 2019
Newtown, Powys, UK.

These electronic drive products and motors are intended to be used with controllers, electrical protection components and other equipment to form complete end products or systems. Compliance with safety and EMC regulations depends upon installing and configuring the drives and motors correctly, including using the specified input filters. The drives must be installed only by professional installers who are familiar with requirements for safety and EMC. Refer to the Product Documentation. An EMC data sheet is available giving detailed information. The assembler is responsible for ensuring that the product or system complies with all the relevant laws in the country where it is to be used.

4. Maintenance and Inspection

🚫	Never attempt to repair the product.
❗	For safe use of the product, be sure to perform regular maintenance and inspection of the drive and motor.
	Ensure the electrical and mechanical safety before each inspection.

This product assumes the following operating conditions.

Ambient Temperature	Average annual temperature of 30 ℃ (not exceeding the rated temperature range)
Load Factor	80 % max
Operating Hours	20 hours a day

Maintenance

For safe use of the product, perform regular inspections.

Check the following before each operation:

Ambient temperature, humidity and atmosphere
No foreign objects or dust; especially ensure that nothing is blocking the vent holes
No excessive bending or damage of the wires
Power supply voltage is within the specifications
No foreign objects in moving parts of the device e.g. fan and the range of motion.
No unusual noise or smell right after the machinery starts.

Check the following at least once a year:

No loose clamp screw problems in the drive and motor.
No deformation or discoloration in the drive, motor, cables, and terminal blocks due to overheating.
No loose wiring fixings or loose terminal block screws.

2. Overview

Misuse or mishandling of the product will not only result in its sub-optimal performance, but also failure or shorter service life.
For safety and proper use of the product, please read the instruction manuals carefully.

About This Product and This Instruction Manual

- ■ Product features and parts are subject to change without prior notice due to potential future product improvement initiatives.
- ■ Please contact us in advance if you are to acquire safety standards certification etc. for equipment with this product installed.
- ■ Include the following precautions in the User Guide of your Digitax SF application product:
  - ・This is a high-voltage product which can be hazardous.
  - ・Residual voltage exists at the terminals and inside the equipment (even after power shutoff), which is hazardous.
  - ・The product contains high temperature components.
  - ・It is prohibited to disassemble the product.
- ■ For optimal service life of the Digitax SF product, use of the product under proper conditions is essential. Follow the safety precautions and instructions described in this manual.
- ■ We always strive to include up-to-date information in the instruction manual; therefore, it is subject to change without prior notice.
- ■ For a copy of the latest version of the instruction manual, please contact us.
- ■ Reproducing or copying this document, in whole or in part, without prior approval of Control Techniques, is strictly prohibited.

Check Items Upon Unpacking

Please compare the actual items received with your product purchase order.
Inspect all items received for evidence of damage during transit.
Should you have any problems, please contact the supplier.

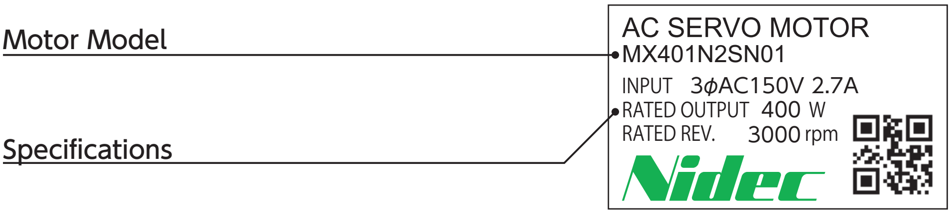
2. Overview

1. Product Label

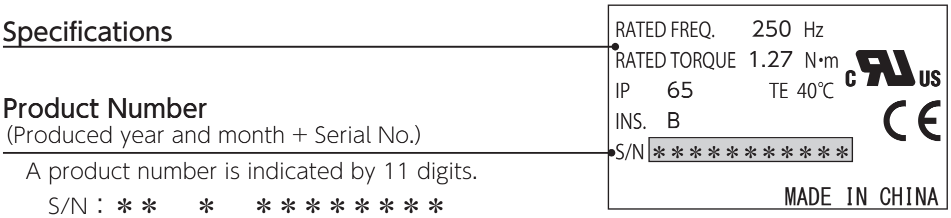
Motor Label

The product label is separated in two parts which are located shown in this picture.

Label 1



Label 2

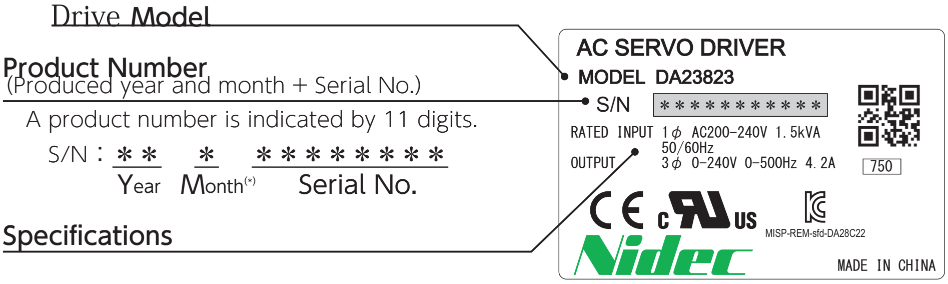


A product number is indicated by 11 digits.

S/N : ** * ********
Year Month(*) Serial No.

Drive Label

The product label is located on the side cover of the drive.



A product number is indicated by 11 digits.

S/N : ** * ********
Year Month(*) Serial No.

---

*) About indication of "the month".
"1"=Jan., ··· "9"=Sep., "X"=Oct., "Y"=Nov., and "Z" = Dec.

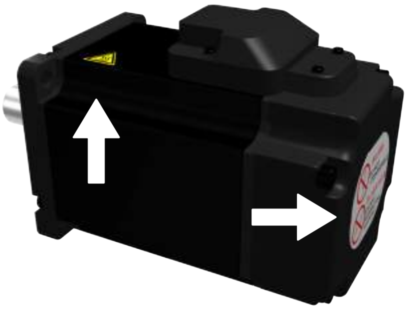
2. Danger Signs

NO IMPACT/NO DISASSEMBLY LABEL

Do not remove the encoder cover. Never attempt to repair or replace the encoder.
Any shock applied to the encoder cover may cause encoder failure.
Do not apply strong impact to the motor or its shaft

HOT SURFACE WARNING

Do not touch the product during operation or for a sufficient period of time afterwards, or you may get burned from the heat.



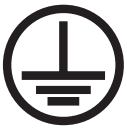
ELECTRIC SHOCK WARNING

Do not touch the drive during operation and within 5 minutes after the power has been isolated, or you may get injured.

DANGER・CAUTION

Incorrect use of the drive may cause injury or damage. Avoid misuse or improper handling of the drive, or injury may result

FG (PROTECTIVE FRAME GROUND/EARTH) SYMBOL



Be sure to perform grounding with the screw located at this sign.

MEMO

2 Specifications

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    50 W. 5
    100 W 7
    200 W 9
    400 W 11
    750 W 13
    1 kW 15
    1.5 kW 18
    2 kW 2

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2. Specifications

1. Motor

1. Models

MX 201 N 2 S N * *

Control Number

Encoder

Code	Specifications
N	17 bit (Incremental)
A	17 bit (Absolute)

Shaft end specifications/Oil Seal

Code	Rated Output	Oil Seal
S (P)	Straight	Without
K (H)	Key	Without
T (R)	Straight	With
L (J)	Key	With

Voltage

Code	Specifications
2	AC200 V to 240 V

Brake

Code	Holding Brake
N	Without
A	With

Rated Output

Code	Rated Output
500	50 W
101	100 W
201	200 W
401	400 W
751	750 W
102	1 kW
152	1.5 kW
202	2 kW

Series

Code	Specifications
MX	Low Inertia
MY	Middle Inertia
MM	
MZ	High Inertia
MH	

Inertia

Low Inertia

Middle Inertia

High Inertia

Flange Size

40 mm x 40 mm

60 mm x 60 mm

80 mm x 80 mm

130 mm x 130 mm

Rotational Speed

Rated Motor Speed / Max. [rpm]

2,000 / 3,000 [rpm]

3,000 / 6,000 [rpm]

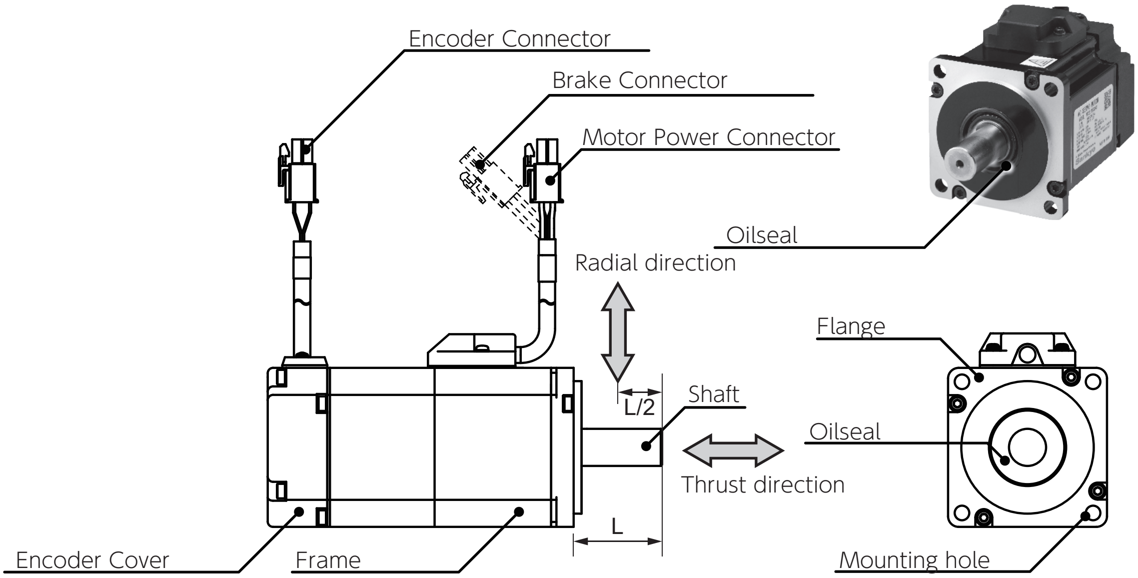
IP Code

IP65

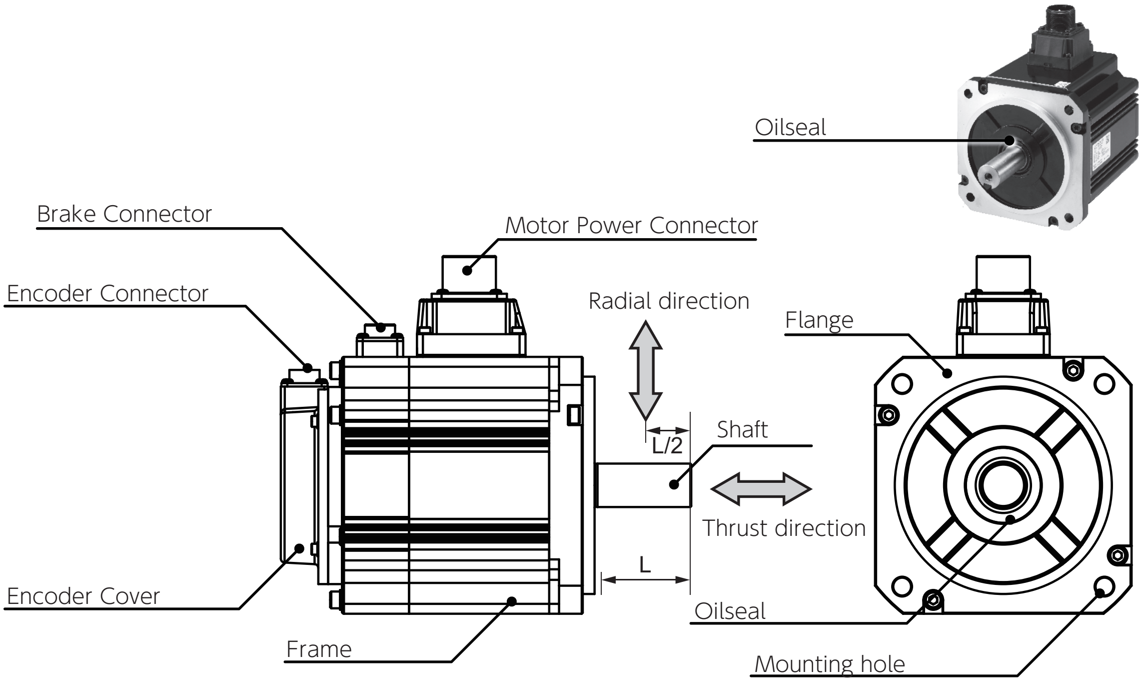
IP67

2. Names of parts

Motor: 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



Motor: 50W 100W 200W 400W 750W 1kW 1.5kW 2kW
(MM102 & MH102)



3. Specifications

Item	Specifications
Ambient temperature for operation	0 to 40 ℃
Ambient humidity for operation	20 to 85 %RH (no condensation)
Ambient temperature for storage	− 20 to 65 ℃ (no condensation) (not subjected to direct sunlight) 80 ℃ for 72 hours
Ambient humidity for storage	20 to 85 %RH (no condensation)
Atmosphere for operation / storage	Indoors (not subject to direct sunlight) , Free from corrosive gases, flammable gases, oil mist, dust, flammables, grinding fluid
Insulation resistance	≥ 5 MΩ at 1,000 VDC
Dielectric strength	AC 1500 V for one minute across the primary and Ground/Earth FG
Operating altitude	≤ 1,000 m
Vibration class	V15 (JEC2121)
Vibration resistance	49 m/s^2 (5 G)
Impact resistance	98 m/s^2 (10 G)
Protective structure	IP65 : 50 W to 750 W IP67 : 1 kW to 2 kW
Electric shock protection	Class I (Mandatory grounding)
Overvoltage category	Ⅱ
Installation environment	Pollution degree 2

The brake has polarity.

Lead wire color: Connection
Yellow (BRK+): +24 V
Blue (BRK－): GND

Incorrect wiring may result in motor failure or sub-optimal performance of the motor.

1. Motor

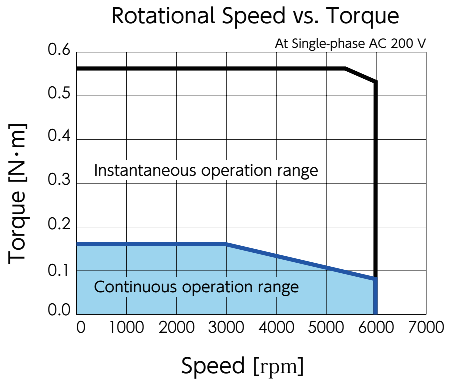
50 W

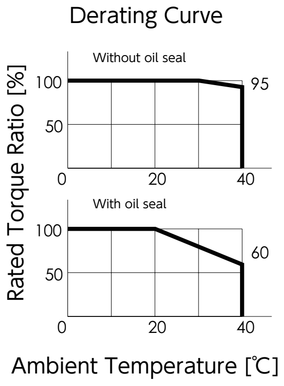
Motor Model : MY500□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.4
	With brake		0.6
Compatible drive model		–	DA2YZ _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	50
Rated torque		N·m	0.16
Instantaneous maximum torque		N·m	0.56
Rated current (stall current)		A	0.68
Instantaneous maximum current		A	2.4
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.25
Induced voltage constant per phase		mV/rpm	8.8
Rated power rate	Without brake	kW/s	6.5
	With brake		5.4
Mechanical time constant	Without brake	ms	1.92
	With brake		2.31
Electrical time constant		ms	0.74
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.039
	With brake		0.047

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.25
Static friction torque	N·m	≥ 0.16
Engage time	ms	≤ 35
Release time	ms	≤ 20
Release voltage	V	≥ DC 1 V

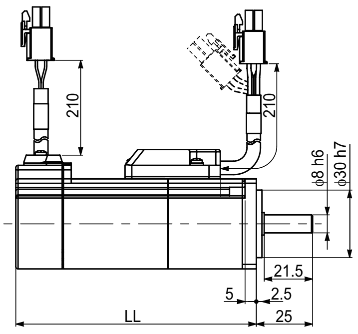
Item	Unit	Specifications
Radial	N	68
Thrust	N	58

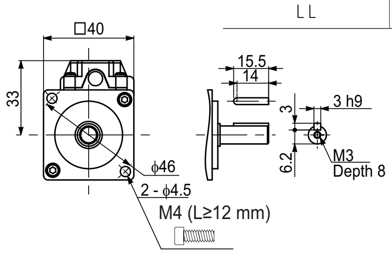




(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY500N2S MY500N2K	MY500N2T MY500N2L	MY500A2S MY500A2K	MY500A2T MY500A2L
LL	66.4	72.0	106.8	112.4





1. Motor

100 W

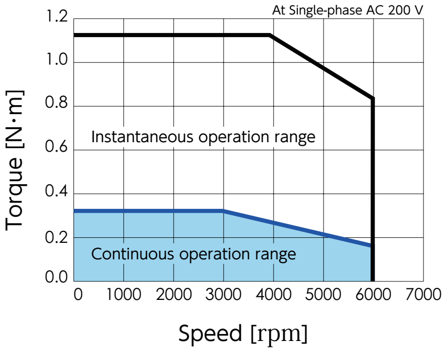
Motor Model : MY101 □2□□ ∗∗

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	40 sq.
Approximate mass	Without brake	kg	0.5
	With brake		0.8
Compatible drive model		–	DA2Z1 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	100
Rated torque		N·m	0.32
Instantaneous maximum torque		N·m	1.12
Rated current (stall current)		A	0.97
Instantaneous maximum current		A	3.3
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.35
Induced voltage constant per phase		mV/(rpm)	12.3
Rated power rate	Without brake	kW/s	16.5
	With brake		14.6
Mechanical time constant	Without brake	ms	1.17
	With brake		1.32
Electrical time constant		ms	0.89
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.061
	With brake		0.069

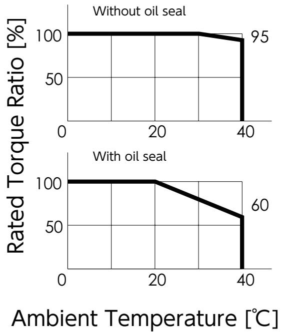
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.25
Static friction torque	N·m	≥ 0.32
Engage time	ms	≤ 35
Release time	ms	≤ 20
Release voltage	V	≥ DC 1 V

Item	Unit	Specifications
Radial	N	68
Thrust	N	58

Rotational Speed vs. Torque

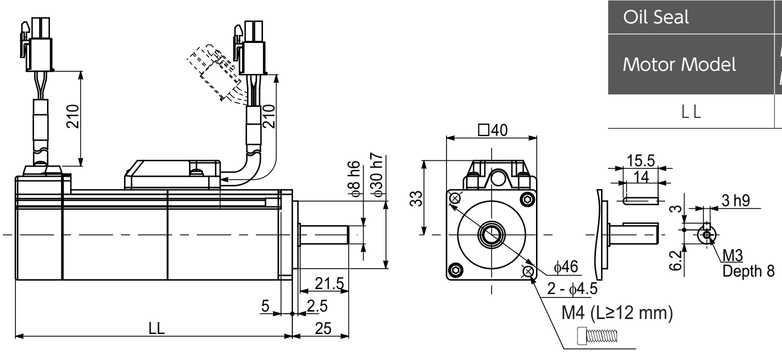


Derating Curve



(mm)

Brake	Without		With	
Oil Seal	Without	With	Without	With
Motor Model	MY101N2S MY101N2K	MY101N2T MY101N2L	MY101A2S MY101A2K	MY101A2T MY101A2L
LL	82.4	88.0	122.8	128.4



1. Motor

200 W

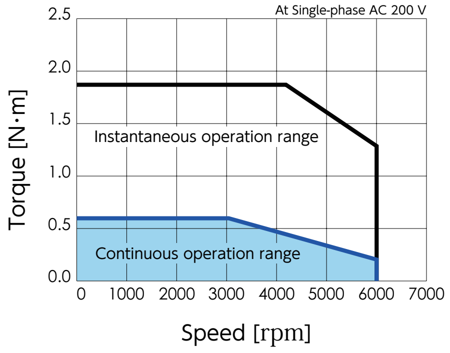
Motor Model : MX201□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	0.8
	With brake		1.3
Compatible drive model		–	DA212 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(rpm)	14.3
Rated power rate	Without brake	kW/s	28.2
	With brake		23.5
Mechanical time constant	Without brake	ms	0.72
	With brake		0.87
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.14
	With brake		0.17

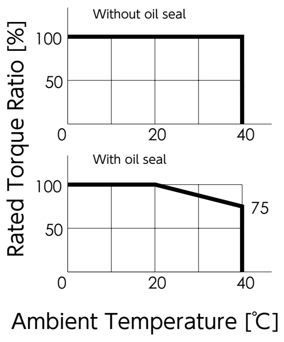
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24V ± 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Engage time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	≥ DC 1 V

Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque

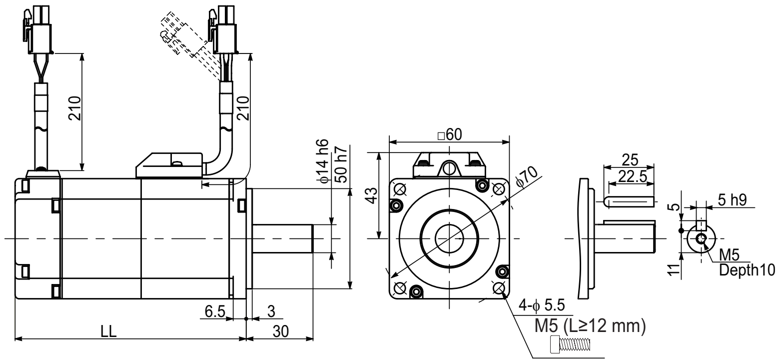


Derating Curve



(mm)

Brake	Without	With
Motor Model	MX201N	MX201A
LL	76.5	113.0



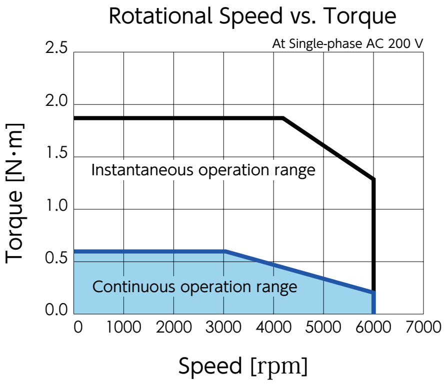
1. Motor

Motor Model : MZ201 □ 2 □ □ ＊＊

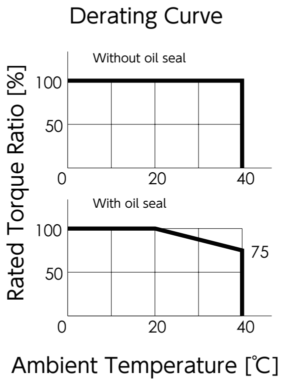
Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.0
	With brake		1.5
Compatible drive model		–	DA212 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	200
Rated torque		N·m	0.64
Instantaneous maximum torque		N·m	1.91
Rated current (stall current)		A	1.7
Instantaneous maximum current		A	5.2
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.41
Induced voltage constant per phase		mV/(rpm)	14.3
Rated power rate	Without brake	kW/s	9.1
	With brake		8.6
Mechanical time constant	Without brake	ms	2.23
	With brake		2.38
Electrical time constant		ms	2.53
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.44
	With brake		0.47

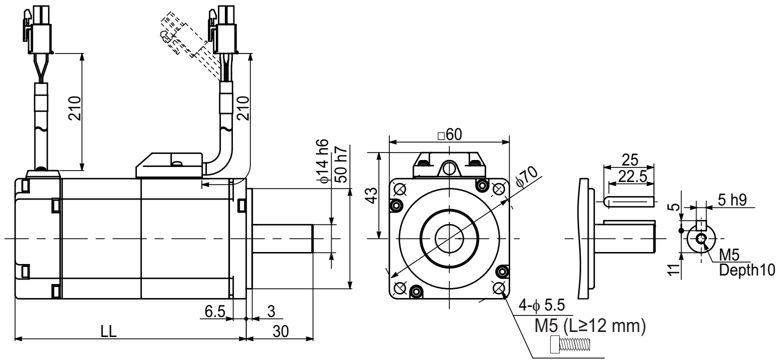
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Engage time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	≥ DC 1 V

Item	Unit	Specifications
Radial	N	245
Thrust	N	98


Rotational Speed vs. Torque

At Single-phase AC 200 V


Derating Curve



(mm)

Brake	Without	With
Motor Model	MZ201N	MZ201A
LL	93.5	130.0

1. Motor

400 W

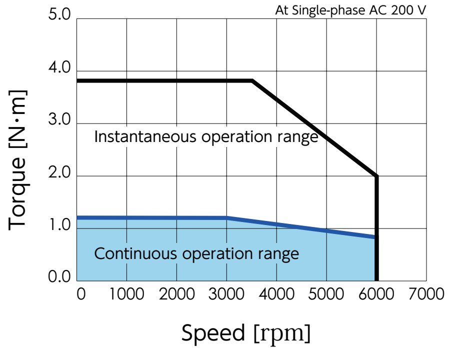
Motor Model : MX401 □2□□ ＊＊

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.3
	With brake		1.8
Compatible drive model		–	DA224 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(rpm)	17.1
Rated power rate	Without brake	kW/s	69.4
	With brake		61.8
Mechanical time constant	Without brake	ms	0.47
	With brake		0.53
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.23
	With brake		0.26

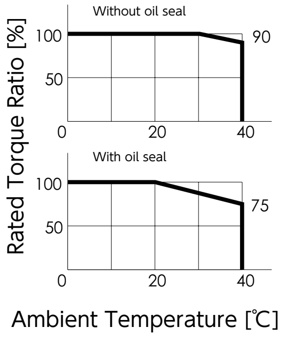
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Engage time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	≥ DC 1 V

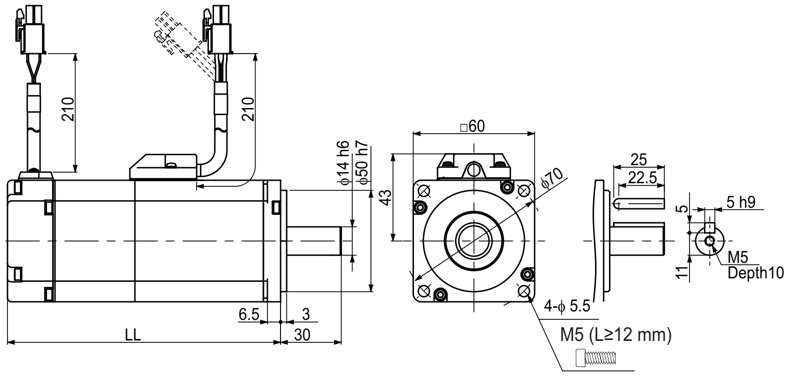
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MX401N	MX401A
LL	93.5	130.0

2. Specifications

1. Motor

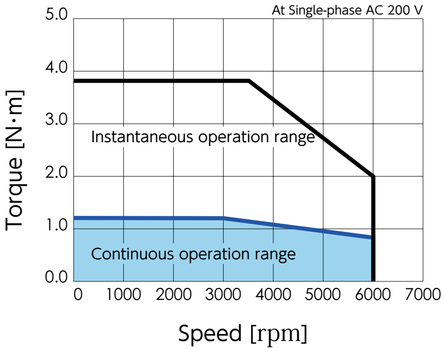
Motor Model： MZ401□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	60 sq.
Approximate mass	Without brake	kg	1.5
	With brake		2.0
Compatible drive model		–	DA224 _ _
Voltage		V	AC200 V to 240 V
Rated output Power		W	400
Rated torque		N·m	1.27
Instantaneous maximum torque		N·m	3.82
Rated current (stall current)		A	2.7
Instantaneous maximum current		A	8.5
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.49
Induced voltage constant per phase		mV/(rpm)	17.1
Rated power rate	Without brake	kW/s	23.0
	With brake		22.1
Mechanical time constant	Without brake	ms	1.42
	With brake		1.47
Electrical time constant		ms	2.92
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.71
	With brake		0.73

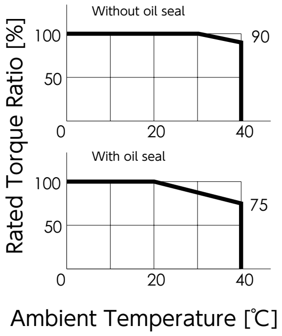
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.3
Static friction torque	N·m	≥ 1.27
Engage time	ms	≤ 50
Release time	ms	≤ 15
Release voltage	V	≥ DC 1 V

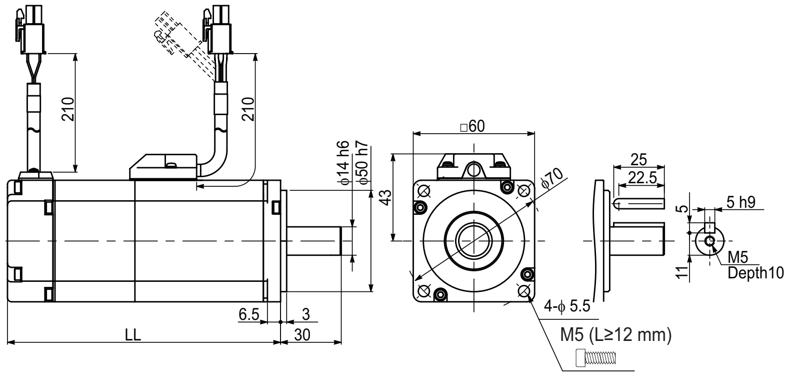
Item	Unit	Specifications
Radial	N	245
Thrust	N	98

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ401N	MZ401A
LL	110.5	147.0

1. Motor

750 W

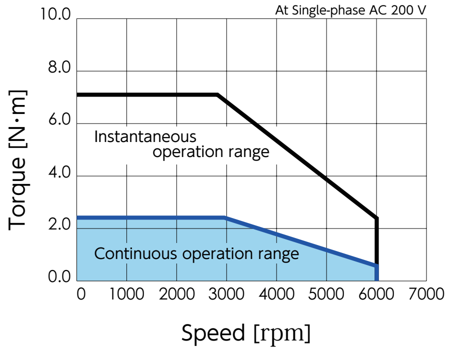
Motor Model : MX751□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Low
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.2
	With brake		3.0
Compatible drive model		–	DA238 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(rpm)	21.9
Rated power rate	Without brake	kW/s	76.6
	With brake		60.7
Mechanical time constant	Without brake	ms	0.40
	With brake		0.50
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	0.74
	With brake		0.94

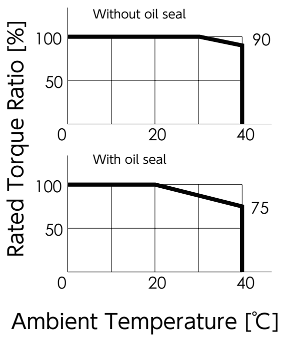
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.4
Static friction torque	N·m	≥ 2.39
Engage time	ms	≤ 70
Release time	ms	≤ 20
Release voltage	V	≥ DC 1 V

Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque

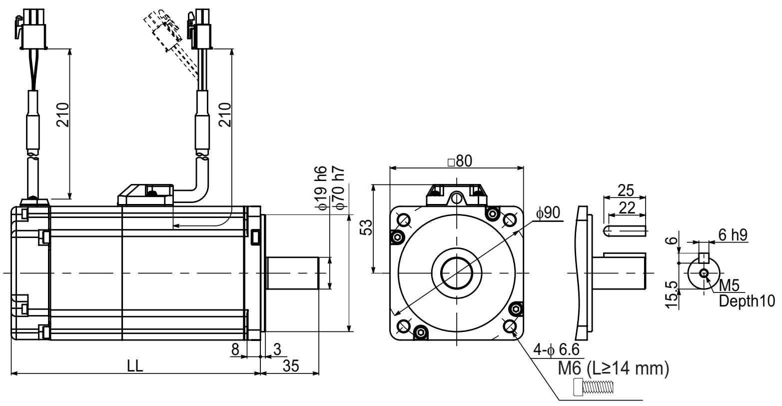


Derating Curve



(mm)

Brake	Without	With
Motor Model	MX751N	MX751A
LL	107.3	144.3



1. Motor

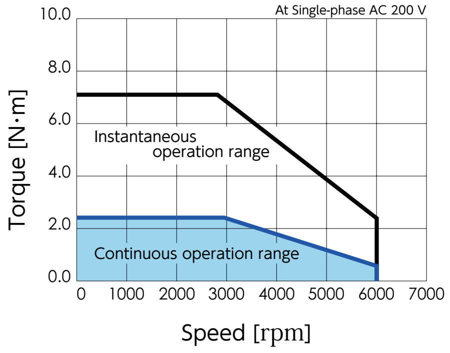
Motor Model : MZ751 □ 2 □ □ ＊＊

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	80 sq.
Approximate mass	Without brake	kg	2.5
	With brake		3.3
Compatible drive model		–	DA238 _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	750
Rated torque		N·m	2.39
Instantaneous maximum torque		N·m	7.1
Rated current (stall current)		A	4.2
Instantaneous maximum current		A	12.2
Rated revolving speed		rpm	3,000
Maximum revolving speed		rpm	6,000
Torque constant		N·m/A	0.63
Induced voltage constant per phase		mV/(rpm)	21.9
Rated power rate	Without brake	kW/s	35.4
	With brake		31.6
Mechanical time constant	Without brake	ms	0.86
	With brake		0.96
Electrical time constant		ms	4.60
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	1.61
	With brake		1.81

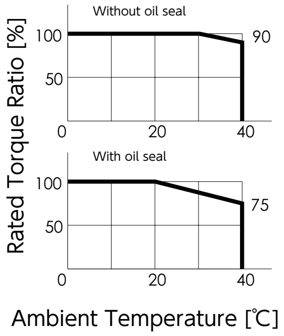
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	0.4
Static friction torque	N·m	≥ 2.39
Engage time	ms	≤ 70
Release time	ms	≤ 20
Release voltage	V	≥ DC 1 V

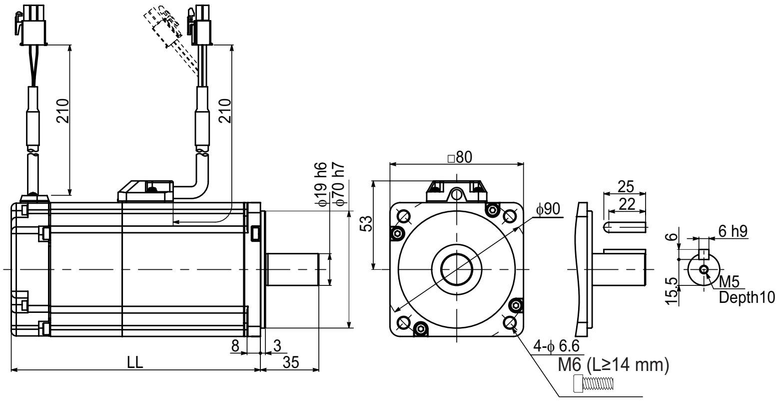
Item	Unit	Specifications
Radial	N	392
Thrust	N	147

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MZ751N	MZ751A
LL	122.3	159.3

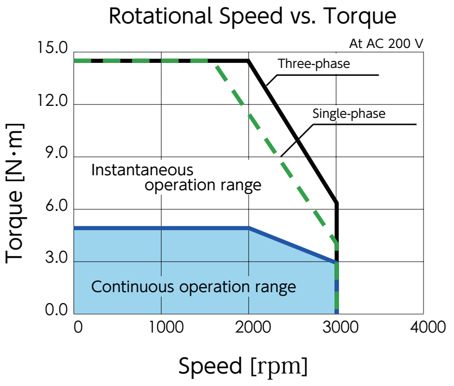
1kW 130 SQUARE M 3000 2000 IP67

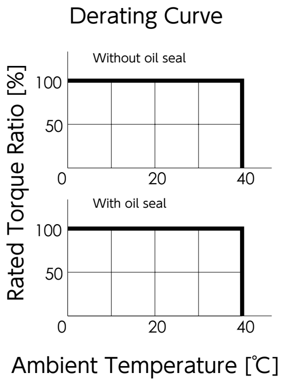
Motor Model： MM102□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	5.6
	With brake		7.0
Compatible drive model		–	DA24A _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		rpm	2,000
Maximum revolving speed		rpm	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(rpm)	30.9
Rated power rate	Without brake	kW/s	50.0
	With brake		36.5
Mechanical time constant	Without brake	ms	0.76
	With brake		1.05
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	4.56
	With brake		6.24

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Engage time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC 1 V

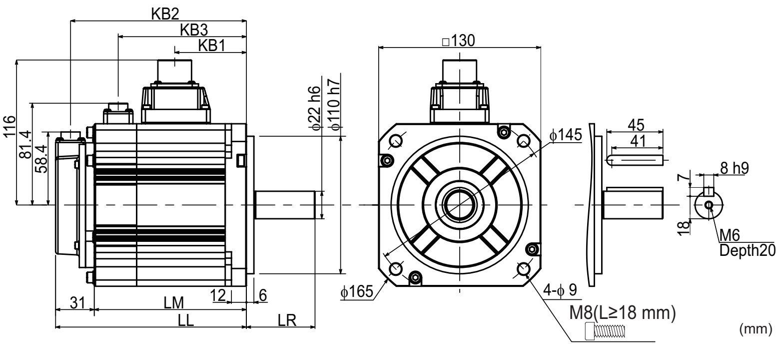
Item	Unit	Specifications
Radial	N	490
Thrust	N	196





(mm)

Brake	Without	With
Motor Model	MM102N	MM102A
LL	128.0	153.0
LM	97.0	122.0
LR	55.0	
KB1	57.5	
KB2	116.0	141.0
KB3	–	102.8



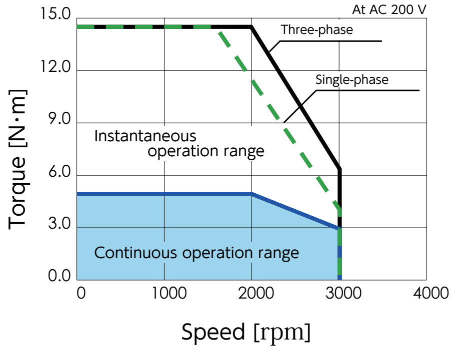
1. Motor

Motor Model : MH102□2□□＊＊

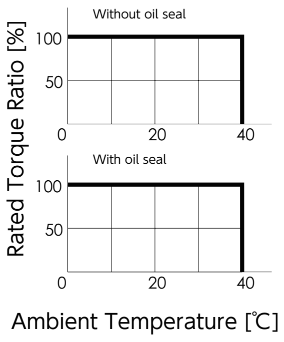
Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.6
	With brake		9.0
Compatible drive model		–	DA24A _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	1,000
Rated torque		N·m	4.77
Instantaneous maximum torque		N·m	14.3
Rated current (stall current)		A	5.6
Instantaneous maximum current		A	16.8
Rated revolving speed		rpm	2,000
Maximum revolving speed		rpm	3,000
Torque constant		N·m/A	0.88
Induced voltage constant per phase		mV/(rpm)	30.9
Rated power rate	Without brake	kW/s	9.2
	With brake		8.6
Mechanical time constant	Without brake	ms	4.17
	With brake		4.43
Electrical time constant		ms	10.1
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	24.9
	With brake		26.4

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Engage time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC 1 V

Item	Unit	Specifications
Radial	N	490
Thrust	N	196



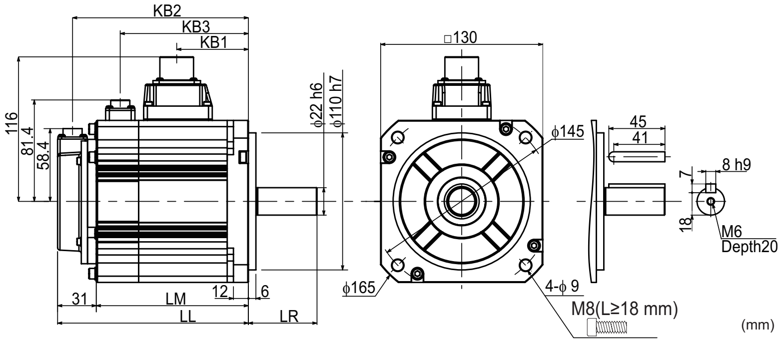
Rotational Speed vs. Torque



Derating Curve

(mm)

Brake	Without	With
Motor Model	MH102N	MH102A
LL	163.0	188.0
LM	132.0	157.0
LR	70.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8



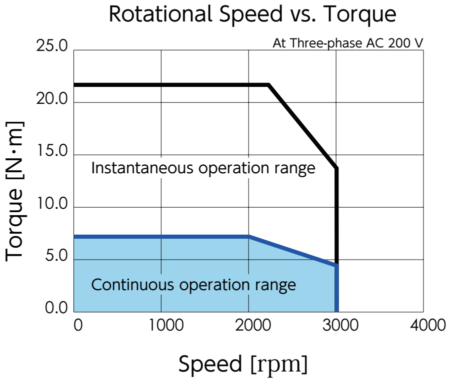
1.5 kW

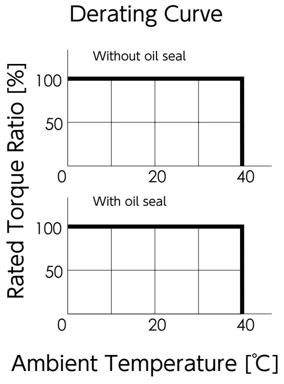
Motor Model : MM152□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	7.0
	With brake		8.4
Compatible drive model		–	DA26B _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		rpm	2,000
Maximum revolving speed		rpm	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(rpm)	28.4
Rated power rate	Without brake	kW/s	76.9
	With brake		61.4
Mechanical time constant	Without brake	ms	0.60
	With brake		0.75
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	6.67
	With brake		8.35

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Engage time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC 1 V

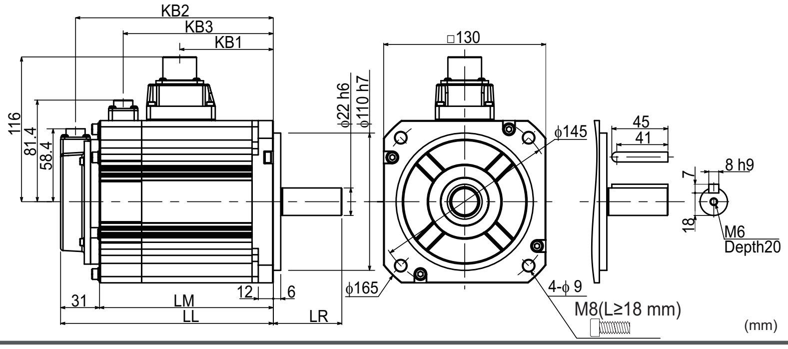
Item	Unit	Specifications
Radial	N	490
Thrust	N	196





(mm)

Brake	Without	With
Motor Model	MM152N	MM152A
LL	145.5	170.5
LM	114.5	139.5
LR	55.0	
KB1	75.0	
KB2	133.5	158.5
KB3	–	120.3



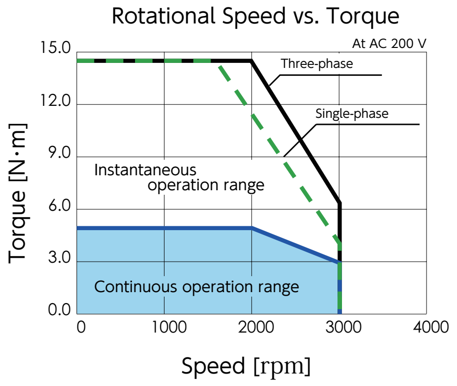
1. Motor

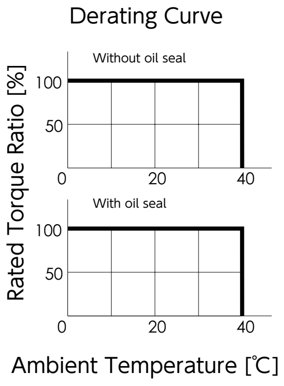
Motor Model : MH152□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	High
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	9.0
	With brake		10.4
Compatible drive model		–	DA26B _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	1,500
Rated torque		N·m	7.16
Instantaneous maximum torque		N·m	21.5
Rated current (stall current)		A	9.0
Instantaneous maximum current		A	27
Rated revolving speed		rpm	2,000
Maximum revolving speed		rpm	3,000
Torque constant		N·m/A	0.81
Induced voltage constant per phase		mV/(rpm)	28.4
Rated power rate	Without brake	kW/s	13.8
	With brake		13.3
Mechanical time constant	Without brake	ms	3.32
	With brake		3.46
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	37.12
	With brake		38.65

Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Engage time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC 1 V

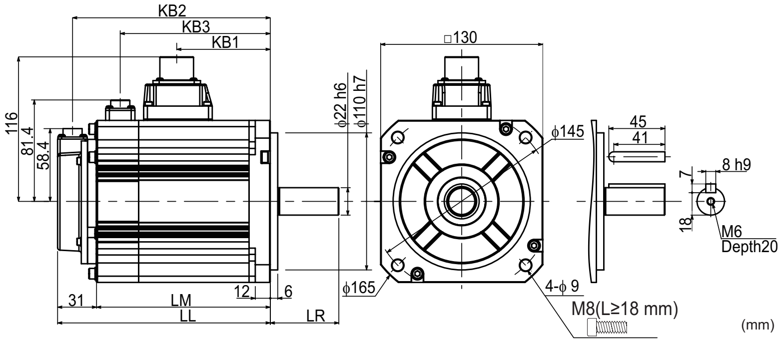
Item	Unit	Specifications
Radial	N	490
Thrust	N	196


Rotational Speed vs. Torque


Derating Curve

(mm)

Brake	Without	With
Motor Model	MH152N	MH152A
LL	180.5	205.5
LM	149.5	174.5
LR	70.0	
KB1	110.0	
KB2	168.5	19.35
KB3	–	155.3



1. Motor

2 kW

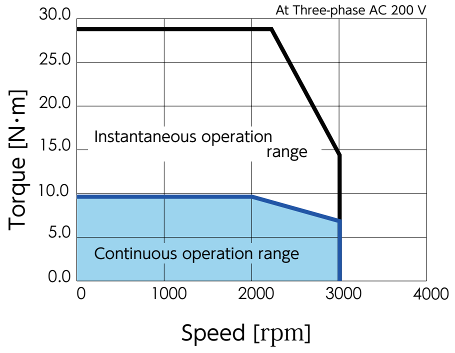
Motor Model : MM202□2□□＊＊

Item		Unit	Specifications
Rotor inertia		–	Middle
Fitting flange size		mm	130 sq.
Approximate mass	Without brake	kg	8.4
	With brake		9.8
Compatible drive model		–	DA28C _ _
Voltage		V	AC200 V to 240 V
Rated output power		W	2,000
Rated torque		N·m	9.55
Instantaneous maximum torque		N·m	28.6
Rated current (stall current)		A	11.9
Instantaneous maximum current		A	35.7
Rated revolving speed		rpm	2,000
Maximum revolving speed		rpm	3,000
Torque constant		N·m/A	0.85
Induced voltage constant per phase		mV/(rpm)	29.6
Rated power rate	Without brake	kW/s	104.9
	With brake		87.9
Mechanical time constant	Without brake	ms	0.58
	With brake		0.69
Electrical time constant		ms	12.2
Rotor moment of inertia	Without brake	$\times 10^{-4}$ kg·m^2	8.70
	With brake		10.38

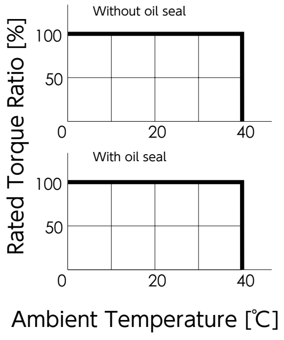
Item	Unit	Specifications
Usage	–	Holding
Rated voltage	V	DC 24 V ± 10 %
Rated current	A	1.0
Static friction torque	N·m	≥ 9.55
Engage time	ms	≤ 120
Release time	ms	≤ 30
Release voltage	V	≥ DC 1 V

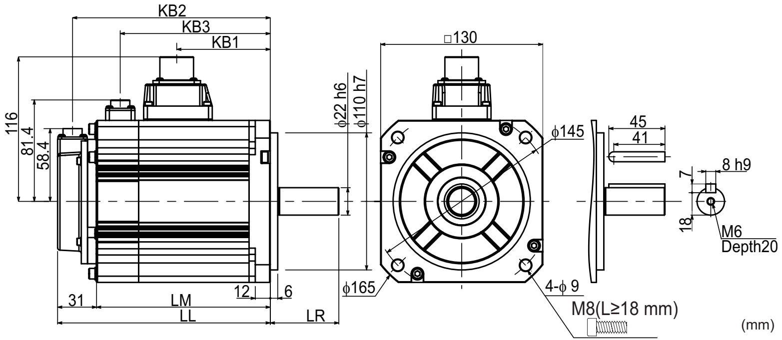
Item	Unit	Specifications
Radial	N	490
Thrust	N	196

Rotational Speed vs. Torque



Derating Curve





(mm)

Brake	Without	With
Motor Model	MM202N	MM202A
LL	163.0	188.0
LM	132.0	157.0
LR	55.0	
KB1	92.5	
KB2	151.0	176.0
KB3	–	137.8

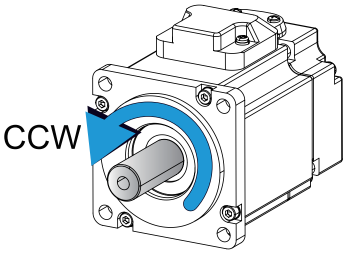
2. Encoder

1. Specifications

Item			Specifications	
Motor model			M□□□□□2□N＊＊	M□□□□□2□A＊＊
Resolution			Incremental 17 bit	Absolute 17 bit
Environmental requirements	Ambient operating temperature		0 to 85 ℃	
	External disturbance magnetic field		±2 mT (20 G) or below	
Electrical specifications	Power supply	Voltage	DC 4.5 to 5.5 V (Power supply ripple ≤ 5 %)	
		Current consumption	160 mA typ. (Not including inrush current)	
	External battery	Voltage	–	DC 2.4 to 4.2V
		Current consumption	–	10 μA typ. (*1)
	Multi-turn count		–	65,536 counts
	Maximum revolving speed		6,000 rpm	
	Count-up direction		CCW (*2)	
	Input/output type		Differential	
Communication specification	Transmission method		Half-duplex asynchronous serial communication	
	Communication speed		2.5 Mbps	

*1) Measurement conditions
room temperature, the motor not in motion, battery voltage of 3.6 V.

*2) CCW when viewed from the load side shaft end.



Precautions

Using the motor with rotations of 180 degrees or less will reduce the encoder's rotational accuracy.
For a motor equipped with a brake, follow the brake voltage and polarity specifications.
If the brake voltage is less than 12 V or the polarity is reversed, the encoder's rotational accuracy will be reduced due to changes in the magnetic field around the encoder.

3. Drive

1. Model

DA 2 Y Z 2 3

Series

Specifications	
Code	Specifications
22	Standard
23	Standard

Main Circuit Power Supply	
Code	Supply
Z	50 W
1	100 W
2	200 W
4	400 W
8	750 W
A	1 kW
B	1.5 kW
C	2 kW

Compatible Motor		
Code	Model	Rated Output
Y	M □ 500 □ 2 □ □ * *	50 W
Z	M □ 101 □ 2 □ □ * *	100 W
1	M □ 201 □ 2 □ □ * *	200 W
2	M □ 401 □ 2 □ □ * *	400 W
3	M □ 751 □ 2 □ □ * *	750 W
4	M □ 102 □ 2 □ □ * *	1 kW
6	M □ 152 □ 2 □ □ * *	1.5 kW
8	MM202 □ 2 □ □ * *	2 kW

Input Power Supply		
Code	Main Circuit Power	Control Power
2	AC200 V to 240 V (*)	DC24 V

(*) Single- or Three-phase option depends on compatible motor.

50 W to 750 W : Single-phase
1 kW : Single-phase / Three-phase
1.5 kW, 2 kW : Three-phase

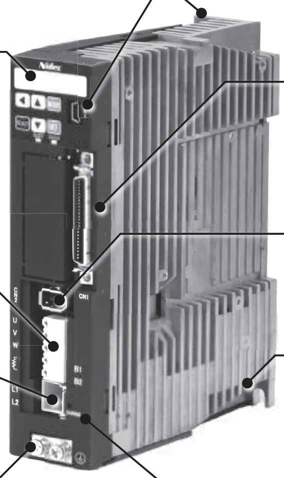
Drive / Motor Combinations

Drive	Motor	Motor Rated Output Power
DA2YZ23	MY500 □ 2 □□* *	50 W
DA2Z123	MY101 □ 2 □□* *	100 W
DA21223	MX201 □ 2 □□* * , MZ201 □ 2 □□* *	200 W
DA22423	MX401 □ 2 □□* * , MZ401 □ 2 □□* *	400 W
DA23823	MX751 □ 2 □□* * , MZ751 □ 2 □□* *	750 W
DA24A23	MM102 □ 2 □□* * MH102 □ 2 □□* *	1 kW
DA26B23	MM152 □ 2 □□* * , MH152 □ 2 □□* *	1.5 kW
DA28C23	MM202 □ 2 □□* *	2 kW

Use a motor and the drive in a correct combination.

2. Names of parts

Drive: **50W** **100W** **200W** **400W** 750W 1kW 1.5kW 2kW



Mounting holes
⌀ 5.5 (one location)
The recommended screw: M5x12 mm, with spring washer

Setting panel
Used for parameter setting, tuning, and status display

Motor power connector
UVW: Motor power output
B1 B2: Braking resistor connection

Main power connection
L1 L2: Single-phase AC200 V input

Ground/Earth FG(Protective earth) terminal
Two terminals:
M4x8 mm screw with spring washer

CN3 PC communication connector
Used for parameter settings, tuning, and status display in the dedicated software “Digitax SF Connect”

CN1 User I/O connector
Control power input, Command input, Parallel I/O, and ABZ output

CN2 Encoder connector
Encoder connection

Mounting notch
⌀ 5.5 (one location)
The recommended screw:
M5x12 mm with spring washer

Hazardous voltage display LED
This will be lit while there is residual hazardous voltage inside the drive.

Drive: 50W 100W 200W 400W **750W** 1kW 1.5kW 2kW

Mounting holes
⌀ 5.5 (one location)
The recommended screw: M5 × 12 mm, with spring washer

Setting panel
Used for parameter setting, tuning, and status display

Motor power connector
UVW: Motor power output

Main power connection
B1 B2: Braking resistor connection

L1 L2: Single-phase AC200 V input

Hazardous voltage display LED
This will be lit while there is residual hazardous voltage inside the drive.

Ground/Earth FG(Protective earth) terminal
Two terminals:
M4x8 mm screw with spring washer

CN3 PC communication connector
Used for parameter settings, tuning, and status display in the dedicated software “Digitax SF Connect”

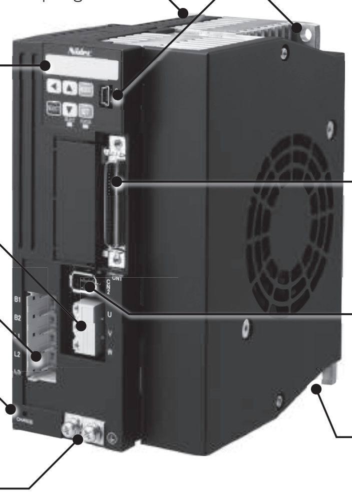
CN1 User I/O connector
Control power input, Command input, Parallel I/O, and ABZ output

CN2 Encoder connector
Encoder connection

Mounting notch
⌀ 5.5 (one location)
The recommended screw:
M5x12 mm with spring washer

3. Drive

Drive: 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



Mounting holes

⌀ 5.5 (two locations)
The recommended screw: M5x12 mm and 8 mm, with spring washer

Setting panel

Used for parameter setting, tuning, and status display

Motor power connector

UVW: Motor power output

Main power connection

B1 B2: Braking resistor connection
L1 L2 L3: Single-phase AC200 V input

Hazardous voltage display LED

This will be lit while there is residual hazardous voltage inside the drive.

Ground/Earth FG(Protective earth) terminal

Two terminals:
M4x8 mm screw with spring washer

CN3 PC communication connector

Used for parameter settings, tuning, and status display in the dedicated software "Digitax SF Connect"

CN1 User I/O connector

Control power input, Command input, Parallel I/O, and ABZ output

CN2 Encoder connector

Encoder connection

Mounting notch

⌀ 5.5 (one location)
The recommended screw:
M5x12 mm with spring washer

3. Drive

3. Specifications

Basic Specifications

Item		Specifications							
Model		DA2YZ _ _	DA2Z1 _ _	DA212 _ _	DA224 _ _	DA238 _ _	DA24A _ _	DA26B _ _	DA28C _ _
Compatible Motor		M□500	M□101	M□201	M□401	M□751	M□102	M□152	MM202
External dimensions		(See "Dimensions" beginning on page 31.)							
Weight (kg)		0.7				0.8	1.0	1.6	
Input power	Main circuit power	Single-phase AC200 V to 240 V ± 10 % 50 / 60 Hz					Three-phase AC200 V to 240 V (*1) ± 10 % 50 / 60 Hz		
	Control power (*2)	DC24V ±10 %							
	Input current (Arms typ)	0.8	1.3	2.4	3.6	7.2	Single-phase : 9.7 Three-phase : 5.1	6.1	9.0
	Control power Current Consumption (mA Typ.)	170			210	260	350		
		(Inrush current approx.1.4 A)							
Control type		Three-phase PWM inverter sine-wave driven							
Output Rating	Rated current (A)	0.7	1.0	1.7	2.7	4.3	5.6	9.9	12.2
	Output frequencies (Hz)	0 to 500					0 to 250		
Encoder feedback		17 bit single-turn absolute (The product can function as a multi-turn absolute type when batteries are added.)							
Control signal	Input	8-point (24 VDC system, opto-coupler input insulation) inputs whose functions are switched by the control mode							
	Output	8-point (24 VDC system, open-collector output insulation) outputs whose functions are switched by the control mode							
Analog signal	Input	Single ended (±10 V) input whose functions can be switched by the control mode							
Pulse signal	Input	RS-422 differential Open-collector							
	Output	Encoder feedback pulse (A-/B-/Z-phase), RS-422 differential output Z-phase pulse through open-collector as well							
Communication function		USB : connection to PC with "Digitax SF Connect" installed RS-485 : host remote control communication (multi-drop compatible)							
Drive status display function		Drive status display function 6 digits of seven-segment display on Setup Panel Normal/Error display on STATUS LED Green light when Power ON Normal, Red light when Power ON Error, Dim when Power OFF							
Regeneration function		A braking resistor may be installed externally (*3)							
Control mode		Position Control, Velocity Control, Torque Control							

Environmental Specification

Item		Specifications
Ambient temperature	For operation	0 to 50 ℃ (*5)
	For storage	−20 to 65 ℃
Ambient humidity	For operation	20 to 85 % RH (no condensation)
	For storage	
Atmosphere for operation and storage		Indoors (not subject to direct sunlight), Free from corrosive gases, flammable gases, oil mist, dust, flammables, grinding fluid
Altitude		≤ 1,000 m
Vibration		≤ 5.8 m/s^2 (0.6 G) 10 to 60 Hz (no continuous operation allowed at resonant frequency)
Dielectric strength		AC 1,500 V for one minute across the primary and Ground/Earth FG
Electric shock protection		Class I (mandatory grounding)
Overvoltage category		II
Installation environment		Pollution degree 2

3. Drive

Functions Specifications

Position Control Mode

Item		Specifications
Pulse Input	Control input	Servo ON, alarm reset, command input inhibit, emergency stop, position error counter clear, 2-stage torque limit, CCW/CW run inhibit (limit switch input), ABS data demand, homing start
	Control output	Alarm status, servo status, servo ready, under torque limit, brake release, positioning complete, motion complete, alarm, emergency stop brake release, ABS data transmitting, homing complete
	Maximum command pulse frequency	RS-422 differential : 4 Mpps Open-collector : 200 kpps
	Input pulse signal form (*6)	Pulse + Direction, A-/B-phase quadrature encoder pulse, CW + CCW pulse
	Command pulse-paired ratio	ratio A/B 1/1,000 < A/B < 1,000 Setting range A : 1 to 65,535 B : 1 to 65,535
Internal Position	Control input	Servo ON, alarm reset, position error counter clear, motion start point selection 16, home position sensor input, homing start
	Control output	Alarm status, servo status, servo ready, under torque limit, brake release, homing complete, motion complete
	Operation mode	Point table, communication operation
Smoothing filter		FIR Filter
Damping control		Enabled

Velocity Control Mode

Item		Specifications
Analog Velocity	Control input	Servo ON, alarm reset, command input inhibit (zero torque command), 2-stage torque limit, CCW/CW run limit switch inputs.
	Control output	Alarm status, servo status, servo ready, under torque limit, brake release
	Speed command input	Input voltage − 10 V to +10 V (max speed is reached at ± 10 V)
Internal Velocity	Control input	Servo ON, alarm reset, start 1 (CCW), start 2 (CW), 8-stage speed command 2-stage torque limit
	Control output	Alarm status, servo status, servo ready, under torque limit, brake release
Smoothing filter		IIR Filter, FIR Filter

Torque Control Mode

Item		Specifications
Analog Torque	Control input	Servo ON, alarm reset, command input inhibit (zero clamp command) 2-stage torque limit, CCW/CW run inhibit (limit switch inputs)
	Control output	Alarm status, servo status, servo ready, under torque limit, brake release
	Torque command input	Input voltage, − 10 V to +10 V (max speed is reached at ± 10 V)
Smoothing filter		IIR Filter

Common Features

Item		Specifications
Speed observer		Available
Auto-tuning		Available
Encoder output Division /Multiplication		Available
Tuning & Function Setup		Available through the Digitax SF setup software "Digitax SF Connect" Tuning with the setup panel on the drive front side
Protective functions	By hardware	Overvoltage, low voltage, Overcurrent, Abnormal temperature, Overload, Encoder error
	By software	Overspeed, Position error too high, Parameter errors
Alarm Log		Can be referenced with the setup software Digitax SF Connect

Notice

*1) In the Drive DA24A □□ (1 kW), single-phase can be used as the AC Supply source. To use single-phase 200 to 240 VAC, connect it to the primary circuit L1 and L3 power connectors.

Item		Specifications	
Drive Model		DA24A22, DA24A23	
Compatible Motor		1kW M □ 102 □ 2 □□ ＊＊)	
AC Supply	Voltage Range	Three-phase 200 to 240 VAC ± 10 % 50/60 Hz	Single-phase 200 to 240 VAC ± 10 % 50/60 Hz
	Input Current	Rated at 4.5 A (200 VAC input) Rated at 3.8 A (230 VAC input) Up to approximately 13 A	Rated at 8.6 A (200 VAC input) Rated at 7.3 A (230 VAC input) Up to approximately 23 A

*2) Use SELV (Safety Extra Low Voltage/Non-Hazardous Voltage) power supply with reinforced isolation from hazardous voltage. As a countermeasure against drive failure, install overcurrent protection or use power output capacity of no higher than 100 W.
The current consumption values in the table assume that no I/O signals except the Servo-On signal are connected. Current consumption by all I/O signals in use must be added up.

If multiple drives are to share control power, select a power source that will support the total inrush current of all connected drives.

*3) Braking resistor values do not guarantee optimal performance. If the generated heat becomes too high, increase the resistance value or select a resistor whose allowable power is large enough. Whether or not a braking resistor installation is necessary can be checked on the Setup Panel or Digitax SF Connect

☞ 3 Preparation
☞ 5 Setting Parameters

*4) Digitax SF drives are equipped with a software–based emergency stop braking function to stop the equipment. This emergency stop braking function does not necessarily work in case of disconnection from control power such as drive failure and power outage.
An external citcuit is required. Please perform thorough testing before actual use.

☞ 3 Preparation

*5) When mounting drives in an enclosure such as a protection case, install a cooling device, or maintain required clearance around it so that ambient temperature will not rise above the specified temperature.

☞ 3 Preparation

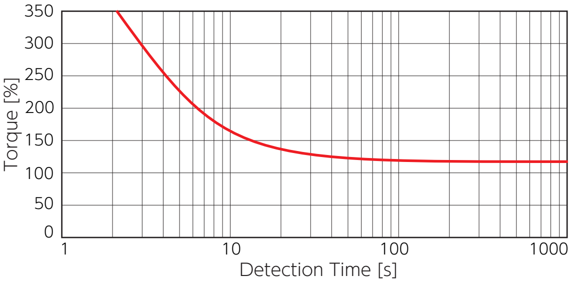
*6) The minimum time interval varies depending on input format.

☞ 4 Connections

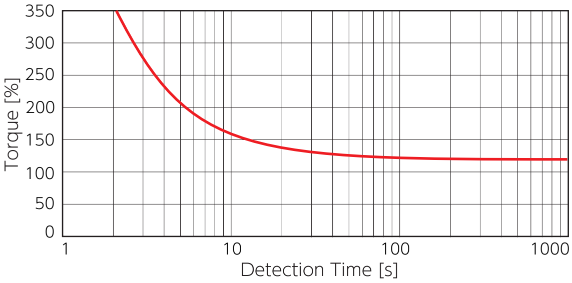
Overload Detection Feature

Digitax SF drives provide overload protection - overload alarm output and emergency stop upon alarm output -in case of motor operation with load level above the overload detection curve shown below.

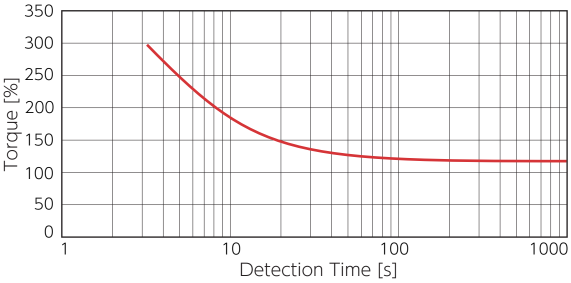
50W



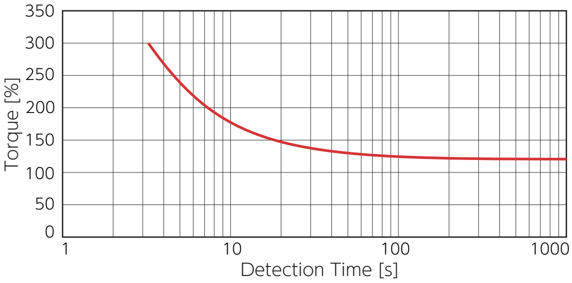
100W



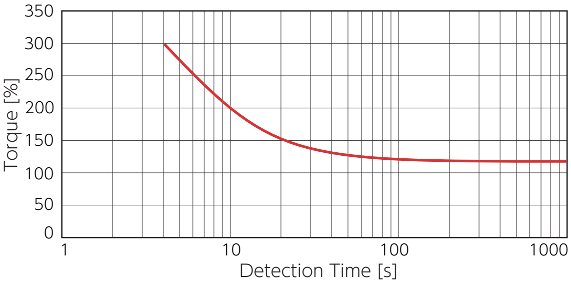
200W



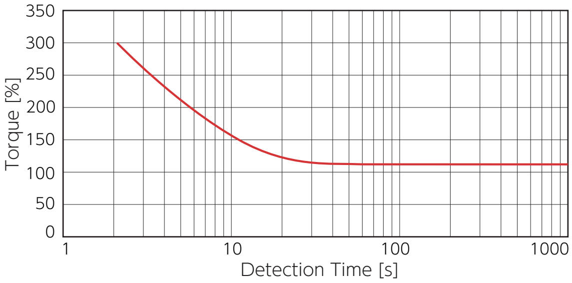
400W



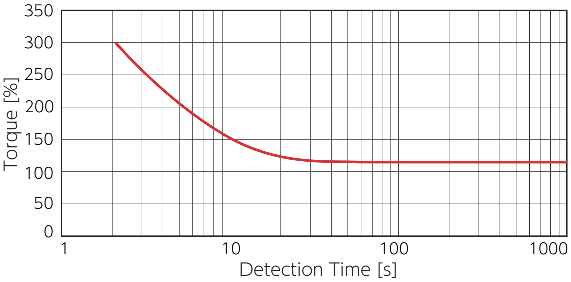
750W



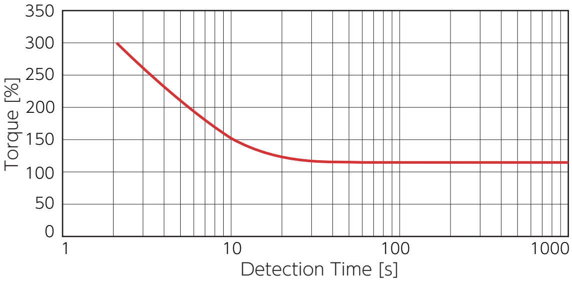
1kW (MM102, MH102)



1.5kW



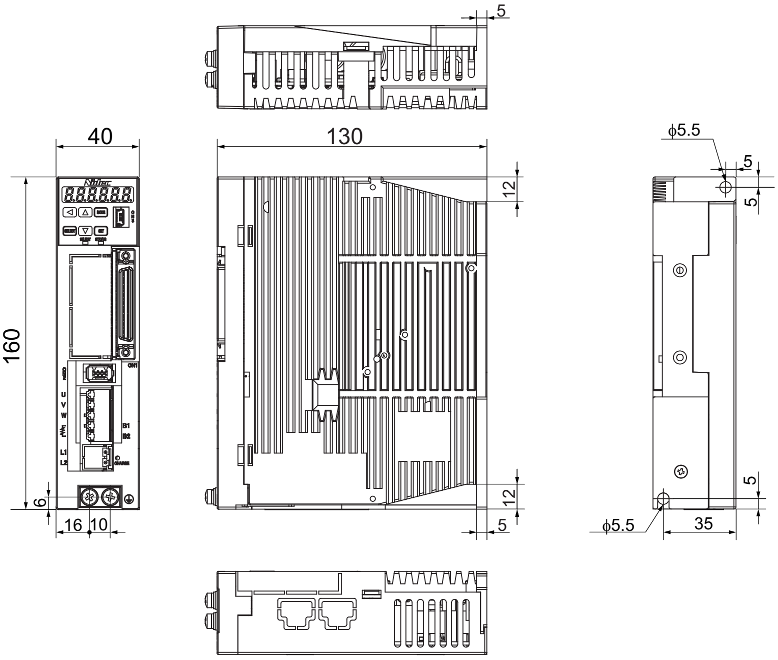
2kW

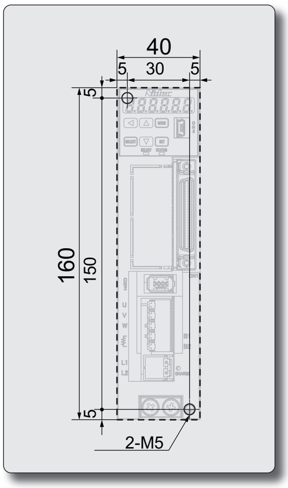


4. Dimensions

Figure 1

50W 100W 200W 400W 750W 1kW 1.5kW 2kW



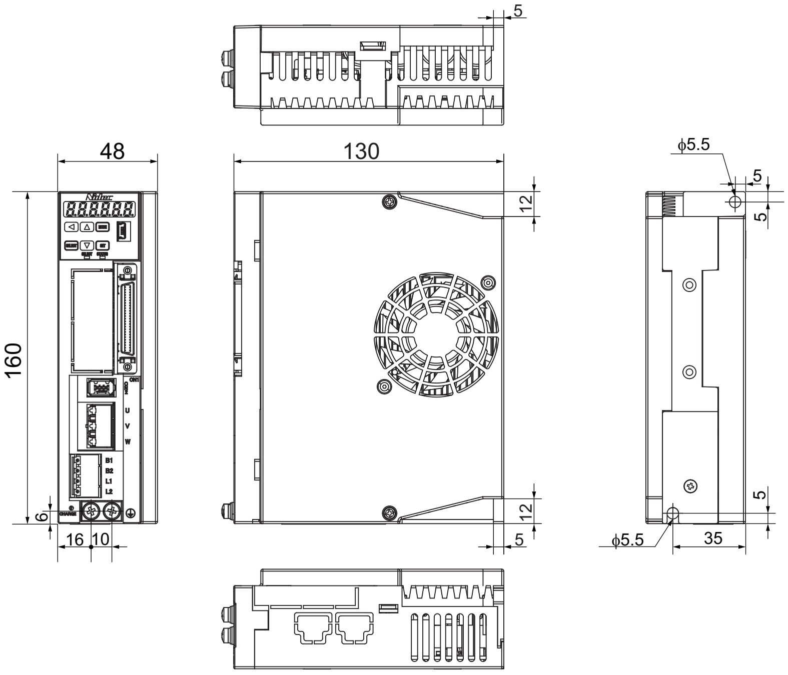


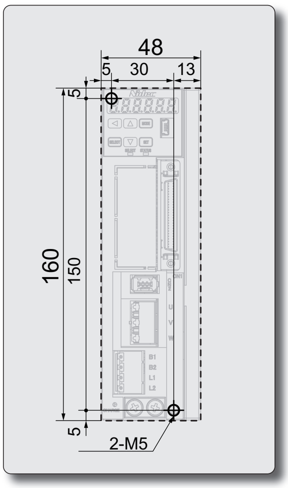
Mounting Dimension

(mm)

Figure 2

50W 100W 200W 400W 750W 1kW 1.5kW 2kW

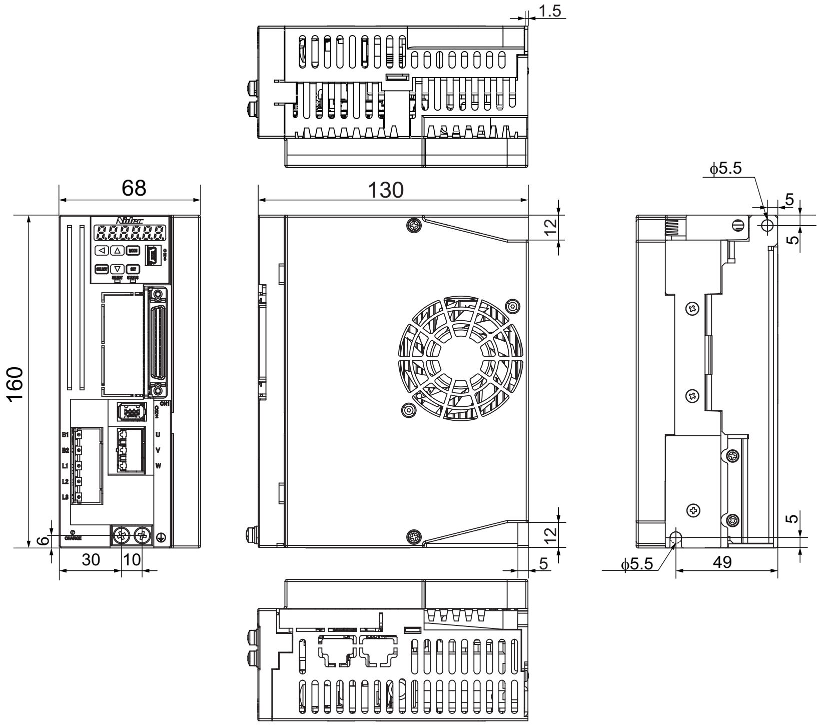


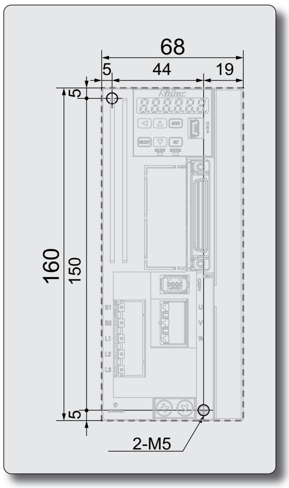


Mounting Dimension

(mm)

Figure 3 50W 100W 200W 400W 750W **1kW** 1.5kW 2kW

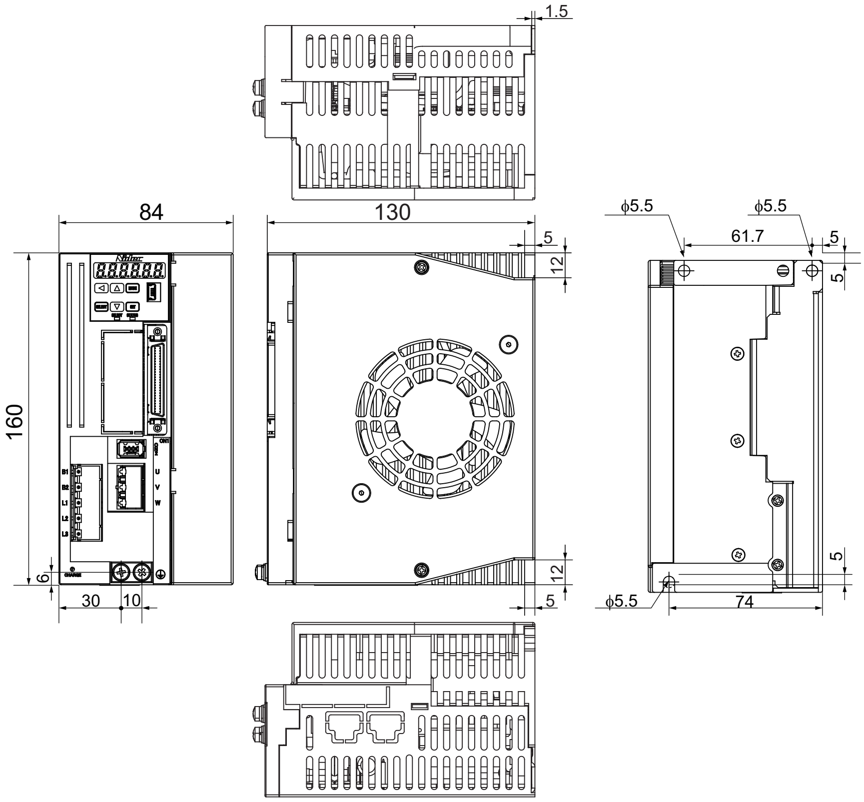


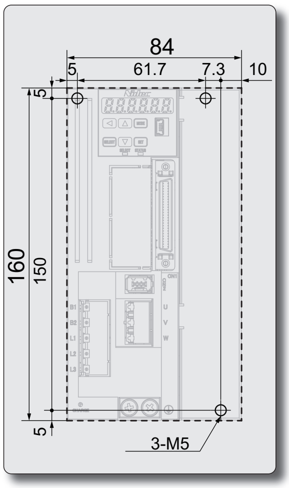


Mounting Dimension

(mm)

Figure 4 50W 100W 200W 400W 750W 1kW **1.5kW** **2kW**





Mounting Dimension

(mm)

3 Preparation

1. Installation 2
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  1. System Wiring. 8
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3. Timing Diagrams 24

1. Installation

Installation and Operating Environment

Ensure that the environment for installation and operation meet the requirements specified in this document.

Should you use the product in conditions different from the specifications, please contact us.

- Do not install the product where it could be directly exposed to direct sunlight.
- Be sure to install each drive inside a control panel.
- Install the product in an environment free from humidity and ingress of water and oil such as cutting oil and oil mist.
- Never use the product in an environment containing explosive or flammable gases, chloride, acidic or alkaline corrosive environment such as sulfur dioxide, chlorine, ammonia and so on.
- Use the product in an environment free from dust, iron dust, and chips.
- Do not use the product near locations exposed to high temperatures, continuous vibrations, or excessive shock.

Precautions

- The control power and the host control device must share one power supply (24 VDC).
- When performing maintenance, be sure to isolate all power supplies beforehand.
- Be aware of the residual voltage in the drive remaining for 5 minutes after the main power shut off. The drive of 750 W or more has a cooling fan on the right side.
  Do not touch or block the air vent of the drive. Do not place objects which would block the air vent.

Dust-proof and Waterproof

Drives are not waterproof.

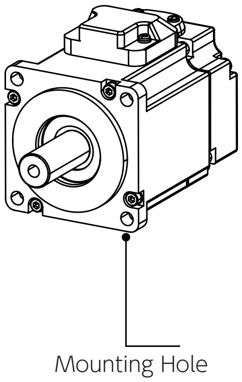
The protective enclosure rating of motors depends on the rated output.

50 W to 1 kW : IP65
1 kW to 2 kW : IP67
(except for the shaft output component and the connectors)

1. Installation

1. Motor Installation

Do not use any other screws but those in the recommended sizes.



Motor Mounting Screws

Motor Model	Mounting Hole Diameter	Recommended Size
MM500, MY500 MM101, MY101	2- ø 4.5	M4 × 12 mm or more Hexagon socket head bolt
MA201, MH201, MX201, MZ201 MA401, MH401, MX401, MZ401	4- ø 5.5	M5 × 12 mm or more Hexagon socket head bolt
MA751, MH751, MX751, MZ751	4- ø 6.6	M6 × 14 mm or more Hexagon socket head bolt
MM102, MH102, MM152, MH152, MM202	4- ø 9	M8 × 18 mm or more Hexagon socket head bolt

Installation Precautions

Never remove the encoder from the motor or disassemble the motor.
The motor shaft has anti-rust oil applied at the time of shipment. Before installing the motor, wipe off the oil completely
Perform precise axis alignments. Otherwise, the motor operation will cause vibration or result in shorter service life of the motor.

Shock and Impact Force

When transporting, installing or removing the motor, do not apply excessive impact force or load.
Do not hold the encoder unit, cables, or connectors when carrying the motor.
Shock resistance of the motor is 200 m/s^2 (20 g) or less.

During installation or operation, radial load or axial load applied to each motor has to be within the withstand rating.
When attaching a coupling to the motor shaft end or removing it, avoid direct impact by a tool such as hammer.
To remove the pulley, coupling, or any other parts from the shaft, use a puller.

1. Installation

Connection with Machines

Use a coupling to absorb angle and direction deviations so that the motor shaft load will be less than the rated allowable axial load.
Otherwise, the bearing life in the motor will be shorter, or the shaft may become damaged.
If you are using a rigid coupling, install it very carefully such that the axial misalignment will be minimal. (Using a flexible coupling is recommended.)

Countermeasure for Oil and Water

Do not use any cable immersed in water or oil.
Install the motor such that the cable side is facing downward.
Do not use the motor in an environment where it will be constantly subjected to oil or water splash.
In the case that a speed reducer is to be connected to a motor and it is to be be located above the motor shaft, use an oil-sealed motor so that no oil from the speed reducer permeates into the motor.

Types of Mounting and Oil Seal

Digitax SF motors can be mounted in two different ways, horizontally and vertically. Observe the following precautions for motor installation.

Horizontal Installation

To protect the motor from oil or water, have the cable-pull side downward.

Vertical Installation

If a speed reducer is connected to a motor such that it will be located above the motor shaft, use an oil-sealed motor so that no oil from the speed reducer permeates into the motor.

Stress to the Cables

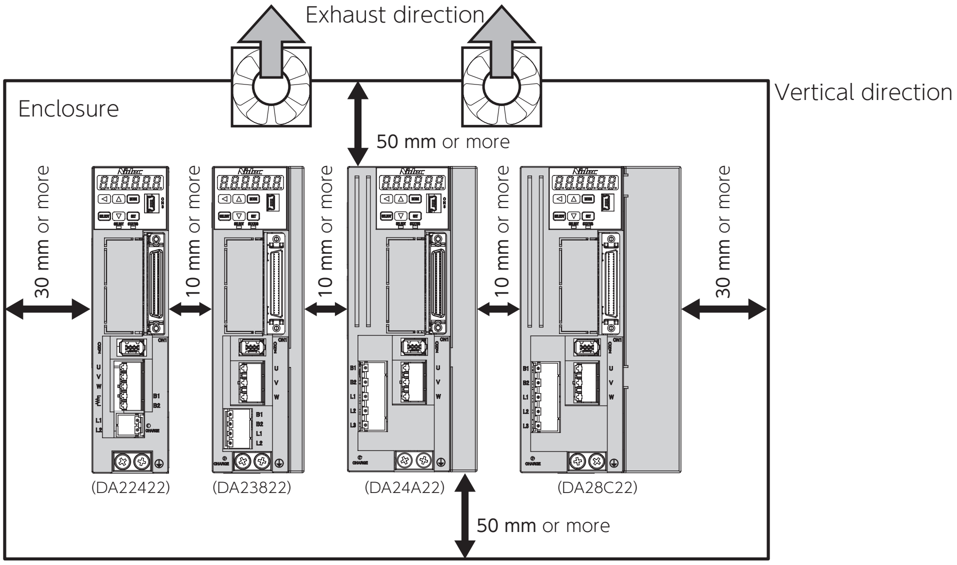
Be careful not to apply stress, such as excessive bending or motor weight, to the cable-pull part or its connecting section.
If the the motor is attached to mounting machinery, be sure to use a flexible cable.
When placing the cable in a cableveyor, minimize the bending stress to the cable.
Bending radii of the motor power cable must be more than R20 mm.

2. Drive Installation

Do not turn on the AC Supply or the control power until all wiring work is completed.

Mounting Orientation and Clearance

When installing drives, maintain required clearances for protective enclosures and control panels for heat dissipation and air flow.



- Install all drives vertically. Use M5 screws at two locations to mount 50 W to 750 W drives and three locations to mount 1 kW to 2 kW drives.

☞ 2 Specifications: Drive Dimensions

- If you are mounting the drive into an enclosure such as protective casing, use a fan or air conditioner so that the ambient temperature inside will not exceed 50 ˚ C.

- The temperature of the heat sink at its surface may become 30 ˚C (or more) higher than the ambient temperature.

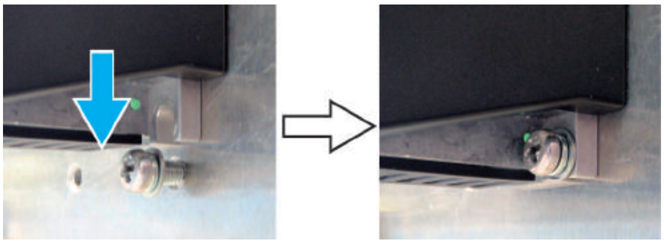
- Use heat resistant wiring materials and keep drives away from heat-sensitive equipment and wiring.

- The service life of each drive depends on the ambient temperatures of the internal electrolytic capacitor. Electrolytic capacitors last approximately 5 to 6 years under the conditions of 30 ˚ C annual average temperature, 80 % load factor, and 20 hours or less average daily operation.

Mounting Drives

Be sure to mount each drive on a conductive surface such as aluminum brushed plate.

Hook the U-shaped installation notch of the drive to the bolt that has been screwed in advance.



Tighten the mounting screws on the drive top.

Loosely screw all drives to the chassis first, and then securely tighten them all together. (Tightening torque: 1.4 to 1.6 N·m)

⚠ DANGER

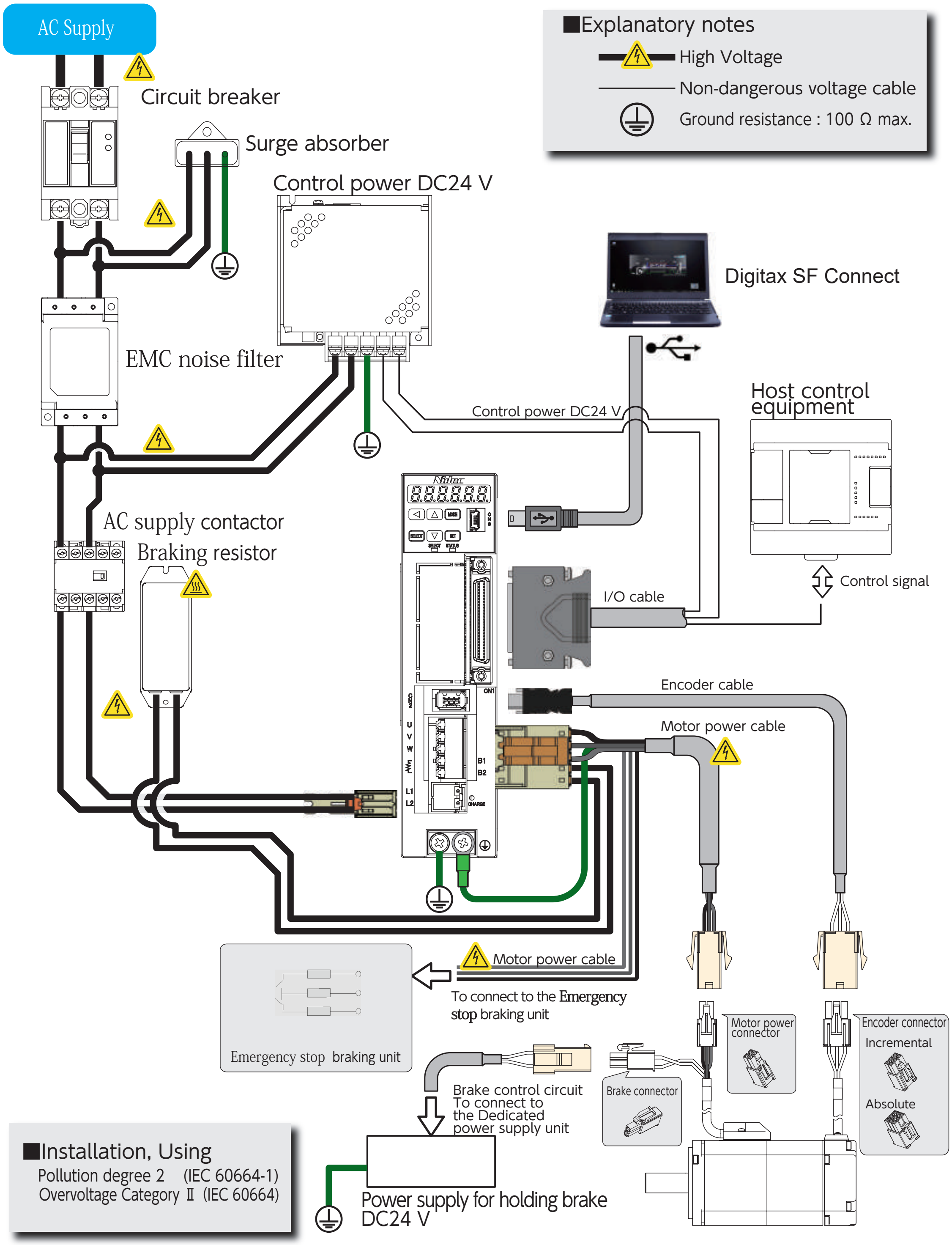
❗	Be mindful when wiring and handling high voltage materials	⚠ ⚠ ⚠

❗	Earth / Ground connection is a must.
	Ensure the incoming supply to the power supply providing the control 24V supply is from the same source as the AC Supply
	Do not use the AC supply contactor (installed on the AC Supply side) to run or stop the motor.
	Do not install a switch between the control power supply and the drive. Install the switch on the primary input side of the control power supply.
	For high-voltage cables, use wires of 600V withstand voltage or more.
	For a CN1 connector cable, use a shielded twisted-pair cable of 2 m or less.
	The encoder cable length must be 20 m or less.
	For stranded wire, use insulation coating, rod or ring crimp terminals.

2. System Wiring

1. System Wiring

Wiring pattern 1 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



■Installation, Using
Pollution degree 2 (IEC 60664-1)
Overvoltage Category Ⅱ (IEC 60664)

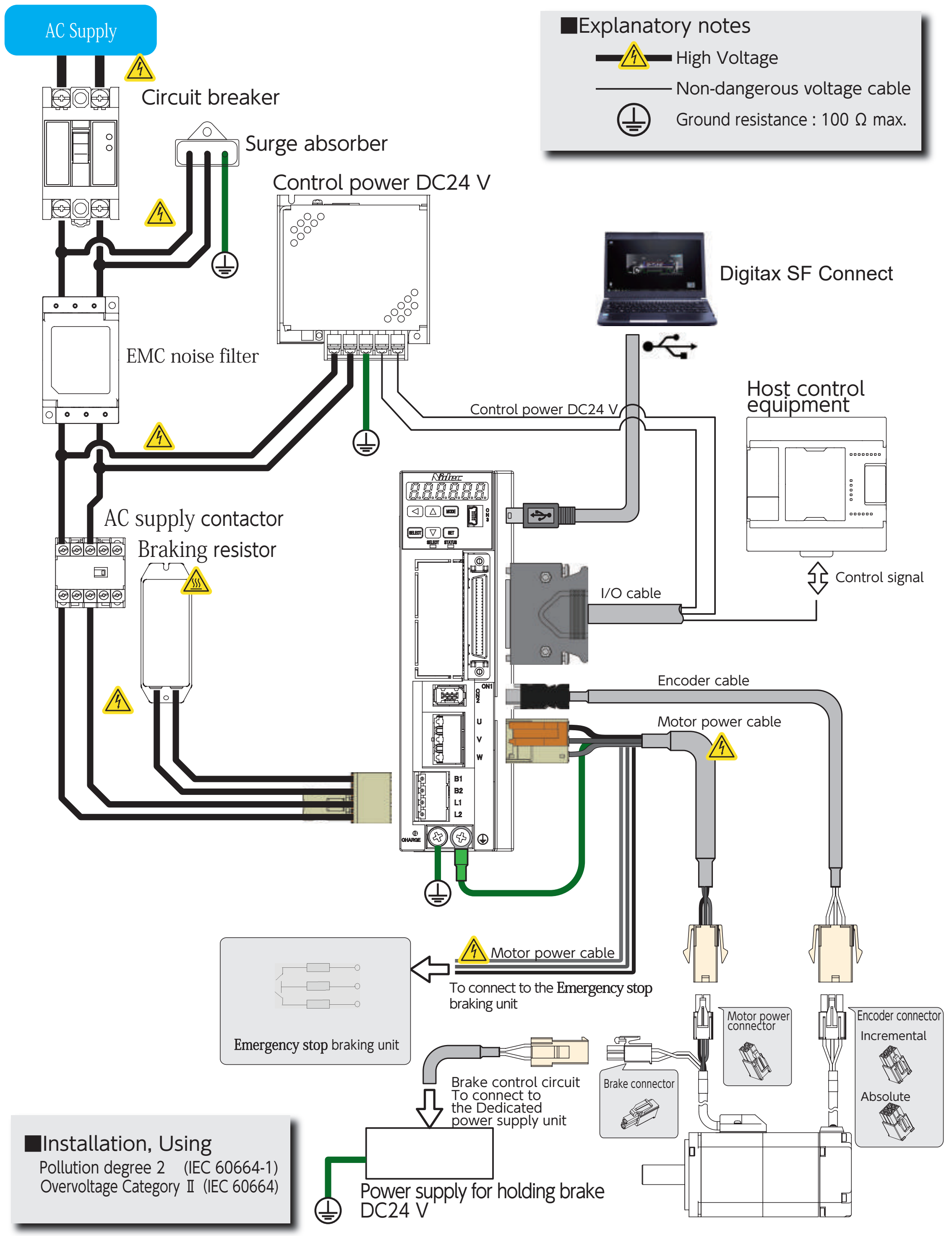
For compliance with the stated EMC radio frequency emission standard the following conditions must be met:

- The specified filter must be used.
- The filter and the drive must be mounted close together on the same metal plate, ensuring direct metallic contact with the plate (the plate must have a conductive surface, not painted or anodised). The connections between the filter and drive must be as short as practicable.
- The screen (shield) of the motor cable must be fixed in direct contact with the same plate. The contact must be by direct contact, no wire or "pigtail" is permitted.
- The specified ferrite core must be fitted to the signal cable(s).
- For compliance with the stated surge immunity standard the specified surge absorber must be fitted as shown in the wiring diagrams

2. System Wiring

Wiring Pattern 2

50W 100W 200W 400W **750W** 1kW 1.5kW 2kW



■Explanatory notes

High Voltage

Non-dangerous voltage cable

Ground resistance : 100 Ω max.

■Installation, Using

Pollution degree 2 (IEC 60664-1)
Overvoltage Category Ⅱ (IEC 60664)

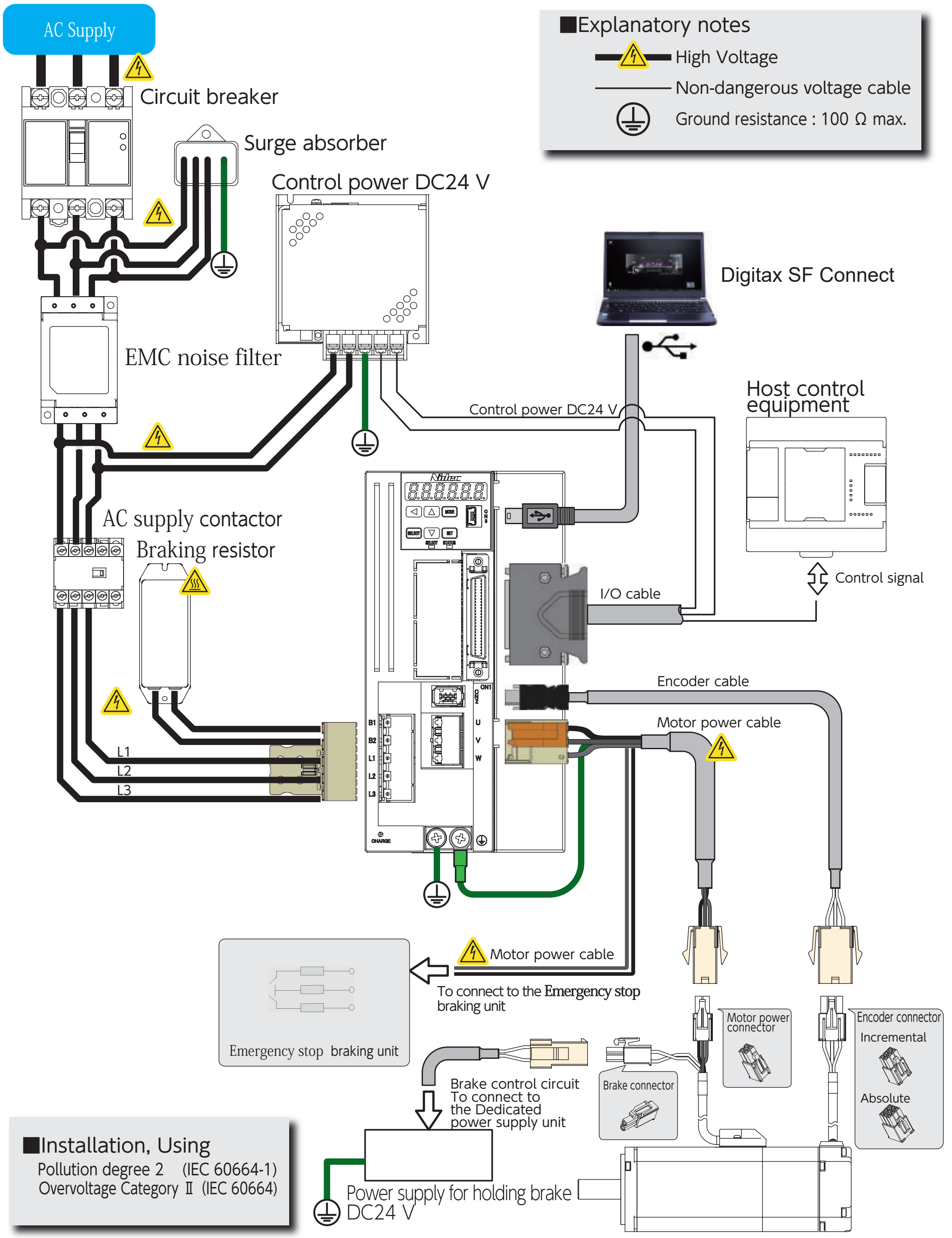
For compliance with the stated EMC radio frequency emission standard the following conditions must be met:

- The specified filter must be used.
- The filter and the drive must be mounted close together on the same metal plate, ensuring direct metallic contact with the plate (the plate must have a conductive surface, not painted or anodised). The connections between the filter and drive must be as short as practicable.
- The screen (shield) of the motor cable must be fixed in direct contact with the same plate. The contact must be by direct contact, no wire or "pigtail" is permitted.
- The specified ferrite core must be fitted to the signal cable(s).
- For compliance with the stated surge immunity standard the specified surge absorber must be fitted as shown in the wiring diagrams

2. System Wiring

Wiring Pattern 3

50W 100W 200W 400W 750W **1kW** 1.5kW 2kW



Installation, Using
Pollution degree 2 (IEC 60664-1)
Overvoltage Category Ⅱ (IEC 60664)

For compliance with the stated EMC radio frequency emission standard the following conditions must be met:

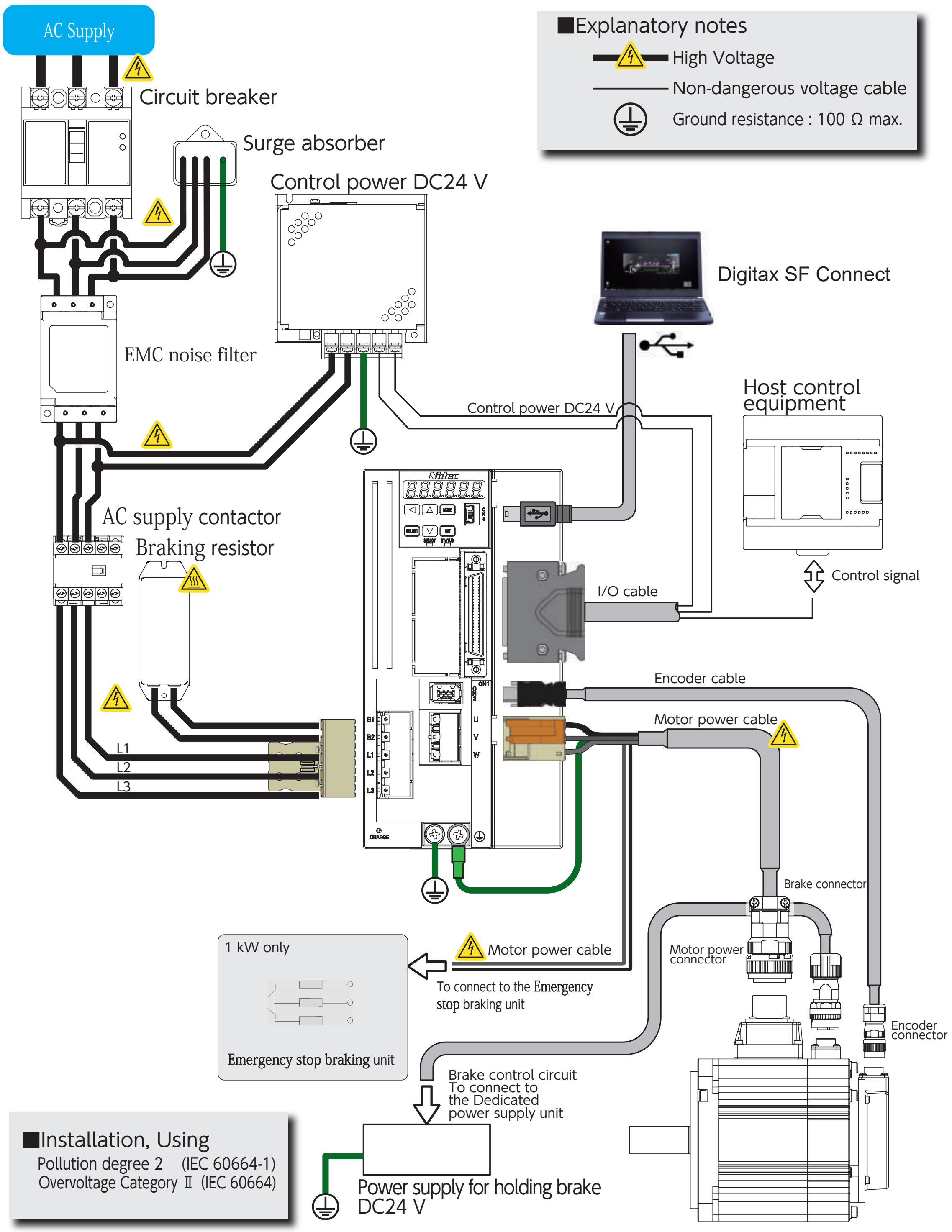
- The specified filter must be used.
- The filter and the drive must be mounted close together on the same metal plate, ensuring direct metallic contact with the plate (the plate must have a conductive surface, not painted or anodised). The connections between the filter and drive must be as short as practicable.
- The screen (shield) of the motor cable must be fixed in direct contact with the same plate. The contact must be by direct contact, no wire or “pigtail” is permitted.
- The specified ferrite core must be fitted to the signal cable(s).
- For compliance with the stated surge immunity standard the specified surge absorber must be fitted as shown in the wiring diagrams

2. System Wiring

Wiring Pattern 4

50W 100W 200W 400W 750W 1kW 1.5kW 2kW

(MM102 & MH102)



■Explanatory notes

High Voltage

Non-dangerous voltage cable

Ground resistance : 100 Ω max.

■Installation, Using

Pollution degree 2 (IEC 60664-1)
Overvoltage Category Ⅱ (IEC 60664)

For compliance with the stated EMC radio frequency emission standard the following conditions must be met:

- The specified filter must be used.
- The filter and the drive must be mounted close together on the same metal plate, ensuring direct metallic contact with the plate (the plate must have a conductive surface, not painted or anodised). The connections between the filter and drive must be as short as practicable.
- The screen (shield) of the motor cable must be fixed in direct contact with the same plate. The contact must be by direct contact, no wire or “pigtail” is permitted.
- The specified ferrite core must be fitted to the signal cable(s).
- For compliance with the stated surge immunity standard the specified surge absorber must be fitted as shown in the wiring diagrams

2. System Wiring

2. Connecting Equipment and Recommended Peripherals

AC Supply

Please use this product in the power supply environment of Over-Voltage Category Ⅱ defined by IEC60664-1. This is the AC Supply for drives.

50 W to 750 W Drives : Single-phase AC200 V -10 % to AC240 V +10 %
1 kW to 2 kW Drives : Three-phase AC200 V -10 % to AC240 V +10 %

Using an overvoltage protection relay is recommended.

When having single-phase power wired to a 1 kW drive, wire the primary circuit AC200 V between the L1 and L3 terminals of the drive.

To avoid unbalance of the three-phase AC200 V wiring in your factory, we recommend that you consider balance of current in your three-phase wirings.

Confirm that your contract with the electric power company is not limited to use of three-phase.

Control power

This is power supply of DC24 V ± 10 % for drive control power, I/O power and motor brake release power.

Use a SELV (Safety Extra Low Voltage) power supply with reinforced insulation against hazardous voltages. Be sure to connect a varistor to the motor brake release power supply.

Cables (*)

Use of UL wires and cables suitable for motor rated output are recommended.

High-voltage cables and Ground/Earth FG cables:
AWG18 / 600 V breakdown voltage or equivalent for 50 W to 750 W
AWG14 / 600 V breakdown voltage or equivalent for 1 kW to 2 kW

Motor power cables:
AWG18 / 300 V breakdown voltage or equivalent for 50 W to 750 W
AWG14 / 300 V breakdown voltage or equivalent for 1 kW to 2 kW

Encoder cables:
AWG22 and AWG24 compound / 30 V breakdown voltage or equivalent
Shielded cables with twisted pair wires
Length not exceeding 20 m

User I/O cable:
AWG26 / 300 V breakdown voltage or equivalent
Shielded cables with twisted pair wires
Length not exceeding 2 m

*) Should you use a cable longer than the specification, please contact us in advance.

Circuit breaker

To protect the power supply line, circuit breakers shut the circuit down in the event of over-current.
Be sure to use an IEC standard and UL-certified circuit breaker between the power supply and the EMC noise filter. To ensure compliance with EMC, use an earth leakage circuit breaker that we recommend.

Recommended Product	Fuji Electric Co Ltd	Single-phase : EW32AAG-2P020B Three-phase : EW32AAG-3P020B

20 A for single-phase (three-phase) 200 V
Leakage current of 30 mA. An equivalent product is acceptable
Select the capacity and other characteristics according to your entire system configuration.

2. System Wiring

EMC noise filter

EMC filters prevent emission of electromagnetic interference onto the AC supply lines .To ensure compliance with EMC, use the recommended EMC noise filter.

Recommended Product	OKAYA Electric Industries Co Ltd	Single–phase：4200-0056 Three–phase：4200-3106

Included in Digitax SF drive's EMC testing.

Select the capacity and other characteristics according to your entire system configuration.

AC supply contactor

This is an on/off switch for the main power supply. Use a surge absorber on the input side of the AC supply.

Recommended Product	Fuji Electric Co Ltd	SK06G-E10

An equivalent product is acceptable.
Select the capacity and other characteristics according to your entire system configuration.

Surge absorber

To ensure compliance with EMC, connect the recommended surge absorber to the primary side of the AC supply.

Recommended Product	OKAYA Electric Industries Co Ltd	Single-phase：2490-2754 Three-phase：2490-0004

Included in Digitax SF drive's EMC testing

Signal line EMC noise filter/ferrite core

To ensure compliance with EMC, use the recommended signal line EMC noise filter/ferrite core.

Recommended Product	SEIWA ELECTRIC MFG. CO., LTD. (Misumi Corporation)	E04SR401938 (ATCK-1130) https://uk.misumi–ec.com/

Included in Digitax SF drive' s EMC testing

Braking resistor

This product is not equipped with a braking resistor. If the smoothing capacitor inside the servo drive cannot absorb the system regenerative power, an external braking resistor is required. As a guideline, check the regeneration state on the settings panel, and use a braking resistor if the regenerative voltage warning is ON. Build an overheating prevention circuit using a resistor which has built-in thermostat. If the temperature of generated heat becomes high, you can suppress the heat by installing a cooling device, or selecting a resistor whose allowable power is 5 to 10 times larger than regenerative voltage.

Recommended Product	Chiba Techno Co., Ltd.	For 50 W to 750 W：CAN100S 47 Ω J 100W For 1 kW, 1.5 kW：CAN400S 30 Ω J 400 W For 2 kW：CAN750S 20 Ω J 750 W

When considering a braking resistor other than the recommended above, use the following as a guideline.

Drive Model	DA2YZ22	DA2Z122	DA21222	DA22422	DA23822	DA24A22		DA26B22	DA28C22
Compatible Motor	M□500	M□101	M□201	M□401	M□751		M□102	M□152	MM202
Rated output	50 W	100 W	200 W	400 W	750 W	1 kW		1.5 kW	2 kW
Regeneration Resistance	40 Ω to 50 Ω					30 Ω			20 Ω
Allowable regeneration power	20 W					40 W			60 W
Recommended Wattage	100 W to 200 W					400 W to 800 W			600 W to 1,200 W

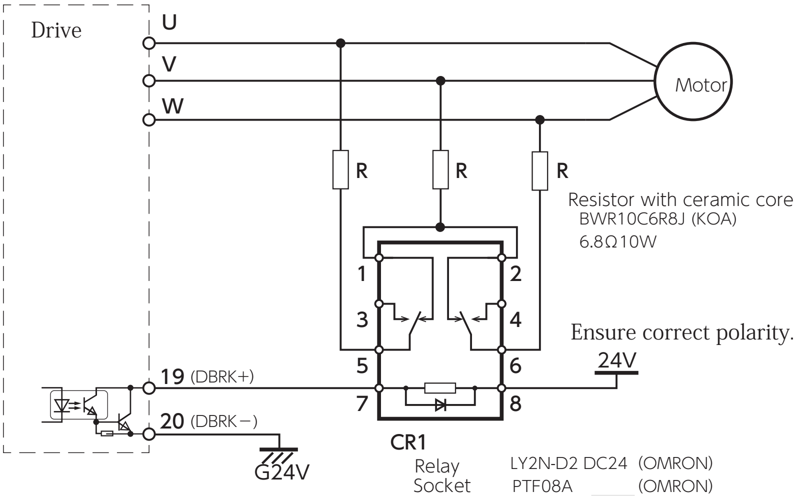
The braking resistor values do not guarantee the optimal performance. Regeneration allowable voltages above are minimum values as a point of reference.
The braking resistor may become very hot. It requires sufficient margin of regeneration allowable power.

2. System Wiring

Emergency stop brake

This product is not equipped with a emergency stop brake

Use the following circuit example when building a emergency stop brake circuit.
Select a cement resistor of 6.8 Ω 10 W.
Select coil surge protection relays with diode.
For wiring with the motor power line, UL wires (AWG18 / 600 V or equivalent) are recommended.



To build a emergency stop brake circuit, please use our recommended products listed below.

	Device	Manufacturer	Model Code
Recommended Product	Relay	OMRON	LY2N-D2 DC24V
	Relay socket	OMRON	PTF08A
	Resistor with ceramic core	KOA	BWR10C6R8J

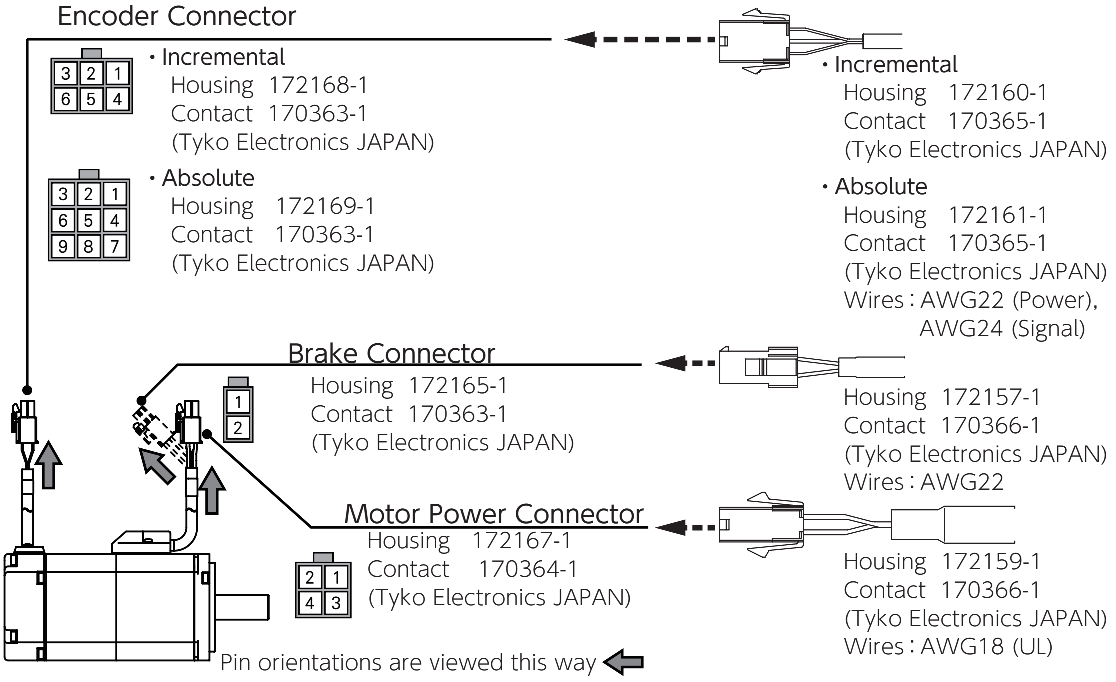
Grounding

Since this product is Class I device, protective grounding is mandatory. (Type D grounding: grounding resistance of up to 100 Ω)
Properly ground the product using protective grounding terminals through EMC-compatible casing and control panel.

3.Wiring to the Connectors

Motor Connector Pinout

Motor 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



Encoder Connector

- Incremental
  Housing 172168-1
  Contact 170363-1
  (Tyko Electronics JAPAN)
- Absolute
  Housing 172169-1
  Contact 170363-1
  (Tyko Electronics JAPAN)

- Incremental
  Housing 172160-1
  Contact 170365-1
  (Tyko Electronics JAPAN)
- Absolute
  Housing 172161-1
  Contact 170365-1
  (Tyko Electronics JAPAN)
  Wires : AWG22 (Power),
  AWG24 (Signal)

Brake Connector
Housing 172165-1
Contact 170363-1
(Tyko Electronics JAPAN)

Housing 172157-1
Contact 170366-1
(Tyko Electronics JAPAN)
Wires : AWG22

Motor Power Connector
Housing 172167-1
Contact 170364-1
(Tyko Electronics JAPAN)

Housing 172159-1
Contact 170366-1
(Tyko Electronics JAPAN)
Wires : AWG18 (UL)

Pin orientations are viewed this way ⇦

Name	Pin No.	Signal	Description
Motor Power	1	U	Motor power U-phase
	2	V	Motor power V-phase
	3	W	Motor power W-phase
	4	FG	Motor frame ground
Brake (*1)	1	BRK＋	Brake power supply DC24 V
	2	BRK−	Brake power supply GND
Encoder (Incremental)	1	-	(No Connect)
	2	+D	Serial communication data ＋Data
	3	−D	Serial communication data －Data
	4	VCC	Encoder power supply ＋5 V
	5	SG	Signal ground
	6	SHIELD	Shield
Encoder (Absolute)	1	BAT	External battery (*2)
	2	-	(No Connect)
	3	SHIELD	Shield
	4	＋D	Serial communication data ＋Data
	5	−D	Serial communication data －Data
	6	-	(No Connect)
	7	VCC	Encoder power supply ＋5 V
	8	SG	Signal ground
	9	-	(No Connect)

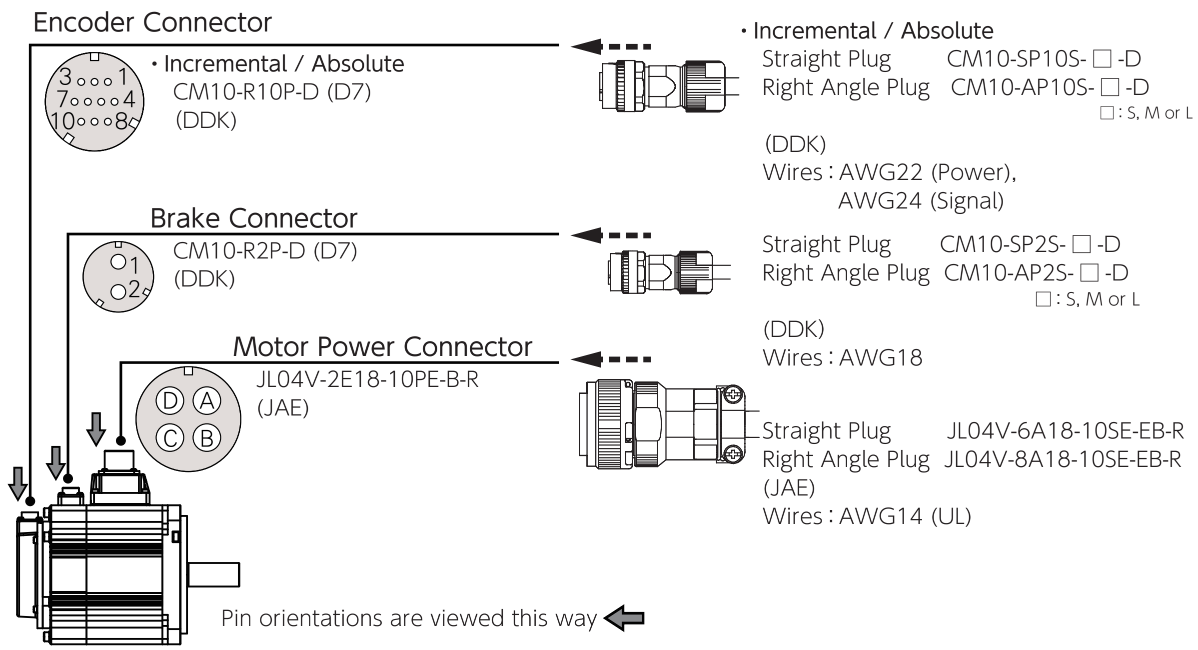
*1) Only for a motor equipped with a brake

*2) Connect the negative pole of the battery to SG (Signal Ground).

2. System Wiring

Motor 50W 100W 200W 400W 750W 1kW 1.5kW 2kW

(MM102 & MH102)



Name	Pin No.	Signal	Description
Motor Power	A	U	Motor power U-phase
	B	V	Motor power V-phase
	C	W	Motor power W-phase
	D	FG	Motor frame ground
Brake (*1)	1	BRK+	Brake power supply DC24 V
	2	BRK−	Brake power supply GND
Encoder (Incremental)	1	VCC	Encoder power supply +5 V
	2	SG	Signal ground
	3, 4	–	(No Connect)
	5	+D	Serial communication data + Data
	6	−D	Serial communication data − Data
	7, 8, 9	–	(No Connect)
	10	SHIELD	Shield
Encoder (Absolute)	1	VCC	Encoder power supply +5 V
	2	SG	Signal ground
	3	–	(No Connect)
	4	BAT	External battery (*2)
	5	+D	Serial communication data + Data
	6	−D	Serial communication data − Data
	7, 8	–	(No Connect)
	9	SG	Signal ground
	10	SHIELD	Shield

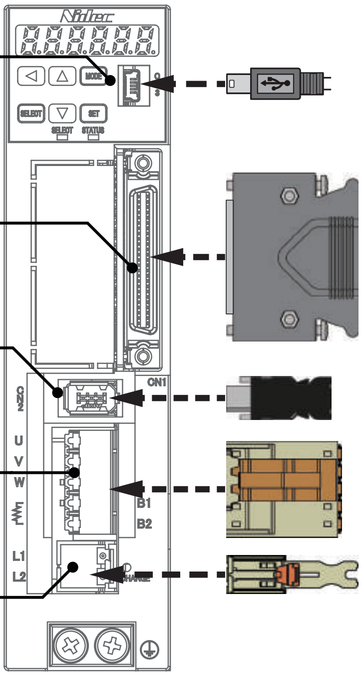
*1) Only for a motor equipped with a brake

*2) Connect the negative pole of the battery to SG (Signal Ground).

2. System Wiring

Drive Connectors and Pinouts

Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



PC Communication Connector
UC60SC-MB-5ST
(Hirose Electric)

User I/O Connector
DF02R050NA1 (JAE)

Encoder Connector
3E106-2230KV (3M)

Motor Power Connector
2092-1325 (WAGO JAPAN)

AC Supply Power Connector
2092-1422 (WAGO JAPAN)

USB mini B

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26

Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22 (Power), AWG24 (Signal)

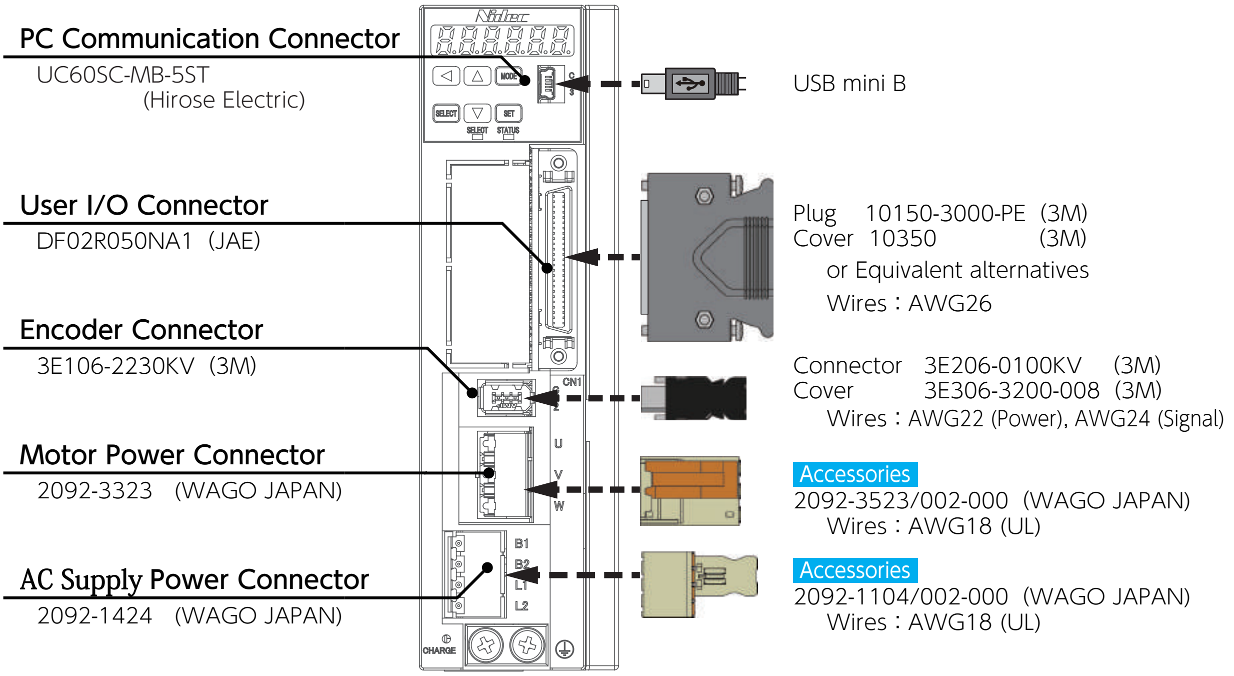
Accessories
2092-1525/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Accessories
2092-1102/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
AC Supply	L1L2	1	L1	AC Supply power cable 1
		2	L2	AC Supply power cable 2
Motor Power	UVW / B1B2	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
		4	B1	Braking resistor connection (+)
		5	B2	Braking resistor connection (−)
Encoder	CN2	1	VCC	Encoder power supply +5 V
		2	GND	Signal ground
		3, 4	-	(No Connect)
		5	+D	Serial communication data + Data
		6	−D	Serial communication data − Data
		-	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5 V
		2	D−	USB data −
		3	D+	USB data +
		4	-	(No Connect)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See “Example of I/O Wiring”)		

2. System Wiring

Drive 50W 100W 200W 400W **750W** 1kW 1.5kW 2kW



PC Communication Connector
UC60SC-MB-5ST
(Hirose Electric)

USB mini B

User I/O Connector
DF02R050NA1 (JAE)

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26

Encoder Connector
3E106-2230KV (3M)

Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22 (Power), AWG24 (Signal)

Motor Power Connector
2092-3323 (WAGO JAPAN)

Accessories
2092-3523/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

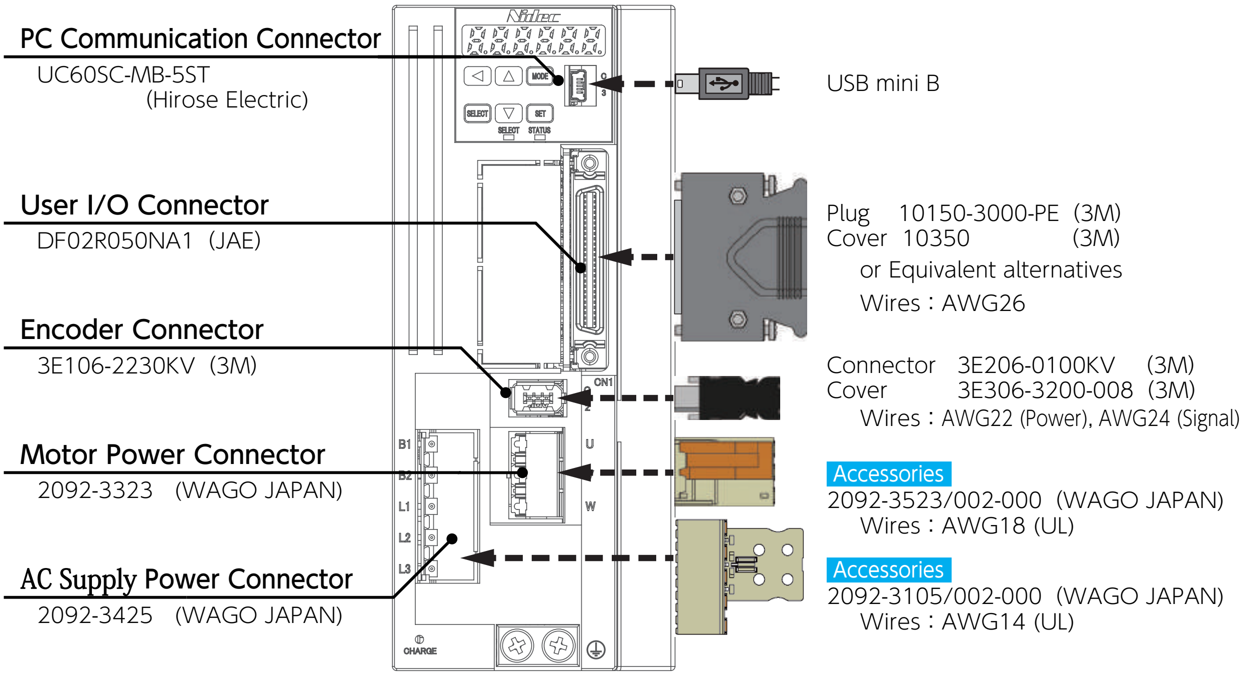
AC Supply Power Connector
2092-1424 (WAGO JAPAN)

Accessories
2092-1104/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

Name	Code	Pin No.	Signal	Description
AC Supply	L1L2 / B1B2	1	B1	Braking resistor connection (+)
		2	B2	Braking resistor connection (−)
		3	L1	AC Supply power cable 1
		4	L2	AC Supply power cable 2
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5 V
		2	GND	Signal ground
		3, 4	-	(No Connect)
		5	+D	Serial communication data + Data
		6	− D	Serial communication data − Data
		-	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5 V
		2	D −	USB data −
		3	D+	USB data +
		4	-	(No Connect)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See “Example of I/O Wiring”)		

2. System Wiring

Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



PC Communication Connector
UC60SC-MB-5ST
(Hirose Electric)

USB mini B

User I/O Connector
DF02R050NA1 (JAE)

Plug 10150-3000-PE (3M)
Cover 10350 (3M)
or Equivalent alternatives
Wires : AWG26

Encoder Connector
3E106-2230KV (3M)

Connector 3E206-0100KV (3M)
Cover 3E306-3200-008 (3M)
Wires : AWG22 (Power), AWG24 (Signal)

Motor Power Connector
2092-3323 (WAGO JAPAN)

Accessories
2092-3523/002-000 (WAGO JAPAN)
Wires : AWG18 (UL)

AC Supply Power Connector
2092-3425 (WAGO JAPAN)

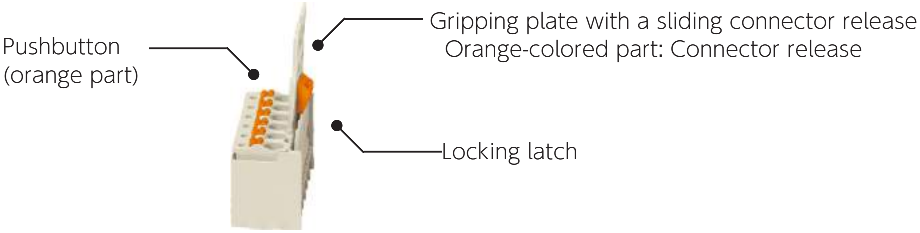
Accessories
2092-3105/002-000 (WAGO JAPAN)
Wires : AWG14 (UL)

Name	Code	Pin No.	Signal	Description
AC Supply	L1L2L3 / B1B2	1	B1	Braking resistor connection (+)
		2	B2	Braking resistor connection (−)
		3	L1	AC Supply power cable 1 (*1)
		4	L2	AC Supply power cable 2 (*2)
		5	L3	AC Supply power cable 3 (*1)
Motor Power	UVW	1	U	Motor power U-phase
		2	V	Motor power V-phase
		3	W	Motor power W-phase
Encoder	CN2	1	VCC	Encoder power supply +5 V
		2	GND	Signal ground
		3, 4	-	(No Connect)
		5	+D	Serial communication data + Data
		6	−D	Serial communication data − Data
		-	FG	SHIELD wired to the connector casing
PC Communication	CN3	1	VBUS	USB power supply +5 V
		2	D−	USB data −
		3	D+	USB data +
		4	-	(No Connect)
		5	GND	USB signal ground
User I/O	CN1	Route power and signal wiring suitable for your operation mode. (See "Example of I/O Wiring")		

*1) When having single-phase power wired to 1kW drives (DA24A22), connect to L1 and L3.
*2) **Do not connect** when using with single-phase power.

4. Accessory Connector

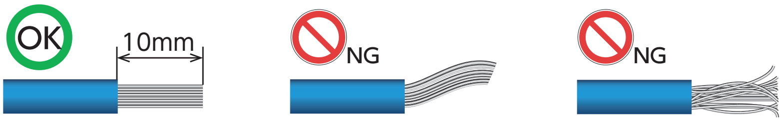
Connector Parts



Stripping cables with recommended tools

Model Code		Image
Pushbutton Tools	Use this tool to connect or disconnect a cable to a connector. 210-720 (standard type made in Europe)	
Wire Stripper	Use this tool to make a clean cut without damaging wires. 206-124 (QUICKSTRIP 10)	

Trimming the cable insulation:
The leftmost image illustrates a good result. Other two are bad examples.



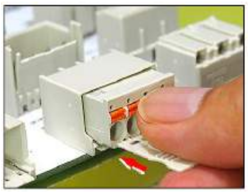
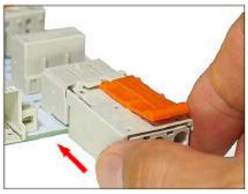
Specialized Ferrule (recommended)

For stranded wire, a specialized ferrule helps you with wiring more safely and effectively.

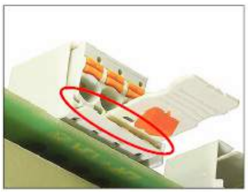
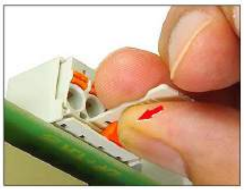
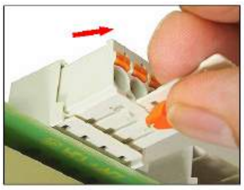
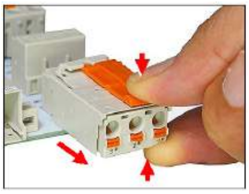
Model Code		Image
Ferrule	Insulated ferrule with sleeve 216-203, red sleeve (for AWG18) 216-206, blue sleeve (for AWG14)	
	Non-insulated ferrule (no sleeve) 216-143 (for AWG18) 216-106 (for AWG14)	
Ferrule crimping tool	206-204	

2. System Wiring

Connecting the connectors

AC Supply power connector		Hold the grip plate and keep pushing in until you hear a clicking sound.
Motor power connector		Hold the frame of the connector and keep pushing in until you hear a clicking sound.

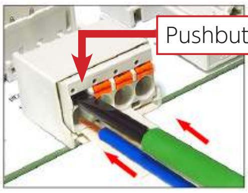
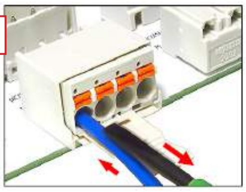
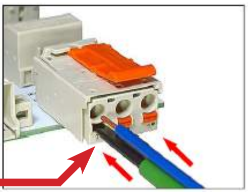
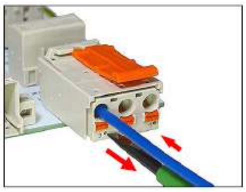
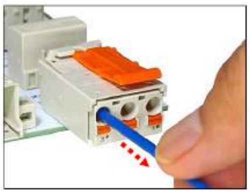
Disconnecting the connectors

AC Supply power connector			
	The connector is fixed with the locking latch.	Push in the orange-colored connector release.	Pull out the connector.
Motor power connector		Keep pressing the top lever in the direction of the arrow and pull out the connector.	

2. System Wiring

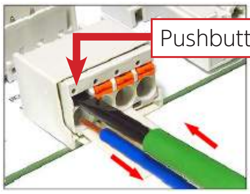
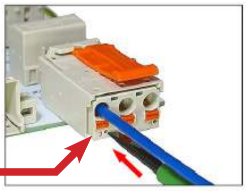
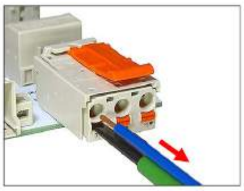
Wire connection

With the orange pushbutton pushed in with the tool, insert the wire until it hits the round insertion slot. (the image to the left). Release the pushbutton to finish. (the image in the middle)
Pull the wire slightly to verify that the wire connection is not loose. (the image to the right)

AC Supply power connector			
Motor power connector			

Wire disconnection

While pushing in the pushbutton, pull out the cable.

AC Supply power connector		
Motor power connector		

2. System Wiring

5. Cables

Recommended cable wires

Use our recommendations below to select cables based on your actual usage. (Equivalent alternatives are also good)

Cable Name	AWG	UL	Temperature Rating	Voltage Rating	Note
Motor power (≤ 750 W)	18	2517	105 ℃	300 V	
Motor power (≥ 1 kW)	14	2517	105 ℃	300 V	AWG16 wires can be used only for 1 kW motors
Main circuit power (≤ 750 W) (Including Earth/ Ground FG cable)	18	1015	105 ℃	600 V	
Main circuit power (≥ 1 kW) (Including Earth/ Ground FG cable)	14	1015	105 ℃	600 V	AWG16 wires can be used only for 1 kW motors.
Encoder	Power : 22 Signal : 24	20276	80 ℃	30 V	Shielded twisted pair cables of length not exceeding 20 m
User I/O	26	1007	80 ℃	300 V	Shielded twisted pair cables Length not exceeding 2 m is recommended
Braking resistor	18	1015	105 ℃	600 V	
Emergency stop brake	18	1015	105 ℃	600 V	
Mechanical Brake	18	2517	105 ℃	300 V	1 pair (2 cores)

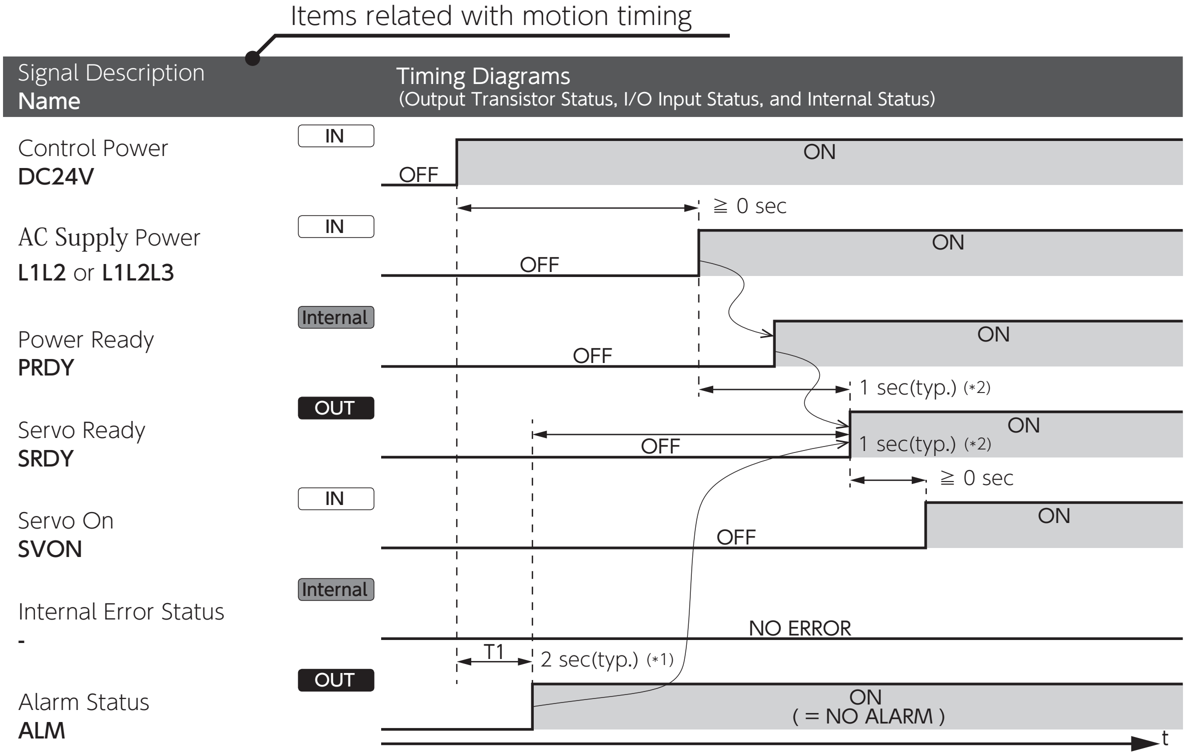
3. Timing Diagrams

List of Timing Diagrams

When designing a host controller system, consider the timing of control signal input from the controller to the drive, or alarm signal output from the drive.

Description	Refer to
Turning the Power On	25
Servo OFF → ON	26
Servo ON → OFF (Motor idling)	27
Servo ON → OFF (Motor rotating)	28
Alarm Occurs	29
Alarm Reset (Servo ON)	30
Alarm Reset (Servo OFF)	31
Motor Brake Release	32
Emergency stop Brake Release	33
Deceleration Stop Status During Coast to stop	34
Delay time for Quick Stop Complete	35

Timing Diagram Overview



OUT : Output Signal

Output Transistor	I/O Output Status
OFF	Open
ON	Close (The contact paired with COM- is closed)

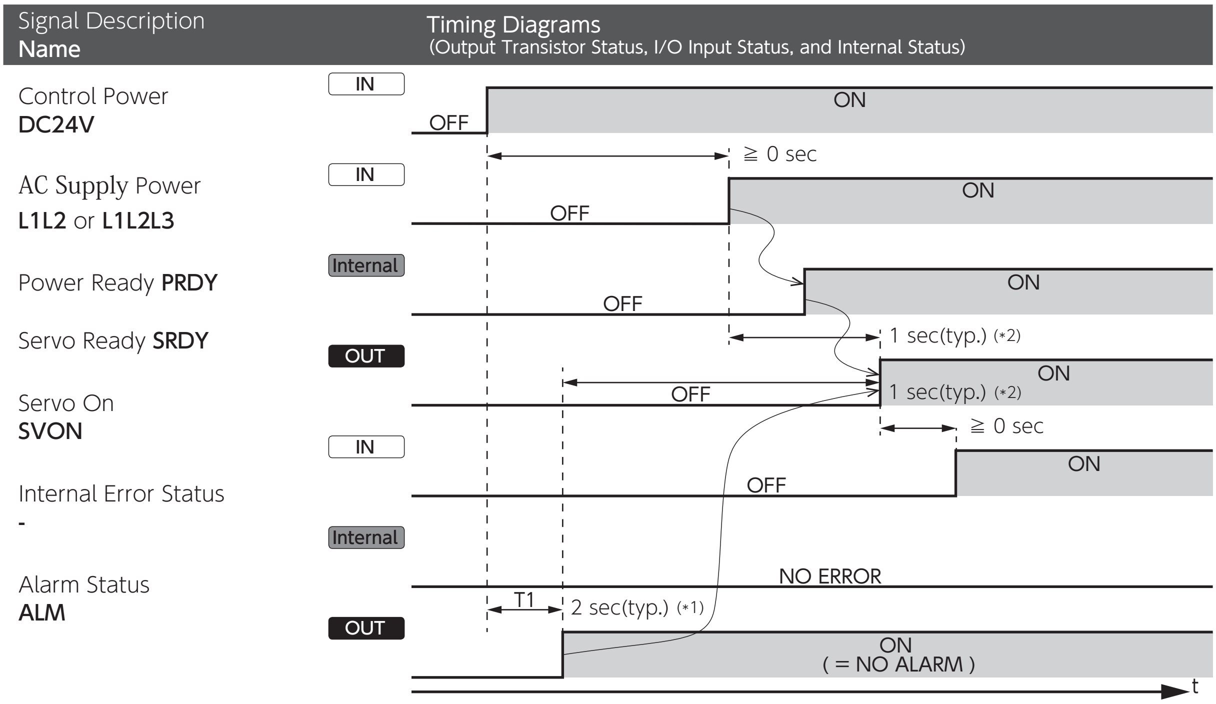
IN : Input Signal

Contacts of Input Circuit	I/O Input Status
Open	OFF
Close (Close the contact paired with GND)	ON

Internal : Internal Status of the Drive

3. Timing Diagrams

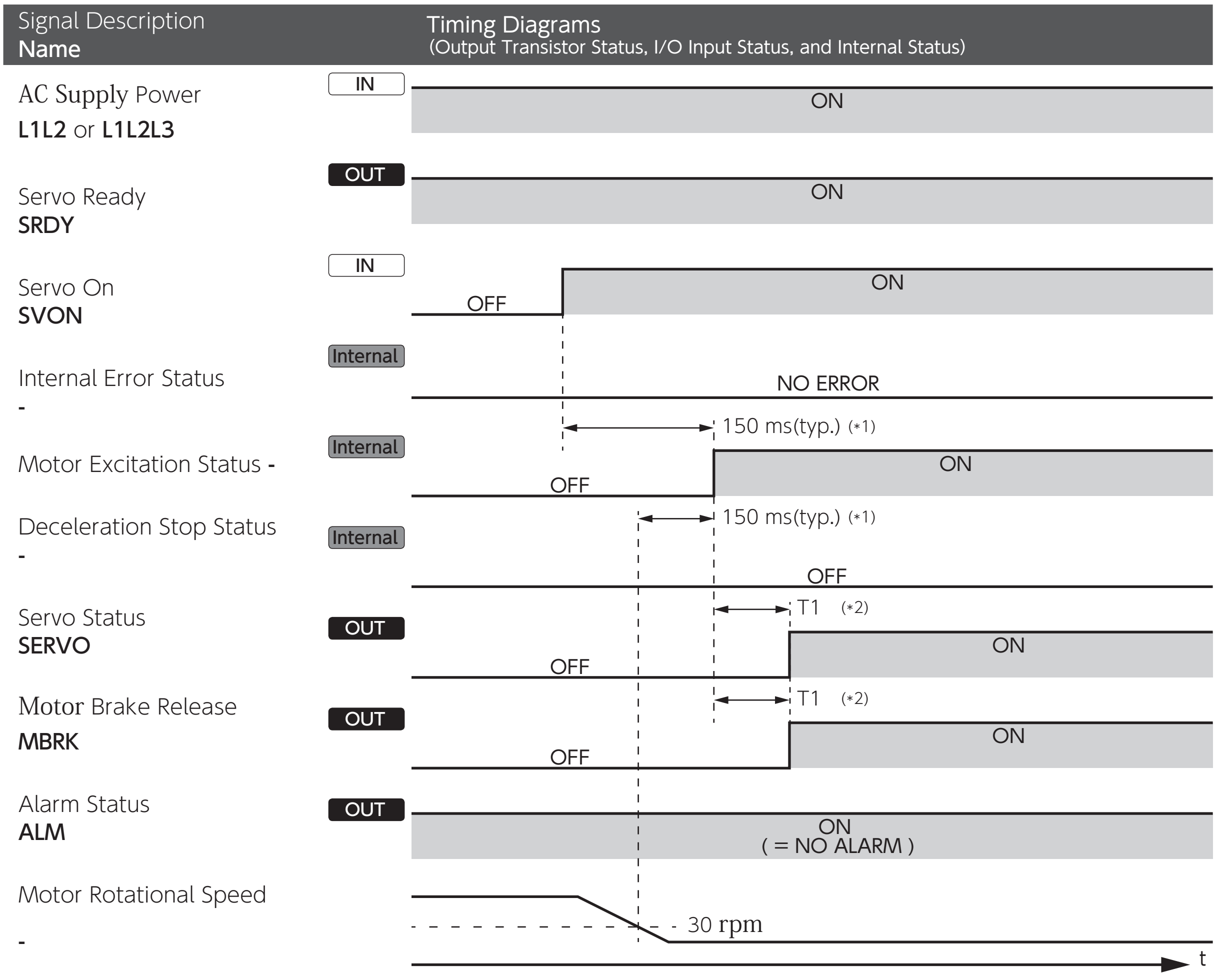
Turning the Power On



*1) After Clear Parameter execution, T1 needs approximately 5 seconds for parameter initialization.
*2) **SRDY** turns ON when **AC Supply** and **PRDY** turns ON consecutively while **Internal Error Status** remains **No Errors**.

3. Timing Diagrams

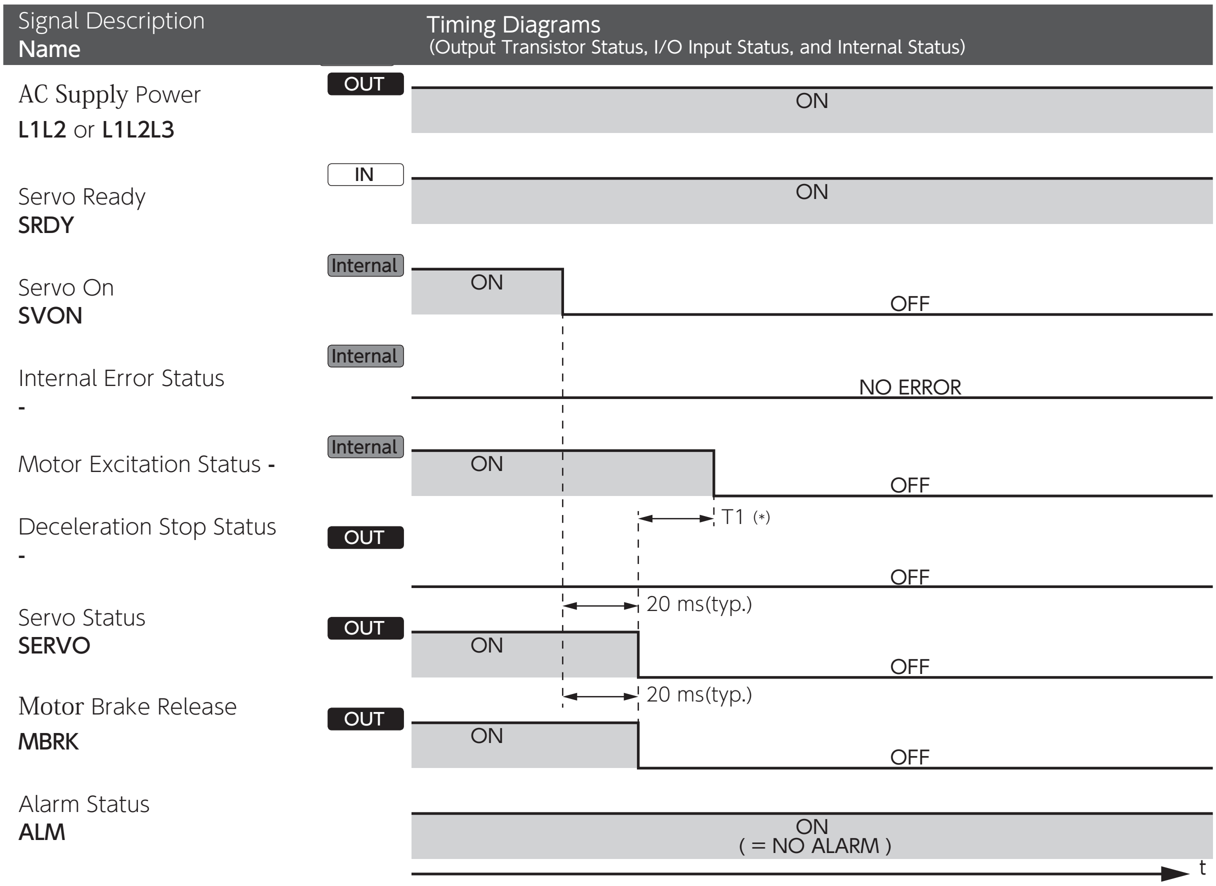
Servo OFF → ON



*1) **Motor Excitation Status** remains OFF until **Motor Rotational Speed** drops to 30 rpm or below.
*2) T1 is specified by Bake-Release Delay Time (No.238.0).

3. Timing Diagrams

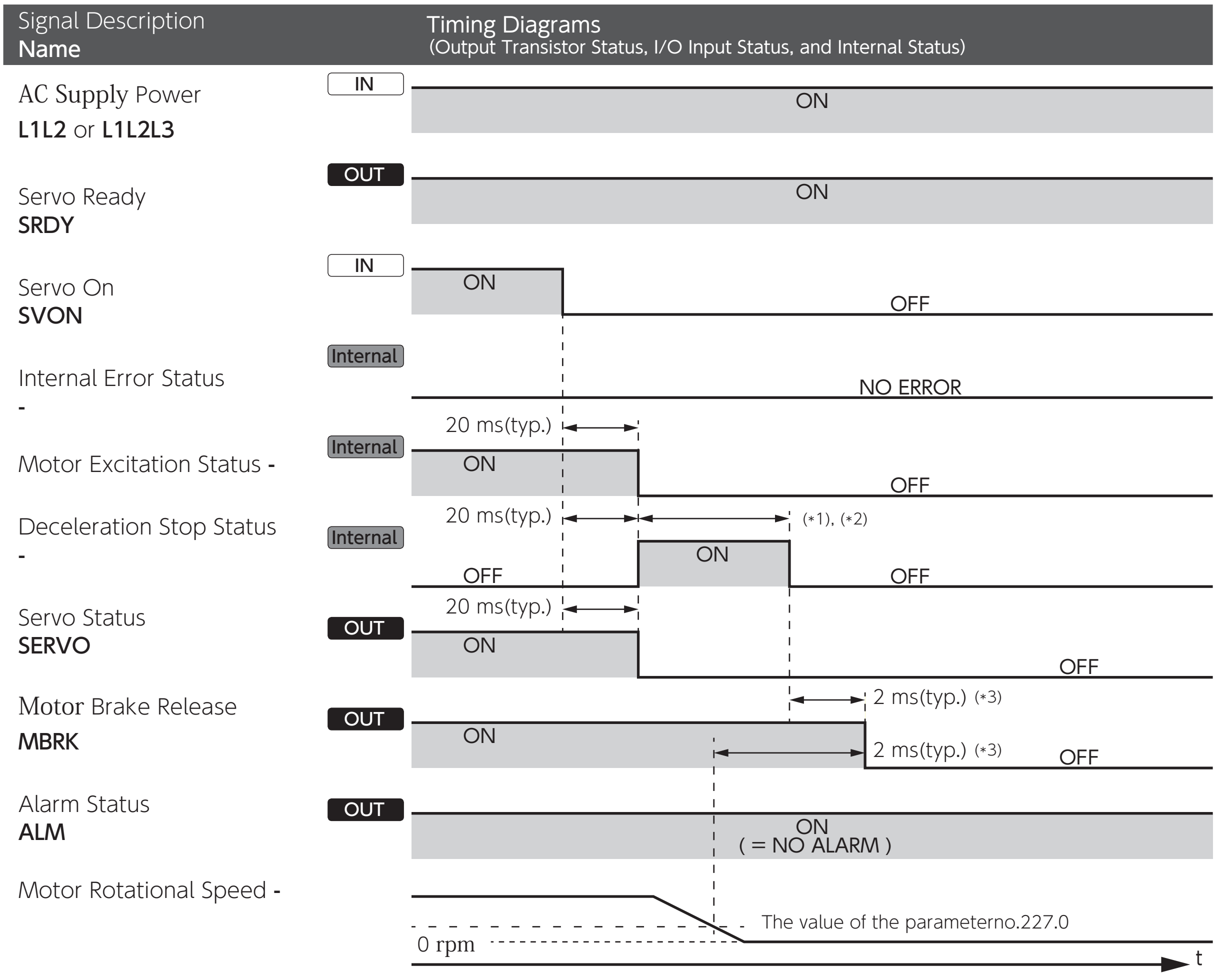
Servo ON → OFF (Motor idling)



*) T1 is specified by Servo OFF Delay time (No.237.0).

3. Timing Diagrams

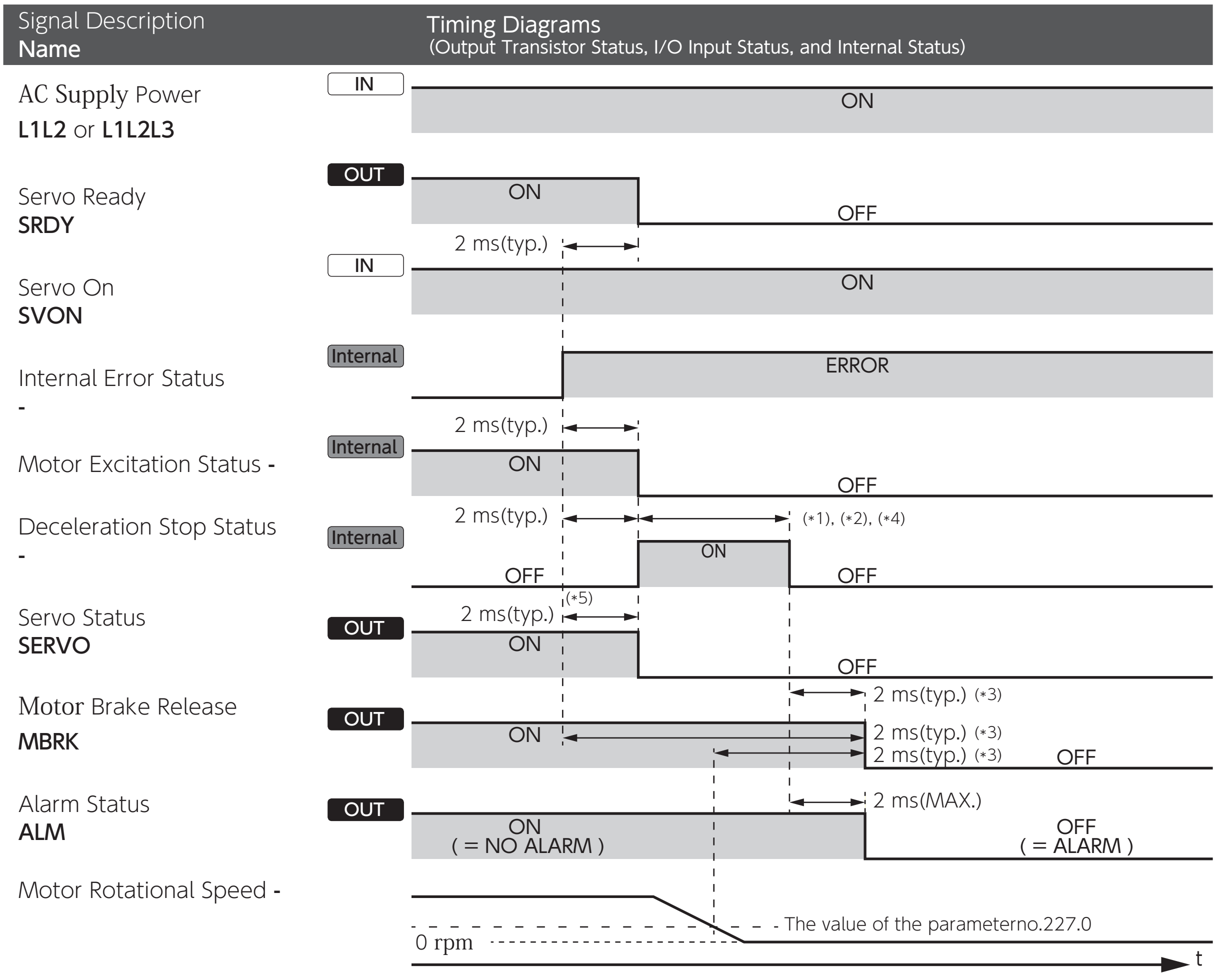
Servo ON → OFF (Motor rotating)



*1) The motor decelerates according to the method specified by Deceleration Stop Method (No.224.0)
*2) Quick stop or Short brake ends when deceleration stop conditions set by parameters (No.224.1, No.226.0, and No.227.0) are met.
*3) Deceleration Stop Method (No.224.0) = 2 (quick stop) or 1 (short brake)
MBRK turns OFF when one of the following conditions is met:
a) **Deceleration Stop Status** turns OFF
b) The rotational speed drops to the value specified by [Deceleration stop Rotational speed to cancel (No.227.0)] or below.
Deceleration Stop Method (No.224.0) = 0 (coast to stop)
MBRK turns OFF when **Motor Excitation Status** becomes OFF.

3. Timing Diagrams

Alarm Occurs



*1) The motor will stop per Deceleration Stop Method (No.224.0) as follows.

2 (quick stop) or 1 (short brake)	: the motor decelerates and stops by short brake.
0 (Coast to stop)	: no brake.

*2) **Deceleration Stop Status** ends when deceleration stop conditions set by the parameters (No.224.1, No.226.0, and No.227.0) are met.

*3) Timing of **MBRK** turning OFF

If Deceleration Stop Method (No.224.0) = 2 (quick stop) or 1 (short brake),
MBRK turns OFF when one of the following conditions is met.
1) **Deceleration Stop Status** turns OFF
2) **Motor Rotational Speed** drops to the value specified by the parameter No.227.0 or below.
If Deceleration Stop Method (No.224.0) = 0 (no brake),
MBRK turns OFF when **Motor Excitation Status** turns OFF.

If any of the following alarms occurs,
MBRK turns OFF when the internal error status becomes **ERROR**.

a) Encoder related errors	b) Control Power voltage drop error
c) Errors related to Inverter output part	d) Overvoltage error

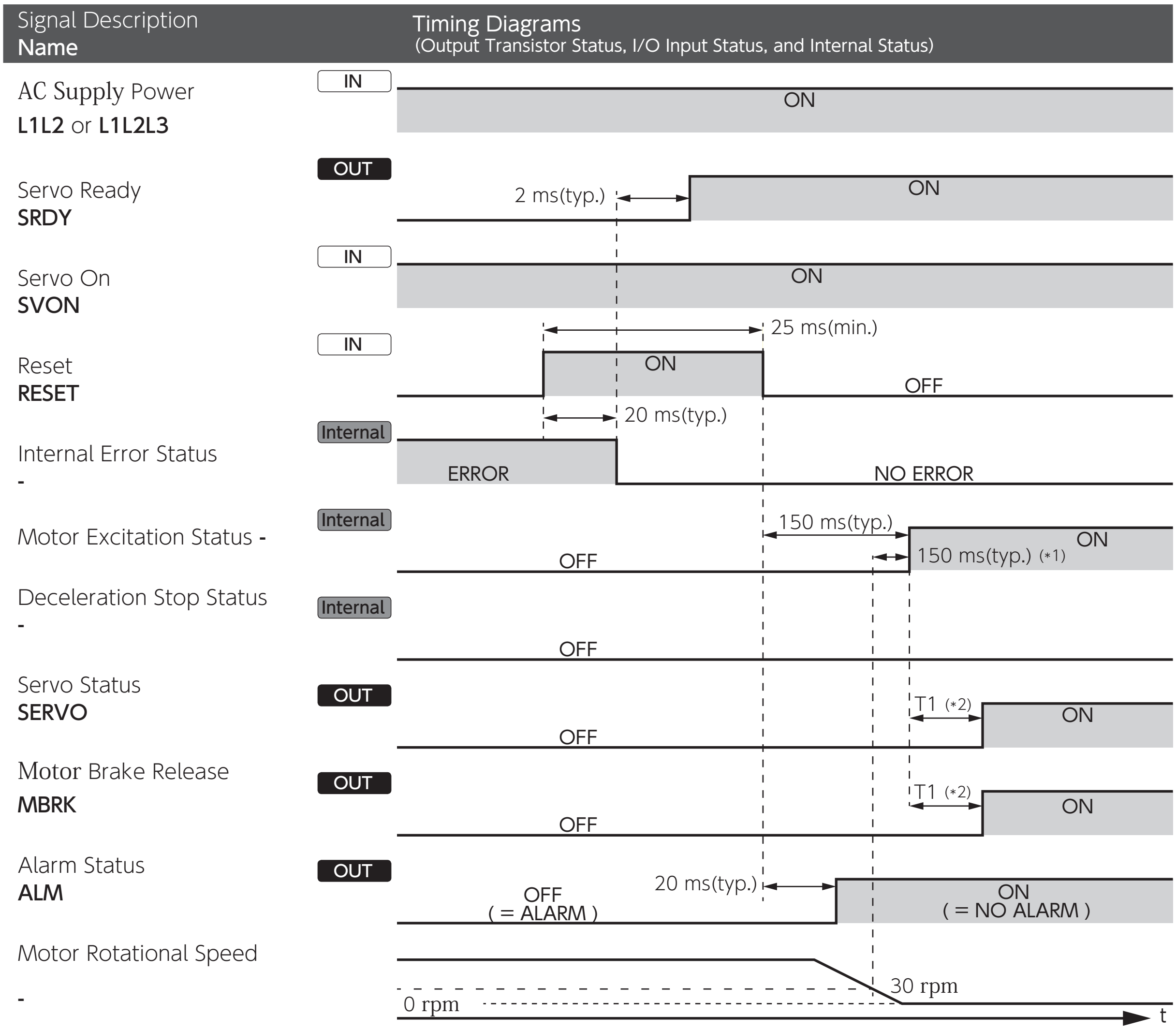
If any alarm except above four occurs, the motion pattern will be exactly as this timing diagram suggests.

*4) Deceleration Stop behaves as follows depending on the error type:
a) Encoder related errors: Deceleration Stop per [Deceleration stop operating time (Parameter No. 226.0)]
b) Control Power voltage drop error: Deceleration Stop per [Deceleration stop (upon control power failure) Operating time (No.228.0)]
c) Errors related to Inverter output part: Coast to stop

*5) In case of the following alarms, **Servo Status** will remain ON until **Deceleration Stop Status** turns OFF.
a) Encoder related errors
b) Control power voltage drop error

3. Timing Diagrams

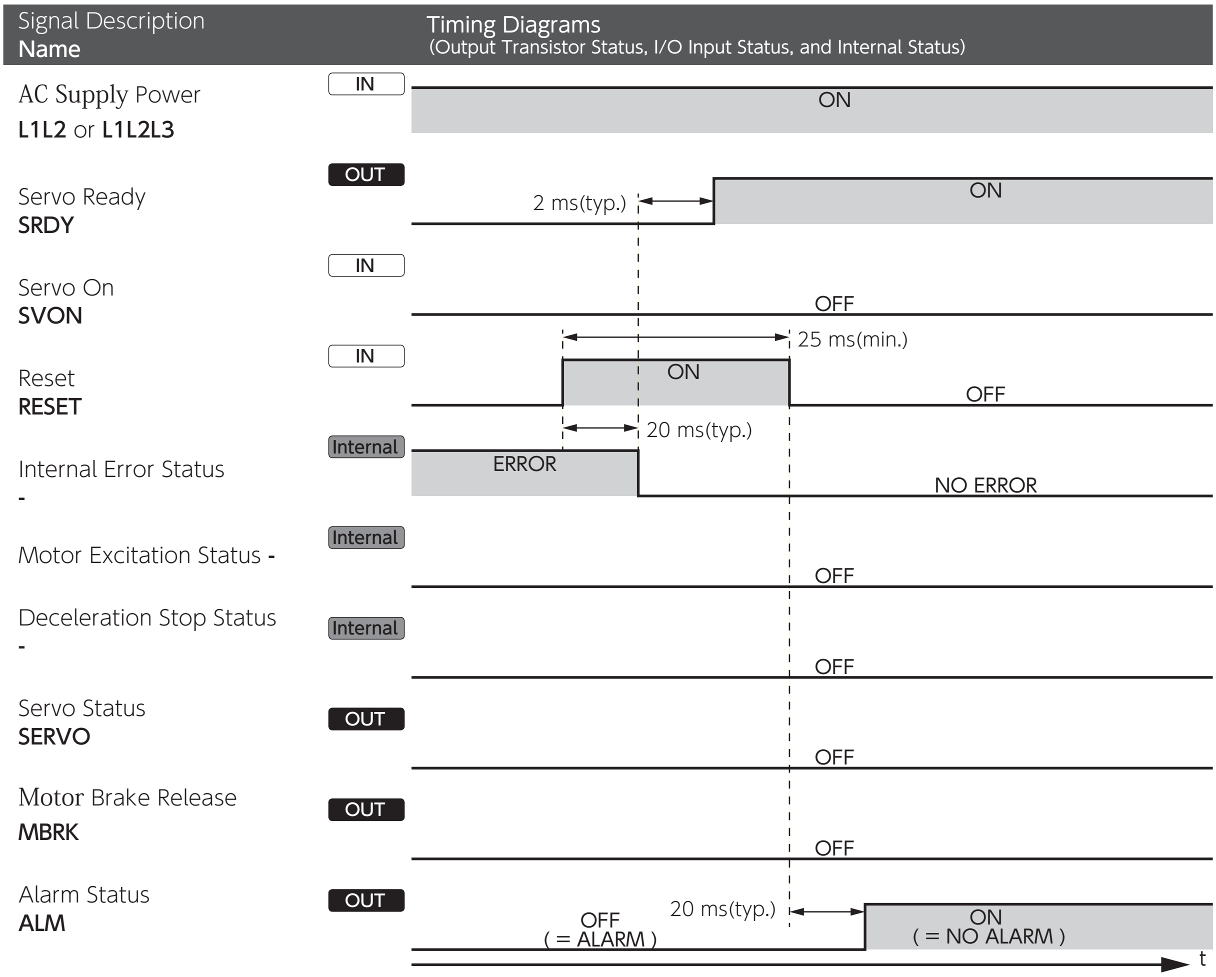
Alarm Reset (Servo ON)



*1) **Motor Excitation Status** remains OFF until motor rotational speed drops to 30 rpm or below.
*2) T1 is specified by Brake release Delay time (No.238.0).

3. Timing Diagrams

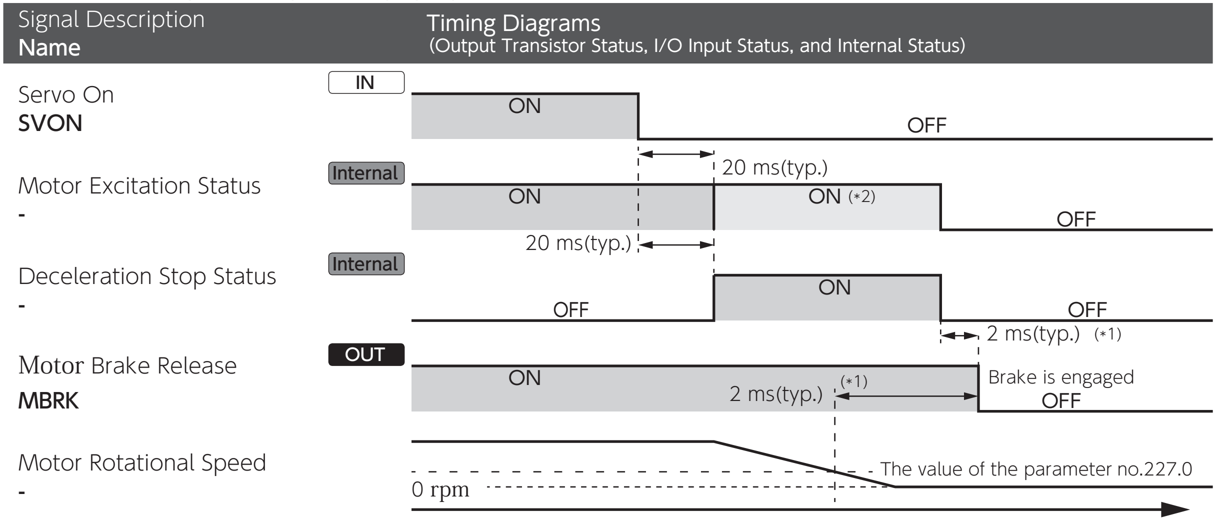
Alarm Reset (Servo OFF)



3. Timing Diagrams

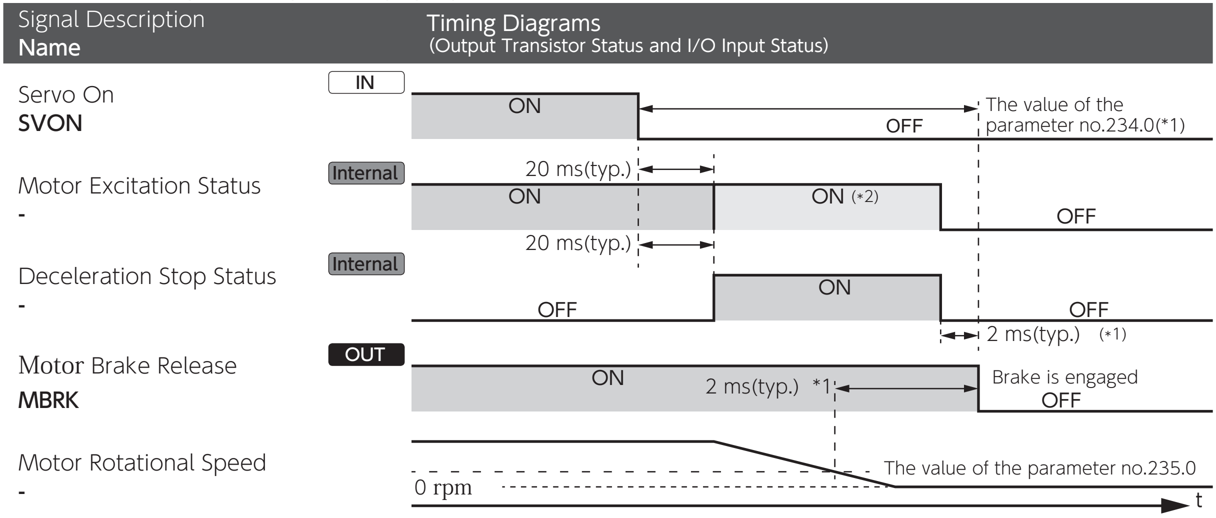
Motor Brake Release

Deceleration Stop: Timing for Engaging Brake (No.232.3) = 0



*1) **MBRK** turns OFF is when one of the following becomes true, a) Deceleration Stop completes, or b) **Motor rotational speed** drops to the value of [Deceleration stop - Rotational speed to cancel (No.227.0)] or below.
*2) If the deceleration stop method is quick stop, the motor will remain excited during deceleration stop.

Deceleration Stop: Timing for Engaging Brake (No.232.3) = 1

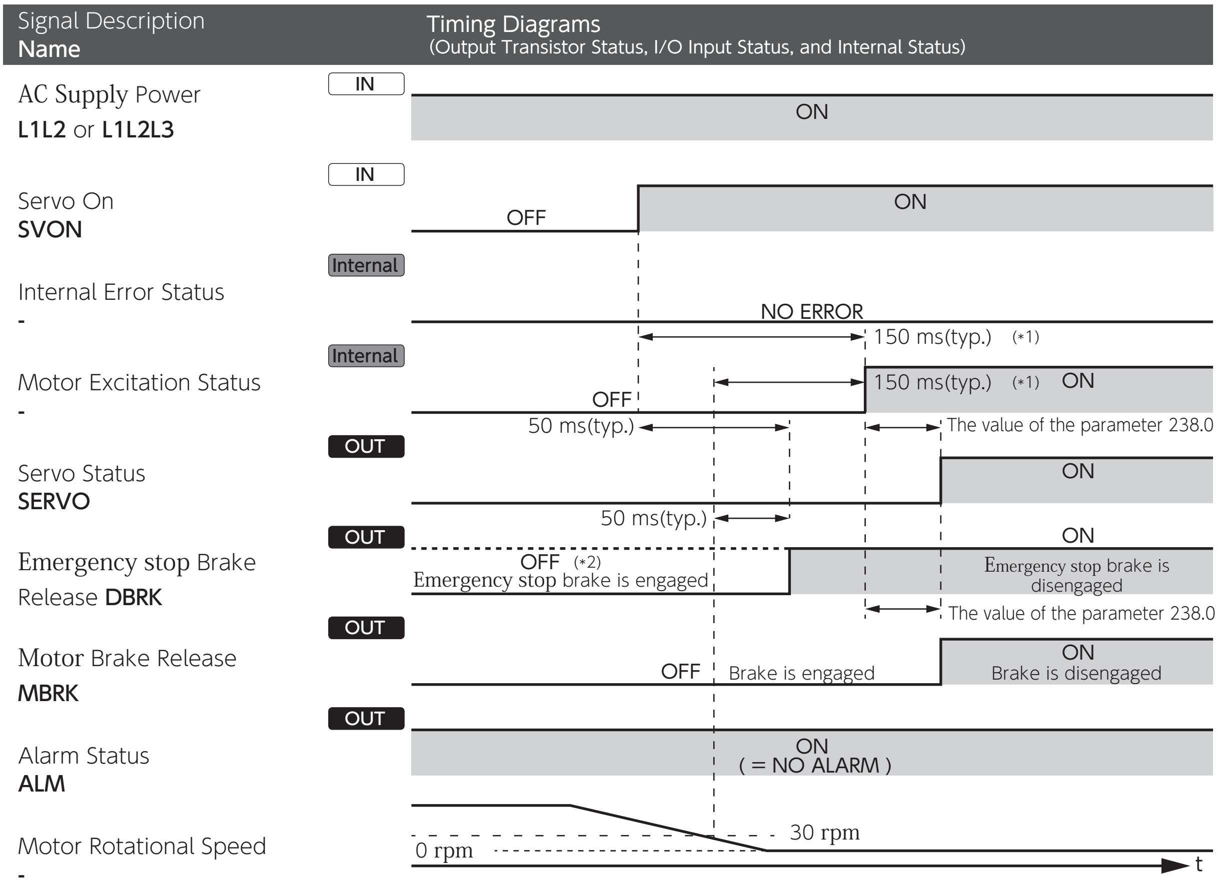


*1) **MBRK** turns OFF is when one of the following becomes true, a) Deceleration Stop completes, or b) Motor rotational speed, after the time specified by Parameter No.234.0 elapses, drops to the value specified by Parameter No.235.0 or below.
*2) If the deceleration stop method is quick stop, the motor will remain excited during deceleration stop.

3. Timing Diagrams

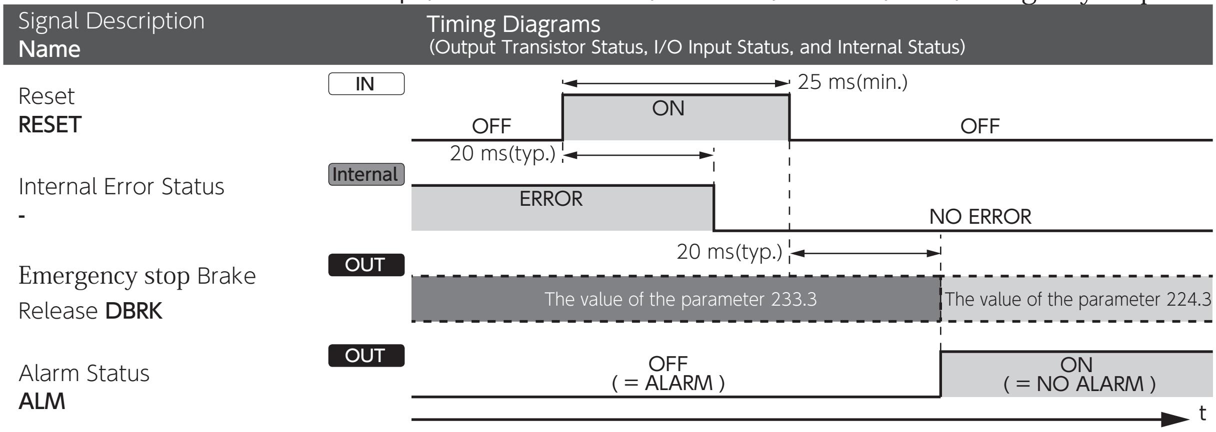
Emergency stop Brake Release

Upon Servo ON, if Deceleration stop (when Servo is OFF) : Method (No.224.0) = 3 (emergency stop brake)



*1) **SERVO** does not turn ON until **Motor Rotational Speed** drops below 30 rpm.
*2) When **DBRK** output (No.224.3) = 1 (emergency stop brake) after a stop per Deceleration Stop (when Servo is OFF)

Upon Alarm Clear, if Deceleration stop (when Servo is OFF) Method (No.224.0) = 3 (emergency stop brake)

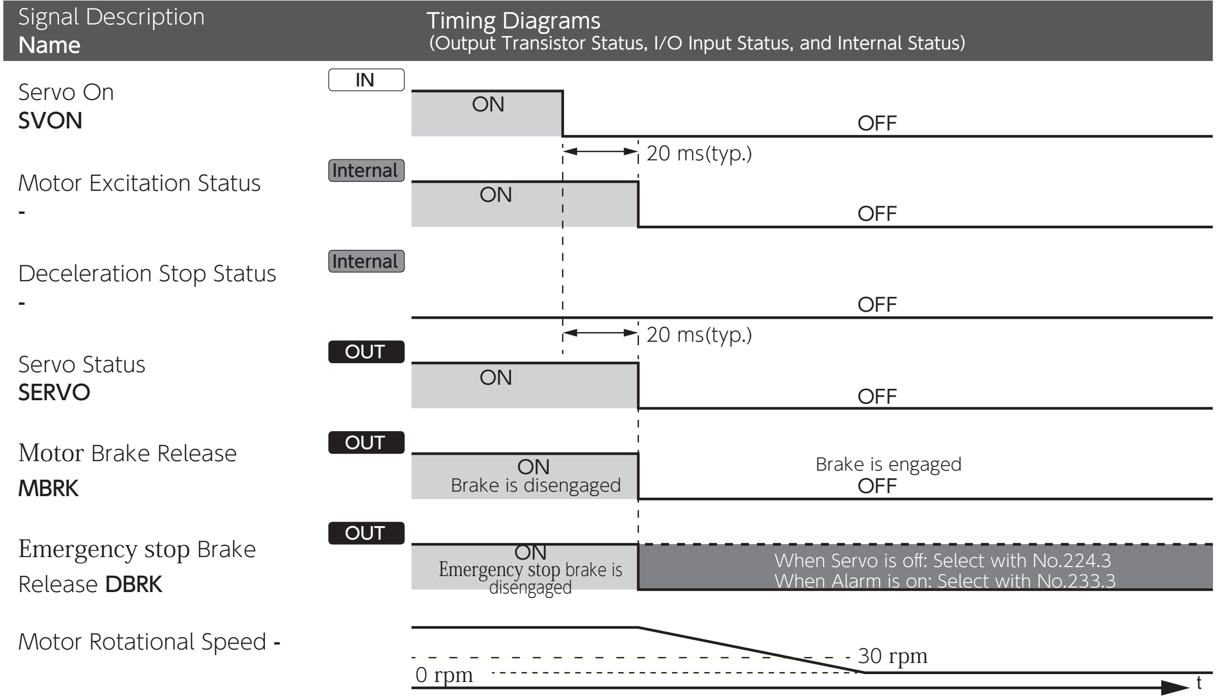


3. Timing Diagrams

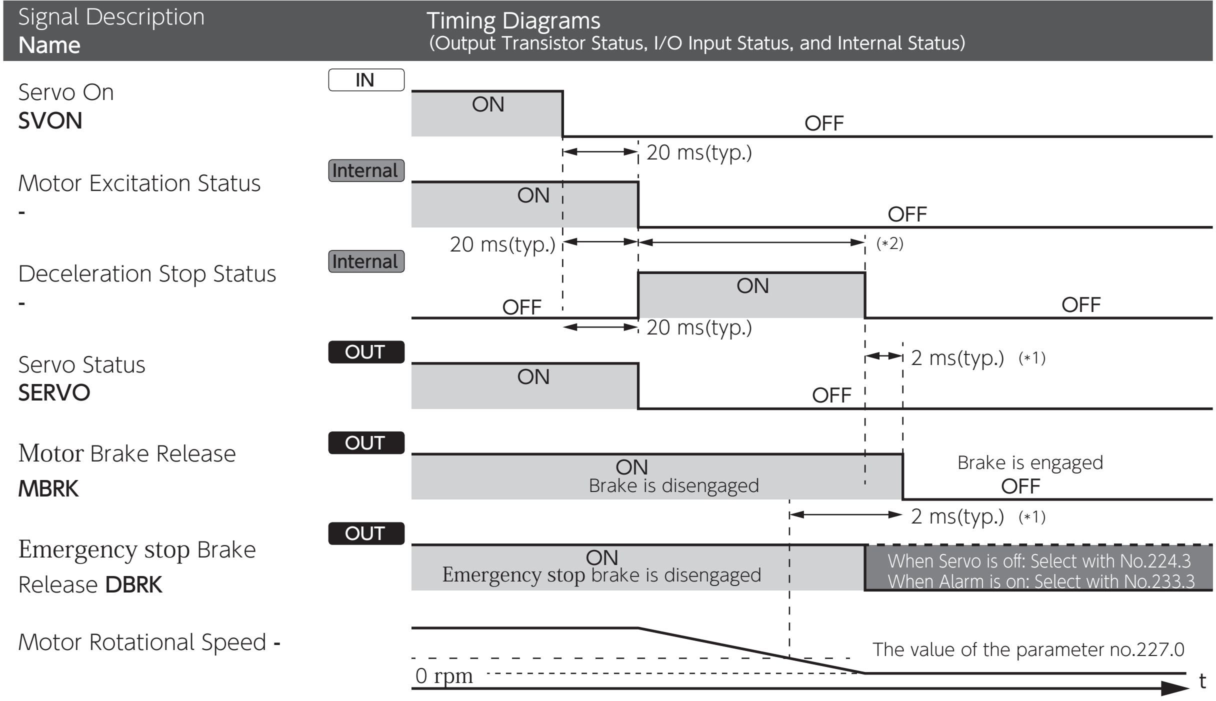
Deceleration Stop Status where [Deceleration Stop Method (at Servo OFF) (No.224.0)] and [Deceleration Stop Method (at Alarm ON)] are set to coast to stop

Deceleration Stop Status During Coast to Stop

Deceleration stop: Deceleration stop status during coast to stop (No.232.1) = 0 (OFF)



Deceleration stop: Deceleration stop status during coast to stop (No.232.1) = 1 (ON)



*1) **MBRK** turns OFF when one of the following conditions is met:
  a) **Deceleration Stop Status** turns OFF.
  b) **Motor Rotational Speed** drops to the value of [Deceleration stop - Rotational speed to cancel (No.227.0)] or below.

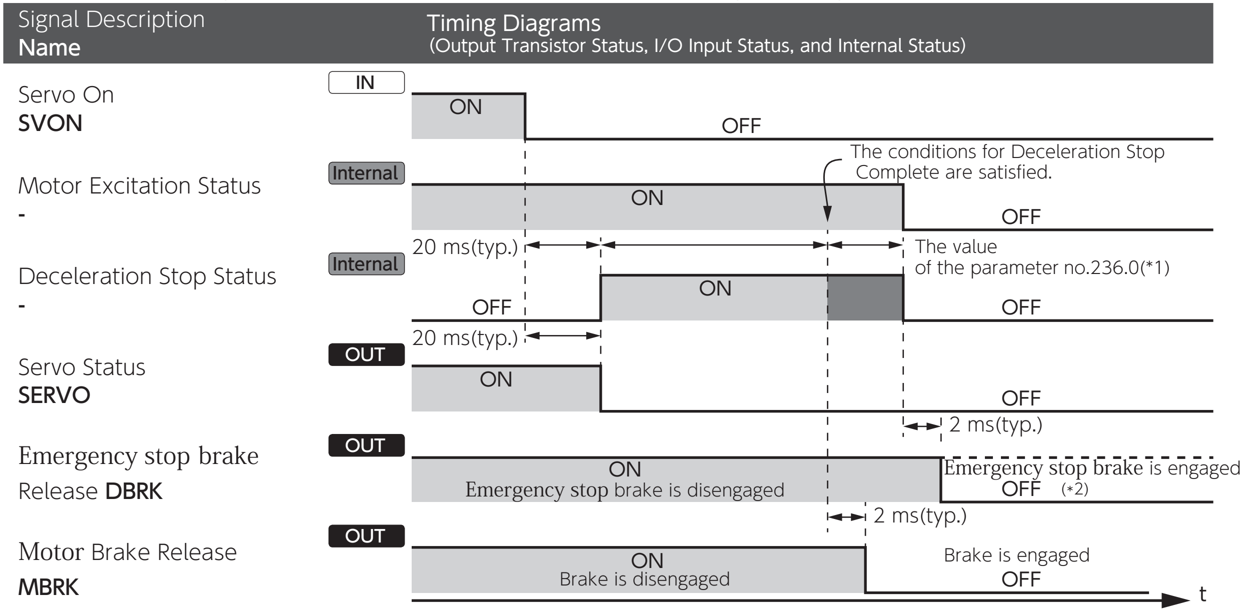
*2) **Deceleration Stop Status turns** OFF when deceleration stop conditions (No.224.1, 226.0, or 227.0) are met.

3. Timing Diagrams

When Servo becomes OFF while motor is in motion and then the motor decelerates to stop by the quick stop method.

Delay time for Quick Stop Complete

Deceleration stop: Method (at Servo OFF) (No.224) = 2 (quick stop)



*1) **Deceleration Stop Status** turns OFF after the deceleration stop conditions set by the parameters (No.224.1, 226.0, and 227.0) are met and the time amount set to [Quick Brake Delay Time (No.236.0)] elapses.

*2) when **DBRK** output (No.224.3) = 1 (emergency stop brake) after Deceleration Stop (at Servo OFF) ends.

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1. Introduction

Digitax SF features seven operation modes for motor, which are combinations of Control Mode and Command Mode options. Follow the appropriate CN1 connector wiring according to the mode that you are using.

Control Mode	Command Mode	Command Input Signal Format
Position Control	Pulse Train Command (*)	Differential
		24V open collector
		5V open collector
	Internal Command (*)	I/O Operation
Velocity Control	Analog Command	Analog Voltage
	Internal Command	I/O Operation
Torque Control	Analog Command	Analog Voltage

*) Select one of I/O setup types: "Standard I/O configuration" or "Optional I/O configuration"
When using one of the optional I/O configurations, use Digitax SF Connect to make the setting change.

Pulse Train Command

Select the pulse signal input from the following three types:

- pulse and direction
- quadrature pulse (A-phase+B-phase)
- positive or negative pulse (CCW and CW)

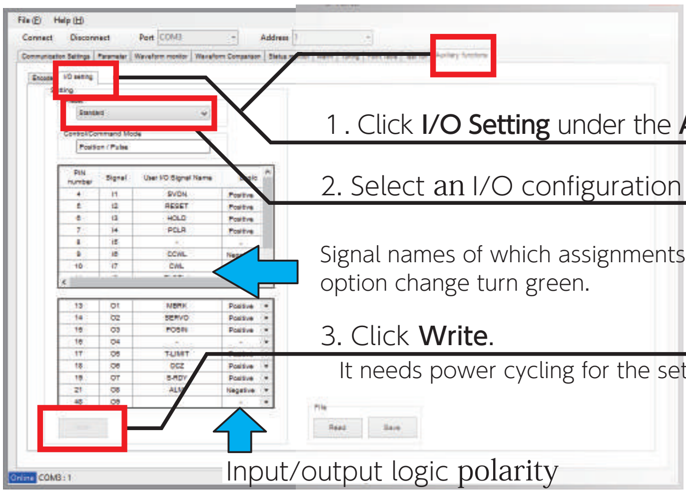
Analog Command

The range of input voltages is -10V to +10V.

Internal Command

The motor is operated based on the motion conditions that are preset in the drive. Operations are changed by combinations of command selection pins assigned to the I/O.

Changing the I/O configuration by Digitax SF Connect



1 . Click **I/O Setting** under the **Auxiliary Functions** tab.

2. Select an I/O configuration type

Signal names of which assignments change due to your I/O preset option change turn green.

3. Click **Write**.

It needs power cycling for the setting changes to take effect.

Input/output logic polarity

1. Introduction

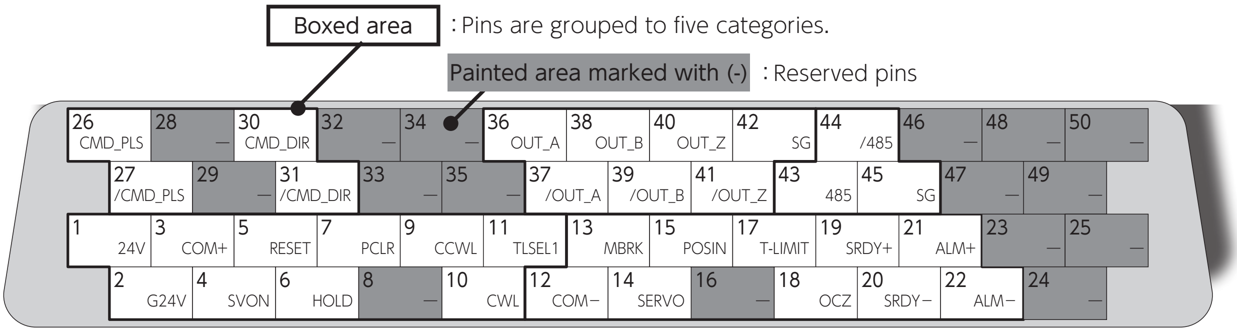
Pinout Diagram

The pinout depends on the control mode / motion mode that you are using. Pins are grouped to five categories.

Group	Description
General-Purpose Input	The pinout depends on the control mode / motion mode that you are using. These are input terminals, such as control power, I/O power, and Servo ON. You can change the input logic. *
General-Purpose Output	The pinout depends on the control mode / motion mode that you are using. This is an output terminal such as Servo Status that connects to the host controller You can change the output logic. *
Command Input	The pinout depends on the control mode / motion mode that you are using. This is an input terminal that receives a command signal from the host controller such as Pulse Train Command or Analog Command.
Encoder Output	A terminal to output encoder pulse to the host controller.
RS-485 Communication	RS-485 interface to communicate with the host controller.

* ☞ page 24 Descriptions of CN1 Connector signals

The pinout diagram below illustrates the pin layout when viewing the plug–in connector looking at the pins to which the control cables are soldered
Do not connect anything to reserved pins.



Example: Position control mode- Pulse Train Command, Differential, Standard I/O Configuration

CN1 Connector Wiring Example

Example of CN1 Connector Wiring The pinout depends on the control mode･motion mode that you are using.
For actual wiring, check the pin numbers etched on the connector body as well.
For further details, refer to Descriptions of CN1 Connector Signals and Interface Circuit of CN1 Connector.

☞ page 24 Descriptions of CN1 Connector Signals
☞ page 45 Interface Circuit of CN1 Connector

2. Position Control Mode

1. Pulse Train Command

Differential, Standard I/O Setting

PLS DIF.

Pinout Diagram

Command Input

Pin No.	Signal Description
26	**CMD_PLS** Pulse, QEP A-phase or CCW
27	**/CMD_PLS** /Pulse, QEP /A-phase or /CCW
30	**CMD_DIR** Direction, QEP B-phase or CW
31	**/CMD_DIR** /Direction, QEP /B-phase or /CW

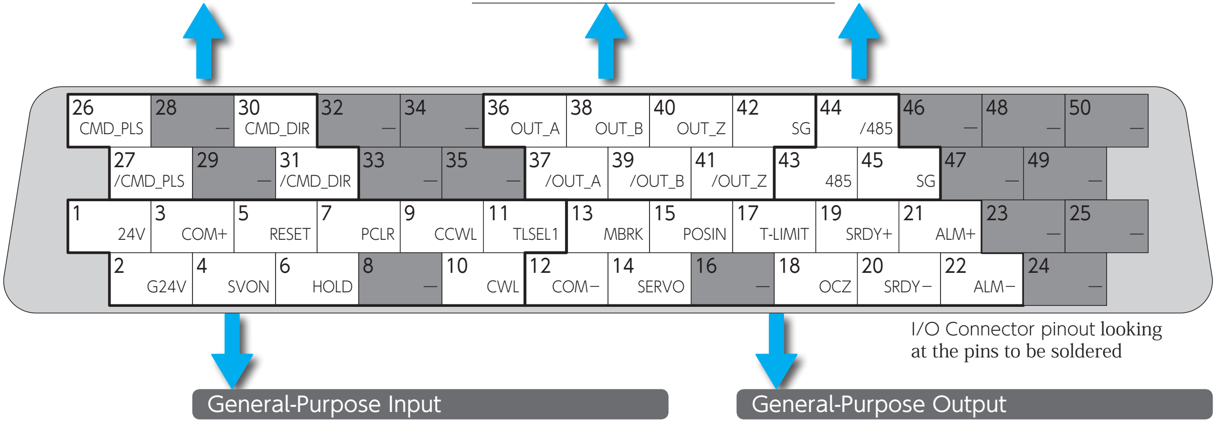
QEP: Quadrature encoder pulse

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

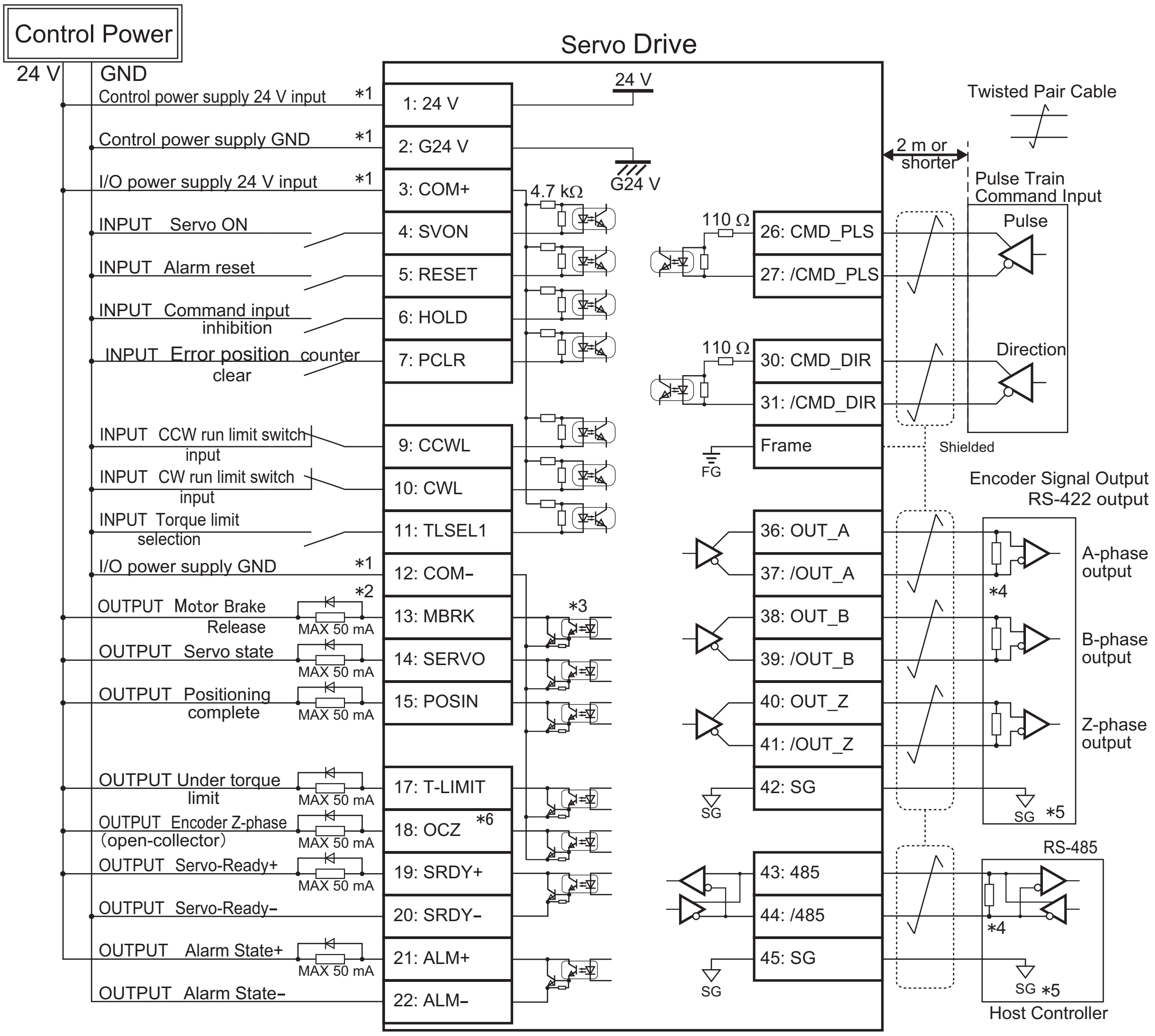
Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
7	**PCLR** Error counter clear
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
15	**POSIN** Positioning complete
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

CN1 Connector Wiring Example

Pulse Train Command, Differential, Standard I/O Configuration



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio $\times 2^{17}$) × 60 × 1,000.

2. Position Control Mode

Differential, I/O Setting Option 1

Pinout Diagram

Command Input

Pin No.	Signal Description
26	**CMD_PLS** Pulse, QEP A-phase or CCW
27	**/CMD_PLS** /Pulse, QEP /A-phase or /CCW
30	**CMD_DIR** Direction, QEP B-phase or CW
31	**/CMD_DIR** /Direction, QEP /B-phase or /CW

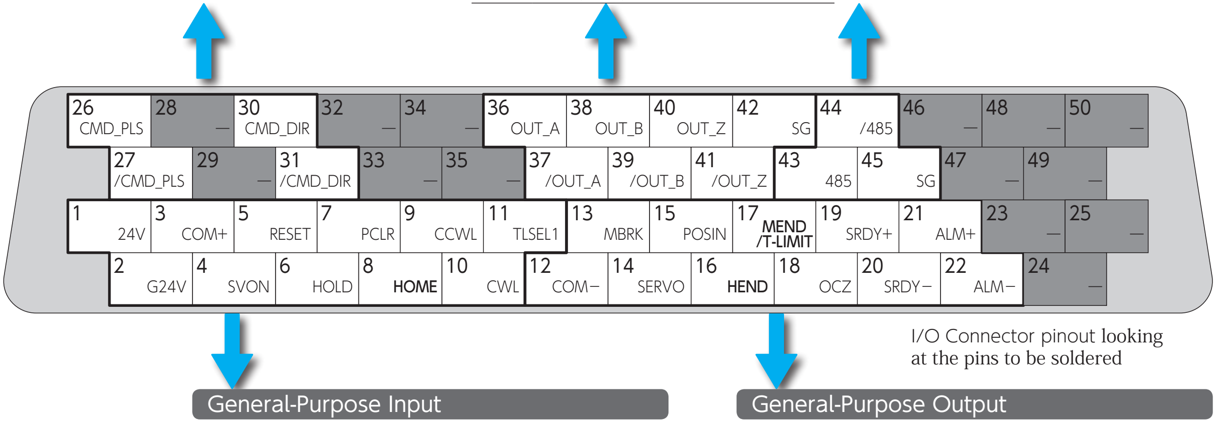
QEP: Quadrature encoder pulse

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
7	**PCLR** Position Error counter clear
8	**HOME*** Homing start
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

General-Purpose Output

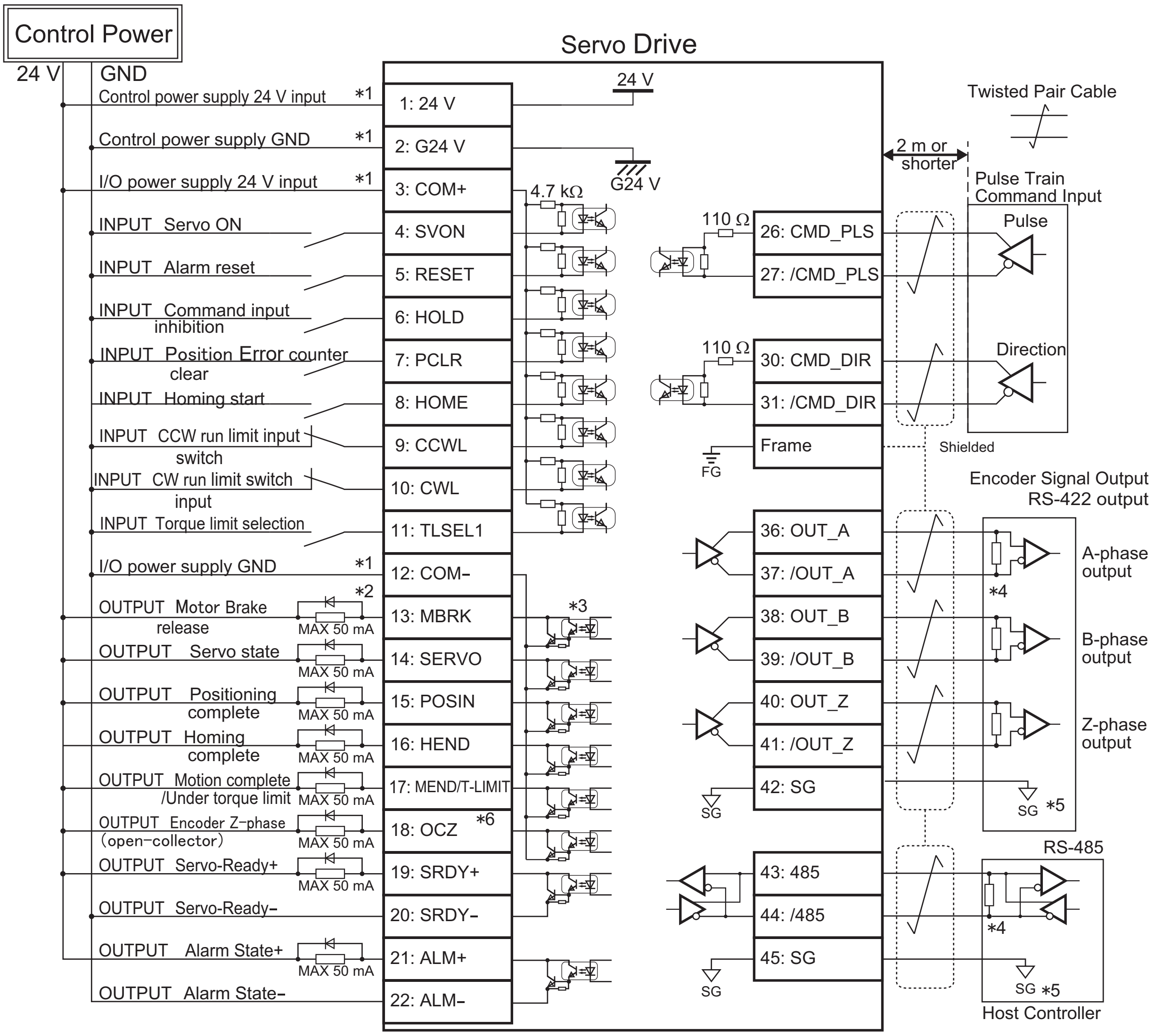
Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
15	**POSIN** Positioning complete
16	**HEND*** Homing complete
17	**MEND/T-LIMIT*** Motion complete/Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

* For these pins function, change I/O setting with Digitax SF Connect

2. Position Control Mode

CN1 Connector Wiring Example

Pulse Train Command, Differential, I/O Configuration Option 1



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

2. Position Control Mode

Differential, I/O Setting Option 2

Pinout Diagram

Command Input

Pin No.	Signal Description
26	**CMD_PLS** Pulse, QEP A-phase or CCW
27	**/CMD_PLS** /Pulse, QEP /A-phase or /CCW
30	**CMD_DIR** Direction, QEP B-phase or CW
31	**/CMD_DIR** /Direction, QEP /B-phase or /CW

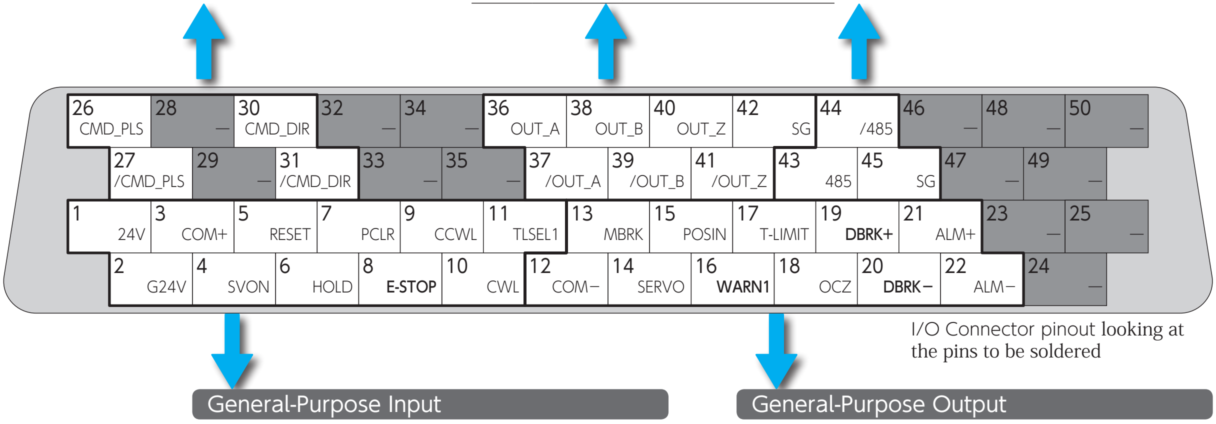
QEP: Quadrature encoder pulse

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



26 CMD_PLS	28 —	30 CMD_DIR	32 —	34 —	36 OUT_A	38 OUT_B	40 OUT_Z	42 SG	44 /485	46 —	48 —	50 —
27 /CMD_PLS	29 —	31 /CMD_DIR	33 —	35 —	37 /OUT_A	39 /OUT_B	41 /OUT_Z	43 485	45 SG	47 —	49 —	
1 24V	3 COM+	5 RESET	7 PCLR	9 CCWL	11 TLSEL1	13 MBRK	15 POSIN	17 T-LIMIT	19 DBRK+	21 ALM+	23 —	25 —
2 G24V	4 SVON	6 HOLD	8 E-STOP	10 CWL	12 COM−	14 SERVO	16 WARN1	18 OCZ	20 DBRK−	22 ALM−	24 —	

I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
7	**PCLR** Position Error counter clear
8	**E-STOP *** Emergency stop
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

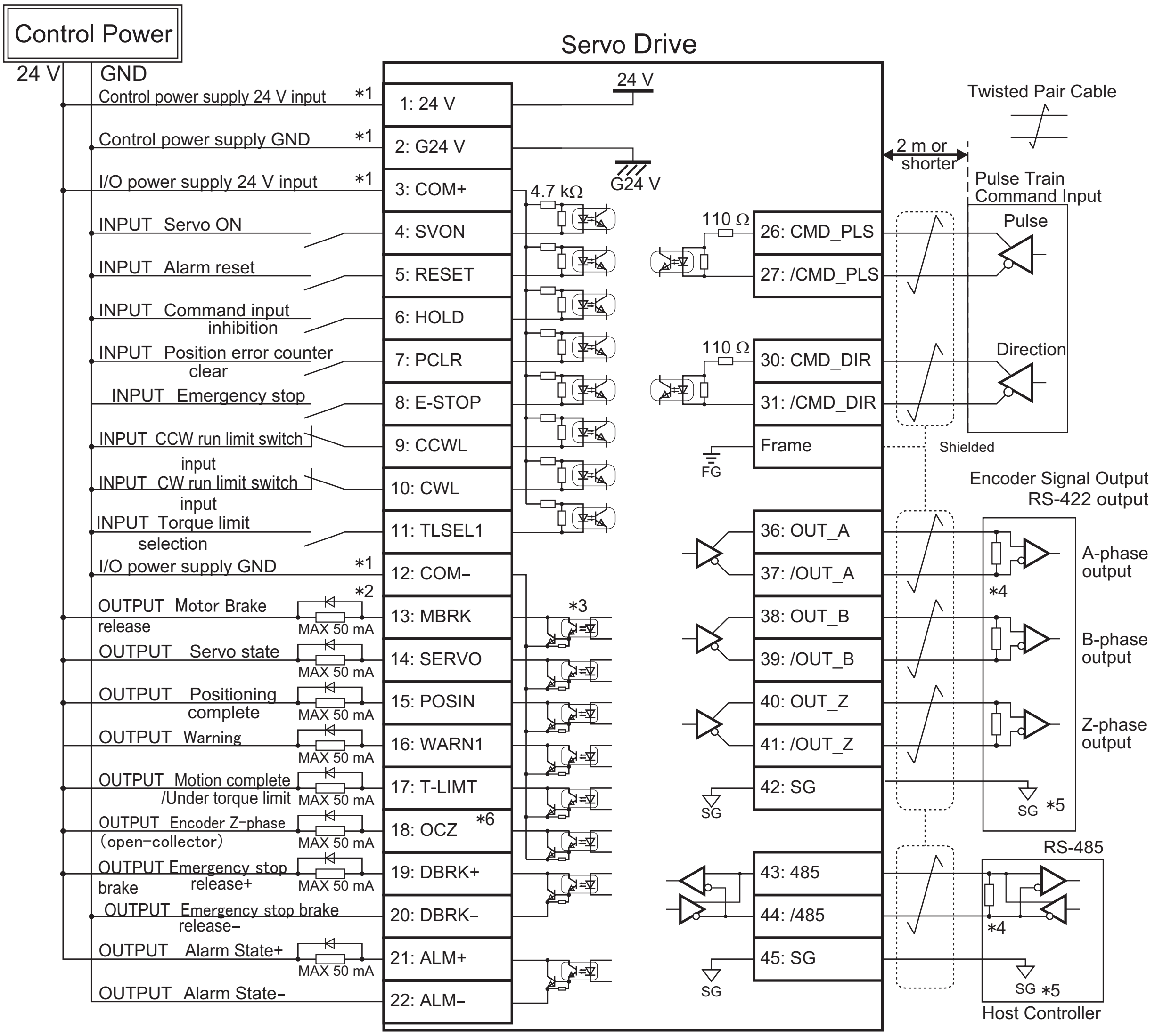
General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
15	**POSIN** Positioning complete
16	**WARN1*** Warning
17	**T-LIMIT** Torque Limit
18	**OCZ** Encoder Z-phase (open collector)
19	**DBRK+ *** Emergency stop brake release+
20	**DBRK − *** Emergency stop brake release −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

* For these pins function, change I/O setting with Digitax SF Connect

CN1 Connector Wiring Example

Pulse Train Command, Differential, I/O configuration Option 2



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

24V open collector, Standard I/O configuration

Pinout Diagram

Command Input

Pin No.	Signal Description
27	**/CMD_PLS** /Pulse, QEP /A-phase or /CCW
28	**CC-P** Open collector power 24V-PLS
29	**CC-D** Open collector power 24V-DIR
31	**/CMD_DIR** /Direction, QEP /B-phase or /CW

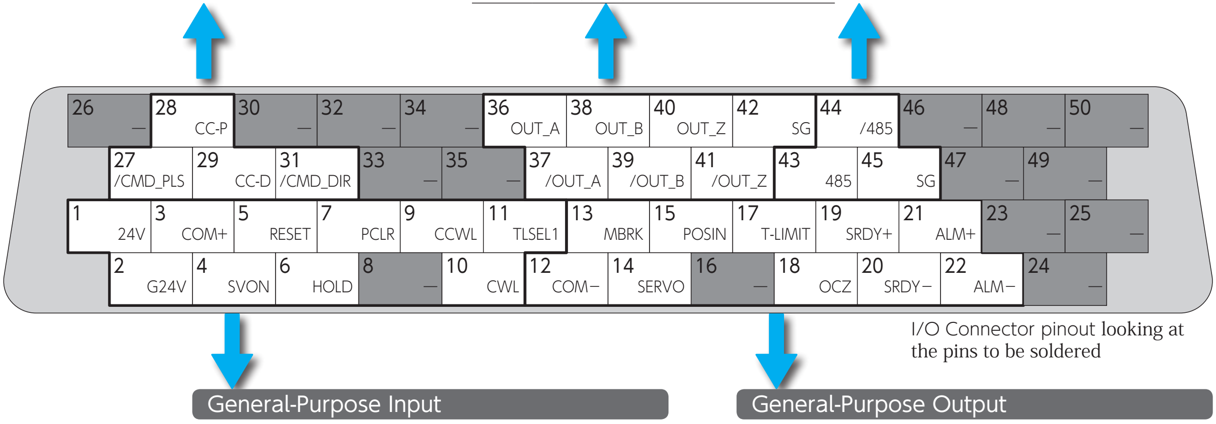
QEP: Quadrature encoder pulse

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

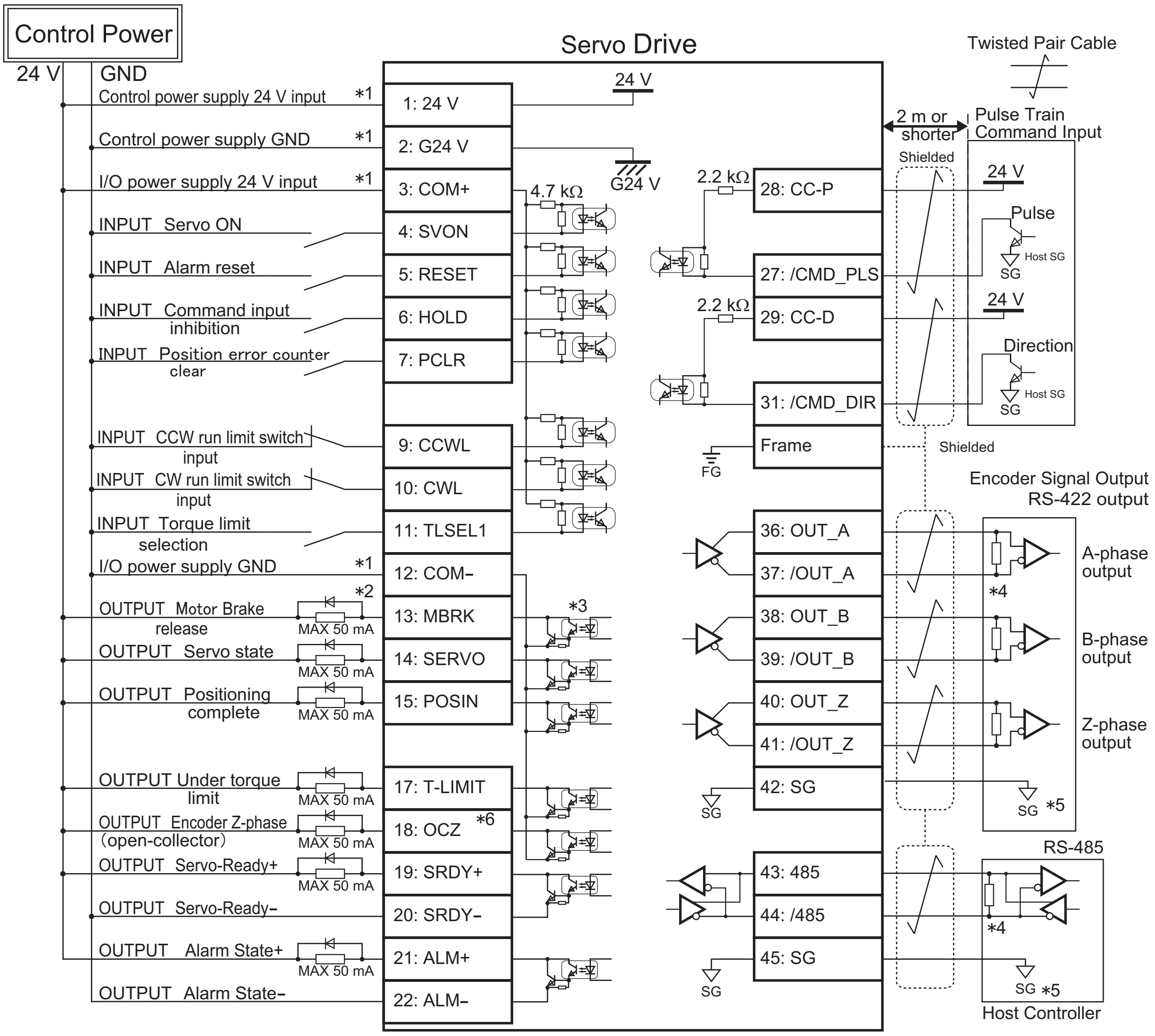
Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
7	**PCLR** Position Error counter clear
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Brake release
14	**SERVO** Servo status
15	**POSIN** Positioning complete
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

CN1 Connector Wiring Example

Pulse Train Command, 24V Open Collector, Standard I/O Configuration



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

2. Position Control Mode

5V open collector, Standard I/O configuration

Pinout Diagram

Command Input

Pin No.	Signal Description
49	**CC-P_5V_** Open collector power 5V-PLS
27	**/CMD_PLS** /Pulse, QEP /A-phase or /CCW
50	**CC-D_5V** Open collector power 5V-DIR
31	**/CMD_DIR** /Direction, QEP /B-phase or /CW

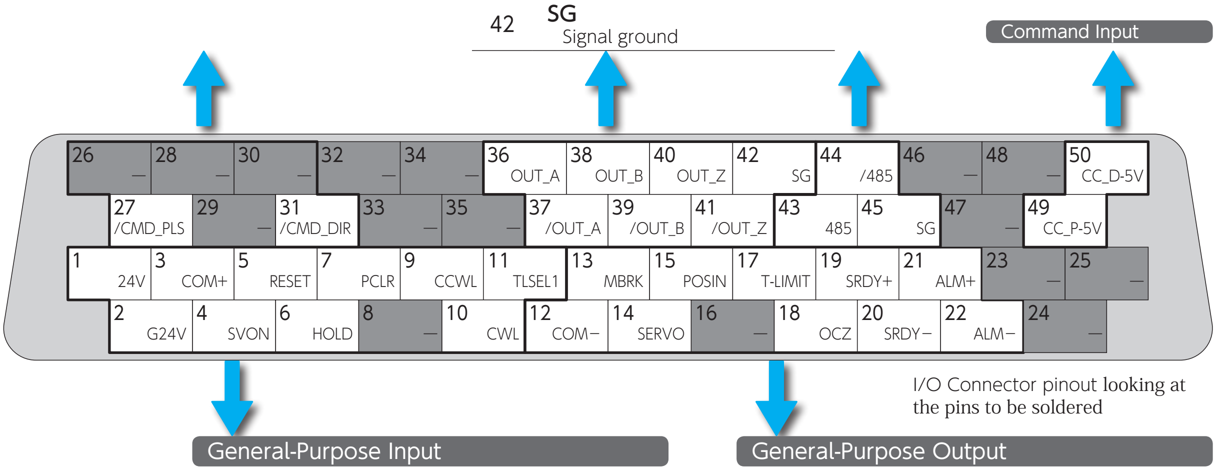
QEP: Quadrature encoder pulse

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

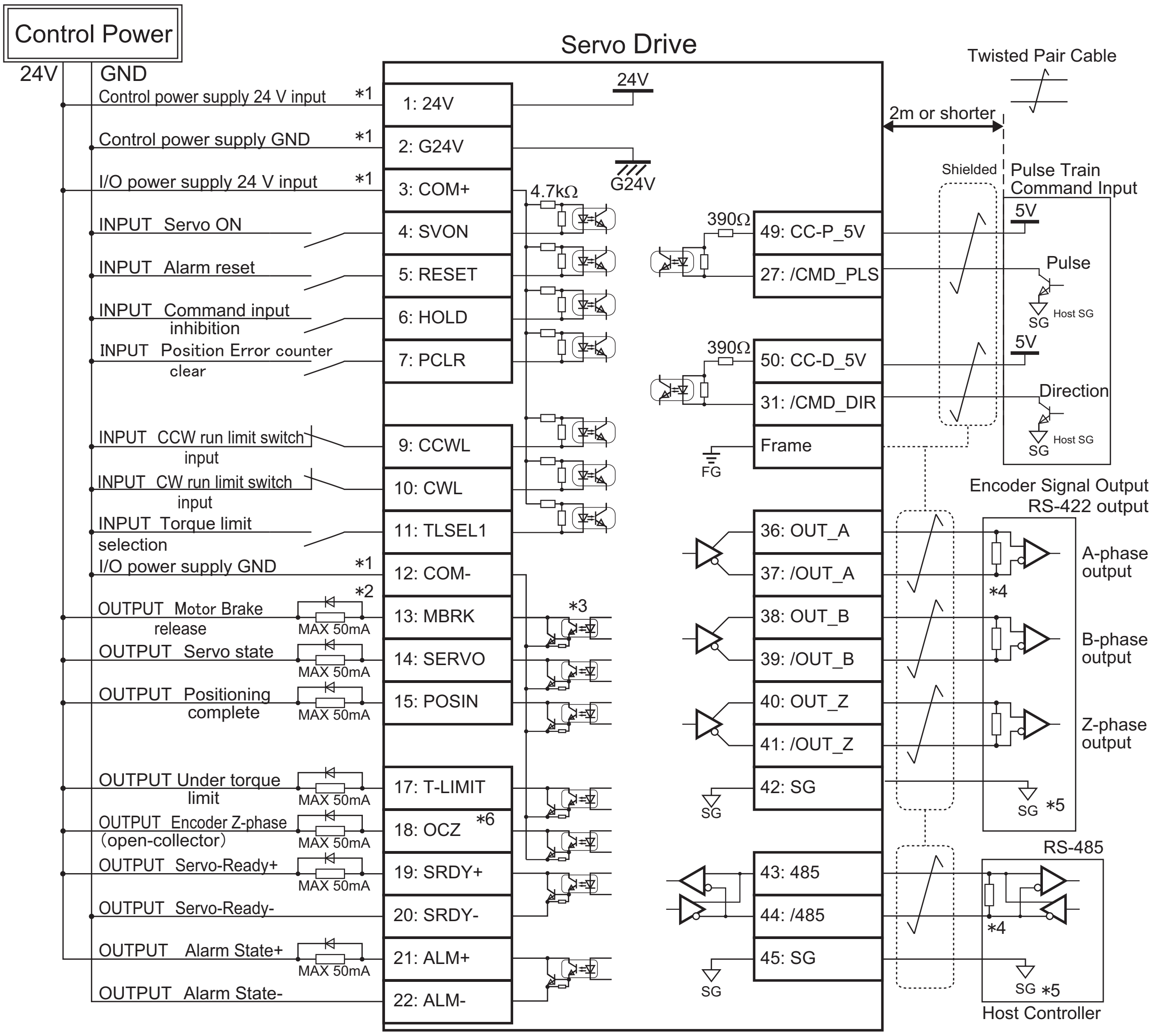
Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
7	**PCLR** Position Error counter clear
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
15	**POSIN** Positioning complete
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

CN1 Connector Wiring Example

Pulse Train Command, 5V Open Collector, Standard I/O Configuration



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode). The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.

Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators. Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V; a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω .

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

2. Internal Position Command

Standard I/O Configuration

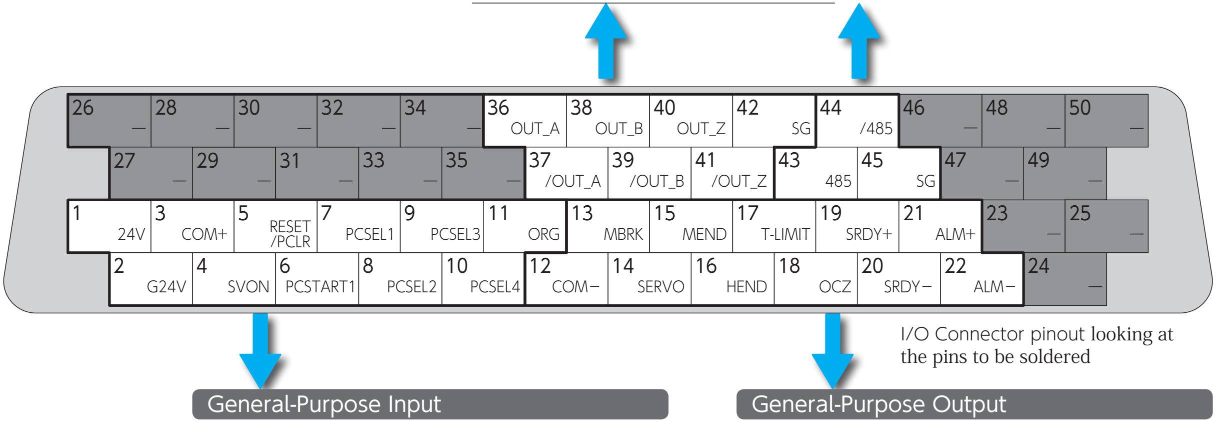
Pinout Diagram

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET/PCLR** Alarm Reset / Position Error Counter Clear
6	**PCSTART1** Start Forward Rotation
7	**PCSEL1** Point No. Select 1
8	**PCSEL2** Point No. Select 2
9	**PCSEL3** Point No. Select 3
10	**PCSEL4** Point No. Select 4
11	**ORG** Home position sensor

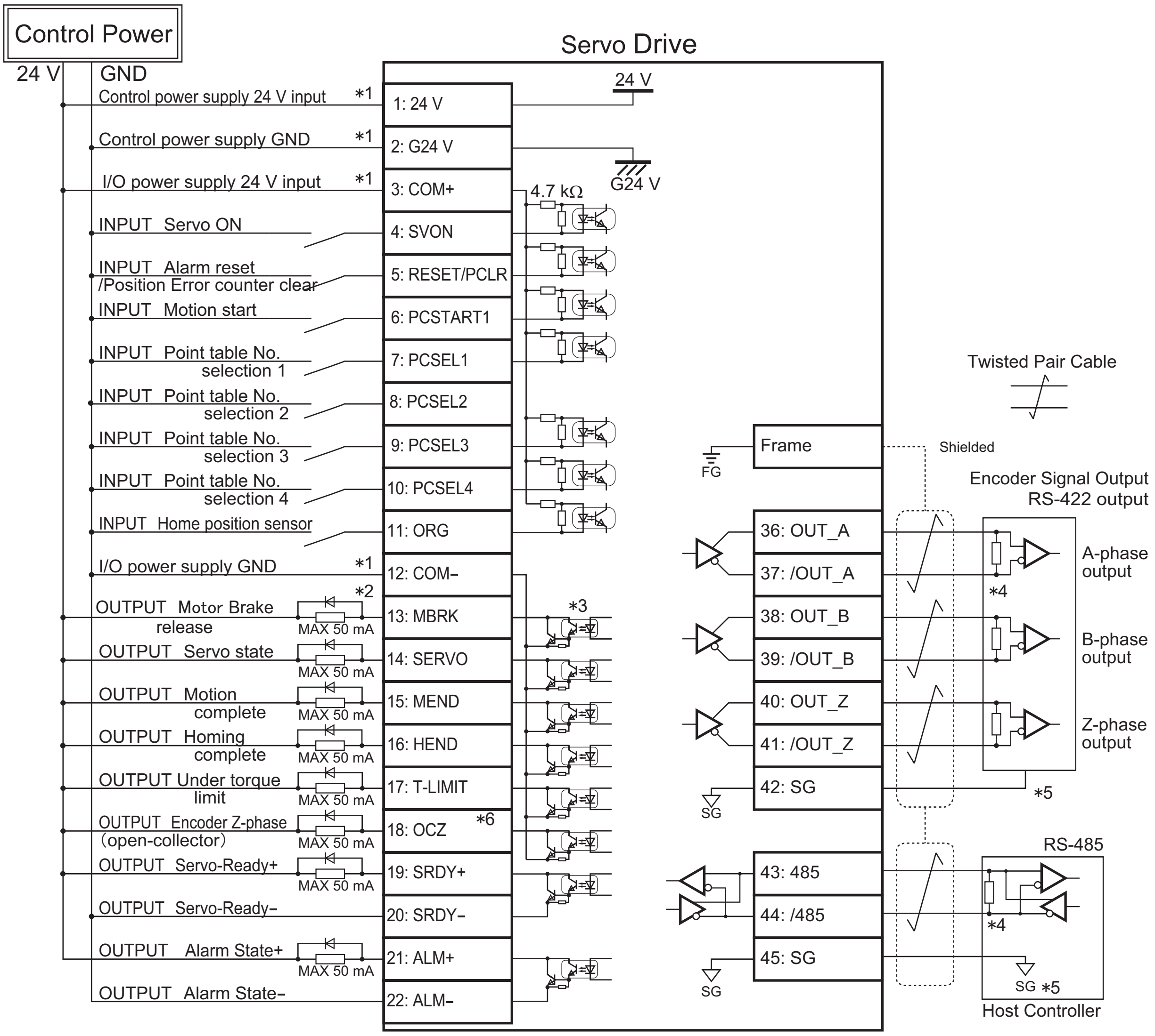
General-Purpose Output

Pin No.	Signal Description
12	**COM –** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
15	**MEND** Motion complete
16	**HEND** Homing complete
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY –** Servo ready –
21	**ALM+** Alarm status+
22	**ALM –** Alarm status –

2. Position Control Mode

CN1 Connector Wiring Example

Internal Position Command, Standard I/O Configuration



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

Optional I/O Configuration

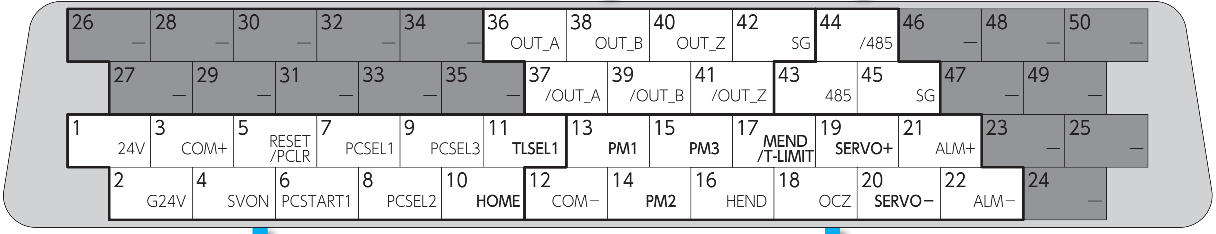
Pinout Diagram

Encoder Output

Pin No.	Signal Description
36	OUT_A A-phase
37	/OUT_A /A-phase
38	OUT_B B-phase
39	/OUT_B /B-phase
40	OUT_Z Z-phase
41	/OUT_Z /Z-phase
42	SG Signal ground

RS-485 Communication

Pin No.	Signal Description
44	/485 /Data
43	485 Data
45	SG Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET/PCLR** Alarm Reset/Position error Counter Clear
6	**PCSTART1** Start Forward Rotation
7	**PCSEL1** Point No. Select 1
8	**PCSEL2** Point No. Select 2
9	**PCSEL3** Point No. Select 3
10	**HOME** * Homing start
11	**TLSEL1** * Torque limit

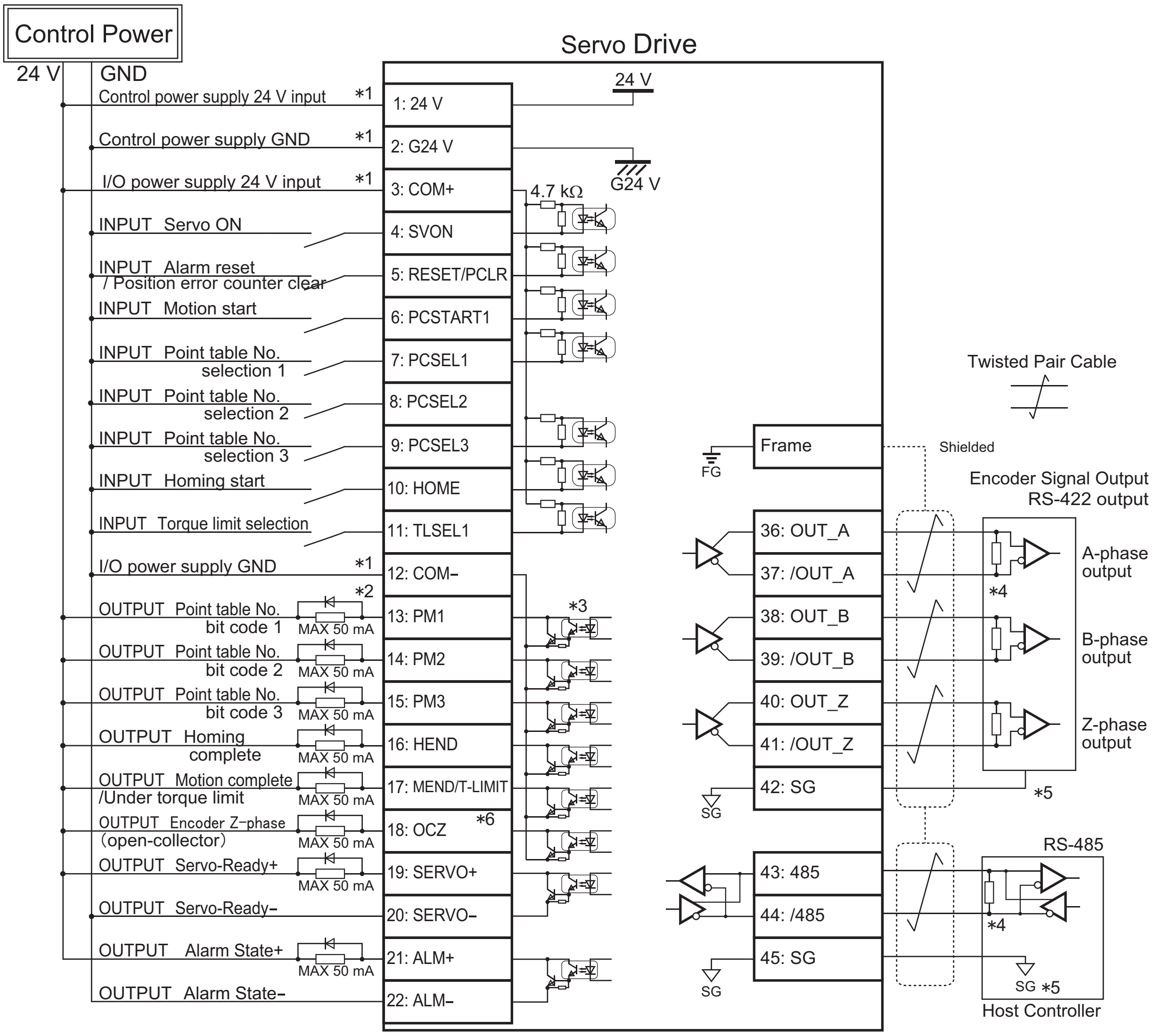
General-Purpose Output

Pin No.	Signal Description
12	**COM –** I/O power GND
13	**PM1** * Point No.1
14	**PM2** * Point No.2
15	**PM3** * Point No.3
16	**HEND** Homing complete
17	**MEND/T-LIMIT** * Motion Complete/Torque Limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SERVO+** * Servo Status+
20	**SERVO –** * Servo Status –
21	**ALM+** Alarm status+
22	**ALM –** Alarm status –

* For these pins function, change I/O setting with Digitax SF Connect

CN1 Connector Wiring Example

Internal Position Command, Optional I/O Configuration



*1) Control power (24V, G24V) and power for I/O (COM+, COM-) must share one common power supply.

*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

3. Velocity Control Mode

1. Analog Velocity Command

Pinout Diagram

Command Input

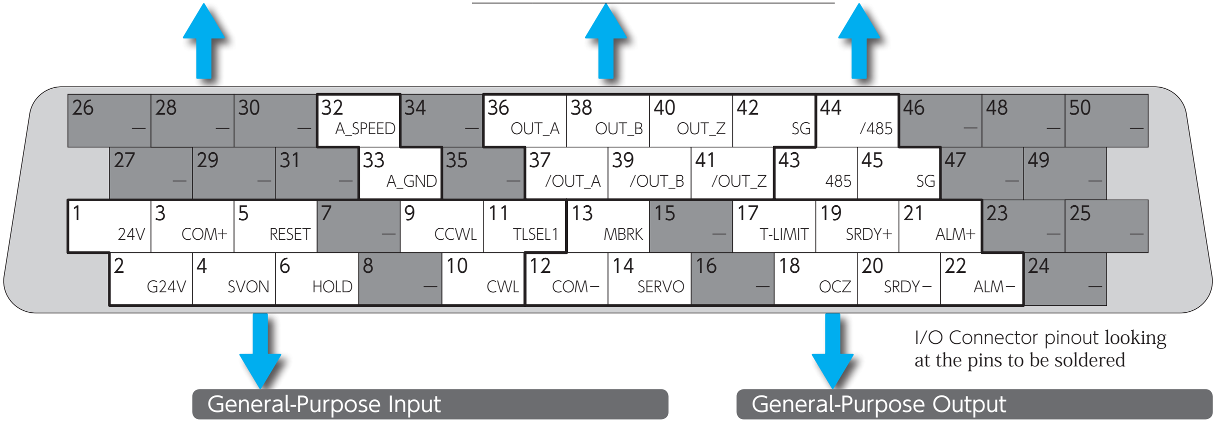
Pin No.	Signal Description
32	**A_SPEED** Analog Command
33	**A_GND** Analog Command Ground

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
9	**CCWL** CCW drive limit switch input
10	**CWL** CW drive limit switch input
11	**TLSEL1** Torque Limit

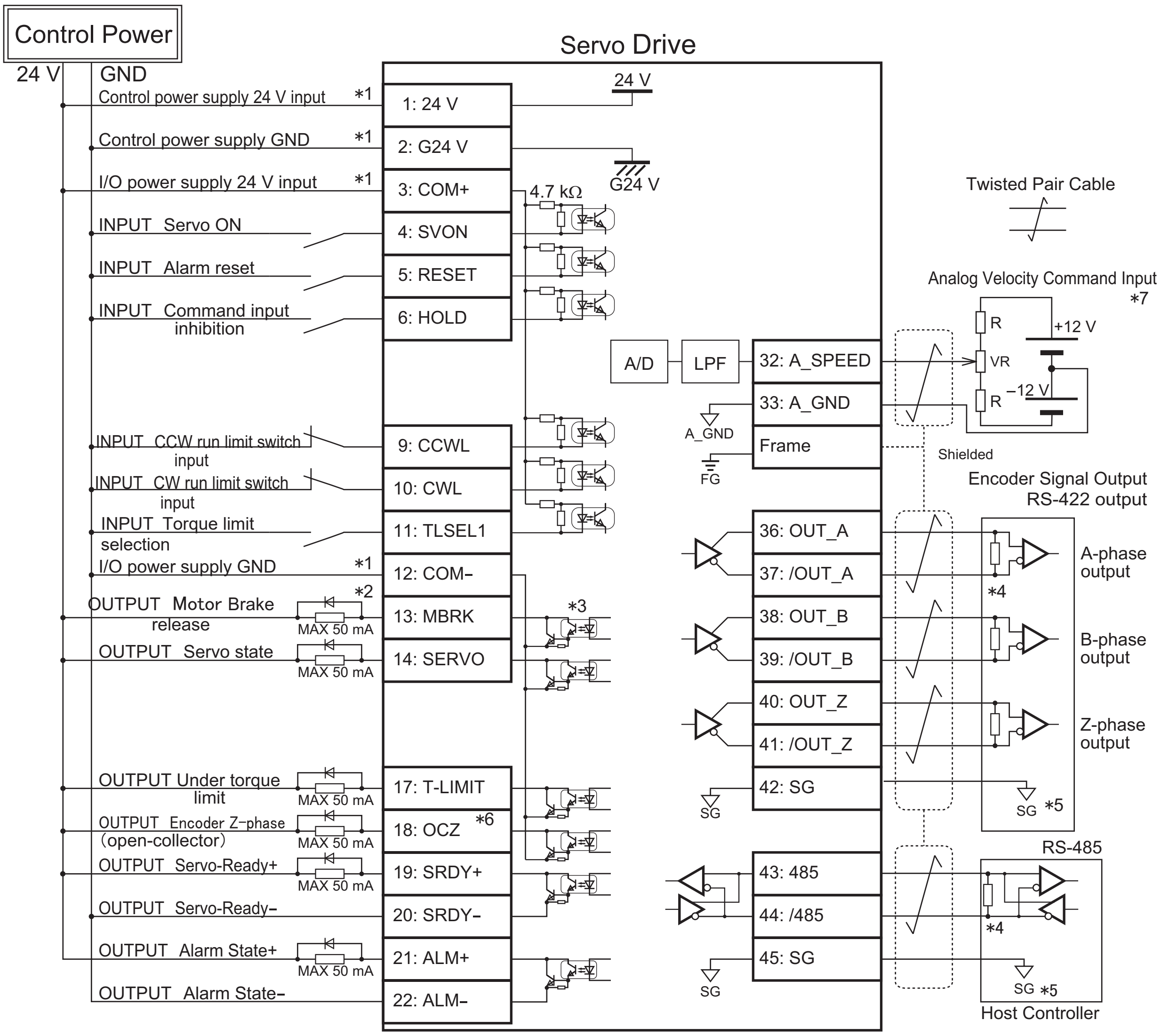
General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

3. Velocity Control Mode

CN1 Connector Wiring Example

Analog Velocity Command



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*2) When driving a load containing inductance (component such as a relay) connect a protection circuit (diode).
The motor brake cannot be driven directly. Be sure to use a circuit that interfaces with a diode built-in type relay.
Page 46 Connection to general-purpose output signals

*3) The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators.
Note that when the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V;
a standard TTL IC does not satisfy VIL and cannot be connected directly.

*4) Be sure to connect a termination resistor of approximately 220 Ω.

*5) Make the connection to the communication IC signal ground of the host controller that the drive encoder output signals are connecting to. Connecting signal ground SG to control power GND may result in malfunction.

*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

$$\text{Pulse width [ms]} = 2 / \text{rotational speed [rpm]} / (\text{division ratio} \times 2^{17}) \times 60 \times 1{,}000.$$

*7) For the command circuit configuration with a variable resistor (VR) and a resistor (R), VR must be 2kΩ (1/4W or more) and R must be 100Ω to 200Ω (1/4W or more) , so that command input voltage range is -10V to +10V. If the analog velocity command circuit of the host controller is isolated from 24V control power supply, connect A_GND to signal ground of the host controller, not to GND of control power, If the analog velocity command circuit is not isolated, connect A_GND to GND of control power.

3. Velocity Control Mode

2. Internal Velocity Command

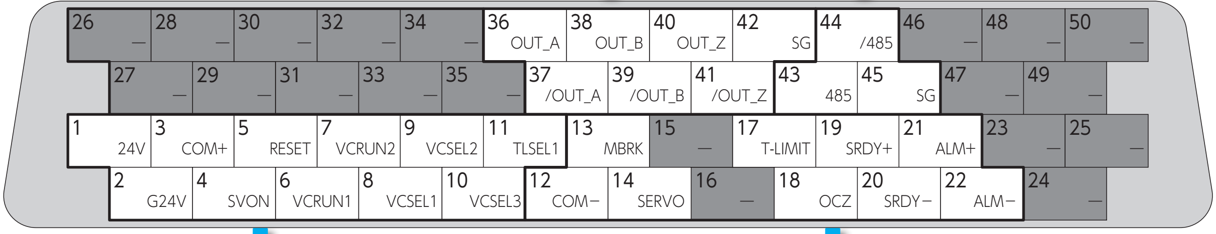
Pinout Diagram

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



26 —	28 —	30 —	32 —	34 —	36 OUT_A	38 OUT_B	40 OUT_Z	42 SG	44 /485	46 —	48 —	50 —
27 —	29 —	31 —	33 —	35 —	37 /OUT_A	39 /OUT_B	41 /OUT_Z	43 485	45 SG	47 —	49 —	
1 24V	3 COM+	5 RESET	7 VCRUN2	9 VCSEL2	11 TLSEL1	13 MBRK	15 —	17 T-LIMIT	19 SRDY+	21 ALM+	23 —	25 —
2 G24V	4 SVON	6 VCRUN1	8 VCSEL1	10 VCSEL3	12 COM−	14 SERVO	16 —	18 OCZ	20 SRDY−	22 ALM−	24 —	

I/O Connector pinout looking at the pin to be soldered

General-Purpose Input

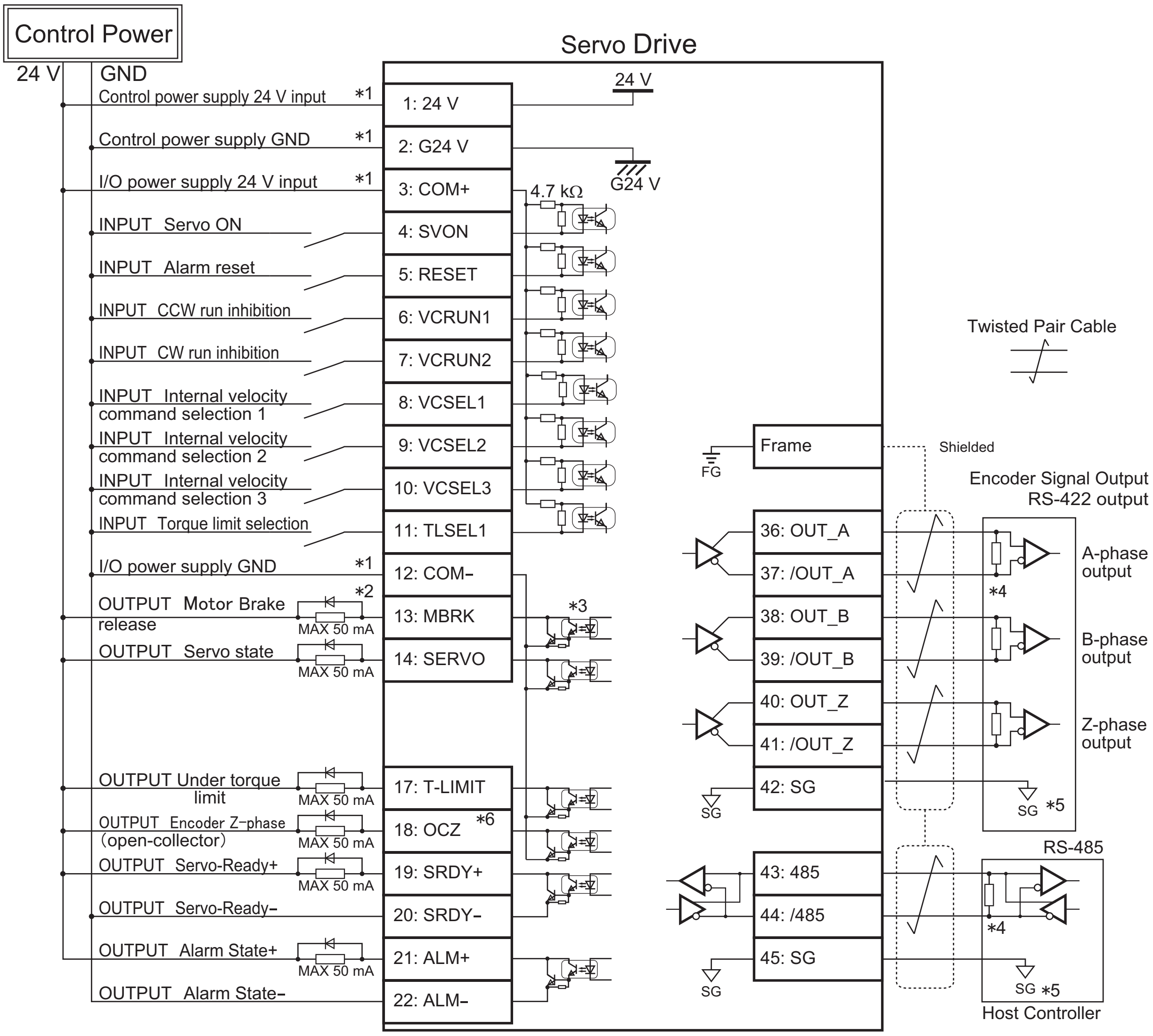
Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**VCRUN1** Start 1 (CCW rotation)
7	**VCRUN2** Start 2 (CW rotation)
8	**VCSEL1** Speed Select 1
9	**VCSEL2** Speed Select 2
10	**VCSEL3** Speed Select 3
11	**TLSEL1** Torque Limit

General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

CN1 Connector Wiring Example

Internal Velocity Command



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Page 46 Connection to general-purpose output signals

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*6) If Z-phase pulse width is too small to be measured accurately by the host controller, decrease pulse division rate by using pulse output ratio (parameters No.276.0 and No.278,0) or decrease rotational speed to increase the pulse width.

Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

4. Torque Control Mode

1. Analog Torque Command

Pinout Diagram

Command Input

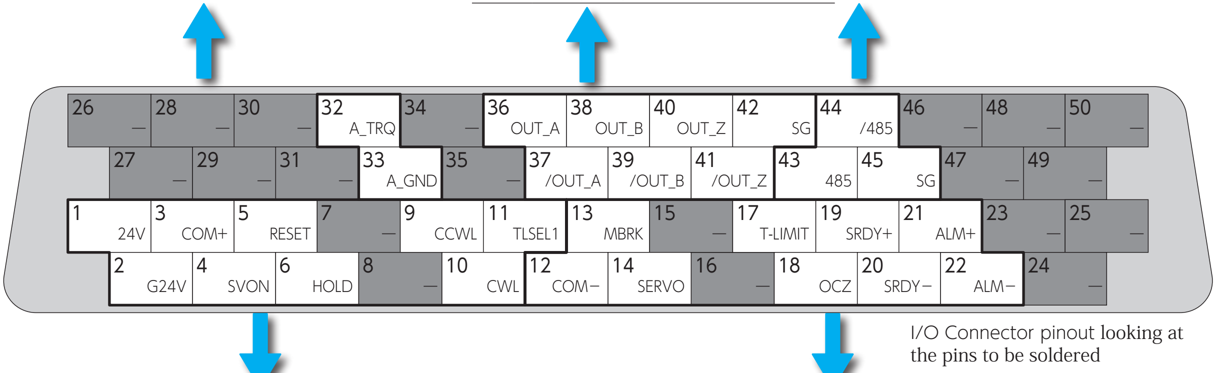
Pin No.	Signal Description
32	**A_TRQ** Analog Command
33	**A_GND** Analog Command Ground

Encoder Output

Pin No.	Signal Description
36	**OUT_A** A-phase
37	**/OUT_A** /A-phase
38	**OUT_B** B-phase
39	**/OUT_B** /B-phase
40	**OUT_Z** Z-phase
41	**/OUT_Z** /Z-phase
42	**SG** Signal ground

RS-485 Communication

Pin No.	Signal Description
44	**/485** /Data
43	**485** Data
45	**SG** Signal ground



I/O Connector pinout looking at the pins to be soldered

General-Purpose Input

Pin No.	Signal Description
1	**24V** Control power 24V
2	**G24V** Control power GND
3	**COM+** I/O Power 24V
4	**SVON** Servo ON
5	**RESET** Alarm reset
6	**HOLD** Command input prohibited
9	**CCWL** CCW drive limit input switch
10	**CWL** CW drive limit input switch
11	**TLSEL1** Torque Limit

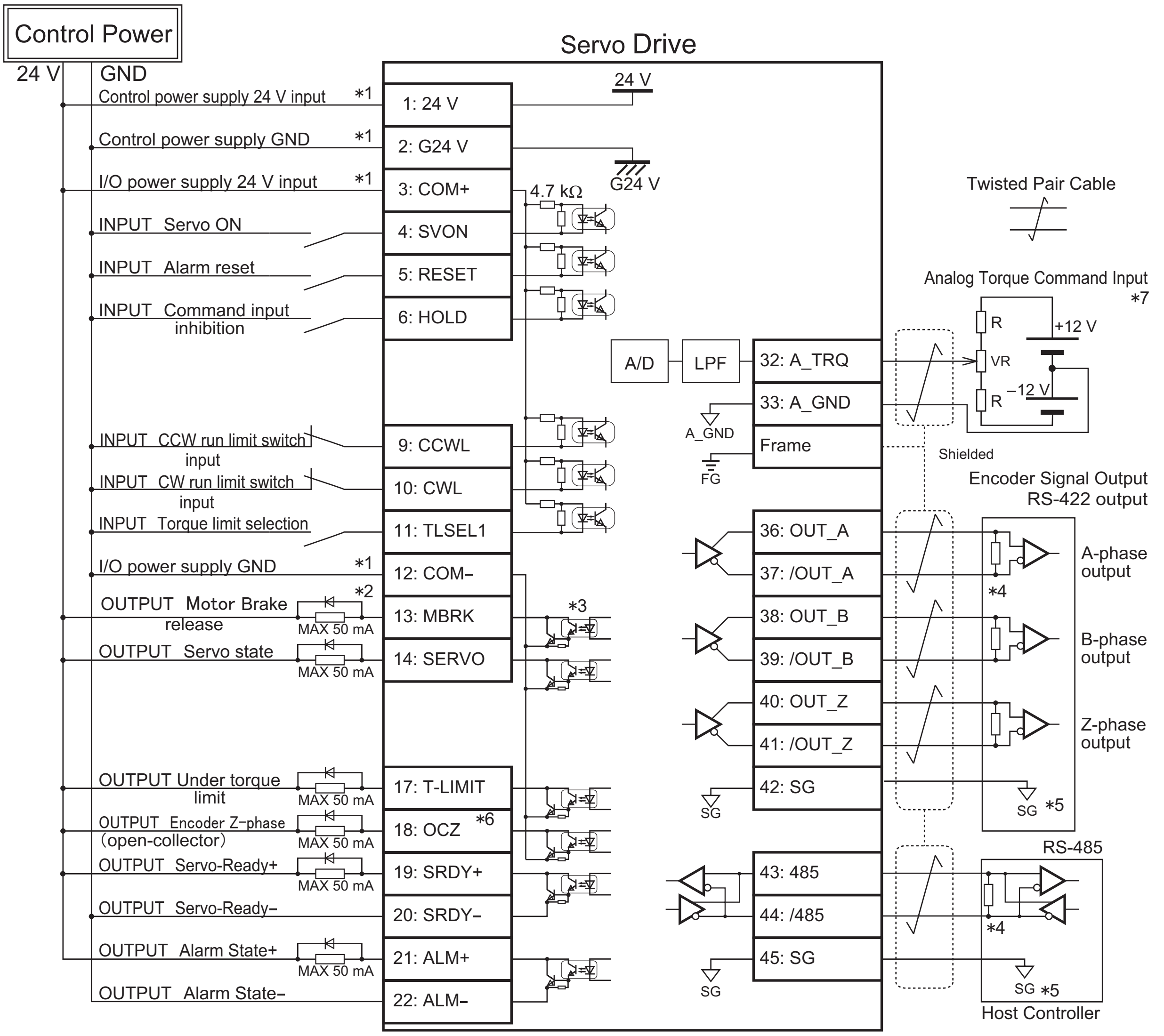
General-Purpose Output

Pin No.	Signal Description
12	**COM −** I/O power GND
13	**MBRK** Motor Brake release
14	**SERVO** Servo status
17	**T-LIMIT** Torque limiting
18	**OCZ** Encoder Z-phase (open collector)
19	**SRDY+** Servo ready+
20	**SRDY −** Servo ready −
21	**ALM+** Alarm status+
22	**ALM −** Alarm status −

4 . Torque Control Mode

CN1 Connector Wiring Example

Analog Torque Command



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Page 46 Connection to general-purpose output signals

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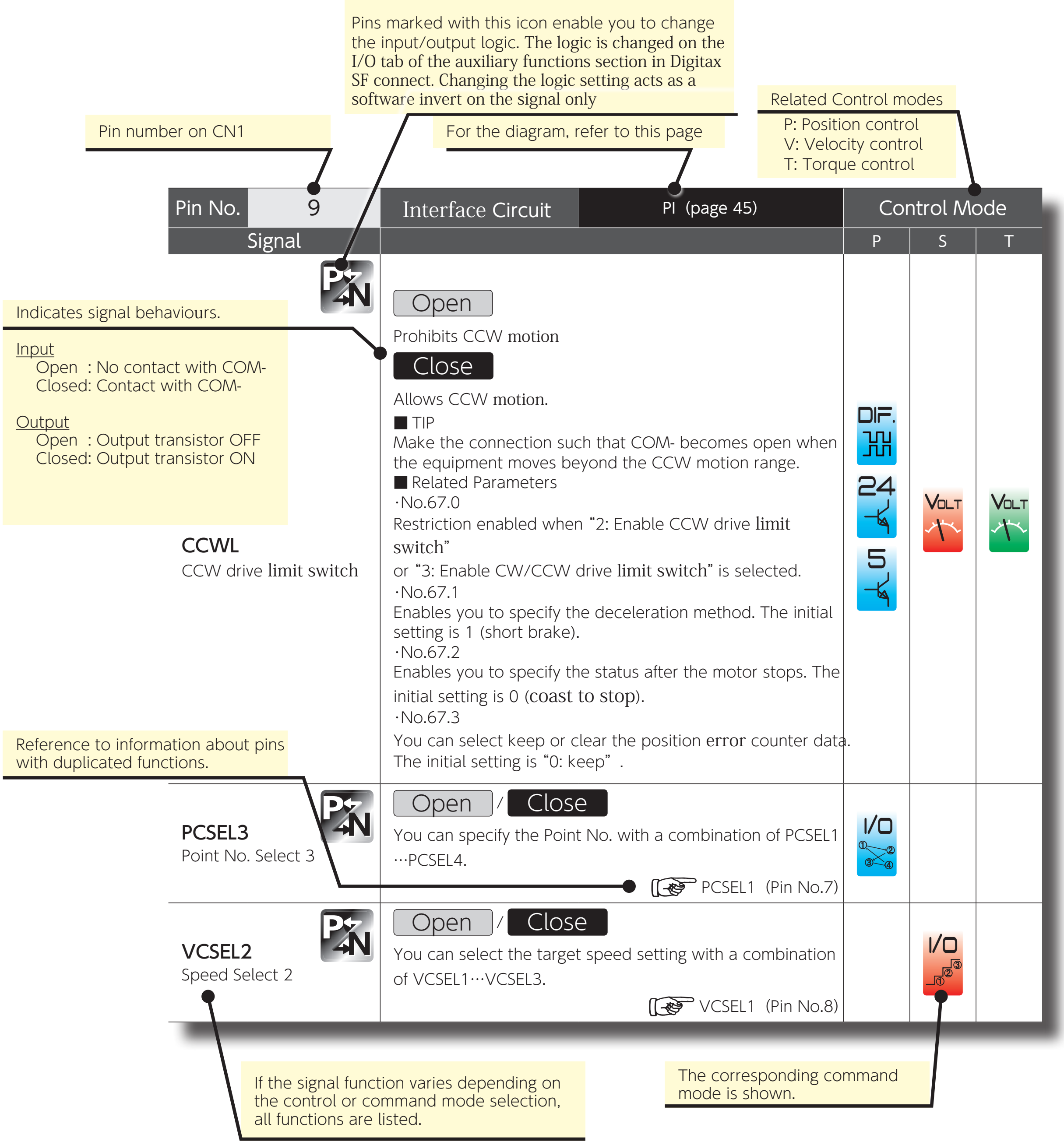
Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 2^{17}) × 60 × 1,000.

*7) For the command circuit configuration with a variable resistor (VR) and a resistor (R), VR must be 2kΩ (1/4W or more) and R must be 100Ω to 200Ω (1/4W or more) , so that command input voltage range is -10V to +10V. If the analog velocity command circuit of the host controller is isolated from 24V control power supply, connect A_GND to signal ground of the host controller, not to GND of control power. If the analog velocity command circuit is not isolated, connect A_GND to GND of control power.

5. Descriptions of CN1 Connector Signals

1. Descriptions of CN1 Connector Signals

Each pin assignment of CN1 connector varies depending on the Control Mode/Command Mode.
Review the functions of each pin before using the product.



Pins marked with this icon enable you to change the input/output logic. The logic is changed on the I/O tab of the auxiliary functions section in Digitax SF connect. Changing the logic setting acts as a software invert on the signal only

Pin number on CN1

For the diagram, refer to this page

Related Control modes
P: Position control
V: Velocity control
T: Torque control

Indicates signal behaviours.

Input
Open : No contact with COM-
Closed: Contact with COM-

Output
Open : Output transistor OFF
Closed: Output transistor ON

Reference to information about pins with duplicated functions.

Pin No. 9		Interface Circuit PI (page 45)	Control Mode		
Signal			P	S	T
CCWL CCW drive limit switch	P⇄N	Open Prohibits CCW motion Close Allows CCW motion. ■ TIP Make the connection such that COM- becomes open when the equipment moves beyond the CCW motion range. ■ Related Parameters ·No.67.0 Restriction enabled when “2: Enable CCW drive limit switch” or “3: Enable CW/CCW drive limit switch” is selected. ·No.67.1 Enables you to specify the deceleration method. The initial setting is 1 (short brake). ·No.67.2 Enables you to specify the status after the motor stops. The initial setting is 0 (coast to stop). ·No.67.3 You can select keep or clear the position error counter data. The initial setting is “0: keep” .	DIF. 24 5	VOLT	VOLT
PCSEL3 Point No. Select 3	P⇄N	Open / Close You can specify the Point No. with a combination of PCSEL1 ···PCSEL4. ☞ PCSEL1 (Pin No.7)	I/O		
VCSEL2 Speed Select 2	P⇄N	Open / Close You can select the target speed setting with a combination of VCSEL1···VCSEL3. ☞ VCSEL1 (Pin No.8)		I/O	

If the signal function varies depending on the control or command mode selection, all functions are listed.

The corresponding command mode is shown.

Icon	Control Mode Command	Icon	Control Mode Command
DIF.	Position Control Mode Differential	VOLT	Velocity Control Mode Analog Velocity Command
24	Position Control Mode 24V open collector	I/O	Velocity Control Mode Internal Velocity Command
5	Position Control Mode 5V open collector	VOLT	Torque Control Mode Analog Torque Command
I/O	Position Control Mode Internal Position Command		

General-Purpose Input

Pin No.	1, 3	Interface Circuit	PS (page 45)	Control Mode		
Signal		Description		P	S	T
24V (Pin No.1) Control power 24V **COM+** (Pin No.3) I/O Power 24V		Connect to the positive pole of the external DC power supply. Power voltage: DC24V ± 10% Use SELV power supply with reinforced insulation that is isolated from hazardous voltages. COM+ and G24V drive control power must share one common power supply. **24V:** Drive control power **COM+ :** A common power supply for optical isolators of general-purpose input circuits.		DIF. 24 5 I/O	VOLT I/O	VOLT

Pin No.	2	Interface Circuit	PS (page 45)	Control Mode		
Signal		Description		P	S	T
G24V Control power GND		Drive control power. Connect to the negative pole of the external DC power supply. Power voltage: DC24V ± 10% Use SELV power supply with reinforced insulation that is isolated from hazardous voltages.		DIF. 24 5 I/O	VOLT I/O	VOLT

DIF. Differential	24 24V open collector	5 5V open collector	I/O Internal Position	VOLT Analog Velocity	I/O Internal Velocity	VOLT Analog Torque

5. Descriptions of CN1 Connector Signals

<table>
<tr><td>Pin No.</td><td>4</td><td>Interface Circuit</td><td>PI (page 45)</td><td colspan="3">Control Mode</td></tr>
<tr><td colspan="2">Signal</td><td colspan="2">Description</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td colspan="2">P⇄N
SVON
Servo ON</td><td colspan="2">Open
Turns the servo OFF.
Close
Turns the servo ON.</td><td>DIF.
24
5
I/O</td><td>VOLT
I/O</td><td>VOLT</td></tr>
</table>

<table>
<tr><td>Pin No.</td><td>5</td><td>Interface Circuit</td><td>PI (page 45)</td><td colspan="3">Control Mode</td></tr>
<tr><td colspan="2">Signal</td><td colspan="2">Description</td><td>P</td><td>S</td><td>T</td></tr>
<tr><td colspan="2">P⇄N
RESET
Alarm Reset</td><td colspan="2">Close
Resets an alarm.
■ TIP
■ Be sure to turn off this signal after alarm reset execution.
■ Encoder-, product code-, and system- alarms are not reset by this signal.
■ You must cycle control power of the drive.</td><td>DIF.
24
5</td><td>VOLT
I/O</td><td>VOLT</td></tr>
<tr><td colspan="2">P⇄N
RESET/PCLR
Alarm Clear / Position Error Counter Clear</td><td colspan="2">Close
Clears Alarm and Error counter.
■ Related parameters
No. 67.3</td><td>I/O</td><td></td><td></td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>6</th><th>Interface Circuit</th><th>PI (page 45)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">P⇄N
HOLD
Command input prohibit
(Position Control mode)
Zero command clamp
(Velocity Control mode,
Torque Control mode)</td><td colspan="2">Open
Allows command input.
Close
Prohibits command input. Until command input becomes allowed, the motor does not move regardless of the state of the command inputs.
■ Related Parameter
·No.67.3
In Position Control mode, you can select whether the pulse counter data to is be maintained while command input is prohibited.</td><td>DIF.
24
5</td><td>VOLT</td><td>VOLT</td></tr>
<tr><td colspan="2">P⇄N
PCSTART1
Start Forward Rotation</td><td colspan="2">Close
Starts motor operation.
Executes Motion or Homing per Point No. specified with PCSEL1…4.
■ TIP
Be sure to turn off this signal after the motion is completed.</td><td>I/O</td><td></td><td></td></tr>
<tr><td colspan="2">P⇄N
VCRUN1
Internal velocity Start 1</td><td colspan="2">Close
Motor rotates in CCW direction
<table>
<tr><th>Motor Rotational Direction (Pin No.)</th><th>VCRUN1 (No.6)</th><th>VCRUN2 (No.7)</th></tr>
<tr><td>CCW</td><td>Close</td><td>Open</td></tr>
<tr><td>CW</td><td>Open</td><td>Close</td></tr>
<tr><td>Motor Stop</td><td>Open</td><td>Open</td></tr>
<tr><td>Motor Stop</td><td>Close</td><td>Close</td></tr>
</table>
■ Related Parameters
·No.390.0, No.391.0
These are used to set acceleration/deceleration time for Homing.
·No.392.0…No.399.0
These parameters are used to set 8 speeds. You can switch between the target speeds with combinations of signals, VCSEL1, VCSEL2 , and VCSEL3</td><td></td><td>I/O</td><td></td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>7</th><th>Inteface Circuit</th><th>PI (page 45)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">PCLR
Position Error
Counter Clear</td><td colspan="2">Close
Error Counter Clear is executed.
■ TIP
Be sure to turn off this signal after Error counter execution.
■ Related Parameters
No. 67.3</td><td>DIF.
24
5</td><td></td><td></td></tr>
<tr><td colspan="2">PCSEL1
Point No. Select 1</td><td colspan="2">Open / Close
You can specify the Point No. with a combination of PCSEL1… PCSEL4.
<table>
<tr><th>Point No.
(PinNo.)</th><th>PCSEL1
(No.7)</th><th>PCSEL2
(No.8)</th><th>PCSEL3
(No.9)</th><th>PCSEL4
(No.10)</th></tr>
<tr><td>0 Homing</td><td>Open</td><td>Open</td><td>Open</td><td>Open</td></tr>
<tr><td>1</td><td>Close</td><td>Open</td><td>Open</td><td>Open</td></tr>
<tr><td>2</td><td>Open</td><td>Close</td><td>Open</td><td>Open</td></tr>
<tr><td>3</td><td>Close</td><td>Close</td><td>Open</td><td>Open</td></tr>
<tr><td>4</td><td>Open</td><td>Open</td><td>Close</td><td>Open</td></tr>
<tr><td>5</td><td>Close</td><td>Open</td><td>Close</td><td>Open</td></tr>
<tr><td>6</td><td>Open</td><td>Close</td><td>Close</td><td>Open</td></tr>
<tr><td>7</td><td>Close</td><td>Close</td><td>Close</td><td>Open</td></tr>
<tr><td>8</td><td>Open</td><td>Open</td><td>Open</td><td>Close</td></tr>
<tr><td>9</td><td>Close</td><td>Open</td><td>Open</td><td>Close</td></tr>
<tr><td>10</td><td>Open</td><td>Close</td><td>Open</td><td>Close</td></tr>
<tr><td>11</td><td>Close</td><td>Close</td><td>Open</td><td>Close</td></tr>
<tr><td>12</td><td>Open</td><td>Open</td><td>Close</td><td>Close</td></tr>
<tr><td>13</td><td>Close</td><td>Open</td><td>Close</td><td>Close</td></tr>
<tr><td>14</td><td>Open</td><td>Close</td><td>Close</td><td>Close</td></tr>
<tr><td>15</td><td>Close</td><td>Close</td><td>Close</td><td>Close</td></tr>
</table>
■ Related Parameters
·No.646.3
This parameter enables you to select motion per Point No.0 from either Homing or Point Table Motion.</td><td>I/O</td><td></td><td></td></tr>
<tr><td colspan="2">VCRUN2
Internal Velocity Start 2</td><td colspan="2">Close
Motor rotates in CW direction
☞ VCRUN1 (Pin No.6)</td><td></td><td>I/O</td><td></td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>8</th><th>Interface Circuit</th><th>PI (page 45)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">PCSEL2
Point No. Select 2</td><td colspan="2">Open / Close
You can specify the Point No. with a combination of PCSEL1⋯PCSEL4.
☞ PCSEL1 (Pin No.7)</td><td>I/O</td><td></td><td></td></tr>
<tr><td colspan="2">VCSEL1
Speed Select 1</td><td colspan="2">Open / Close
You can select the target speed pin number with a combination of VCSEL1⋯VCSEL3.
<table>
<tr><th>Target speed (Pin No.)</th><th>PCSEL1 (No.7)</th><th>PCSEL2 (No.8)</th><th>PCSEL3 (No.9)</th></tr>
<tr><td>0</td><td>Open</td><td>Open</td><td>Open</td></tr>
<tr><td>1</td><td>Close</td><td>Open</td><td>Open</td></tr>
<tr><td>2</td><td>Close</td><td>Close</td><td>Open</td></tr>
<tr><td>3</td><td>Close</td><td>Close</td><td>Open</td></tr>
<tr><td>4</td><td>Open</td><td>Open</td><td>Close</td></tr>
<tr><td>5</td><td>Close</td><td>Open</td><td>Close</td></tr>
<tr><td>6</td><td>Open</td><td>Close</td><td>Close</td></tr>
<tr><td>7</td><td>Close</td><td>Close</td><td>Close</td></tr>
</table>
☞ VCRUN1 (Pin No.6)</td><td></td><td>I/O</td><td></td></tr>
<tr><td colspan="2">HOME
Start Homing</td><td colspan="2">Close
Homing starts.
■ TIP
Be sure to set this terminal to Open after homing is completed.</td><td>DIF.
*</td><td></td><td></td></tr>
<tr><td colspan="2">E-STOP
Emergency Stop</td><td colspan="2">Open
The motor makes an emergency stop. Deceleration stop starts upon Servo OFF and the motor stops its motion. No alarm occurs. A warning is output by parameter setting.
☞ 9 Appendix Functions</td><td>DIF.
**</td><td></td><td></td></tr>
</table>

* In I/O configuration Option 1
** In I/O configuration Option 2

5. Descriptions of CN1 Connector Signals

Pin No. 9	Interface Circuit PI (page 45)	Control Mode		
Signal	Description	P	S	T
P⇄N **CCWL** CCW drive limit switch input	Open Prohibits CCW motion. Close Allows CCW motion. ■ TIP Make the connection such that COM- becomes open when the equipment moves beyond the CCW motion range. ■ Related Parameters ·No.67.0 Restriction enabled when "2: Enable CCW drive limit switch" or "3: Enable CW/CCW drive limit switch" is selected. ·No.67.1 Enables you to specify the deceleration method. The initial setting is 1 (short brake). ·No.67.2 Enables you to specify the status after the motor stops. The initial setting is 0 (coast to stop). ·No.67.3 You can select keep or clear the position error counter data. The initial setting is "0: keep" .	DIF. 24 5	VOLT	VOLT
P⇄N **PCSEL3** Point No. Select 3	Open / Close You can specify the Point No. with a combination of PCSEL1…PCSEL4. ☞ PCSEL1 (Pin No.7)	I/O		
P⇄N **VCSEL2** Speed Select 2	Open / Close You can select the target speed setting with a combination of VCSEL1…VCSEL3. ☞ VCSEL1 (Pin No.8)		I/O	

5. Descriptions of CN1 Connector Signals

Pin No. 10	Interface Circuit PI (page 45)	Control Mode		
Signal	Description	P	S	T
CWL CW Drive limit switch input	Open Prohibits CW motion. Close Allows CW motion. ☞ CCWL (Pin No.9)	DIF. 24 5	VOLT	VOLT
PCSEL4 Point No. Select 4	Open / Close You can specify the Point No. with a combination of PCSEL1…PCSEL4. ☞ PCSEL1 (Pin No.7)	I/O *		
HOME Start Homing	Close Homing starts. ■ TIP Be sure to turn off this signal after homing is completed.	I/O **		
VCSEL3 Speed Select 3	Open / Close You can select the target speed setting with a combination of VCSEL1…VCSEL3. ☞ VCRUN1 (Pin No.8)		I/O	

* In Standard I/O configuration
** In Optional I/O configuration.

Pin No. 11	Interface Circuit PI (page 45)	Control Mode		
Signal	Description	P	S	T
P⇄N **TLSEL1** Torque Limit	Open Torque command limit: Value 1 (No.147.0) is applied. Close Torque command limit: Value 2 (No.148.0) is applied. ■ Related Parameters ·No.144.0 Torque Limit is enabled when 1 (enable) is selected. ·No.147.0, No.148.0 Set Torque Command Limit Values 1 and 2.	DIF. 24 5 I/O **	VOLT I/O	VOLT
P⇄N **ORG** Home Sensor	Open Home sensor has not been detected. Close Home sensor has been detected. ■ Related Parameters ·No.645.0 Enables you to select home-sensor-front. ·No.646.1 Enables you to change the polarity of home sensor detection.	I/O *		

* In Standard I/O configuration
** In Optional I/O configuration.

General-Purpose Output

Pin No.	12	Interface Circuit	PS (page 45)	Control Mode		
Signal		Description		P	S	T
COM − I/O power GND		A common emitter terminal of output transistors in the general-purpose output circuit. COM+ and G24V drive control power must share one common power supply.		DIF. 24 5 I/O	VOLT I/O	VOLT

Pin No.	13	Interface Circuit	PO (Page 46)	Control Mode		
Signal		Description		P	S	T
PN **MBRK** Motor Brake Release		Open Does not release the brake. Close Releases the brake. ■ TIP The motor brake cannot be driven directly. To drive the motor brake, be sure to use a relay. Place a surge absorber to suppress surge voltage caused by relay' s on/off. Note that, if you use a diode instead of a surge absorber, the time between brake release and brake clamp is longer.		DIF. 24 5 I/O *	VOLT I/O	VOLT
PN **PM1** Point No.1		Open / Close Outputs the started or completed Point No. with a combination of PM1… PM3. Right after turning the power on for the drive or at Servo OFF or Homing, all three are Open (i.e. Point No. = 0).		I/O **		

Point No. (Pin No.)	PM1 (No.7)	PM2 (No.8)	PM3 (No.9)
0, 8, etc.	Open	Open	Open
1, 9	Close	Open	Open
2, 10	Open	Close	Open
3, 11	Close	Close	Open
4, 12	Open	Open	Close
5, 13	Close	Open	Close
6, 14	Open	Close	Close
7, 15	Close	Close	Close

■ Related Parameters
·No.644.0
Enables you to select timing of Point No. output and its content.

5. Descriptions of CN1 Connector Signals

Pin No. 14	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
PN **SERVO** Servo Status	Open Servo-Off Close Servo-On	DIF. 24 5 I/O *	VOLT I/O	VOLT
PN **PM2** Point No.2	Open / Close Outputs the started or completed Point No. with a combination of PM1… PM3. ☞ PM1 (Pin No.13)	I/O **		

*1) In Standard I/O configuration
*2) In Optional I/O configuration.

Pin No. 15	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
PN **POSIN** Positioning Complete	Open Positioning is not complete. Close Positioning is complete.	DIF. 24 5		
PN **MEND** Motion Complete	Open Motion motion is not complete. Close · Ready to receive next motion directive after Point table motion and Testing motion complete. · In Servo-Off state	I/O *		
PN **PM3** Point No.3	Open / Close Outputs the started or completed Point No. with a combination of PM1… PM3. ☞ PM1 (Pin No.13)	I/O **		

* In Standard I/O configuration.
** In Optional I/O configuration.

5. Descriptions of CN1 Connector Signals

Pin No. 16	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
P⇄N **HEND** Homing Complete	Open · State of Home Lost · During Homing Close State of Homing Complete	DIF. * 24 * 5 *		
P⇄N **WARN1** Warning	Open No warning Close A warning state is present ☞ 9 Appendix Warning Output	DIF. ** 24 ** 5 **		

* In Standard I/O configuration
** In Optional I/O configuration.

5. Descriptions of CN1 Connector Signals

Pin No. 17	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
PN **T-LIMIT** Torque Limiting	Close Motor output torque is limited. ■ Related Parameters ·No.144.1 Enables you to select conditions for torque limit.	DIF. 24 5 I/O *	VOLT I/O	VOLT
PN **MEND/T-LIMIT** Motion Complete /Torque Limiting	Close State of one of the following: •. . . .MEND Motion Complete •. . . .Torque Limiting ☞ MEND (Pin No.15) ■ Related Parameters ·No.144.1 Enables you to select conditions for torque limiting. ■ TIP Use this signal as T-LIMIT during press motion. Otherwise, use it as MEND. For T-LIMIT, turn TLSEL1 (Torque Limit) ON. For MEND, turn TLSEL1 (Torque Limit) OFF.	DIF. ** 24 *** 5 *** I/O ***		

* In Standard I/O configuration

** In Optional I/O configuration

*** In I/O configuration Option 1

Pin No. 18	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
P⇄N **OCZ** Encoder Z-Phase	**Close** Open collector output of Encoder Z-phase ■ TIP Z-phase pulse is synchronized with A-phase pulse and is output with the same width as A-phase pulse. Open-collector output ■ Related Parameters ·No.276.0, No.278.0 If Z-phase pulse width is too small to be measured accurately by the host controller, decrease frequency division ratio or rotational speed to increase the pulse width. Pulse width [ms] = 2 / rotational speed [rpm] / (division ratio × 217) × 60 × 1,000.	DIF. 24 5 I/O	VOLT I/O	VOLT

5. Descriptions of CN1 Connector Signals

Pin No. 19, 20	Interface Circuit PO (Page 46)	Control Mode		
Signal	Description	P	S	T
P⇄N **SREDY +** (Pin No.19) **SREDY −** (Pin No.20) Servo ready	Open In one of the following conditions An alarm is occurring. The AC supply is not supplied to the drive. Close The following conditions are met at the same time. No alarm is occurring. The AC Supply is supplied to the drive. ■ TIP The emitter side of the output transistor is independent of COM-. Cascade connection to multiple drives is possible.	DIF. * 24 5 I/O **	VOLT I/O	VOLT
P⇄N **SERVO +** (Pin No.19) **SERVO −** (Pin No.20) Servo status	Open Servo-off status Close Servo-on status ■ TIP The emitter side of the output transistor is independent of COM-. Cascade connection to multiple drives is possible.	I/O ***		
DBRK + (Pin No.19) **DBRK −** (Pin No.20) Emergency stop brake release	Open Engages the Emergency stop brake. Close Disengages the emergency stop brake. See preparation chapter to build an emergency stop breaking circuit.	24 **** 5 **** I/O ****		

* 1) In Standard I/O configuration
** 2) In Standard I/O configuration
*** 3) In Optional I/O configuration
**** 4) In I/O configuration Option 2

5. Descriptions of CN1 Connector Signals

Pin No.	21, 22	Interface Circuit	PO (Page 46)	Control Mode		
Signal		Description		P	S	T
P N **ALM +** (Pin No.21) **ALM −** (Pin No.22) Alarm		Open In one of the following conditions An alarm is occurring. Control power is not supplied to the drive. Close The following conditions are met at the same time. No alarm is occurring. Control power is supplied to the drive. ■ TIP The emitter side of the output transistor is independent of COM-. Cascade connection to multiple drives is possible.		DIF. 24 5 I/O	VOLT I/O	VOLT

Command Input

<table>
<tr><th>Pin No.</th><th>26</th><th>Interface Circuit</th><th>CP (page 47)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">CMD_PLS
Pulse
A-phase
CCW</td><td colspan="2">Command signal input from the host controller to the drive.
Select command pulse train command signal to input. (No.32.0)<table>
<tr><th>Parameter No.32.0</th><th>Command Signal Form</th><th>Input Signal</th></tr>
<tr><td>0</td><td>Pulse and Direction</td><td>Pulse</td></tr>
<tr><td>1</td><td>QEP (Quadrature Encoder Pulse)</td><td>A-phase</td></tr>
<tr><td>2</td><td>CCW and CW</td><td>CCW</td></tr>
</table>■ Related Parameters
·No.2.0, No.3.0, No,32.0</td><td>DIF.</td><td></td><td></td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>27</th><th>Interface Circuit</th><th>CP (page 47)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">/CMD_PLS
/Pulse
/A-phase
/CCW</td><td colspan="2">Command signal input from the host controller to the drive.
Select command pulse train command signal to input. (No.32.0)<table>
<tr><th>Parameter No.32.0</th><th>Command Signal Form</th><th>Input Signal</th></tr>
<tr><td>0</td><td>Pulse and Direction</td><td>/Pulse</td></tr>
<tr><td>1</td><td>QEP (Quadrature Encoder Pulse)</td><td>/A-phase</td></tr>
<tr><td>2</td><td>CCW and CW</td><td>/CCW</td></tr>
</table>■ Related Parameters
·No.2.0, No.3.0, No,32.0</td><td>DIF.
24
5</td><td></td><td></td></tr>
</table>

<table>
<tr><th>Pin No.</th><th>28, 29</th><th>Interface Circuit</th><th>CP (page 47)</th><th colspan="3">Control Mode</th></tr>
<tr><th colspan="2">Signal</th><th colspan="2">Description</th><th>P</th><th>S</th><th>T</th></tr>
<tr><td colspan="2">CC-P
(Pin No.28)
CC-D
(Pin No.29)
24V open collector power</td><td colspan="2">Command signal input from the host controller to the drive.
A power input terminal of 24V open collector.
CC-P:
Use this in combination with /CMD_PLS.
CC-D:
Use this in combination with /CMD_DIR.</td><td>24</td><td></td><td></td></tr>
</table>

5. Descriptions of CN1 Connector Signals

Pin No.	30	Interface Circuit	CP (page 47)	Control Mode		
Signal		Description		P	S	T
CMD_DIR Direction B-phase CW		Command signal input from the host controller to the drive. Select command pulse train command signal to input. (No.32.0)		DIF.		

Parameter No.32.0	Command Signal Form	Input Signal
0	Pulse and Direction	Direction
1	QEP (Quadrature Encoder Pulse)	B-phase
2	CCW and CW	CW

■ Related Parameters
·No.2.0, No.3.0, No,32.0

Pin No.	31	Interface Circuit	CP (page 47)	Control Mode		
Signal		Description		P	S	T
/CMD_DIR /Direction /B-phase /CW		Command signal input from the host controller to the drive. Select command pulse train command signal to input. (No.32.0)		DIF. 24 5		

Parameter No.32.0	Command Signal Form	Input Signal
0	Pulse and Direction	/Direction
1	QEP(Quadrature Encoder Pulse)	/B-phase
2	CCW and CW	/CW

■ Related Parameters
·No.2.0, No.3.0, No,32.0

Pin No.	49, 50	Interface Circuit	CP (page 47)	Control Mode		
Signal		Description		P	S	T
CC_P-5V (Pin No.49) **CC_D-5V** (Pin No.50) 5V Open collector power		Command signal input from the host controller to the drive. A power input terminal of 5V open collector. **CC-P-5V:** Use this in combination with /CMD_PLS **CC-D-5V:** Use this in combination with /CMD_DIR.		5		

Pin No.	32	Interface Circuit	CA (page 48)	Control Mode		
Signal		Description		P	S	T
A_SPEED Analog Velocity Command		Speed command input with analog voltages (-10V to +10V). A_GND (Pin No.33) is the reference point of electric potential.			VOLT	
A_TRQ Analog Torque Command		Torque command input with analog voltages (-10V to +10V). A_GND (Pin No.33) is the reference point of electric potential.				VOLT

Pin No.	33	Interface Circuit	CA (page 48)	Control Mode		
Signal		Description		P	S	T
A_GND Analog Command Ground		This is the reference point of electric potential for Analog command voltage input to Pin No.32. ■ TIP If the analog velocity command circuit of the host controller is isolated from 24V control power supply, connect A_GND to signal ground of the host controller, not to GND of control power, If the analog velocity command circuit is not isolated, connect A_GND to GND of control power.			VOLT	VOLT

Encoder Output

Pin No. 36, 37,···, 42	Interface Circuit EO (page 49)	Control Mode		
Signal	Description	P	S	T
OUT_A (Pin No.36) **/OUT_A** (Pin No.37) A-phase output **OUT_B** (Pin No.38) **/OUT_B** (Pin No.39) B-phase output **OUT_Z** (Pin No.40) **/OUT_Z** (Pin No.41) Z-phase output **SG** (Pin No.42) Signal ground	**OUT_A, /OUT_A:** **OUT_B, /OUT_B:** **OUT_Z, /OUT_Z:** Differential output of encoder signal divided and multiplied (equivalent to RS-422) **SG:** Signal ground of the communication IC in the output circuit. This signal is connected to signal ground inside the drive. It is isolated from control power (G24V, COM-). Make the connection to signal ground of the communication IC of the host controller. ■ Related Parameters · No.276.0 No.278.0	DIF. 24 5 I/O	VOLT I/O	VOLT

RS-485 Communication

Pin No. 43, 44, 45	Interface Circuit RS (page 50)	Control Mode		
Signal		P	S	T
485 (Pin No.43) 485 data **/485** (Pin No.44) /485 data **SG** (Pin No.45) Signal ground	**485, /485:** RS-485 interface with the host controller For cascade connection, be sure to connect a termination resistor of approximately 220 Ω to the end drive. **SG:** Signal ground of the drive communication IC. It is connected to signal ground inside the drive. Isolated from control power (G24V, COM-). Connect signal ground of the communication IC of the host controller.	DIF. 24 5 I/O	VOLT I/O	VOLT

2. Interface Circuit of CN1 Connector

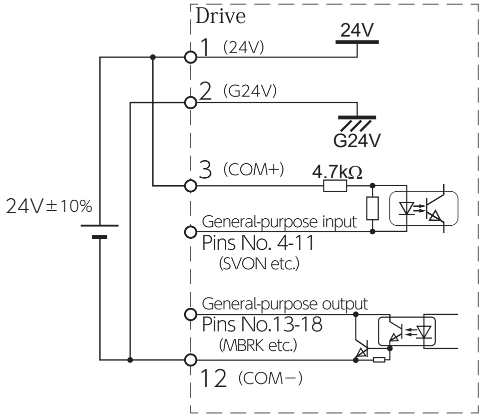
Interface Circuit

PS Connection to DC24V Power Supply

Control Mode		
P	S	T
DIF. 24 5 I/O	VOLT I/O	VOLT

Connect control power of the drive and I/O power.
Be careful not to reversely connect plus and minus terminals of the power supply.
Accidental reverse connection may damage the drive.

Control power and I/O power must share one common power supply.

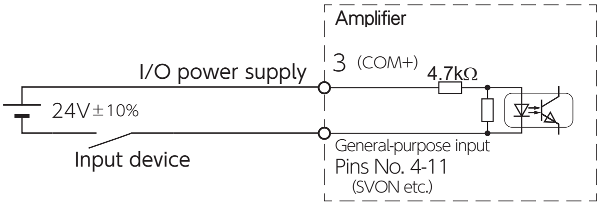


PI Connections to General-Purpose Input Signal

Control Mode		
P	S	T
DIF. 24 5 I/O	VOLT I/O	VOLT

Pin No.3
Connect to +terminal of I/O power supply. Use power supply of 24V ± 10%.

Pin No.4 to No.11
Connect to input devices such as switch, open-collector output transistor, and relay contact.
When the input device contact is closed and the contact pair of general-purpose pin and power supply GND becomes closed, the drive turns on.



PO Connections to General-Purpose Output Signal

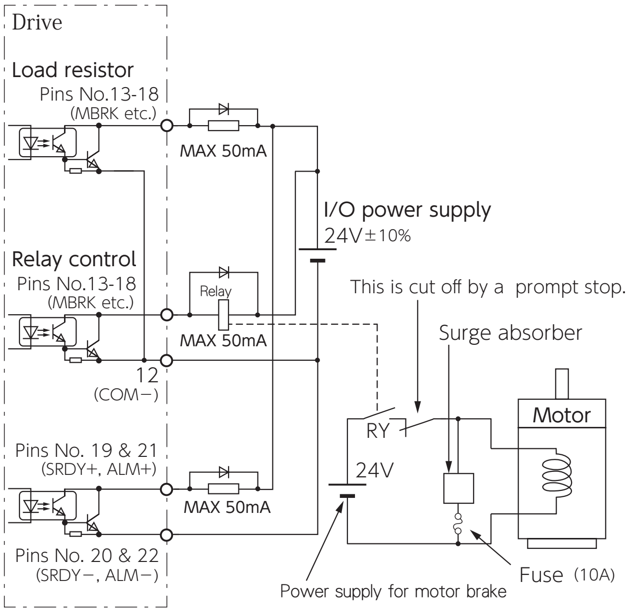
Control Mode		
P	S	T
DIF. 24 5 I/O	VOLT I/O	VOLT

The motor brake cannot be driven directly. To drive the motor brake, be sure to use a relay.

When driving a load containing inductance component such as a relay, connect a protection circuit (diode). Install a diode in the direction shown in the figure below.
The output circuit configuration is an open collector Darlington transistor output. Connects to relays and optical isolators. When the transistor is on, connector-emitter voltage VCE (SAT) is approximately 1V; a standard TTL IC does not satisfy VIL, and cannot be directly connected.

The maximum rating of output circuit is 30V 50mA.
Pin No.13 – 18
The emitter of output transistor is common to COM- of control power.

Pin No.19, No.21
The emitter of output resistor is Pins No.20 and No.22 and independent of COM-.



CP Connection to Pulse Train Command Signal

Control Mode		
P	S	T

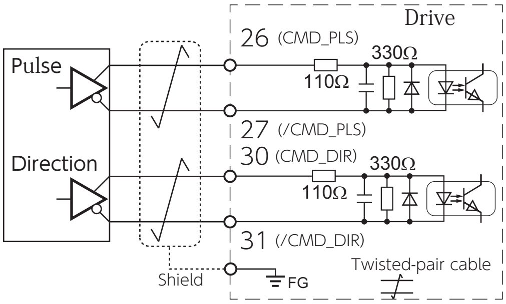
Use this for pulse train input in Position Control mode.
You can set the form of pulse signal input with [Pulse train command: Input mode (No.32.0)]

In case of positional disturbance due to noise, take noise countermeasures, for example,

1) Make the signal line short between the host controller and the drive.
2) Be sure to use shielded twisted-pair cables for the signal lines.
3) Segregate the signal lines from the AC Supply cable and the motor power cable.
4) Adjust [Pulse train command: Input filter (No.33.0)].

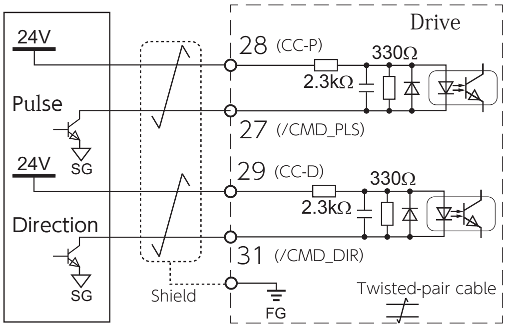
Differential

Max command pulse frequency: 4Mpps



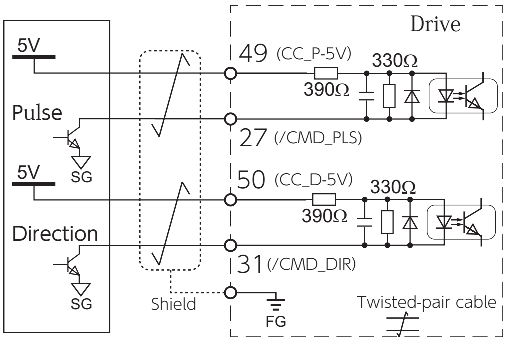
24V open collector

Max command pulse frequency: 200kpps
Be sure to set [Pulse train command Input filter (No.33.0)] to at least 7.



5V open collector

Max command pulse frequency: 200kpps
Be sure to set [Pulse train command Input filter (No.33.0)] to at least 7.



5. Descriptions of CN1 Connector Signals

CA Connection to Analog Command Signal

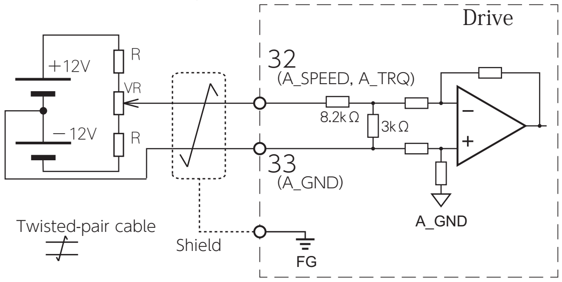
Control Mode		
P	S	T
	VOLT	VOLT

Input voltage tolerance range is ± 10 V. For input circuit impedance, see the figure below.
For the command circuit configuration with a variable resistor (VR) and a resistor (R), VR must be 2kΩ (1/4W or more) and R must be 100 Ω to 200 Ω (1/4W or more), so that command input voltage range is -10V to +10V.
Be sure to use shielded twisted-pair cables as a noise countermeasure.

■ Isolation/non-isolation of the host analog command circuit and 24V control power

If isolated
Connect A-GND with signal ground of the host controller. (Do not connect to GND of control power)

If not isolated
Connect A_GND with GND of control power.



EO Connection to Encoder Output Circuit

Control Mode		
P	S	T
DIF. 24 5 I/O	VOLT	VOLT

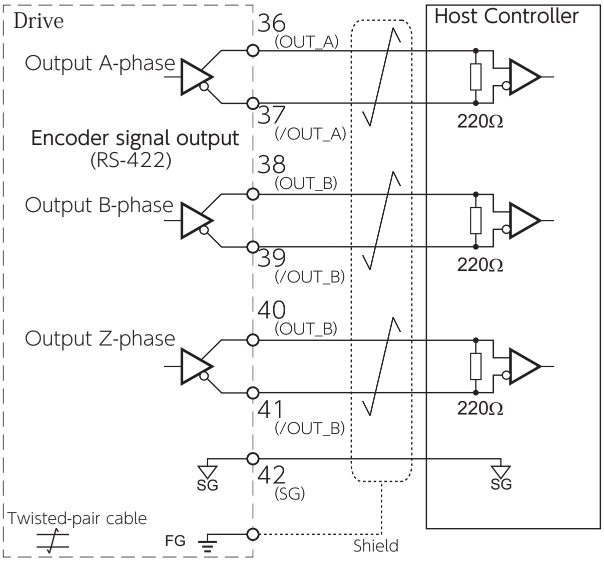
Differential output of encoder signal (A-phase, B-phase, Z-phase) which has been processed with pulse division ratio.

Be sure to connect a termination resistor to the receiver circuit of the host controller. Approximately 220 Ω (1/4W or more)

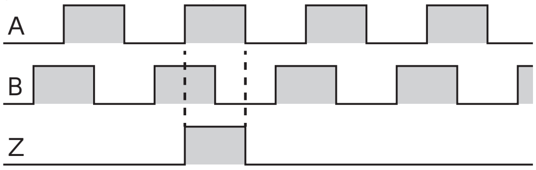
Signal ground of the communication IC in the output circuit is connected to signal ground inside the drive.

Connect signal ground of communications IC of the host controller to Pin No.42.

Be sure to use shielded twisted-pair cable as a noise countermeasure.



Encoder Z-phase is synchronized with A-phase and output.



5. Descriptions of CN1 Connector Signals

RS Connection to RS-485 circuit

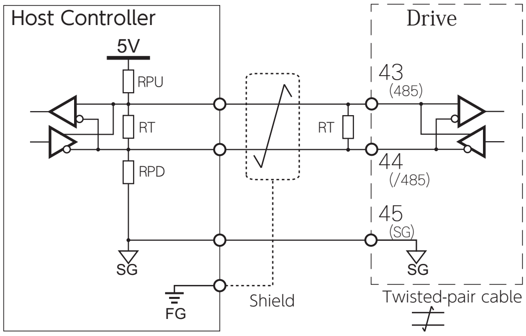
Control Mode		
P	S	T
DIF. 24 5 I/O	VOLT	VOLT

RS-485 communications with the host controller
When connecting multiple drives, be sure to install a termination resistor of approximately 200 Ω between signal lines of the end drive.
Be sure to connect a pull-up resistor (RPU) and a pull-down resistor (RPD) of approximately 1.2 k Ω inside the host controller. Be sure to connect a termination resistor of approximately 220 Ω .

Make the wiring between the host controller and the drive less than 3m.
Between drives, make it less than 1m.

Signal ground of communication IC of the drive is connected to signal ground inside the drive. Connect signal ground of communications IC of the host controller to Pin No.45.

Be sure to use shielded twisted-pair cable as a noise countermeasure.



5 Settings

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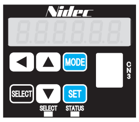
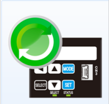
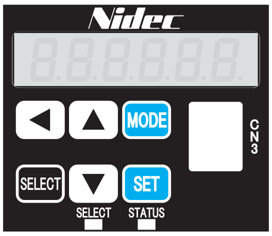
1. Overview

This section explains a variety of parameters that are required to set up the various product functions and features. Read this section carefully to become familiar with the setup methods, functions, and usages of the parameters, then adjust the parameters to best suit your operating requirements.

Parameter Tuning Method	
	Tuning with the Setup Panel on the front the drive.
	Tuning with the setup software Digitax SF Connect. Install it on the user-supplied PC.

2. Setup Panel

1. Setup Panel Features



Setup Panel

<table>
<tr><th>Items</th><th>Descriptions</th></tr>
<tr><td>
Display Panel</td><td>Displays a status or a setting value (with six digits at a time) on 7-segment display.</td></tr>
<tr><td>MODE
MODE Button</td><td>Use this button to switch between the six modes in the main menu or return to the main menu.</td></tr>
<tr><td>SET
SET Button</td><td>Use this button to select items and set values.</td></tr>
<tr><td>STATUS
STATUS LED</td><td><table>
<tr><th>Control power</th><th>LED</th><th>Status</th></tr>
<tr><td>ON</td><td>Green ON</td><td>Normal</td></tr>
<tr><td></td><td>Red ON</td><td>Alarm occurring</td></tr>
<tr><td>OFF</td><td>OFF</td><td>Normal</td></tr>
</table></td></tr>
<tr><td>▲
UP Button
▼
DOWN Button</td><td>In each mode, use these buttons to change the display item, change data, select the parameter, execute operation and so forth.
Use ▲ to increase or ▼ to decrease a numeric value</td></tr>
<tr><td>◀
LEFT Button</td><td>Use this button to move to higher order digits when changing the data.</td></tr>
</table>

Do not press more than one button simultaneously on the Setup Panel.

Otherwise, the information displayed on the DISPLAY LED will be incomplete.

2. Setup Panel

Displaying A Number with 6 or More Digits

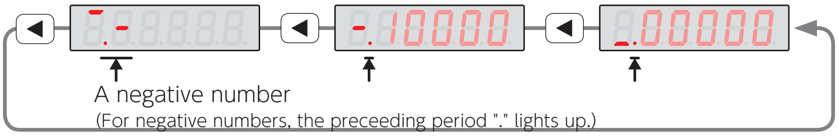
You can display a 6 to 10-digit number on the display panel with 3 separate portions, 5 digits at a time. The leftmost letter indicates which segment of the number is currently displayed: sign , first 5-digit , or last 5-digit segment. The last 5-digit sement is displayed first.

ex. 1 : Positive number

+1,234,567,890

ex. 2 : Negative number

-1,000,000,000



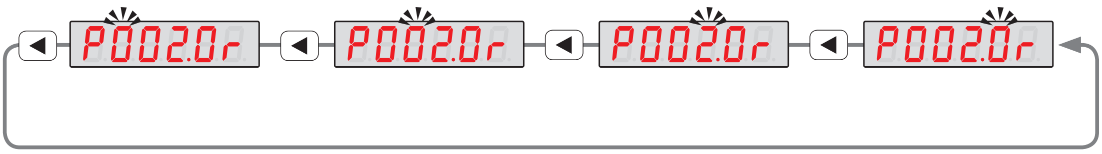
ex. 3 : Model Code and Serial Number

0002020400

Selecting the digit to edit

Use ◀ button to move the blinking position to the digit place that you want to edit.

Use ▲ ▼ button to change the value of the blinking digit.

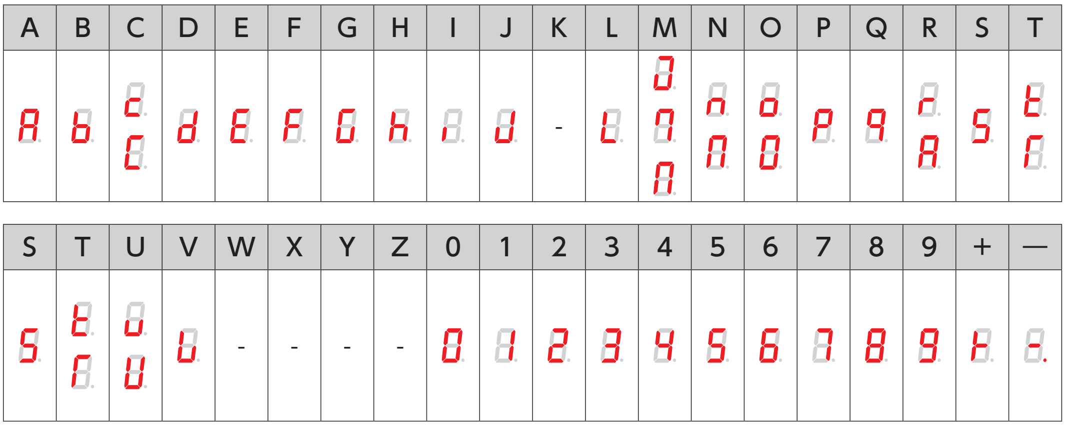


2. Using the Setup Panel

The Setup Panel shows seven modes, each of which represents a group of functions.

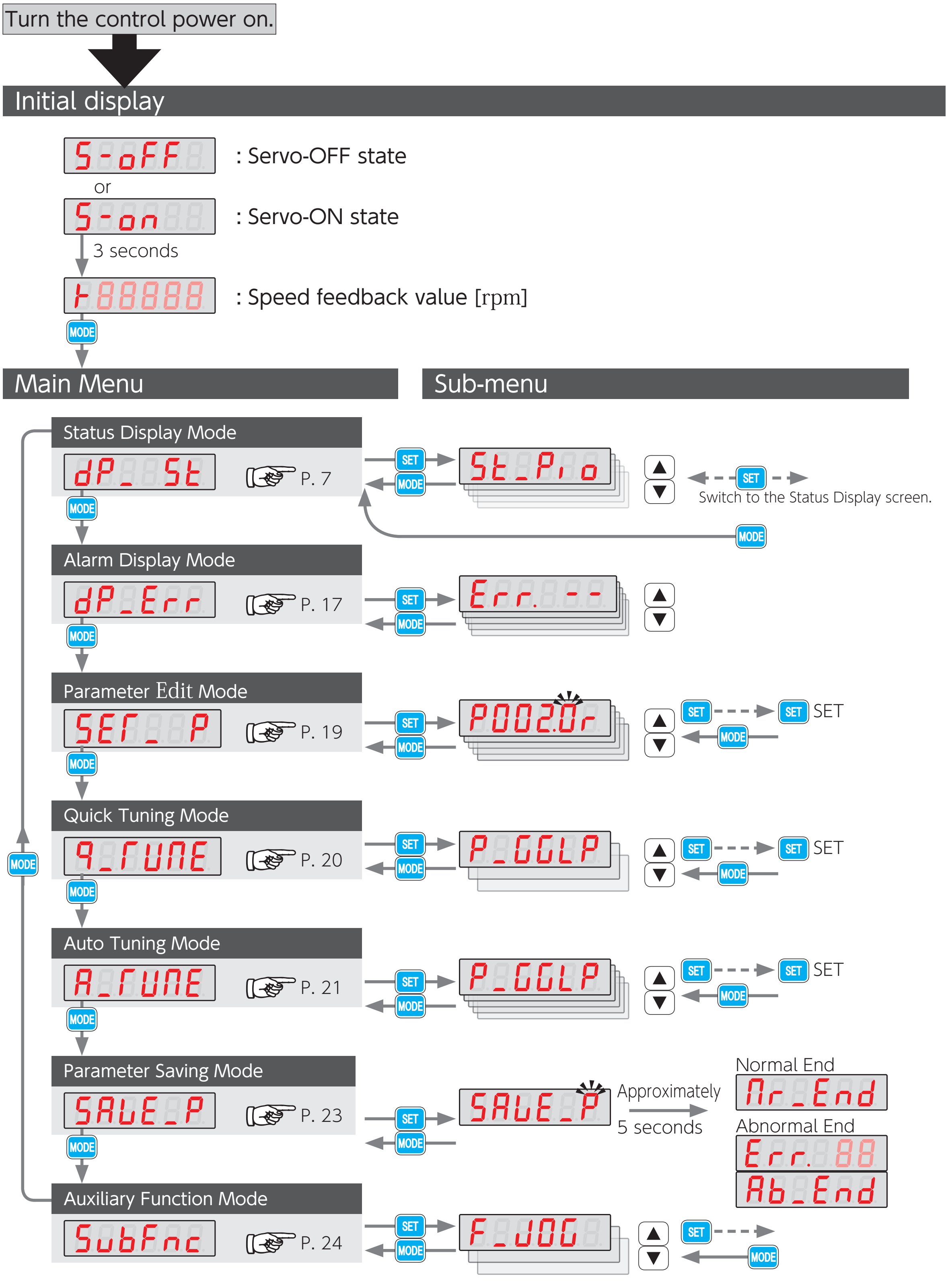
Display Mode	Overview
 Status Display Mode	Motor and drive statuses can be verified. Not displayed when an alarm is occurring
 Alarm Status Display Mode	You can check the active alarm in this mode.
 Parameter Edit Mode	Use this mode to edit each parameter
 Quick Tuning Mode	This mode is used for tuning the control gain set based on the selected inertia. (Position Control Mode only)
 Auto Tuning Mode	This mode is used to set up the parameters required for auto tuning. Not available in Torque Control Mode.
 Parameter Saving Mode	This mode enables you to save the parameters set up in Parameter Setting Mode or Auto Tuning Mode to EEPROM.
 Auxiliary Function Mode	You can perform: - JOG Operation to execute testing with no command input from the host controller. - Clear Parameter to reset all parameters to the factory default. - Clear Encoder to initialize multi-turn data of absolute encoder.

Character table for 7-segment LED display



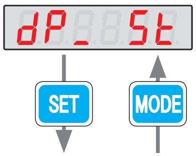
3. Using the Setup Panel

Turn on the control power of the drive and then press MODE twice to bring up the main menu. On the main menu, select the mode you are to set up, then press SET to see the sub-menu.



3. Using the Setup Panel

1. Status Display Mode



On the sub-menu that you just selected, press SET to display a value or proceed to the next setup screen.

☞ Following pages for each sub-menu
☞ 9 Appendix Status List

Sub-menu

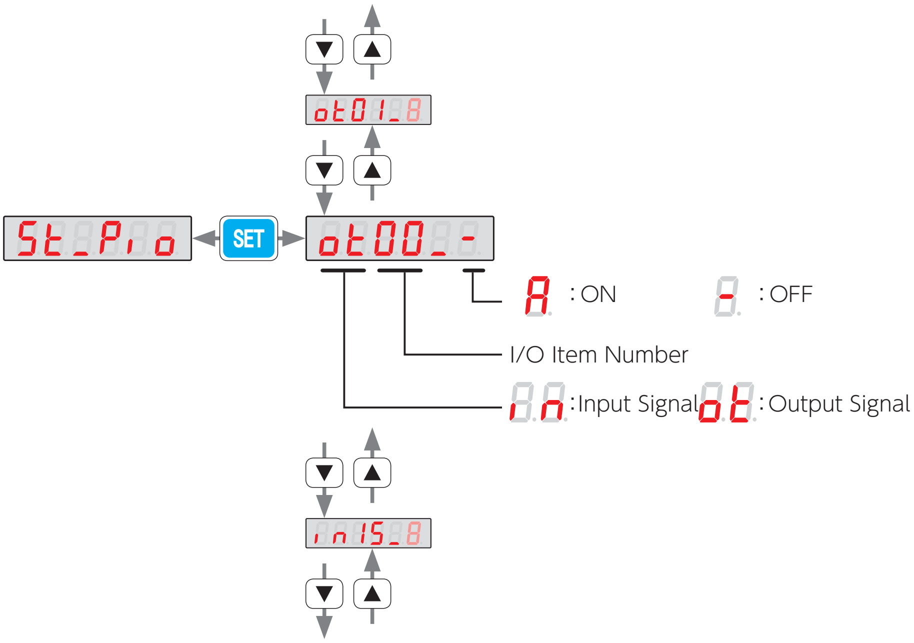
1 ↓	St_Pio	I/O Status	(☞ P. 8)
2 ↓	St_t7P	Control Component Temperature (reference value)	(P. 9)
3 ↓	St_PCP	Pulse Train Command Input (Position)	(P. 9)
4 ↓	St_PCS	Pulse Train Command Input (Speed)	(P. 9)
5 ↓	St_ASC	Analog Velocity Command	(P. 9)
6 ↓	St_PPS	Positioning Status	(P. 10)
7 ↓	St_PCA	ABS Position Command	(P. 10)
8 ↓	St_PFA	ABS Position Feedback	(P. 10)
9 ↓	St_PdC	Command Position Error	(P. 10)
10 ↓	St_PdA	ABS Position Error	(P. 11)
11 ↓	St_PCo	Position Command Value	(P. 11)
12 ↓	St_PFb	Position Feedback	(P. 11)
13 ↓	St_Pdu	Position Error	(P. 11)
14 ↓	St_SCo	Speed Command Setting	(P. 12)
15 ↓	St_SFb	Speed Feedback	(P. 12)
16 ↓	St_Sdu	Speed Error	(P. 12)
17 ↓	St_tr9	Torque Command Value	(P. 12)
18 ↓	St_LoF	Load Factor	(P. 13)
19 ↓	St_inr	Estimated Inertia Ratio	(P. 13)
20 ↓	St_ESt	Encoder Rotor Mechanical Angle (single-turn)	(P. 13)
21 ↓	St_EAb	Encoder Rotor Mechanical Angle (multiple-turns)	(P. 13)
22 ↓	St_EtP	Encoder Temperature (reference value)	(P. 14)
23 ↓	St_Ebu	Encoder Battery Voltage	(P. 14)
24 ↓	St_EAC	Encoder Communication: No. of Retries	(P. 14)
25 ↓	St_EEC	Encoder Data Error Count	(P. 14)
26 ↓	St_AEG	Regeneration Status	(P. 15)
27 ↓	St_PnU	AC Supply Voltage (reference value)	(P. 16)
28 ↓	Pt_drU	Drive Model Code	(P. 16)
↓	Pt_Jot	Motor Model Code	
↓	Pt_Enc	Encoder Model Code	
29 ↓	PS_drU	Drive Serial Number	(P. 16)
↓	PS_Jot	Motor Serial Number	
↓	PS_Enc	Encoder Serial Number	
1 ↓	St_Pio	I/O Status	(P. 8)
⋮			

Press ▲ for the direction of the flow (↓) . Press ▼ for the reverse direction.

1 I/O Status Status No.16

The flow chart below illustrates the I/O status of the CN1 connector.
The assignments of I/O pins depend on each control mode.Check each corresponding pin.

☞ 4 Connections

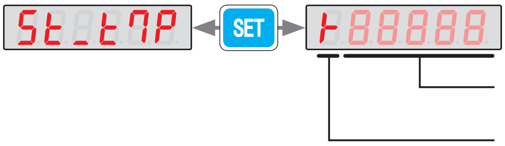


Output Signal		Pin No.
ot00_8		13
ot01_8		14
ot02_8		15
ot03_8		16
ot04_8		17
ot05_-	(*)	18
ot06_8		19
ot07_8		21
ot08_8		Reserved
···		
ot15_8		

Input Signal	Pin No.
in00_8	4
in01_8	5
in02_8	6
in03_8	7
in04_8	8
in05_8	9
in06_8	10
in07_8	11
in08_8	Reserved
···	
in15_8	

*) NOTE: The display of ot05_- is fixed at - (OFF).

2 Control Component Temperature Status No.24

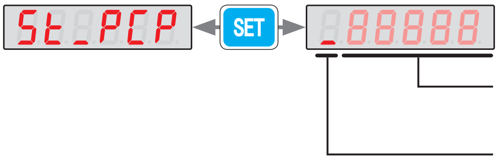


[℃]

Temperature of Drive Control Components (reference value)

+ : positive - : negative

3 Pulse Train Command Input (Position) Status No.33



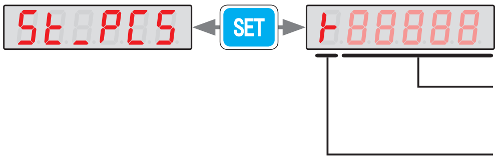
[command pulse]

Pulse count output from the host controller

Current display signs
(Press ◀ to change the display.)

‾+ : +/- sign - : first 5 digits _+ : last 5 digits

4 Pulse Train Command Input (Speed) Status No.35

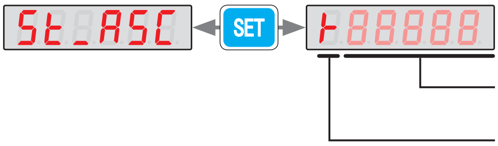


[pulse/160 µs]: 50 W - 750 W
[pulse/200 µs]: 1 kW - 2 kW

Speed derived from Pulse Train Command Input (Position)

+ : positive - : negative

5 Analog Velocity Command Status No.49

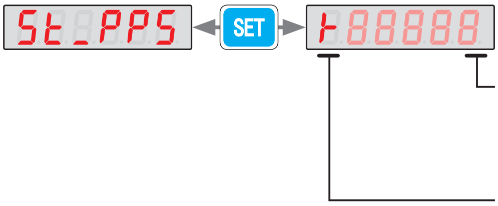


[rpm]

Analog Velocity Command input from the host controller

+ : positive - : negative

6 Positioning Status Status No.64



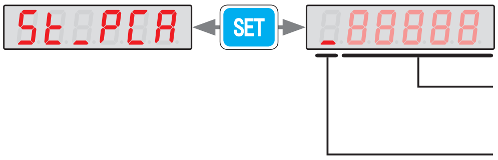
[-]

Positioning Status in Position Control Mode

0 :Executing Positioning 1 : Positioning Complete

+ : Fixed to positive

7 ABS Position Command Status No.74



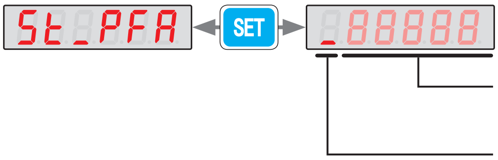
[command pulse]

Indicates a Position command value based on Home position offset

Current display signs
(Press ◀ to change the display.)

‾+ : +/- sign - : first 5 digits _ : last 5 digits

8 ABS Position Feedback Status No.76



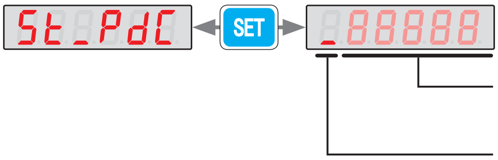
[command pulse]

Indicates the motor angular position returned from the encoder.

Current display signs
(Press ◀ to change the display.)

‾+ : +/- sign - : first 5 digits _ : last 5 digits

9 Command Position Error Status No.78



[command pulse]

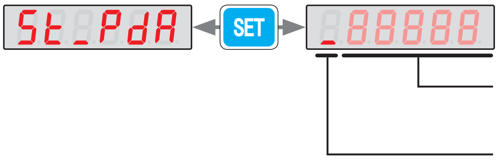
Indicates the difference between the position command value and position feedback value.

Current display signs
(Press ◀ to change the display.)

‾+ : +/- sign - : first 5 digits _ : last 5 digits

10 ABS Position Error

Status No.80



[command pulse]

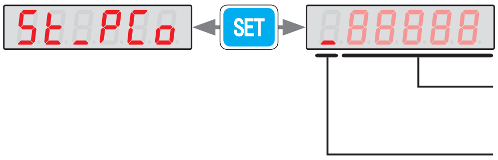
Indicates the difference between ABS Position Command (Status No.74) and ABS Position Feedback (Status No.76)

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

11 Position Command Value

Status No.65



[encoder pulse]

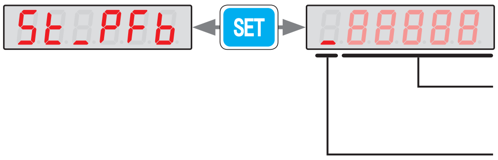
Indicates the position command value input to the position loop

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

12 Position Feedback

Status No.67



[encoder pulse]

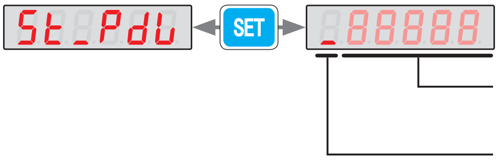
Indicates the motor angular position detected by encoder

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

13 Position Error

Status No.69



[encoder pulse]

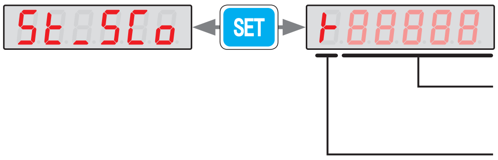
Indicates the difference between the position control value and the position feedback value

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

3. Using the Setup Panel

14 Speed Command Setting Status No.97

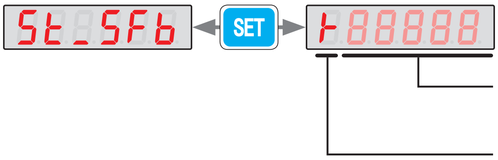


[rpm]

Indicates the value of speed command input to the speed loop

+ : positive - : negative

15 Speed Feedback Status No.98

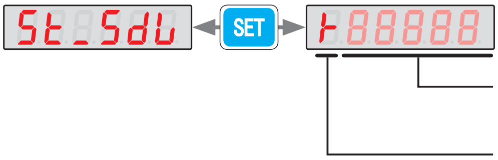


[rpm]

Indicates the motor rotational speed detected by the encoder

+ : positive - : negative

16 Speed Error Status No.99

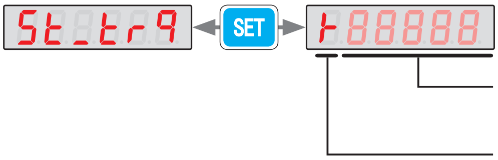


[rpm]

Indicates the difference between the speed command value and the speed feedback value

+ : positive - : negative

17 Torque Command Value Status No.113



[0.1 %]

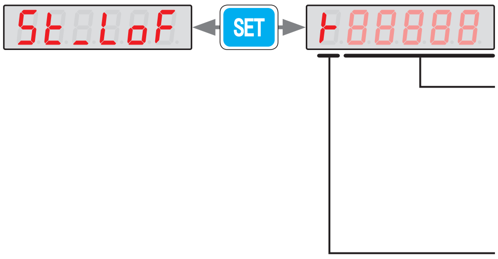
Indicates the value of motor output torque

+ : positive - : negative

3. Using the Setup Panel

18 Load Factor

Status No.131



[digit]

Indicates the load factor threshold to detect overload

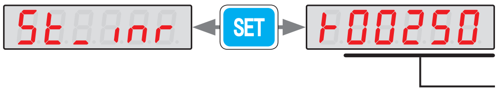
To compare the displayed value to 100% rated torque, use the following conversion formula:

$$\sqrt{\text{Load Factor}_{[\text{digit}]} \times 10} \ [\%]$$

: positive : negative

19 Estimated Inertia Ratio

Status No.371

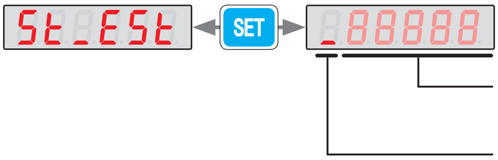


[%]

Indicates the estimated inertia ratio
(Indicates 250 % in this example.)

20 Encoder Rotor Mechanical Angle (Single Turn)

Status No.194



[encoder pulse]

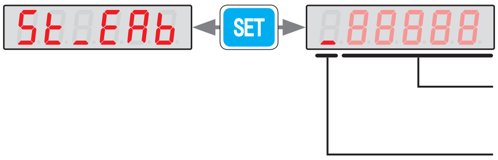
Indicates the single-turn absolute value of the motor

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

21 Encoder Rotor Mechanical Angle (Multi-turn)

Status No.195



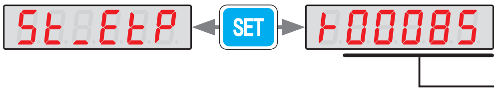
[encoder pulse]

Indicates the cumulative value of the motor' s multiple-turns

Current display signs
(Press ◀ to change the display.)

: +/- sign : first 5 digits : last 5 digits

22 Encoder Temperature Status No.205

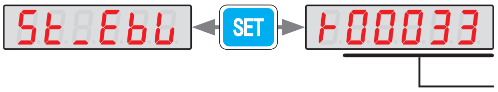


[℃]

Encoder Temperature
(Indicates 85 ℃ in this example.)

23 Encoder Battery Voltage Status No.206

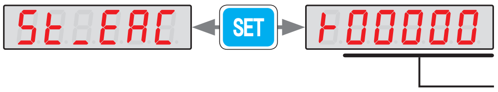
(Absolute encoder only)



[0.1 V]

Encoder battery voltage
(Indicates 3.3 V in this example.)

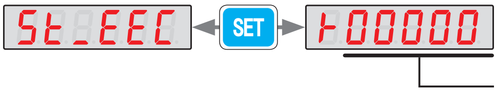
24 Encoder Communication Retry Count Status No.216



[count]

Indicates how many times encoder communication has been retried
(Indicates zero times in this example.)

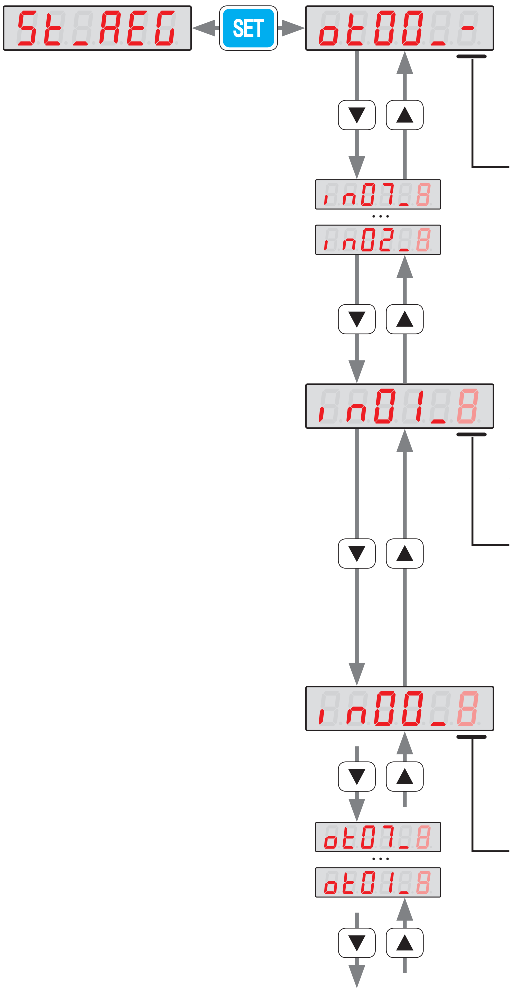
25 Encoder Data Error Counter Status No.218



[count]

Encoder Data Error Count
(Indicates zero times in this example.)

26 Regeneration Status Status No.228



Regeneration control output

Indicates the operation status of the regenerative power processing circuit.
ON : Handle with the braking resistor

A : ON   - : OFF

Regeneration voltage threshold

Indicates the AC Supply voltage has reached the threshold.
A power error, Err. 15, will occur if the braking resistor is not connected.

A : Reached the threshold.   - : Below the threshold

Regeneration voltage warning

Indicates the AC Supply voltage has reached the warning level.
You need to connect a braking resistor to the drive.

A : Reached the warning threshold.   - : Below the warning threshold

How to determine whether or not a braking resistor is needed

1. Display in00 8 as instructed above.
2. Observe if the display on the Setup Panel while gradually increasing the speed of the equipment from a low speed (approximately 20 % of the max speed) to the actual operating speed.

in00 - : you do not need install a braking resistor.

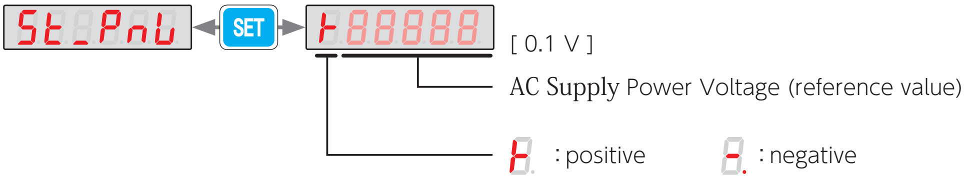
in00 A : install a braking resistor.

☞ 3 Preparation Braking Resistor

⚠ CAUTION

If Err. 15 appears while the motor is decelerating, you may need a braking resistor. Determine if a braking resistor is necessary or not as described above.

27 AC Supply Power Voltage Status No.232



28 Model Code (Drive, Motor, Encoder)

Drive

Motor

Encoder

29 Serial Number (Drive, Motor, Encoder)

Drive

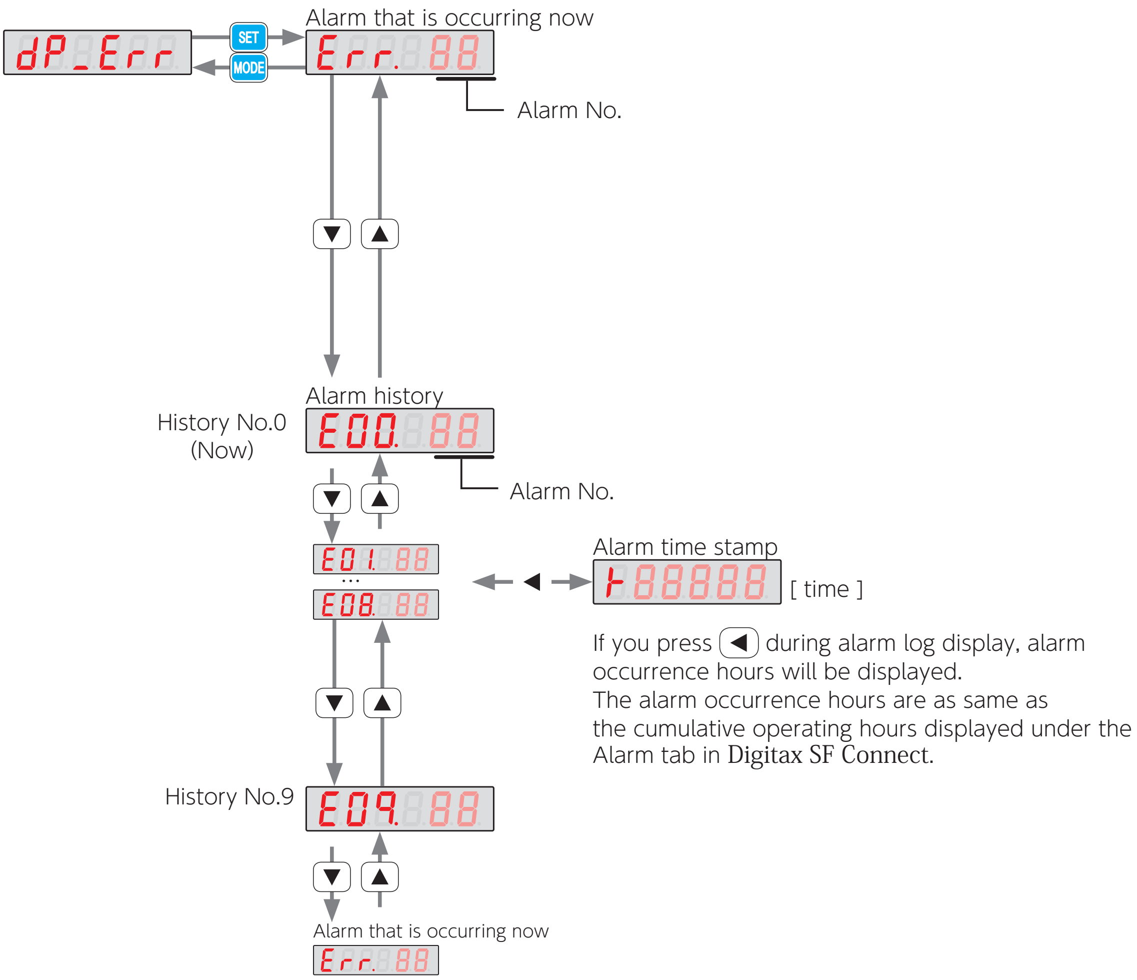
Motor

Encoder

2. Alarm Display Mode

When an alarm occurs, the Setup Panel will automatically switch to the Alarm Display Mode. Note that this does not happen in the following modes: Parameter Setting Mode, Quick Tuning Mode, Auto Tuning Mode, Parameter Saving Mode, and Auxiliary Function Mode.
To switch to Alarm Display Mode from one of these modes, press MODE .
Status Display Mode is disabled while an alarm is occurring.
Up to 10 previous alarms can be displayed.

☞ 8 Troubleshooting



If you press ◀ during alarm log display, alarm occurrence hours will be displayed.
The alarm occurrence hours are as same as the cumulative operating hours displayed under the Alarm tab in Digitax SF Connect.

List of Alarms

Display	Alarm
Err. --	No alarm
Err. 00	System
Err. 01	EEPROM data
Err. 02	Product code
Err. 04	Overspeed
Err. 05	Speed
Err. 06	Position
Err. 07	Overload
Err. 08	Command overspeed
Err. 09	Encoder pulse Output frequency
Err. 10	Internal Position Command overflow Homing failure
Err. 11	Encoder (multi-turn counter overflow)
Err. 12	Overheat
Err. 14	Overvoltage
Err. 15	Power supply (AC Supply)
Err. 16	Encoder (Received data)
Err. 17	Encoder (no response)
Err. 18	Encoder (circuitry)
Err. 19	Encoder (communication)
Err. 20	Encoder (multi-turn data)
Err. 21	Encoder (voltage drop)
Err. 22	Voltage (control power)
Err. 23	Switch circuitry
Err. 24	Overcurrent
Err. 25	Inverter 1
Err. 26	Inverter 2
Err. 27	Current sensor
Err. 28	Encoder (overheat)
Err. 29	Voltage drop (inside the drive)

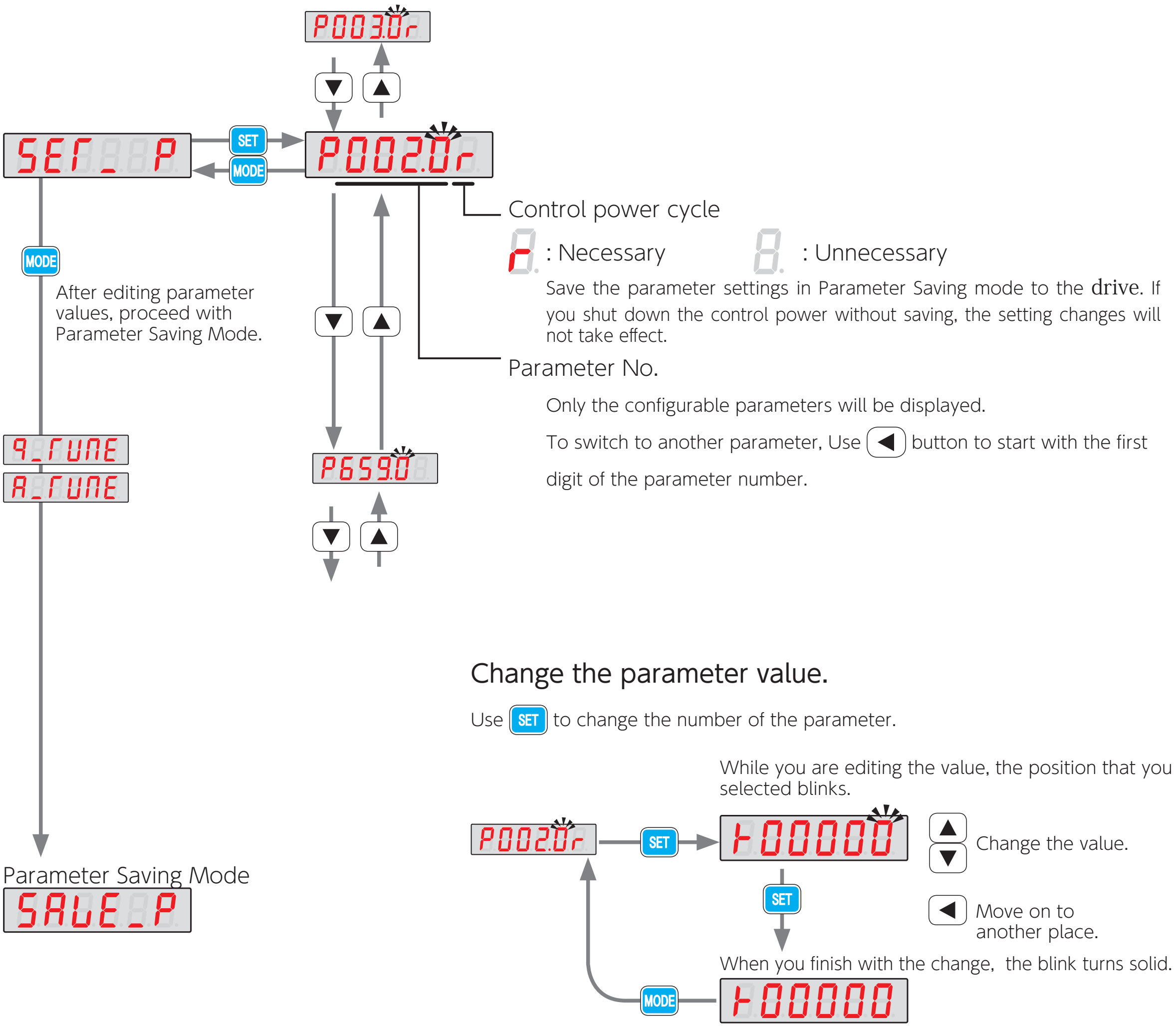
List of Warnings

Display	Warning
Err.900	Encoder overheat detection
Err.901	Encoder battery voltage drop error detection
Err.902	Emergency stop
Err.903	Encoder communication warning
Err.904	Excessive position error

3. Parameter Setting Mode

In Parameter Setting Mode, drive parameters can be checked and set up. For details of each parameter, see the Parameters.

☞ Page 28



After editing parameter values, proceed with Parameter Saving Mode.

Control power cycle

r : Necessary 8 : Unnecessary

Save the parameter settings in Parameter Saving mode to the drive. If you shut down the control power without saving, the setting changes will not take effect.

Parameter No.

Only the configurable parameters will be displayed.

To switch to another parameter, Use ◀ button to start with the first digit of the parameter number.

Change the parameter value.

Use SET to change the number of the parameter.

While you are editing the value, the position that you selected blinks.

Change the value.

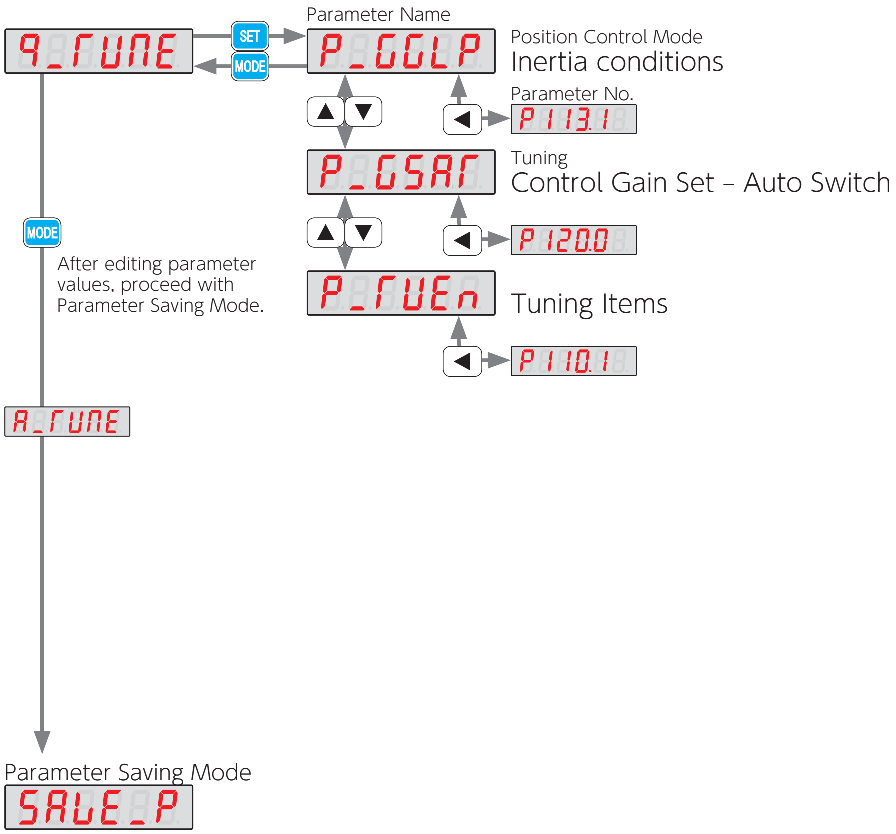
Move on to another place.

When you finish with the change, the blink turns solid.

Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

4. Quick Tuning Mode (Position Control Mode Only)

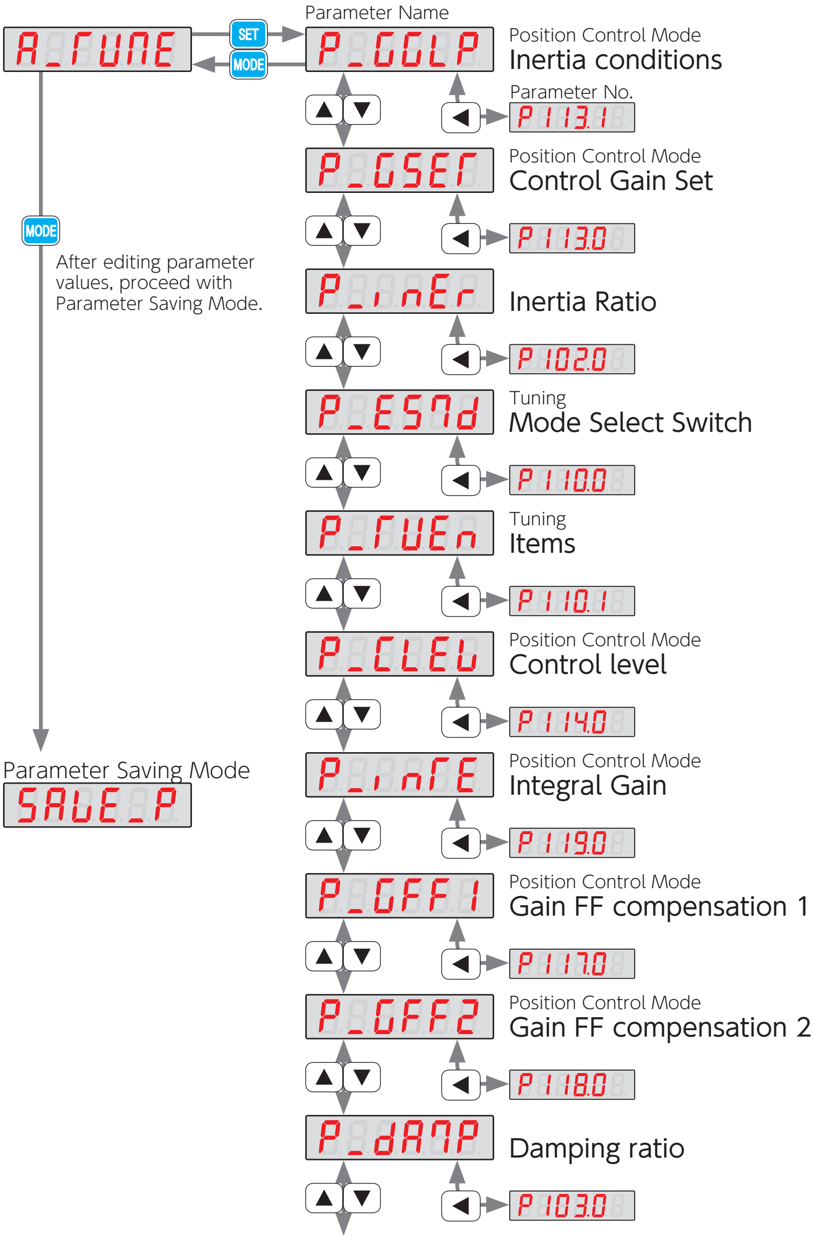
For Tuning Procedures, see 7 Tuning.



Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

5. Auto Tuning Mode (Position Control Mode)

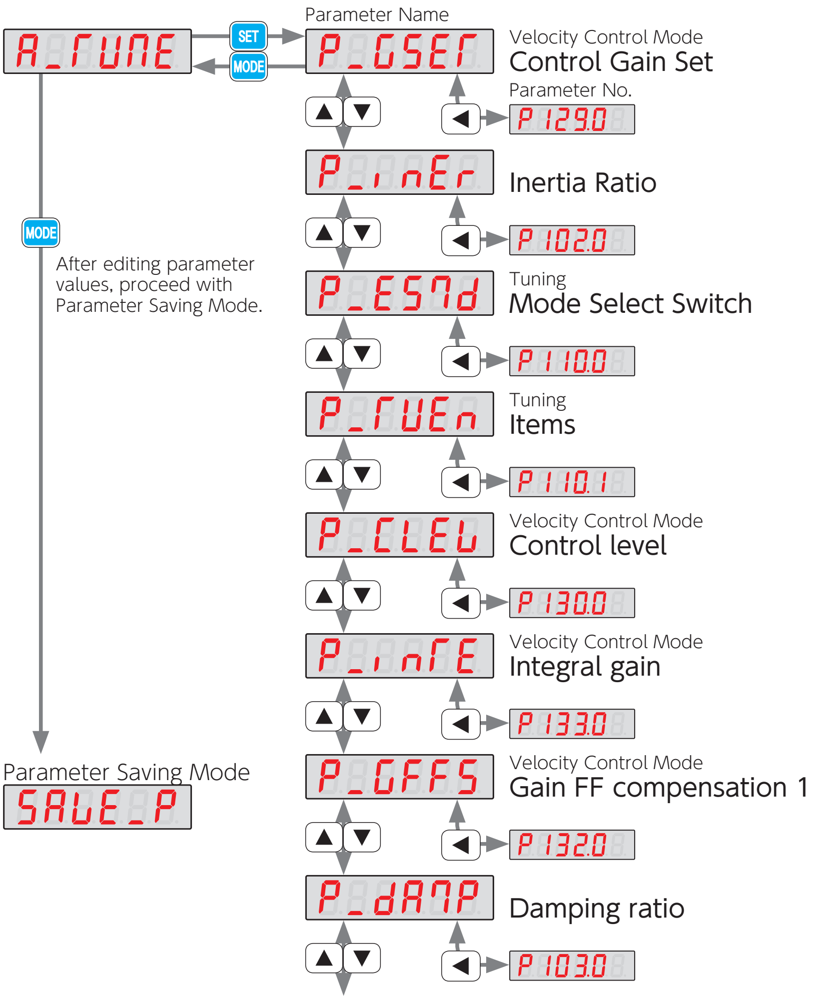
For Tuning Procedures, see 7 Tuning.



!	Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

6. Auto Tuning Mode (Velocity Control Mode)

For Tuning Procedures, see 7 Tuning.



! Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

3. Using the Setup Panel

7. Parameter Saving Mode

This mode allows you to save the parameter settings changed in Parameter Setting Mode or Auto Tuning Mode.

Check in Alarm Display Mode.

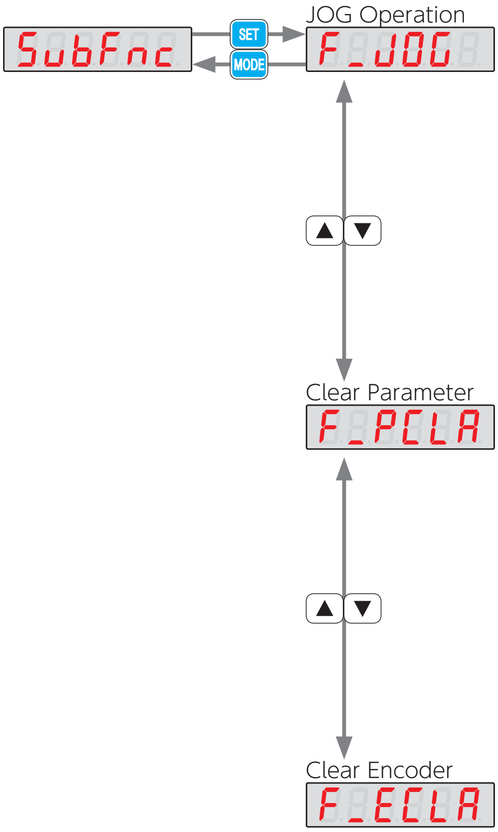
Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

If you changed parameters for which control-power cycle is needed, cycle power after the new parameter settings are saved.

3. Using the Setup Panel

8. Auxiliary Function Mode

Auxiliary Function Mode allows you to perform the operations such as 1) JOG operation, 2) Clear Parameter, and 3) Clear Encoder.



☞ P. 25

This function is used to perform a test run with no command input from the host controller.
If tuning is your purpose, use Test Operation.
The motor rotates only while ▲▼ is being pressed.

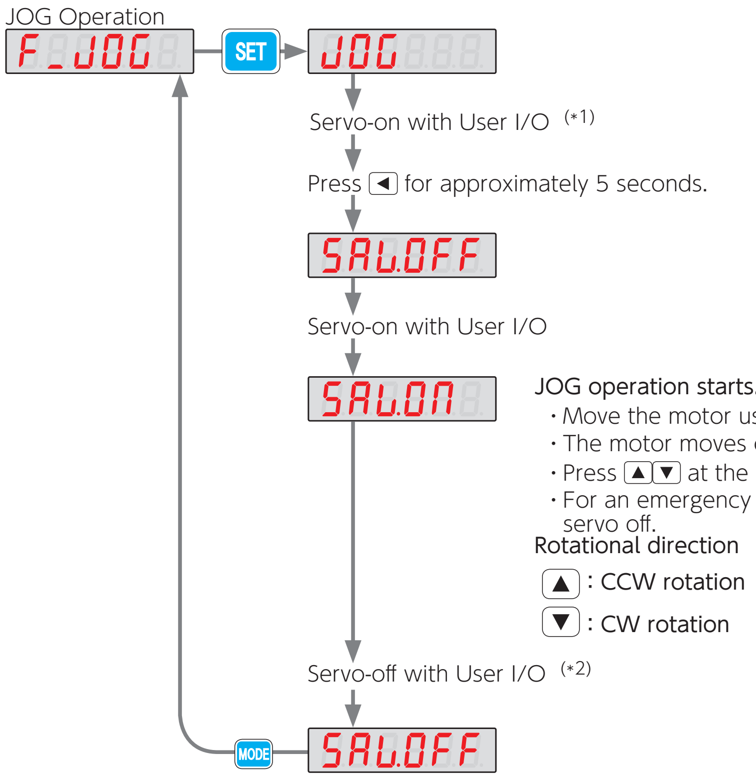
☞ P. 26

The Parameter Clear function is used to reset all parameter settings to the factory default values.
Control-power cycle is required.
Perform this operation in a Servo-OFF state.
If operated in a Servo-ON state, an alarm will occur.
It is recommended to back up the current parameter settings using digitax SF Connect before executing Parameter Clear.

☞ P. 26

This function initializes the multi-turn data of the absolute encoder. Control-power cycle is required.
Perform this operation in a Servo-OFF state.
If operated in a Servo-ON state, an alarm will occur.

JOG Operation



JOG operation starts.
- Move the motor using ▲ or ▼ button.
- The motor moves only when either button is pressed.
- Press ▲▼ at the same time to stop the motor.
- For an emergency stop, shut off the AC supply or turn the servo off.

Rotational direction

▲ : CCW rotation

▼ : CW rotation

*1) Pressing ◀ without turning the servo off will result in Error.
Press MODE to be back to F_JOG.

*2) Press MODE without turning the servo off,
Error will be displayed first
and then SRV.ON in approximately 3 seconds.

Modes and conditions that allow JOG Operation

Control Mode	Command Mode	JOG Operation
Position Control	Pulse Train Command	Yes
	Internal Position Command	No
Velocity Control	Analog Velocity Command	Yes
	Internal Velocity Command	Yes (*)
Torque Control	Analog Torque Command	No

*) Speed selection by I/O input is disabled. (VCRUN1, VCRUN2, VCSEL1, VCSEL2, VCSEL3)

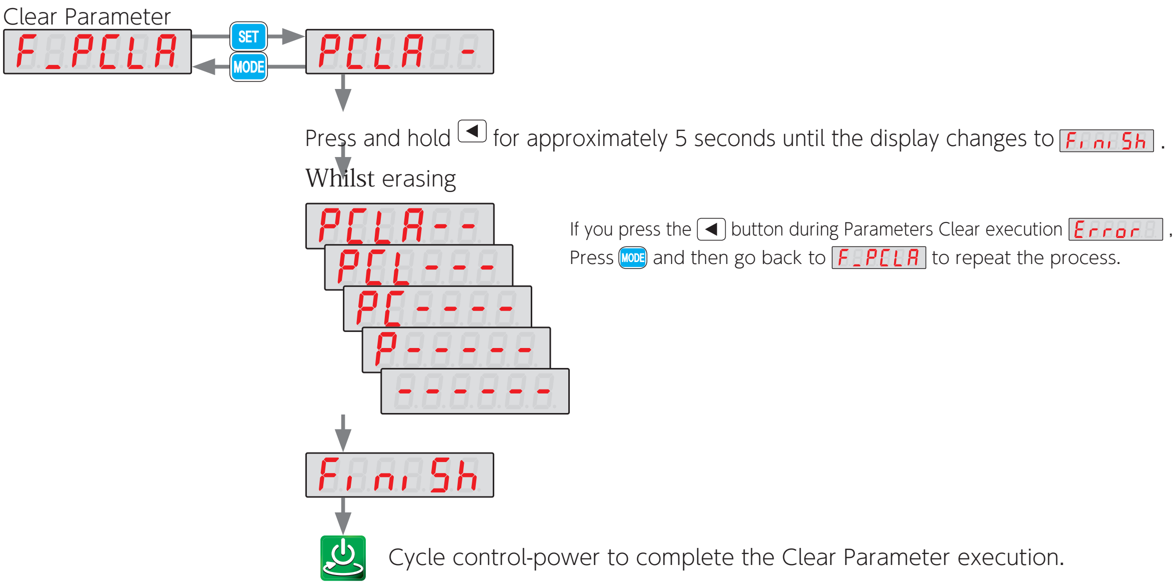
JOG Operation related parameters

No.	Parameter	Default	Range
385.0	Acceleration Time	1,000 [ms]	0 to 60,000
386.0 (*)	Deceleration Time	1,000 [ms]	0 to 60,000
387.0	Target Speed	300 [rpm]	0 to max of motor rotational speed of motor

*) The larger the setting, is the longer it takes for the motor to stop after releasing any of the ▲▼ buttons.

3. Using the Setup Panel

Clear Parameter



Press and hold ◀ for approximately 5 seconds until the display changes to FiniSh .

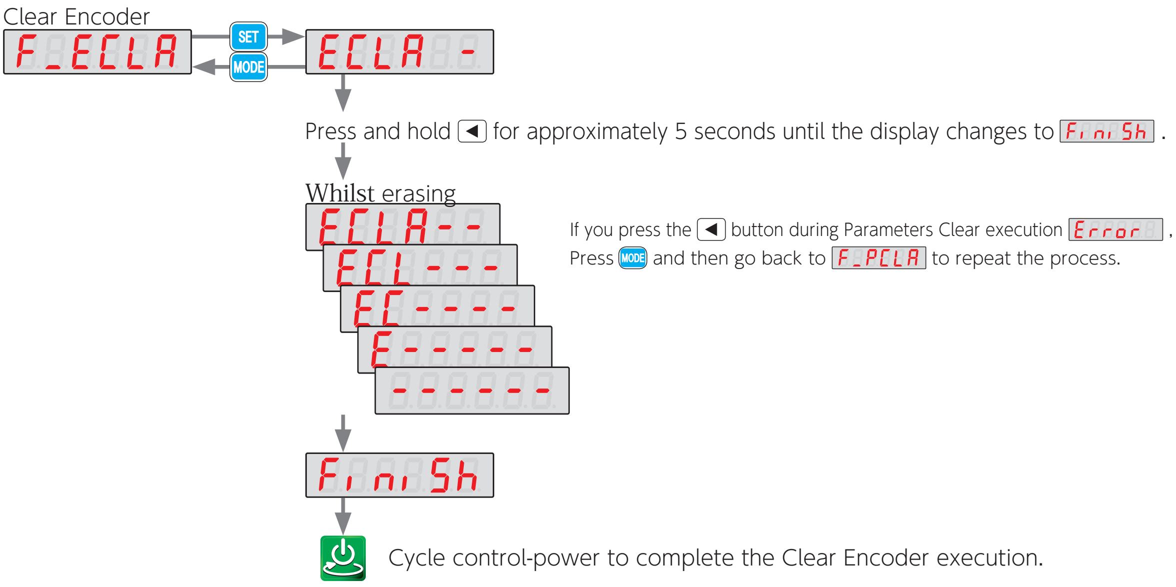
If you press the ◀ button during Parameters Clear execution Error ,
Press MODE and then go back to F_PCLA to repeat the process.

Cycle control-power to complete the Clear Parameter execution.

Use this in a Servo-OFF state.

If used in a Servo-ON state, an alarm will occur.

Clear Encoder (This feature is used in absolute systems)



Press and hold ◀ for approximately 5 seconds until the display changes to FiniSh .

If you press the ◀ button during Parameters Clear execution Error ,
Press MODE and then go back to F_PCLA to repeat the process.

Cycle control-power to complete the Clear Encoder execution.

Use this in a Servo-OFF state.

If used in a Servo-ON state, an alarm will occur.

4. Overview of Digitax SF Connect (Setup Software)

Digitax SF Connect is a dedicated setup software to be installed on a user-supplied PC connecting to a Digitax SF servo drive with a USB cable. It enables you to perform the following operations easily.

Features:

- setting, saving, and writing drive parameters
- measuring, saving, and comparing data, by using a graphical waveform monitor
- monitoring the state of drive, alarm, and input/output
- gain tuning and setting filters
- point-table operation, test operation and homing

System Requirements for Digitax SF Connect

Product	Specifications	
PC	OS	Windows® XP SP3 (32-bit) Windows® 7 (32-bit、64-bit) Windows® 8 (64-bit)
	Language	Japanese, Chinese (Simplified), Chinese (Traditional), Korean, and English
	Minimum CPU	Pentium® III 512 MHz
	Minimum Memory	256 MB (512 MB recommended)
	Minimum Hard Disk Space	512 MB free space
	Serial Communications	USB port
Cable	USB A – USB mini B	In noisy environments, a signal noise filter cable is recommended.

Connecting Drive and PC

Install Digitax SF Connect on your PC.
Connect a USB cable to CN3 at the front of the drive.

☞ Digitax SF Connect Instruction Manual

5. Parameters

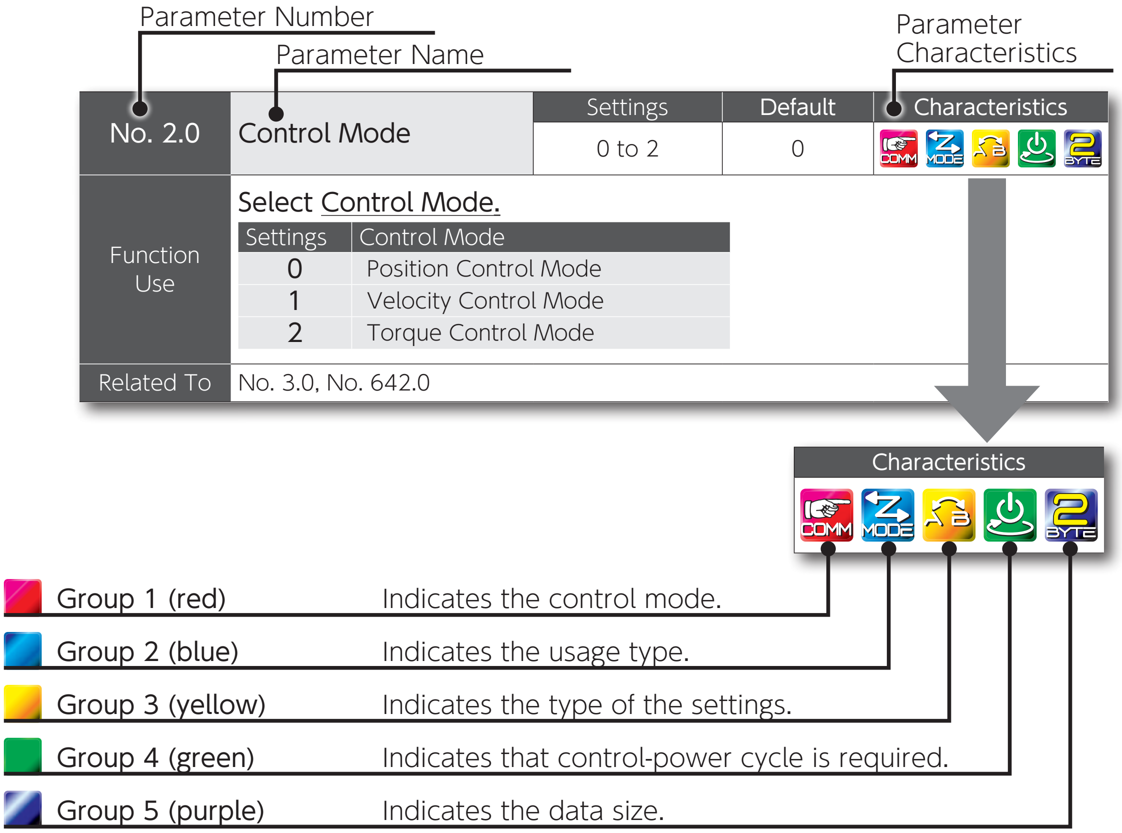
Remark

Some of the tuning parameters are dependent on the settings of other parameters, which makes the values of dependent parameters invalid even if they are within the specification range.

Control Mode	Name	No.
Position Control Mode	Control gain 1	115.0
	Control gain 2	116.0
	Gain FF compensation 1	117.0
	Gain FF compensation 2	118.0
	Integral gain	119.0
Velocity Control Mode	Control gain 1	131.0
	Gain FF Compensation 1	132.0
	Integral gain	133.0

Overview of the parameter list

(Two stacked parameters indicate a fraction.)



No. 2.0	Control Mode	Settings	Default	Characteristics
		0 to 2	0	COMM MODE BYTE
Function Use	Select Control Mode.			
Related To	No. 3.0, No. 642.0			

Settings	Control Mode
0	Position Control Mode
1	Velocity Control Mode
2	Torque Control Mode

🟥	Group 1 (red)	Indicates the control mode.
🟦	Group 2 (blue)	Indicates the usage type.
🟨	Group 3 (yellow)	Indicates the type of the settings.
🟩	Group 4 (green)	Indicates that control-power cycle is required.
🟪	Group 5 (purple)	Indicates the data size.

5. Parameters

Characteristics of Parameters

The parameters are categorized into five groups according to their functions, uses, and features. The following icons are used to represent their characteristics.

Group	Icon		Meaning
1 (Red)	COMM	Common	Used for all Control Modes
	PLS	Position Control Pulse Train Command	Used for Pulse Train Command in Position Control Mode
	IN POS	Position Control Internal Command	Used for Internal Position Command in Position Control Mode
	VEL	Velocity Control Analog Command	Used for Analog Command in Velocity Control Mode
	IN VEL	Velocity Control Internal Command	Used for Internal Velocity Command in Velocity Control Mode
	TRQ	Torque Control Analog Command	Used for Analog Command in Torque Control Mode
2 (Blue)	COM	Communication	Setup parameters for RS-485 Communication
	MODE	Operation Mode	Used for selecting Control Mode, Command Mode, Operation Mode, Pulse Form and so forth.
	CTRL	Operation Control	Used to configure Pulse Ratio and Filters
	ALM	Alarm Detection	Used for configuring Alarm Detection and Timing of Alarm Detection
	TUNE	Tuning	Gain parameters that require Tuning
	HOME	Homing	Used for positioning operation in Position Control Mode
	LIMIT	Torque Limit	Used for configuring Torque limit used in all Control Modes
	STOP	Deceleration Stop/ Emergency Stop/Quick Stop	Used for configuring Stop processes in case of emergency or drive limit switch input active
	SUPP	Vibration Control	Parameters related to Vibration Control
3 (Yellow)	ON OFF	Switch	Parameters to enable or disable functions
	A B	Selection	Used for selecting conditions from multiple items based on your operational purposes
	0 100	Numeric Value	Numeric values are set for these parameters, for example, pulse paired ratio or filter setup parameters.
4 (Green)	⏻	Control Power Cycle	Those parameters need power cycling for their setting changes to take effect.
5 (Dark Blue)	2 BYTE	2-Byte Data	2-byte data ☞ **Communications Manual:** RS-485 Communications
	4 BYTE	4-Byte Data	4-byte data ☞ **Communications Manual:** RS-485 Communications

5. Parameters

1. Parameters

Common

Common

COMM MODE CTRL LIMIT

Name			No.	☞
Control mode			2.0	34
Command mode			3.0	34
Operation mode			9.0	35
Warning latch time			12.0	36
Alarm output timing			13.0	36
Torque command limit	Switch		144.0	62
	Value 1		147.0	63
	Value 2		148.0	63
Torque limit output			144.1	63
Servo OFF: Delay time			237.0	75
Brake release: Delay time			238.0	75
Absolute system			257.0	76
Encoder pulse output	Rotational direction		272.1	77
	Command pulse ratio	Numerator	276.0	78
		Denominator	278.0	78

JOG Operation

COMM CTRL

Name	No.	☞
Acceleration time	385.0	85
Deceleration time	386.0	85
Target speed	387.0	85

Warning/Error Detection

COMM PLS ALM

Name		No.	☞
Position error Error detection	Switch	65.0	41
	Value	87.0	51
	Delay time	89.0	51
Position error Warning detection	Value	363.0	85
	Delay time	365.0	85
Speed error Error detection	Switch	65.1	41
	Value	90.0	51
	Delay time	91.0	51
Encoder pulse output Error detection	Frequency upper limit	285.0	79
	Delay time	286.0	79
Encoder Overheat detection	Switch	259.0	76
	Value	267.0	77
Encoder Battery Voltage drop detection	Switch	259.1	76
	Value	268.0	77
Voltage dip Detection	Delay time	305.0	83

RS-485 Communications

COMM COM

Name	No.	☞
Switch	8.0	35
Address	4.0	34
Communication speed	6.0	34
Stop bit	6.1	35
Parity	6.2	35
Minimum response time	11.0	35

Drive Limit Switch inputs

COMM PLS CTRL

Name	No.	☞
Setup	67.0	43
Deceleration method	67.1	43
Idling status	67.2	43
Retaining position Error counter	67.3	43

Emergency Stop

COMM STOP

Name		No.	☞
Warning output	Switch	225.0	69
	Timing	225.1	69

Deceleration Stop

COMM STOP

Name		No.	☞
Upon Servo Off	Method	224.0	68
	DBRK output after stopping	224.3	69
When alarm is on	Method	233.0	73
	DBRK output after stopping	233.3	74
Release conditions		224.1	68
Operating time		226.0	70
Cancellation speed		227.0	70
Upon control power failure	Switch	224.2	69
	Operating time	228.0	70
Torque command limit		151.0	64
Status during coast to stop		232.1	71
Short brake operation after a stop		232.2	72
Brake engagement	Timing	232.3	72
	Delay time	234.0	74
	Rotational speed	235.0	74

Quick Stop

COMM STOP

Name		No.	☞
Smoothing filter	Switch	225.2	69
	Moving average counter	229.0	71
Extension Time		236.0	75
Deceleration time		239.0	75

Position Command Filter

IN-POS PLS SUPP

Name		No.	☞
Filter 1	Selection	66.0	42
	Smoothing 1 Moving average counter	80.0	48
	Notch frequency	74.0	46
	Notch width	75.0	46
	High frequency gain	76.0	46
	Notch depth	79.0	47
Filter 2	Selection	82.0	49
	Notch frequency	83.0	49
	Notch width	84.0	50
	High frequency gain	85.0	50
	Notch depth	86.0	50
Filter 3	Selection	82.1	49
	Notch frequency	357.0	84
	Notch width	358.0	84
	High frequency gain	359.0	84
	Notch depth	360.0	84
Filter 4	Selection	66.1	42
	Smoothing 2 Moving average counter	81.0	48

Torque Command Filter

COMM SUPP

Name		No.	☞
Low-pass filter	Switch	160.0	64
	Auto setting	160.2	65
	Time constant	162.0	65
Notch filter	Switch	160.1	64
	Frequency	168.0	66
	Width	169.0	66
	Depth	170.0	66
Notch filter 2	Switch	160.3	65
	Frequency	171.0	67
	Width	172.0	67
	Depth	173.0	67

5. Parameters

Position Control Mode

Pulse Train Command

PLS MODE CTRL

Name		No.	☞
Input pulse form		32.0	36
Rotational direction		32.1	37
Input logic		32.3	37
Pulse ratio	Interpolation	32.2	37
	Numerator	34.0	38
	Denominator	36.0	38
Input filter		33.0	37
Feed forward delay compensation		66.3	42

Positioning Complete

PLS CTRL

Name		No.	☞
Determination method		64.0	41
Detection criteria	Range	68.0	44
	Speed	69.0	44
	Command Input	70.0	45
Detection delay time		71.0	45

Homing

PLS IN-POS HOME

Name		No.	☞
Re-detection of home position sensor		645.3	90
Direction		646.0	91
Sensor polarity		646.1	92
Timeout	Switch	646.2	92
	Time	659.0	95
Torque command limit	Switch	647.0	93
	Value	656.0	95
Time to detect press stopper		655.0	95
Creep speed switch		647.1	93
Rapid speed		648.0	94
Creep speed		649.0	94
Acceleration/Deceleration time		650.0	94
Amount of home position shift		651.0	94
Home position data		653.0	95
Z-phase disabled distance		657.0	95
Home reference signal selection		645.0	89
Encoder Z-phase selection		645.1	89

Internal Position

IN-POS MODE CTRL

Name		No.	☞
Pulse ratio	Interpolation	32.2	37
	Numerator	34.0	38
	Denominator	36.0	38
Feed forward delay compensation		66.3	42
Operation mode		642.0	88
Overflow detection		643.0	88
Point table	Point number Output method	644.0	89
	Motion of point No.0	646.3	92
	Command method	720.0 ~	96
	Operation	720.1 ~	96
	Enable/Disable	720.3 ~	96
	Position	722.0 ~	96
	Rotational speed	724.0 ~	97
	Acceleration time	726.0 ~	97
	Deceleration time	727.0 ~	97
	Dwell time	728.0 ~	97
	Positioning completion	729.0 ~	97

Position Control Mode: Tuning

PLS IN-POS TUNE

Name		No.	☞
Inertia ratio		102.0	52
Damping ratio		103.0	52
Mode switch		110.0	53
Tuning items		110.1	53
Inertia ratio upper limit		106.0	52
Control gain set	Automatic switch	120.0	59
	Upper Limit	120.1	59
	Tuning constant	121.0	60
Control gain set		113.0	54
Inertia conditions		113.1	55
Control level		114.0	56
Control gain 1		115.0	57
Control gain 2		116.0	57
Gain FF compensation 1		117.0	58
Gain FF compensation 2		118.0	58
Integral gain		119.0	59
Current control gain		193.0	68

Velocity Control Mode

Analog Velocity Command

VEL CTRL SUPP

Name			No.	☞
Offset	Tuning method		62.2	40
	value		60.0	40
Rotational direction			62.0	40
Input filter	Switch		62.1	40
	Numerator		48.0	38
	Denominator		49.0	38
Input gain	Numerator		50.0	39
	Denominator		51.0	39
Speed limit	CCW	Numerator	52.0	39
		Denominator	53.0	39
	CW	Numerator	54.0	39
		Denominator	55.0	39
Smoothing filter	Switch		77.0	47
	Moving average time		78.0	47

Internal Velocity

IN VEL MODE CTRL

Name		No.	☞
Command method		388.0	86
Acceleration time		390.0	86
Deceleration time		391.0	86
Target speed 1 to 8		392.0 ~	87
Smoothing filter	Switch	77.0	47
	Moving average time	78.0	47

Velocity Control Mode: Tuning

VEL IN VEL TUNE

Name		No.	☞
Inertia ratio		102.0	52
Damping ratio		103.0	52
Tuning	Mode switch	110.0	53
	Items	110.1	53
Control gain set		129.0	60
Control level		130.0	61
Control gain 1		131.0	61
Gain FF compensation 1		132.0	62
Integral gain		133.0	62
Current control gain		193.0	68

Torque Control Mode

Analog Torque

TRQ CTRL

Name			No.	☞
Offset	Tuning method		302.2	83
	Value		300.0	82
Direction of rotation			302.0	82
Input filter	Switch		302.1	82
	Numerator		288.0	80
	Denominator		289.0	80
Input gain	Numerator		290.0	80
	Denominator		291.0	80
Torque limit	CCW	Numerator	292.0	81
		Denominator	293.0	81
	CW	Numerator	294.0	81
		Denominator	295.0	81
Speed Limit			152.0	64

Torque Control: Tuning

TRQ TUNE

Name	No.	☞
Inertia ratio	102.0	52
Damping ratio	103.0	52
Control level	130.0	61
Control gain 1	131.0	61
Gain FF compensation 1	132.0	62
Integral gain	133.0	62
Current control gain	193.0	68

2. Details of Parameters

No. 2.0	Control mode	Settings	Default	Characteristics
		0 to 2	0	COMM MODE AB ⏻ 2 BYTE

Function Use

Select Control Mode

Settings	Control Mode
0	Position Control Mode
1	Velocity Control Mode
2	Torque Control Mode

Related To No. 3.0, No. 642.0

No. 3.0	Command mode	Settings	Default	Characteristics
		0 to 3	1	COMM MODE AB ⏻ 2 BYTE

Function Use

Select Command Mode

Control Mode Settings	0: Position	1: Velocity	2: Torque
1: Pulse train command input	Yes	–	–
2: Analog command	–	Yes	Yes
3: Internal command	Yes	Yes	–

Related To No. 3.0, No. 642.0

No. 4.0	RS-485 communication: Address	Settings	Default	Characteristics
		1 to 32	1	COMM COM AB ⏻ 2 BYTE

Function Use Specify the address of the RS-485 communication.

Remark Set this parameter to a unique address for each drive.

Related To No. 6.0, No. 6.1, No. 6.2, No. 8.0, No. 11.0

No. 6.0	RS-485 communication: Communication speed	Settings	Default	Characteristics
		0 to 5	5	COMM COM AB ⏻ 2 BYTE

Function Use

Specify the communications speed for the RS-485 communication.

Settings	Communications Speed [bps]
0	2,400
1	4,800
2	9,600
3	19,200
4	38,400
5	57,600

Related To No. 4.0, No. 6.1, No. 6.2, No. 8.0, No. 11.0

No. 6.1	RS-485 communication: Stop bit	Settings	Default	Characteristics
		0, 1	0	COMM COM AB ⏻ 2 BYTE

Function Use

Specify the stop bit of the RS-485 communication.

Settings	Stop bit
0	1-bit
1	2-bit

Related To	No. 4.0, No. 6.0, No. 6.2, No. 8.0, No. 11.0

No. 6.2	RS-485 communication: Parity	Settings	Default	Characteristics
		0 to 2	0	COMM COM AB ⏻ 2 BYTE

Function Use

Configure the parity of RS-485 communication.

Settings	Parity
0	None
1	Even
2	Odd

Related To	No. 4.0, No. 6.0, No. 6.2, No. 8.0, No. 11.0

No. 8.0	RS-485 communication: Enable Switch	Settings	Default	Characteristics
		0, 1	0	COMM COM ON OFF ⏻ 2 BYTE

Function Use

Enable/Disable RS-485 communication.

Settings	RS-485 communication
0	Disable
1	Enable

Remark	Select 0 if you are not using RS-485 communication.
Related To	No. 4.0, No. 11.0

No. 9.0	Operation mode	Settings	Default	Characteristics
		0, 1	0	COMM MODE AB - 2 BYTE

Function Use

Select I/O (CN1 connector) or Digitax SF Connect (communication) as I/O signal input source.

Use this parameter to clear an alarm by using Digitax SF Connect

Input source Settings	I/O (CN1 Connector)	Digitax SF Connect (communication)
0	Enable	Disable
1	Disable	Enable

Remark	This item will be back to the default when the control power turns off. You can set this item only with Digitax SF Connect, not with the Setup Panel.

No. 11.0	RS-485 communication: Minimum response time	Range	Default	Characteristics
		0 to 255	3 [ms]	COMM COM 0 100 ⏻ 2 BYTE

Function Use

Use this item to adjust the response time from the drive to meet the communication specifications of the host control device.

Related To	No. 4.0, No. 8.0

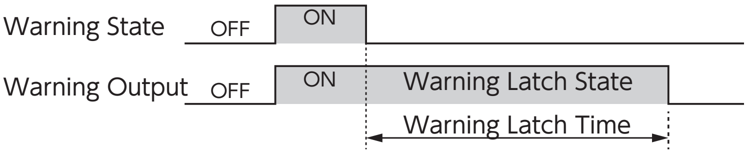
No. 12.0	Warning latch time	Range	Default	Characteristics
		0 to 200	1 [50 ms]	COMM MODE AB – 2 BYTE

Function Use

Specify the length of latch time for warning output.

Setting	Description
0	No limit
1 to 200	Latching Time = (Setting Value) × 50[ms]

Warning Output time = Warning State time + Warning Latch time



Close RESET to release the alarm latch and turn the warning off.

Related To: No. 225.0, No. 225.1

No. 13.0	Alarm output timing	Settings	Default	Characteristics
		0, 1	0	COMM CTRL AB – 2 BYTE

Function Use

Specify when to output an alarm.

Settings	Output
0	After the motor decelerates to stop
1	Immediately after an alarm occurs

Remark

If **Deceleration Stop: Method (when alarm is on)** (No.233) = 0 (coast to stop), the alarm signal will be output regardless of this parameter setting.

No. 32.0	Pulse train command: Input pulse form	Settings	Default	Characteristics
		0 to 2	0	PLS MODE AB ⏻ 2 BYTE

Function Use

Select the input signal form of Pulse Train Command.

Settings	Input Form
0	Pulse and Direction
1	Quadrature phase difference pulse (A-Phase/ B-Phase)
2	Positive pulse and Negative pulse (CCW/CW)

Prerequisite: Position Control Mode

Related To: No. 2.0, No. 3.0, No. 32.1, No. 32.3, No. 33.0, No. 642.0

5. Parameters

No.	Pulse train command	Settings	Default	Characteristics
No. 32.1	Pulse train command: Rotational direction	0, 1	1	PLS CTRL A B ⏻ 2 BYTE

Function Use

Specify the rotational direction of pulse train command.

Settings	Direction of Rotation
0	CCW rotation if negative direction command
1	CCW rotation if positive direction command

Related To No. 2.0, No. 3.0, No. 32.1, No. 32.3, No. 33.0, No. 642.0

No.	Pulse train command	Settings	Default	Characteristics
No. 32.2	Pulse train command: Interpolation with pulse ratio	0, 1	1	PLS CTRL ON OFF ⏻ 2 BYTE

Function Use

Enable/Disable the interpolation to smooth a command where Command Pulse Ratio is set.

Settings	Interpolation with pulse ratio
0	Disable
1	Enable

Related To No. 32.0, No. 34.0, No. 36.0

No.	Pulse train command	Settings	Default	Characteristics
No. 32.3	Pulse train command: Input logic	0, 1	1	PLS CTRL A B ⏻ 2 BYTE

Function Use

Select a logic of how to input Pulse Train Command.

Settings	Input Logic
0	**Positive logic:** Count at the time of rising edge (low to high)
1	**Negative logic:** Count at the time of falling edge (high to low)

Remark For pulse and direction, change the setting of this parameter will reverse the direction signal (DIR) logic.

Related To No. 32.0, No32.1

No.	Pulse train command	Settings	Default	Characteristics
No. 33.0	Pulse train command: Input filter	0 to 15	4	PLS CTRL 0 100 ⏻ 2 BYTE

Function Use

It helps to reduce possibility of malfunctions caused by noise.
This parameter has to be set when Pulse train command input is open collector.

Select a value according to pass-through pulse width (max frequency) of pulse train input. If a value selected did not eliminate the malfunction, select a higher value.

( ) recommended when Input

Settings	Pass-Through Pulse Width [ns]	Settings	Pass-Through Pulse Width [ns]
0	No filter	8	600 (500 kHz)
1	25	9	800
2	50 (4 MHz)	10	1,000
3	100	11	1,200
4	150 (2 MHz)	12	1,600 (250 kHz)
5	200	13	2,000
6	300 (1 MHz)	14	2,300
7	400	15	3,100

Related To No. 3.0, No. 32.0

☞ 9 Appendices

5. Parameters

		Range	Default	Characteristics
No. 34.0	Pulse train command: **Ratio (numerator)**	1 to 65,535	1,000 [pulse/rev]	PLS CTRL 0 100 ⏻ 4 BYTE
No. 36.0	Pulse train command: **Ratio (denominator)**	1 to 65,535		

Function Use

Use these two parameters to set the multiplier and divider for the position command pulse.

When the pulse count per rotation of host command is not equal to its counterpart of motor, select one of the following for (numerator)/(denominator).

(numerator) = (motor pulse count per rotation) /4=32,768
(denominator) = (host command pulse count per rotatio) /4

$$\frac{\boxed{34.0}}{\boxed{36.0}} = \frac{\text{motor pulse count per rotation}}{\text{host command pulse count per rotation}} = \frac{\text{motor pulse count per rotation } \mathbf{/\ 4}}{\text{host command pulse count per rotatio } \mathbf{/\ 4}}$$

Setting Example unit: [pulse/rev]

A Host Command Pulse count per rotation	B No. 34.0	C (= A × 1/4) No. 36.0
16,384	32,768 (=131,072 (*) ÷ 4)	4,096
10,000		2,500
4,096		1,024
4,000		1,000

*) 131,072 is the pulse count per rotation of the motor.
The default setting values are assumed 131072 pulses of the host command pulse number per a rotation.

Remark

Range of Pulse Ratio (numerator/denominator)
- Pulse train command: x0.001 to x1,000
- Internal Position Command: x1 to x1,000

Related To No. 276.0, No. 278.0

		Range	Default	Characteristics
No. 48.0	Analog velocity: **Input filter (numerator)**	0 to 65,535	16,000	VEL CTRL 0 100 ⏻ 2 BYTE
No. 49.0	Analog velocity: **Input filter (denominator)**	1 to 65,535	65,535	

Function Use

These two parameters are used to configure a low-pass filter, which suppresses the noise component of analog velocity command input.

Setting	Noise Resistance	Command Response
small	strong	slow
large	weak	fast

Prerequisite Analog Velocity: Input filter switch (No.62.1) = 1 (Enable)

Remark The ratio of No.288.0 (numerator) to No.289.0 (denominator) must not be higher than 1.
If the ratio = 1, filtering will not take effect.

Related To No. 62.1

		Range	Default	Characteristics
No. 50.0	Analog velocity: Input gain (numerator)	0 to 65,535	Maximum Rotational Speed of Motor	VEL CTRL 0 100 ⏻ 2 BYTE
No. 51.0	Analog velocity: Input gain (denominator)	1 to 65,535		
Function Use	Analog velocity command Input Gain. Set the value of a rotational speed corresponding to input voltage. When (numerator/denominator) = 1/2, a motor rotational speed is a half of maximum command input voltage (± 10 V). The motor rotational speed is max (± 10 V) when (numerator/denominator) = 1. By using this gain, you can adjust the position proportional gain of the host controller.			

		Range	Default	Characteristics
No. 52.0	Analog velocity: CCW speed limit (numerator)	0 to 65,535	Maximum Rotational Speed of Motor	VEL CTRL 0 100 ⏻ 2 BYTE
No. 53.0	Analog velocity: CCW speed limit (denominator)	1 to 65,535		
Function Use	Analog velocity command: CCW speed limit.			

$$\text{CCW Speed Limit} = \text{Maximum rotational speed} \times \frac{\boxed{52.0}}{\boxed{53.0}}$$

		Range	Default	Characteristics
No. 54.0	Analog velocity: CW speed limit (numerator)	0 to 65,535	Maximum Rotational Speed of Motor	VEL CTRL 0 100 ⏻ 2 BYTE
No. 55.0	Analog velocity: CW speed limit (denominator)	1 to 65,535		
Function Use	Analog velocity command: CW speed limit.			

$$\text{CW Speed Limit} = \text{Maximum rotational speed} \times \frac{\boxed{54.0}}{\boxed{55.0}}$$

Maximum Rotational Speed of Motor

Motor Model	Maximum rotational speed [rpm]
MM500, MY500, MM101, MY101, MX201, MZ201, MX401, MZ401, MX751, MZ751,	6,000
MA201, MH201, MA401, MH401	5,000
MA751, MH751	4,500
MM102, MH102, MM152, MH152, MM202	3,000

<table>
<tr><td rowspan="2">No. 60.0</td><td rowspan="2">Analog velocity:
Offset value</td><th>Range</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>− 32,768 to +32,767</td><td>0</td><td>VEL CTRL 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the offset value when Analog velocity: offset tuning method (62.2) = 1 (manual).

Connect power for the analog command, having the input voltage of 0 V, and adjust this parameter such that the rotational speed becomes 0 rpm.

1. For CCW rotations, set this parameter to a negative number, and for CW rotations, set to a positive number.
2. If the actual rotational speed is beyond the ± 10 rpm range, set this parameter to ± 50 and check the motor motion.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Analog velocity: Offset tuning method (62.2) = 1 (manual)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 62.2</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 62.0</td><td rowspan="2">Analog velocity:
Rotational direction</td><th>Settings</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0, 1</td><td>1</td><td>VEL CTRL A B ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Select the rotational direction of analog speed pulse train input.

<table><tr><th>Settings</th><th>Negative Voltage Input</th><th>Positive Voltage Input</th></tr><tr><td>0</td><td>CCW Rotation</td><td>CW Rotation</td></tr><tr><td>1</td><td>CW Rotation</td><td>CCW Rotation</td></tr></table></td></tr>
</table>

<table>
<tr><td rowspan="2">No. 62.1</td><td rowspan="2">Analog velocity:
Input filter enable switch</td><th>Settings</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0, 1</td><td>1</td><td>VEL CTRL ON OFF ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Enable/Disable Input filter for Analog Velocity Command.

This filter is a first-order IIR filter. Use it if there is too much noise in analog command.
<table><tr><th>Settings</th><th>Filter</th></tr><tr><td>0</td><td>Disable</td></tr><tr><td>1</td><td>Enable</td></tr></table></td></tr>
</table>

<table>
<tr><td rowspan="2">No. 62.2</td><td rowspan="2">Analog velocity:
Offset tuning method</td><th>Settings</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0, 1</td><td>1</td><td>VEL CTRL A B ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Select either auto or manual method for offset tuning of Analog Velocity Command.

For manual adjustment, use the parameter Analog velocity: offset value (60.0) for tuning.
<table><tr><th>Settings</th><th>Offset tuning method</th></tr><tr><td>0</td><td>Auto:
Select this to automatically adjust the offset value, such that the speed command becomes 0 rpm with the input voltage at the time of servo on.</td></tr><tr><td>1</td><td>Manual:
Select this to manually adjust the offset value, such that the speed command becomes 0 rpm with 0V input voltage.</td></tr></table></td></tr>
<tr><td>Related To</td><td colspan="4">No. 60.0</td></tr>
</table>

5. Parameters

No. 64.0	Positioning complete: Determination method	Settings	Default	Characteristics
		0, 1	0	PLS CTRL AB ⏻ 2 BYTE

Function Use

Select one of two methods to output the Positioning Complete signal.

Settings	Signal Output Conditions			Parameter settings
	Position Error	Speed	Pulse Train command input	
0	○	○	–	Detection criteria - Range (68.0) - Speed (69.0)
1	○	○	○	Detection criteria - Range (68.0) - Speed (69.0) - command input (70.0)

Related To No. 68.0, No. 69.0, No. 70.0, No. 71.0

No. 65.0	Position error detection: Select switch	Settings	Default	Characteristics
		0 to 3	1	PLS ALM AB – 2 BYTE

Function Use

Specify what to output when excessive position error is detected.

Settings	Output selection
0	No detect (No output)
1	Alarm output
2	Warning output
3	Alarm and Warning output

When using Torque command limit, select 0 (No output) so that an alarm will not occur in a torque limit state.

Related To No. 87.0, No. 89.0, No. 363.0, No. 365.0

No. 65.1	Speed error detection: Enable switch	Settings	Default	Characteristics
		0, 1	1	COMM ALM ON OFF – 2 BYTE

Function Use

Enable/Disable Speed Error Detection.

Settings	Speed error detection
0	Disable
1	Enable

When using Torque command limit, select “Disable” so that an alarm will not occur during limiting.

Related To No. 90.0, No. 91.0

5. Parameters

No. 66.0	Position command filter 1: **Select switch**	Settings	Default	Characteristics
		0 to 3	0	PLS SUPP ON OFF ⏻ 2 BYTE

Function Use

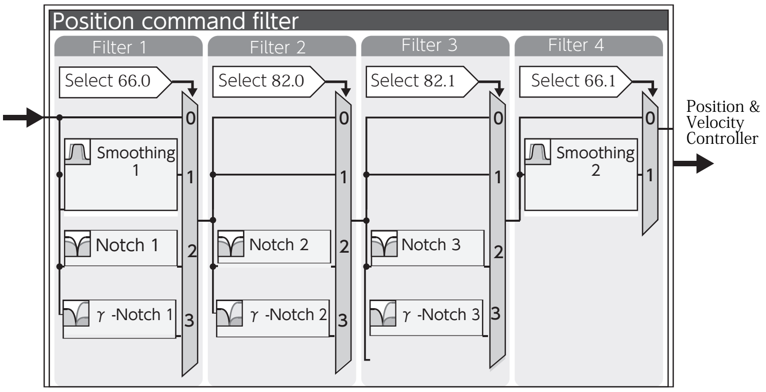
Select no filter or one of the three filters:

Settings	Filter Type
0	None
1	Smoothing 1
2	Notch
3	γ-Notch

Remark	If you are to use Smoothing 1, try Filter 4 (Smoothing 2) first.
Related To	No. 80.0, No. 74.0, No. 75.0, No. 76.0, No. 79.0

☞ 7 Tuning

Up to four levels of Position command filter are available.



Block Diagram of Position Command Filter (Details)

No. 66.1	Position command filter 4: **Enable Switch**	Settings	Default	Characteristics
		0, 1	1	PLS SUPP ON OFF ⏻ 2 BYTE

Function Use

Enable/Disable Position command Smoothing Filter 2 for Filter 4.

Settings	Filter
0	Disable
1	Enable

Remark	If you are to use Smoothing 1, try Filter 4 (Smoothing 2) first.
Related To	No. 81.0

☞ 7 Tuning

No. 66.3	Pulse train command: **Feed forward delay compensation**	Settings	Default	Characteristics
		0, 1	1	PLS CTRL ON OFF ⏻ 2 BYTE

Function Use

Enable/Disable Feed Forward Delay Compensation in Position Control Mode.

Settings	Feed forward delay compensation
0	Disable
1	Enable

Remark	Usually, set 1 (enable) You can set this item only with Digitax SF Connect, not with the Setup Panel.

No. 67.0	Drive limit switch input: **Setup**	Settings	Default	Characteristics
		0 to 3	0	COMM CTRL A B ⏻ 2 BYTE

Function Use

By installing sensors at the ends of linear motion, you can restrict the drive within the motion range.

When “enable” is selected for this parameter, starting the motor will be blocked by I/O input ON.

Settings	CW Drive limit switch input	CCW Drive limit switch input
0	Disable	Disable
1	Enable	Disable
2	Disable	Enable
3	Enable	Enable

Related To No.67.1, No. 67.2, No. 67.3

		Settings	Default	Characteristics
No. 67.1	Drive limit switch input: **Deceleration method**	0 to 2	1	COMM CTRL A B ⏻ 2 BYTE
No. 67.2	Drive limit switch input: **Idling status**	0, 1	0	

Function Use

Select the deceleration method upon drive limit switch input and specify the idling state after the motor stopped its motion.

Use one of the following four combinations.

Possible Combinations	Deceleration method (67.1)	Idling status (67.2)
1	0: Coast to stop	0: Coast to stop
2	1: Short Brake	
3	2: Quick Stop	1: Zero Clamp
4		0: Coast to stop

Prerequisite Drive limit switch input: Setup (67.0) = 1, 2 or 3 (Enable)

Related To No.67.0, No. 67.3

No. 67.3	Drive limit switch input: **Retaining position error counter**	Settings	Default	Characteristics
		0, 1	0	PLS CTRL A B ⏻ 2 BYTE

Function Use

Motor's stopping upon drive limit switch input results in position error from the input pulse.
Use this parameter to select either keep or clear that position error.

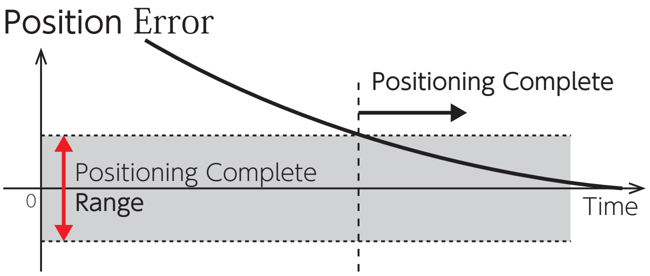
Settings	Position Error Counter
0	Keep
1	Clear

Related To No.67.0, No.67.1, No. 67.2

No. 68.0	Positioning complete: Detection criteria - Range	Range	Default	Characteristics
		0 to 32,767	40 [encoder pulse]	PLS CTRL 0 100 ⏻ 2 BYTE

Function Use

Set the value for a pulse range (position error) to determine Positioning Complete.



When positioning is complete, the signal POSIN (positioning complete) will be output to the host controller.

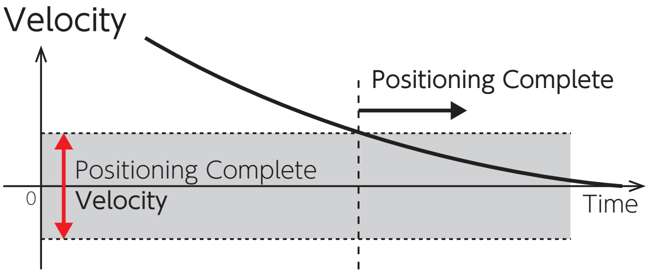
Related To	No. 64.0, No. 69.0, No. 70.0, No. 71.0

No. 69.0	Positioning complete: Detection criteria - Speed	Range	Default	Characteristics
		0 to 32,767	(See below)	PLS CTRL 0 100 ⏻ 2 BYTE

Function Use

Set the upper limit for a speed to determine Positioning Complete.

Motor Capacity	Default	Units	Conversion to Rotational Speed
50 W to 750 W	2	pulse/160 µs	5.72 [rpm]
1 kW to 2 kW	2	pulse/200 µs	4.58 [rpm]



When positioning is complete, the signal POSIN (positioning complete) will be output to the host controller.

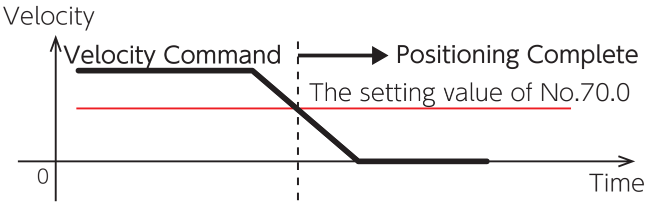
Related To	No. 64.0, No. 68.0, No. 70.0, No. 71.0

No. 70.0	Positioning complete: Detection criteria - Command Input	Range	Default	Characteristics
		0 to 32,767	(See below)	PLS, CTRL, 0 100, ⏻, 2 BYTE

Function Use

Set the value for a pulse train command input (Speed) to determine Positioning Complete.

Motor Capacity	Default	units[encoder pulse]	Conversion to Rotational Speed
50 W to 750 W	0	pulse/160 μs	0 [rpm]
1 kW to 2 kW	0	pulse/200 μs	0 [rpm]



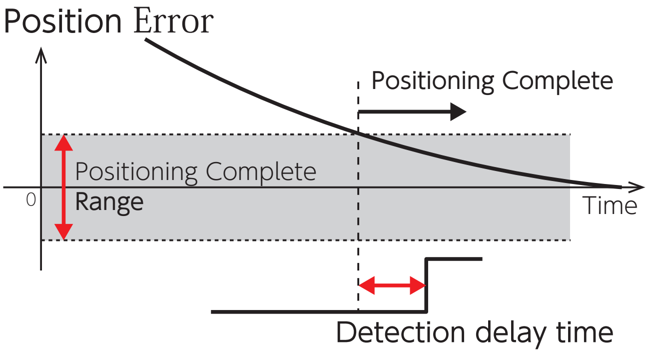
When positioning is complete, the signal POSIN (positioning complete) will be output to the host controller.

No. 71.0	Positioning complete: Detection delay time	Range	Default	Characteristics
		0 to 65,000	(See below)	PLS, CTRL, 0 100, ⏻, 2 BYTE

Function Use

Specify the delay time to output Positioning Complete signal (POSIN) to the host controller after Positioning Complete conditions are met.

Motor Capacity	Default	Units	Conversion to Time
50 W to 750 W	20	160 μs	3.2 [ms]
1 kW to 2 kW	16	200 μs	3.2 [ms]



Related To: No. 64.0, No. 68.0, No. 69.0, No. 70.0

5. Parameters

<table>
<tr><td rowspan="2">No. 74.0</td><td rowspan="2">Position command filter 1:
Notch frequency</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>10 to 2,000</td><td>10
[0.1 Hz]</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the notch frequency for Position command filter 1.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 1: Type (66.0) = 2 (Notch) or 3 (γ-Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 66.0, No. 75.0, No. 76.0, No. 79.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 75.0</td><td rowspan="2">Position command filter 1:
Notch width</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>128 to 2,048</td><td>512</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the width of notch of Position Command Filter 1.
<table>
<tr><th>Setting</th><th>Notch Width</th></tr>
<tr><td>smaller</td><td>narrower</td></tr>
<tr><td>larger</td><td>wider</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 1: Type (66.0) = 2 (Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 66.0, No. 74.0, No. 79.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 76.0</td><td rowspan="2">Position command filter 1:
High frequency gain</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>50 to 200</td><td>100</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the high frequency gain of Position Command Filter1.
<table>
<tr><th>Setting</th><th>Effect</th></tr>
<tr><td>50</td><td>x0.25</td></tr>
<tr><td>100</td><td>x1</td></tr>
<tr><td>200</td><td>x4</td></tr>
</table>
Smaller setting value gives better vibration suppression.
Larger setting value gives faster motion.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 1: Type (66.0) = 3 (γ-Notch).</td></tr>
<tr><td>Related To</td><td colspan="4">No. 66.0, No. 74.0, No. 79.0</td></tr>
</table>

☞ 7 Tuning

		Settings	Default	Characteristics
No. 77.0	Velocity command: Smoothing filter - Enable Switch	0, 1	512	VEL SUPP ON OFF ⏻ 2 BYTE IN VEL

Function Use

Enable/Disable Speed Command Smoothing Filter in Velocity Control Mode.

This function enables the user to smooth the motion during high deceleration/acceleration from Speed Command. In addition, this smoothing filter can be used as a countermeasure against noise in Analog Velocity Command Mode.

Settings	Filter
0	Disable
1	Enable

Related To	No. 78.0

		Range	Default	Characteristics
No. 78.0	Velocity command: Smoothing filter - Moving average time	1 to 1,000	100 [ms]	VEL SUPP 0 100 ⏻ 2 BYTE IN VEL

Function Use

Set the value for Speed Command Smoothing Filter-Moving Average Time in Velocity Control Mode.

however, this will result in a delayed response.

Prerequisite	Velocity command: Smoothing filter switch (77.0) = 1 (Enable)
Related To	No. 77.0

		Range	Default	Characteristics
No. 79.0	Position command filter 1: Notch depth	0 to 100	0	PLS SUPP 0 100 ⏻ 2 BYTE

Function Use

Set the notch depth of Position command filter 1.

Setting	Notch Depth
0	complete shutoff of notch frequency input
100	100 % pass-through

Smaller setting value gives deeper filter.
Larger setting value gives shallower filter.

Prerequisite	Position command filter 1: Type (66.0) = 2 (Notch) or 3 (γ-Notch)
Related To	No. 66.0, No. 74.0, No. 75.0, No. 76.0

5. Parameters

		Range	Default	Characteristics
No. 80.0	Position command filter 1: **Smoothing 1 - Moving average counter**	1 to 6,250	(See below)	PLS SUPP 0 100 ⏻ 2 BYTE
No. 81.0	Position command filter 4: **Smoothing 2 - Moving average counter**	1 to 1,250		

Function Use

These items are used to smooth the speed changes during high deceleration/ acceleration, and can be used to suppress vibrations at settling time as well.

Use Filter 4 (Smoothing 2) first.
To increase the smoothing effect further, use Filter 1 (Smoothing 1).

A larger value makes acceleration and deceleration smoother, but the response will become slower.
See the table below for the delay time calculation formula.
Filter 4 (Smoothing 2) suppress the vibrations caused by the Gain FF compensation 2.

Motor Capacity	Delay time Calculation Formula	
50 W to 750 W	0.16 ms	× (moving average count) = delay time
1 kW to 2 kW	0.2 ms	

■ Setup of Vibration Suppression

Positioning will take longer as much as the delay time specified above. Set this item within the range acceptable to the equipment.
① Check the vibration interval in waveforms of position error and torque command at settling time.
② Calculate the moving average count as described below.
③ Using Filter 4 may reduce the resonant vibrations.
④ If suppression of the vibrations is not effective enough, recalculate the moving average count based on the vibration interval, and set it to Filter 1.

Motor Capacity	Moving average count and Vibration interval to compress	
50 W to 750 W	6,250	× (vibration interval [s]) = Moving average count
1 kW to 2 kW	5,000	

Default

Motor Capacity	Filter 1	Filter 4
50 W to 750 W	25	10
1 kW to 2 kW	20	10

The default value of Position command filter 1: Type (66.0) is 0 (no filter).

Prerequisite

Position command filter 1: Selection (66.0) = 1 (Smoothing 1)
Position command filter 4: Selection (66.1) = 1 (Enable)

Remark

Before setting this parameter, wait at least 3 secs after the motor stops. In addition, configure it when the command pulse is not present.

Setting this parameter during pulse input or presence of residual pulse could cause positioning failure.
The larger the setting is, the longer the delay time from command input will be.

Related To

No. 66.0, No. 66.1

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No. 82.0	Position command filter 2: **Selection**	Settings	Default	Characteristics
		0 to 3	0	PLS SUPP A B ⏻ 2 BYTE

Function Use

Set the Position Command Filter 2.

Settings	Filter Type
0	None
1	Reserved (Do not use)
2	Notch
3	γ-Notch

Related To	No. 83.0, No. 84.0, No. 85.0, No. 86.0

☞ 7 Tuning

No. 82.1	Position command filter 3: **Selection**	Settings	Default	Characteristics
		0 to 3	0	PLS SUPP A B ⏻ 2 BYTE

Function Use

Set Position Command Filter 3.

Settings	Filter Type
0	None
1	Reserved (Do not use)
2	Notch
3	γ-Notch

Related To	No. 357.0, No. 358.0, No. 359.0, No. 360.0

☞ 7 Tuning

No. 83.0	Position command filter 2: **Notch frequency**	Range	Default	Characteristics
		10 to 2,000	10 [0.1Hz]	PLS SUPP 0 100 ⏻ 2 BYTE

Function Use	Set the notch frequency for Position command filter 2.
Prerequisite	Position command filter 2: Select (82.0) = 2 (Notch) or 3 (γ-Notch)
Related To	No. 82.0, No. 84.0, No. 85.0, No. 86.0

☞ 7 Tuning

No. 84.0	Position command filter 2: Notch width	Range	Default	Characteristics
		128 to 2,048	512	PLS SUPP 0 100 ⏻ 2 BYTE

Function Use

Set the notch width of Position Command Filter 2.

Setting	Notch Width
smaller	narrower
larger	wider

Prerequisite	Position command filter 2: Select (82.0) = 2 (Notch)
Related To	No. 82.0, No. 83.0, No. 85.0, No. 86.0

No. 85.0	Position command filter 2: High frequency gain	Range	Default	Characteristics
		50 to 200	100	PLS SUPP 0 100 ⏻ 2 BYTE

Function Use

Set the high frequency gain for Position Command Filter 2.

Setting	Effect
50	x0.25
100	x1
200	x4

Smaller setting value gives better vibration suppression.
Larger setting value gives faster motion.

Prerequisite	Position command filter 2: Type (82.0) = 3 (γ-Notch)
Related To	No. 82.0, No. 83.0, No. 86.0

No. 86.0	Position command filter 2: Notch depth	Range	Default	Characteristics
		0 to 100	0	PLS SUPP 0 100 ⏻ 2 BYTE

Function Use

Specify the notch depth of Position Command Filter2.

Setting	Effect
0	complete shutoff of notch frequency input
100	100 % pass-through

Smaller setting value gives deeper filter.
Larger setting value gives shallower filter.

Prerequisite	Position command filter 2: Select (82.0) = 2 (Notch) or 3 (γ-Notch)
Related To	No. 82.0, No. 83.0, No. 84.0, No. 85.0

No. 87.0	Position error detection: **Value**	Range	Default	Characteristics
		0 to 2,147,483,647	196,608 [encoder pulse]	PLS ALM 0 100 – 4 BYTE

Function Use

This parameter sets a threshold value for a position error detection.

The higher the value, the less likely to detect position error.
(The initial value of 196,608 is equivalent to pulse count of rotor 1.5 rotations.)

Prerequisite	Position error detection: Switch (65.0) = 1 (Enable)
Related To	No. 65.0, No. 89.0

No. 89.0	Position error detection: **Delay time**	Range	Default	Characteristics
		0 to 32,767	(See below)	PLS ALM 0 100 – 2 BYTE

Function Use

This parameter sets a delay time for a position error (Alarm No.6) to be output after the position error exceeded the setting of [Position error detection value (87.0)]

The higher the value, the longer it takes for the error to be output.

Motor Capacity	Default	Converted to Time
50 W to 750 W	250 [160 µs]	40 [ms]
1 kW to 2 kW	200 [200 µs]	

Prerequisite	Position error detection: Switch (65.0) = 1 (Enable)
Related To	No. 65.0, No. 87.0

No. 90.0	Speed error detection: **Value**	Range	Default	Characteristics
		0 to 32,767	(See below)	COMM ALM 0 100 – 2 BYTE

Function Use

This parameter sets a threshold value for a speed error detection.

The higher the value, the less likely to detect a speed error.

Motor Capacity	Default	Speed Conversion
50 W to 750 W	524 [encoder pulse/160 µs]	1,499 [rpm]
1 kW to 2 kW	655 [encoder pulse/200 µs]	

Prerequisite	Speed error detection - Switch (65.1) = 1 (Enable)
Related To	No. 65.1, No. 91.0

No. 91.0	Speed error detection: **Delay time**	Range	Default	Characteristics
		0 to 32,767	(See below)	COMM ALM 0 100 – 2 BYTE

Function Use

This parameter sets a delay time for a speed error (Alarm No.5) to be detected after the speed error exceeded the setting of "Speed error - Detection value" (90.0).

The higher the value, the longer the error detection time.

Motor Capacity	Default	Converted to Time
50 W to 750 W	250 [160 µs]	40 [ms]
1 kW to 2 kW	200 [200 µs]	

Prerequisite	Speed error detection - Switch (65.1) = 1 (Enable)
Related To	No. 65.1, No. 90.0

<table>
<tr><td rowspan="2">No. 102.0</td><td rowspan="2">Tuning:
Inertia ratio</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>100 to 10,000</td><td>250
[%]</td><td>COMM TUNE 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Specify the ratio of the device load inertia to motor rotor inertia (moment of inertia).
$$\text{Inertia Ratio} = \frac{\text{(Load Inertia)} + \text{(Rotor Inertia)}}{\text{(Rotor Inertia)}} \times 100\ [\%]$$
Inertia ratio is estimated by auto-tuning. When estimation is difficult (for example, too large an inertia ratio or too large a torque value), you can enter a calculated value of load inertia.
If vibration occurs after deceleration or acceleration, increase the inertia ratio.</td></tr>
<tr><td>Remark</td><td colspan="4">The inertia ratio being too large or too small will cause noise.</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 103.0</td><td rowspan="2">Tuning:
Damping ratio</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>100 to 5,000</td><td>100
[%]</td><td>COMM TUNE 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">This parameter can be used for tuning to improve poor settling due to viscous friction, or too large an inertia ratio.
Increasing (or decreasing) this parameter value in event of overshoot (or undershoot respectively) may make the settling time shorter.
The value of this parameter is estimated along with inertia ratio simultaneously if **Tuning: Mode switching** (110.1) = 2.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position Control Mode, Velocity Control Mode</td></tr>
<tr><td>Related To</td><td colspan="4">No. 110.1</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 106.0</td><td rowspan="2">Tuning:
Inertia ratio upper limit</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>100 to 10,000</td><td>3,000
[%]</td><td>COMM TUNE 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the upper limit of the inertia ratio automatically adjusted in Quick Tuning.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">**Tuning: Control gain set - Automatic switch (120.0)** : 1 (Enable)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 110.1, No. 120.0</td></tr>
</table>

No. 110.0	Tuning: Mode switch	Settings	Default	Characteristics
		1, 2	2	COMM TUNE AB – 2 BYTE

Function Use

Select a tuning condition depending on the direction of load or the presence of unbalanced load.

Settings	Mode	Motion direction of the device connected to the motor
1	Standard	Horizontal axis force
2	Offset Load	Non-horizontal axis force

Use Offset Load Mode even for the case of axis force (horizontal motion)

Prerequisite Position Control Mode, Velocity Control Mode

☞ 7 Tuning

No. 110.1	Tuning: Items	Settings	Default	Characteristics
		0 to 2	0	COMM TUNE AB – 2 BYTE

Function Use

Select Start or Stop for tuning depending on your choice of items to be estimated.

Settings (Tuning)	Estimate items	
	Inertia ratio	Damping ratio
0 (stop)	no estimate	no estimate
1 (start)	estimate	
2 (start)		estimate

Prerequisite Position Control Mode, Velocity Control Mode

☞ 7 Tuning

5. Parameters

		Range	Default	Characteristics
No. 113.0	Tuning: **Position control mode - Control gain set**	5 to 45	15	PLS TUNE AB - 2 BYTE IN POS

Function Use

Select one control gain set for Position Control Mode.

Control Gain 1 (115.0), **Control Gain 2** (116.0), and **Integral Gain** (119.0) are set to the preset values of pairs.

Noise Solutions

① Use **Torque command filter: Notch filter** (such as 160.1).
② Decrease the value of **Integral Gain** (119.0).
③ Decrease the value of **Control Gain 2** (116.0).

If the above does not work, lower the Control Gain Set.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
5	slower	lower	longer	lower
↑	↑	↑	↑	↑
↓	↓	↓	↓	↓
45	faster	higher	shorter	higher

Prerequisite Position Control Mode

Remark

- Too large a value in this parameter may cause noise.
- The default value varies depending on the setting of **Position Control Mode - Inertia conditions** (113.1).
- If **Torque command filter: Low-pass filter - Auto setting** (160.2) = 1 (auto setting ON), then **Torque command filter: Low-pass filter - Time constant** (162.0) will be included in the gain set.

Related To No. 113.1, No. 114.0, No. 115.0, No. 116.0, No. 117.0, No. 118.0, No. 119.0, No. 162.0

☞ 7 Tuning

		Settings	Default	Characteristics
No. 113.1	Tuning: **Position control mode - Inertia conditions**	0 to 3	2	PLS TUNE AB – 2 BYTE IN POS

Function Use

Set the inertia conditions for Position Control Mode.

This parameter is used to determine the ratio of **Control Gain 1** (115.0) to **Control Gain 2** (116.0), which would be appropriate to equipment characteristics.

Settings	Description
1	Heavy-load equipment or equipment with substantial load fluctuation Equipment with low rigidity, robot arms, and so on
2	(medium setting) For example, general transport machines
3	Light-load equipment Equipment that demands high-speed operation or requires settling

Prerequisite	Position Control Mode
Related To	No. 113.0, No. 115.0, No. 116.0

☞ 7 Tuning

		Range	Default	Characteristics
No. 114.0	Tuning: Position control mode - Control level	5 to 45	15	PLS TUNE AB - 2 BYTE IN POS

Function Use

Set the Control Level of Position Control Mode.

With this parameter, both **Control Gain 1** (115.0) and **Control Gain 2** (116.0) can be set to pairs of preset values.
In Digitax SF Connect, set this parameter under the [Waveform Monitor] tab.

Noise Solutions

① Use **Torque command filter: Notch filter** (such as 160.1).
② Decrease **Position control mode - Integral gain** (119.0).
③ Decrease **Position control mode - Control gain 2** (116.0).

If any of the above does not work, decrease the Control Gain Set value.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
5	slower	lower	longer	lower
↑	↑	↑	↑	↑
↓	↓	↓	↓	↓
45	faster	higher	shorter	higher

Prerequisite	Position Control Mode
Remark	· Setting Control Level will invalidate the setting of **Control gain set** (113.0). · The specified values of **Control Gain 1** (115.0) and **Control Gain 2** (116.0) vary depending on **Inertia conditions** (113.1).
Related To	No. 113.0, No. 113.1, No. 115.0, No. 116.0

☞ 7 Tuning

No. 115.0	Tuning: Position control mode - Control gain 1	Range	Default	Characteristics
		5 to 1,000	50 [rad/s]	PLS TUNE A B – 2 BYTE IN POS
Function Use	Set Control Gain 1 for Position Control Mode. Increasing this parameter value reduces position errors after the command becomes zero. Increase it when the position error convergence at the time of settling is not good. Set a value smaller than the value of **Control Gain 2** (116.0).			
Prerequisite	Position Control Mode			
Remark	· Making a change to any of the following will also change other tuning parameters (such as **Control Gain 2**) to the prearranged parameter set all at once. **Control Gain Set** (113.0) **Inertia conditions** (113.1) **Control Level** (114.0) · To reduce the position error of the command being input, raise **Control Gain 2** (116.0).			
Related To	No. 113.0, No. 113.1, No. 114.0, No. 116.0, No. 117.0			

☞ 7 Tuning

No. 116.0	Tuning: Position control mode - Control gain 2	Range	Default	Characteristics
		80 to 5,000	200 [rad/s]	PLS TUNE 0 100 – 2 BYTE IN POS
Function Use	Set Control Gain 2 for Position Control Mode. Increasing this parameter value decreases the position error during command input. Increasing the parameter value provides faster command response; however, too large a value may result in noise. Set a value larger than the value of **Control Gain 1** (115.0). Noise Solutions ① Use **Torque command filter: Notch filter** (such as 160.1) ② Lower **Integral Gain** (119.0) If the above does not work, decrease the **Control Gain 2**.			
Prerequisite	Position Control Mode			
Remark	· Making a change to any of the following will also change other tuning parameters (such as **Control Gain 1**) to the prearranged parameter set all at once. **Control Gain Set** (113.0) **Inertia conditions** (113.1) **Control Level** (114.0) · To reduce position errors after the command becomes zero, increase the value of **Control Gain 1**(115.0).			
Related To	No. 113.0, No. 113.1, No. 114.0, No. 115.0, No. 118.0			

☞ 7 Tuning

No. 117.0	Tuning: Position control mode - Gain FF compensation 1	Range	Default	Characteristics
		0 to 15,000	10,000 [0.01 %]	PLS TUNE 0 100 – 2 BYTE IN POS
Function Use	Set the Feed Forward Compensation Rate (speed) with respect to [Control Gain 1 (115.0)] for Position Control Mode. Using this parameter is effective to shorten the settling time. Adjust this value after setting the following: Inertia ratio (102.0), Control gain set (113.0), Control level (114.0), Control gain 1 (115.0), Control gain 2 (116.0) Too high a value of this parameter will result in overshooting, and too low in undershooting. Set a relatively moderate value.			
Prerequisite	Position Control Mode			
Related To	No. 113.0, No. 115.0, No. 118.0			

☞ 7 Tuning

No. 118.0	Tuning: Position control mode - Gain FF compensation 2	Range	Default	Characteristics
		0 to 15,000	0 [0.01 %]	PLS TUNE 0 100 – 2 BYTE IN POS
Function Use	Set Feed Forward Compensation Rate (Torque) with respect to [Control Gain 2 (No.116.0)] for Position Control Mode. Using this value will reduce position errors during operation. Setting this item to around 10,000 will make the position errors during operation almost zero. Raise the value of this item only after reducing the position error, by using **Gain FF Compensation 1** (117.0) at settling. Noise Solutions Adjusting **Filter 4: Smoothing 2- Moving average counter** (81.0) may reduce the noise.			
Prerequisite	Position Control Mode			
Related To	No. 113.0, No. 116.0, No. 117.0			

☞ 7 Tuning

No. 119.0	Tuning: Position control mode - Integral gain	Range	Default	Characteristics
		45 to 5,000	160 [rad/s]	PLS TUNE 0 100 – 2 BYTE IN POS
Function Use	**Set the Integral Gain for Position Control mode.** Increasing the value of Integral Gain will improve the convergence (limited by friction or load fluctuation) at the time of settling, and reduce position errors. This will result in rigid and sensitive motion. Noise Solutions ① Use **Torque command filter: Notch filter** (such as 160.1). ② Decrease the value of **Integral Gain**			
Prerequisite	Position Control Mode			
Remark	This parameter will reset to the default if **Inertia conditions** (113.1) or **Control Gain Set** (113.0) is changed.			
Related To	No. 113.0			

☞ 7 Tuning

No. 120.0	Tuning: Control gain set – Automatic Enable switch	Settings	Default	Characteristics
		0, 1	0	PLS TUNE ON OFF – 2 BYTE IN POS
Function Use	**Enable/Disable Auto Tuning for Control Gain Set**			
Prerequisite	Position Control Mode			
Remark	Only Quick Tuning Mode with the Setup Panel. This parameter is not displayed in Digitax SF Connect.			
Related To	No. 106.0, No. 120.1			

Settings	Selection
0	Disable
1	Enable

No. 120.1	Tuning: Control gain set - Upper limit	Range	Default	Characteristics
		5 to 45	15	PLS TUNE 0 100 – 2 BYTE IN POS
Function Use	**Set the upper limit of Control Gain Set in Auto Tuning of Control Gain Set.**			
Prerequisite	Position Control Mode			
Related To	No. 106.0, No. 120.0			

5. Parameters

<table>
<tr><td rowspan="2">No. 121.0</td><td rowspan="2">Tuning:
Control gain set - Tuning constant</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>1 to 200</td><td>24</td><td>PLS TUNE 0 100 - 2 BYTE
IN POS</td></tr>
<tr><td>Function Use</td><td colspan="4">This parameter is used for Quick Tuning. Usually the default value is used.

It is a constant of proportionality to calculate (Control Gain 1 + Control Gain 2) based on the Inertia ratio setting value in their inverse proportionality.
Set it to a small value only if Quick Tuning has caused vibration in an extremely poor rigidity equipment.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position Control Mode
Tuning: Control gain set - Automatic switch (120.0) : 1 (Enable)</td></tr>
<tr><td>Remark</td><td colspan="4">This parameter is not displayed on the Setup Panel.</td></tr>
<tr><td>Related To</td><td colspan="4">No. 120.0</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 129.0</td><td rowspan="2">Tuning:
Velocity control mode - Control gain set</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>1 to 46</td><td>15</td><td>VEL TUNE 0 100 - 2 BYTE
IN VEL</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the Control Gain Set for Velocity Control Mode.
With this, Control gain 1 (131.0) and Integral gain (133.0) will be set to the default together.

Noise Solutions
① Use Torque command filter: Notch filter (such as 160.1)
② Decrease Integral gain (133.0)

If the above does not work, lower the Control Gain Set.

<table>
<tr><th>Setting</th><th>Command Response</th><th>Rigidity</th><th>Settling Time</th><th>Possibility of Noise</th></tr>
<tr><td>1</td><td>slower</td><td>lower</td><td>longer</td><td>lower</td></tr>
<tr><td>↑</td><td>↑</td><td>↑</td><td>↑</td><td>↑</td></tr>
<tr><td>↓</td><td>↓</td><td>↓</td><td>↓</td><td>↓</td></tr>
<tr><td>46</td><td>faster</td><td>higher</td><td>shorter</td><td>higher</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">Velocity Control Mode</td></tr>
<tr><td>Remark</td><td colspan="4">· Too large a value may result in noise.
· If Torque command filter: Low-pass filter constant (162.0) is set to 1 (auto setting ON), Torque command filter: Low-pass filter auto setting (160.2) will be included in the gain set.</td></tr>
<tr><td>Related To</td><td colspan="4">No. 131.0, No. 132.0, No. 133.0, No. 162.0</td></tr>
</table>

☞ 7 Tuning

No. 130.0	Tuning: Velocity control mode - Control level	Range	Default	Characteristics
		1 to 46	15	VEL TUNE A B - 2 BYTE IN VEL

Function Use

Specify the Control Level for Velocity Control Mode.

Sets **Control Gain 1** (131.0) to the preset value which was prepared for each required control level.

Noise Solutions

① Use **Torque command filter: Notch filter** (such as 160.1).
② Decrease **Integral Gain** (133.0).

If any of the above does not work, then lower the **Control Level**.

Setting	Command Response	Rigidity	Settling Time	Possibility of Noise
1	slower	lower	longer	lower
↑	↑	↑	↑	↑
↓	↓	↓	↓	↓
46	faster	higher	shorter	higher

Prerequisite	Velocity Control Mode
Remark	Setting Control Level will invalidate the setting of **Control gain set** (129.0).
Related To	No. 129.0, No. 131.0, No. 133.0, No. 162.0

☞ 7 Tuning

No. 131.0	Tuning: Velocity control mode - Control gain 1	Range	Default	Characteristics
		100 to 6,000	399 [rad/s]	VEL TUNE 0 100 - 2 BYTE IN VEL

Function Use

Set Control Gain 1 for Velocity Control Mode.

The larger this parameter is, the smaller the speed error relative to the command the command being input will become.

Increasing this parameter value provides faster command response; however, too large a value may result in noise.

Noise Solutions

① Use **Torque command filter: Notch filter** (such as 160.1).
② Decrease **Integral Gain** (133.0).

If any of the above does not work, lower the **Control Gain 1**.

Prerequisite	Velocity Control Mode
Remark	Making a change to any of the following will also change other tuning parameters (such as Gain FF Compensation 1) to the prearranged parameter set all at once. · **Control gain set** (129.0) · **Control level** (130.0)
Related To	No. 129.0, No. 130.0, No. 132.0

☞ 7 Tuning

No. 132.0	Tuning: Velocity control mode - Gain FF compensation 1	Range	Default	Characteristics
		0 to 15,000	0 [rad/s]	VEL TUNE 0 100 – 2 BYTE IN VEL

Function Use	Set Feed Forward Compensation Rate with respect to Control Gain 1 for Velocity Control Mode. Increase the value of this parameter to provide faster command response. In the event of noise, decrease the setting by a small amount.
Prerequisite	Velocity Control Mode
Related To	No. 129.0, No. 130.0, No. 131.0, No. 133.0, No. 162.0

☞ 7 Tuning

No. 133.0	Tuning: Velocity control mode - Integral gain	Range	Default	Characteristics
		45 to 5,000	300 [rad/s]	VEL TUNE 0 100 – 2 BYTE IN VEL

Function Use	Set the Integral Gain for Velocity Control Mode. Increase the value of Integral Gain to improve the convergence (interfered by friction or load fluctuation) at the time of settling, and reduce position errors. This will result in rigid and sensitive motion. Noise Solutions ① Use **Torque command filter: Notch filter** (such as 160.1). ② Decrease the value of **Integral Gain**.
Prerequisite	Velocity Control Mode
Remark	This parameter will reset to the prearranged value if Inertia conditions or **Control Gain Set** is changed.
Related To	No. 129.0, No. 130.0, No. 131.0, No. 132.0, No. 162.0

☞ 7 Tuning

No. 144.0	Torque command limit: Switch	Settings	Default	Characteristics
		0, 1	0	COMM LIMIT ON OFF – 2 BYTE

Function Use

Enable/Disable Torque Command Limit

Settings	Selection	Error Detection Position error: 65.0 Speed error : 65.1	Error Detection Value : 87.0, 90.0 Delay time : 89.0, 91.0
0	Disable	-	-
1	Enable	0 (Disable)	-
		1 (Enable)	Select an appropriate value.

If you are to select 1 for this parameter, configure the above settings so that Position error (Alarm No.6) and Speed error (Alarm No.5) will be avoided.

Related To	No. 65.0, No. 65.1, No. 87.0, No. 89.0, No. 90.0, No. 91.0

No. 144.1	Torque command limit: **Torque limit output**	Settings	Default	Characteristics
		0 to 2	0	COMM LIMIT A B - 2 BYTE

Function Use

Select one of the condition sets to indicate that the motor is in a “torque limiting state” .

T-LIMIT (Pin No.17) of I/O connector will indicate the torque limiting state, when, in each row in the table below, 1) any of the parameters marked ○ is set with a valid value, or 2) the one marked with △ is not configured.

Settings	Torque command limit: Value 1 No. 147.0	Torque command limit: Value 2 No. 148.0	Motor Max output Torque value	Homing Torque command limit value No. 656.0	Speed Limit No. 152.0
0	○	○	○	○	△
1	○	○	-	-	-
2	-	○	-	-	-

Prerequisite	**Torque command limit switch** (144.0) = 1 (Enable)
Related To	No. 144.0, No. 147.0, No. 148.0, No. 152.0, No. 656.0

		Range	Default	Characteristics
No. 147.0	Torque command limit: Value 1	0 to 65,535	(See below)	COMM LIMIT 0 100 - 2 BYTE
No. 148.0	Torque command limit: Value 2	0 to 65,535	2,000 [0.1 %]	

Function Use

Set a torque command limit value as % of the rated torque (100 %).

Two torque command limits can be set with Value 1 and 2.

- When TLSEL1 (Pin No.11) of the I/O connector is open, **Value 1** (147.0) is applied. When closed, **Value 2** (148.0) will be applied.
- The setting of 3,000 or above indicates 300 % of the max rated torque.
- If the parameter is set to above 1,000, an overload error will occur in the specified time, depending on the overload characteristic.
- Under some operating conditions, overcurrent error may occur. If this happens, set the upper limit to 2,400.

Motor Capacity	No. 147.0 Default
50 W, 100 W	3,500 [0.1%]
200 W to 2 kW	3,000 [0.1%]

Prerequisite	**Torque command limit switch** (144.0) = 1 (Enable)
Related To	No. 144.0, No. 144.1

No. 151.0	Deceleration stop: Torque command limit	Range	Default	Characteristics
		0 to 65,535	2,400 [0.1 %]	COMM STOP 0 100 – 2 BYTE

Function Use

If [Deceleration stop: Method (when the servo is off) (No.224.0)] = 2 (quick stop), set the value of torque command limit at the time of a quick stop as a ratio to the rated torque (100 %).

- The setting of 3,000 or above results in 300 % of the max torque of each motor.
- If the parameter is set to above 1,000, an overload error will occur in the given time, depending on the overload characteristic.
- Under some operating conditions, overcurrent error may occur.
  If this happens, set the upper limit to the range with 2,400.

Prerequisite	Deceleration stop: Method (upon servo is off) (224.0)] = 2 (Quick stop)
Related To	No. 224.0

No. 152.0	Analog torque: Speed Limit	Range	Default	Characteristics
		0 to 10,000	(See below)	TRQ CTRL 0 100 – 2 BYTE

Function Use

Set the speed limit for Analog Torque Mode.

The default value of this parameter equals to the value of max rotation speed in the table below.

Motor Model	Default [rpm]
MM500, MY500, MM101, MY101, MX201, MZ201, MX401, MZ401, MX751, MZ751,	6,000
MA201, MH201, MA401, MH401	5,000
MA751, MH751	4,500
MM102, MH102, MM152, MH152, MM202	3,000

Prerequisite	Torque Control Mode

No. 160.0	Torque command filter: Low-pass filter - Enable Switch	Settings	Default	Characteristics
		0, 1	1	COMM SUPP ON OFF – 2 BYTE

Function Use

Enable/Disable Low-pass filter.

This filter is a first-order IIR filter.

Settings	Selection
0	Disable
1	Enable

Related To	No. 113.0, No. 160.2, No. 162.0

☞ 7 Tuning

No. 160.1	Torque command filter: Notch filter - Enable Switch	Settings	Default	Characteristics
		0, 1	0	COMM SUPP ON OFF – 2 BYTE

Function Use

Enable/Disable Notch filter.

Settings	Selection
0	Disable
1	Enable

Related To	No. 168.0, No. 169.0, No. 170.0

☞ 7 Tuning

		Settings	Default	Characteristics
No. 160.2	Torque command filter: Low-pass filter - Auto setting	0, 1	0	COMM SUPP ON OFF – 2 BYTE

Function Use

Enable/Disable the automatic configuration of [Torque command filter: Low-pass filter time constant (162.0)] according to the settings of the control gain sets; Position Control Mode (113.0) and Velocity Control Mode (129.0).

Settings	Auto setting
0	Auto setting OFF
1	Auto setting ON

Prerequisite **Torque command filter: Low-pass filter switch** (160.0) = 1 (Enable)

Related To No. 113.0, No.129.0, No. 160.0, No. 162.0

☞ 7 Tuning

		Settings	Default	Characteristics
No. 160.3	Torque command filter: Notch filter 2 - Enable Switch	0, 1	0	COMM SUPP ON OFF – 2 BYTE

Function Use

Enable/Disable Torque command Notch filter 2

Settings	Torque command- Notch filter 2
0	Disable
1	Enable

Related To No. 171.0, No. 172.0, No. 173.0

☞ 7 Tuning

		Range	Default	Characteristics
No. 162.0	Torque command filter: Low-pass filter - Time constant	0 to 65,535	(See below)	COMM SUPP 0 100 – 2 BYTE

Function Use

Set the primary IIR filter time constant of [Torque command filter: Low-pass filter switch (160.0)] = 1 (Enable)

Condition for Time Constant:

$$\frac{(0.1 \text{ to } 0.2)}{\max(\ (\omega 1+\omega 2)\ ,\ \omega_q\ )} \text{ [s] or below}$$

Motor Capacity	Default [0.01 ms/rad]
50 W, 100 W	0
200 W to 2 kW	10

Prerequisite **Torque command filter: Low-pass filter switch** (160.0) = 1 (Enable)

Remark Example: Calculating in time unit and converting to frequency
20 [0.01 ms/rad] → 5,000 [rad/s] (equivalent to 796 [Hz])

Related To No.113.0, No.160.0, No.160.2

☞ 7 Tuning

No. 168.0	Torque command filter: Notch filter - Frequency	Range	Default	Characteristics
		0 to 2,500	2,500 [Hz]	COMM SUPP 0 100 – 2 BYTE
Function Use	Set the notch frequency for the Torque command filter - notch filter.			
Prerequisite	Torque command filter: Notch filter switch (160.1) = 1 (Enable)			
Related To	No. 160.1, No. 169.0, No. 170.0			

☞ 7 Tuning

No. 169.0	Torque command filter: Notch filter - Width	Range	Default	Characteristics
		1 to 16	8	COMM SUPP 0 100 – 2 BYTE

Function Use

Set the notch width of torque command notch filter.

In the default setting of this parameter, notch width=notch frequency (a factor of x1).
The larger this item is, the larger the notch width is.
In the case of multiple notch frequencies, this item increases the notch width.

Setting	Factor	Notch Width
16	x2	large
12	x1.5	↑
8	x1	↓
4	x0.5	small

Prerequisite	Torque command filter: Notch filter switch (160.1) = 1 (Enable)
Related To	No. 160.1, No. 168.0, No. 170.0

☞ 7 Tuning

No. 170.0	Torque command filter: Notch filter - Depth	Range	Default	Characteristics
		0 to 256	0	COMM SUPP 0 100 – 2 BYTE

Function Use

Set the depth at the notch frequency of Torque command Notch filter.

Setting	Notch Depth
0	complete shutoff of notch frequency input
↑	↑
↓	↓
256	100 % pass-through

- The larger this item is, the shallower the notch depth is.
- If the noise cannot be eliminated by setting a notch filter, increase the setting gradually (e.g., 50, 100, 150 and so on), which decreases the notch depth.

Prerequisite	Torque command filter: Notch filter switch (160.1) = 1 (Enable)
Related To	No. 160.1, No. 168.0, No. 169.0

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 171.0</td><td rowspan="2">Torque command filter:
Notch filter 2 - Frequency</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 2,500</td><td>2,500
[Hz]</td><td>COMM SUPP 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the notch frequency of torque command notch filter 2.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Torque command filter: Notch filter 2 switch (160.3) = 1 (Enable)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 160.3, No. 172.0, No. 173.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 172.0</td><td rowspan="2">Torque command filter:
Notch filter 2 - Width</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>1 to 16</td><td>8</td><td>COMM SUPP 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the notch width of torque command notch filter 2.
In the default setting of this parameter, notch width=notch frequency (a factor of x1).
The larger this item is, the larger the notch width is.
In the case of multiple notch frequencies, this item increases the notch width.
<table>
<tr><th>Setting</th><th>Factor</th><th>Notch Width</th></tr>
<tr><td>16</td><td>x2</td><td>large</td></tr>
<tr><td>12</td><td>x1.5</td><td>↑</td></tr>
<tr><td>8</td><td>x1</td><td>↓</td></tr>
<tr><td>4</td><td>x0.5</td><td>small</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">Torque command filter: Notch filter 2 switch (160.3) = 1 (Enable)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 160.3, No. 171.0, No. 173.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 173.0</td><td rowspan="2">Torque command filter:
Notch filter 2 - Depth</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 256</td><td>0</td><td>COMM SUPP 0 100 – 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the depth at the notch frequency of Torque command Notch filter 2.
<table>
<tr><th>Setting</th><th>Notch Depth</th></tr>
<tr><td>0</td><td>0 % pass-through</td></tr>
<tr><td>↑</td><td>↑</td></tr>
<tr><td>↓</td><td>↓</td></tr>
<tr><td>256</td><td>100 % pass-through</td></tr>
</table>
・The larger this item is, the shallower the notch depth is.
・If the noise cannot be eliminated by setting a notch filter, increase the setting gradually (e.g., 50, 100, 150 and so on), which decreases the notch depth.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Torque command filter: Notch filter switch (160.1) = 1 (Enable)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 160.3, No. 171.0, No. 172.0</td></tr>
</table>

☞ 7 Tuning

		Settings	Default	Characteristics
No. 193.0	Tuning: Current control gain switch	0, 1	0	COMM TUNE A B ⏻ 2 BYTE

Function Use

This parameter is used to adjust the gain level of the current control component.

Select 1 to reduce noise generated at the time of servo-on stop.

Settings	Level	Noise	Response
0	standard	more	faster
1	low	less	slower

Remark

- If you changed the setting, perform tuning again.
- Selecting 1 reduces the response; Adjust within the acceptable range.

		Settings	Default	Characteristics
No. 224.0	Deceleration stop: Method (upon Servo Off)	0 to 3	1	COMM STOP A B – 2 BYTE

Function Use

Specify the deceleration stop method in case of servo off while motor is rotating.

Settings	Description
0	F RUN Coast to stop
1	S STOP Short brake
2	P STOP Quick stop
3	D STOP Emergency stop brake

Related To

No. 151.0, No. 224.1, No. 224.3, No. 225.2, No. 226.0, No. 227.0, No. 229.0, No. 232.1, No. 232.2, No. 236.0, No. 239.0

		Settings	Default	Characteristics
No. 224.1	Deceleration stop: Release conditions	0, 1	1	COMM STOP A B – 2 BYTE

Function Use

This parameter indicates conditions to cancel a deceleration stop, if an alarm occurs or the Servo ON signal turns OFF.
It is used for a motor which is slowing down as specified with Deceleration stop: Method (upon Servo Off) (224.0).

Settings	Deceleration stop Operating time (No. 226.0)	Deceleration stop Rotational speed to cancel (No. 227.0)
0	○	-
1	○	○

Prerequisite

Deceleration stop Method (upon servo off)(224.0) = 1 (Short brake) or 2 (Quick stop)

Related To

No. 224.0, No. 226.0, No. 227.0

		Settings	Default	Characteristics
No. 224.2	Deceleration stop: Enable Switch (upon AC Supply loss)	0, 1	1	COMM STOP ON OFF - 2 BYTE

Function Use

Enable/Disable deceleration stop when an AC supply loss condition occurs.

Settings	Selection
0	Disable
1	Enable

Related To No. 228.0

		Settings	Default	Characteristics
No. 224.3	Deceleration stop: DBRK output after stopping (upon Servo Off)	0, 1	1	COMM STOP A B - 2 BYTE

Function Use

Select Stop State when the servo is off

Settings	Description
0	F RUN Coast to stop
1	D STOP Emergency stop brake

Prerequisite No. 224.0, No.232.1

		Settings	Default	Characteristics
No. 225.0	Emergency stop: Warning output enable switch	0, 1	0	COMM STOP A B - 2 BYTE

Function Use

Set whether a warning is to be output or not in case of E-stop input.

Settings	Warning output
0	Disable
1	Enable

		Settings	Default	Characteristics
No. 225.1	Emergency stop: Warning output timing	0, 1	0	COMM STOP A B - 2 BYTE

Function Use

Specify when to output a warning in case of E-stop input.

Settings	Warning output timing
0	After the motor makes a deceleration stop
1	Immediately after the warning occurs

Prerequisite Emergency stop: Warning output switch (225.0) = 1 (Output warning)

		Settings	Default	Characteristics
No. 225.2	Quick stop: Smoothing filter - Enable Switch	0, 1	0	COMM STOP 0 100 - 2 BYTE

Function Use

Enable/Disable the Velocity Command smoothing filter at the time of a quick stop.

This filter suppresses vibration caused by drastic velocity change.

Settings	Velocity Command smoothing filter
0	Disable
1	Enable

Prerequisite No. 229.0

5. Parameters

No. 226.0	Deceleration stop: Operating time	Range	Default	Characteristics
		0 to 16,383	(See below)	COMM STOP 0 100 – 2 BYTE

Function Use

This parameter defines the deceleration stop operation time when an alarm occurs or the Servo ON signal turns OFF. It is used for a motor which is slowing down as specified with the deceleration stop method (224.0).

Motor Capacity	Default	Units	Converted to Time
50 W to 750 W	313	160 µs	50 [ms]
1 kW to 2 kW	250	200 µs	

Prerequisite Deceleration stop Method (upon servo off)(224.0) = 1 (Short brake) or 2 (Quick stop))

Related To No. 224.0, No. 224.1, No. 227.0

No. 227.0	Deceleration stop: Cancellation speed	Range	Default	Characteristics
		0 to 32,767	(See below)	COMM STOP 0 100 – 2 BYTE

Function Use

This parameter defines the rotational speed to cancel deceleration-stop in case an alarm occurs or the Servo ON signal turns OFF.

It is used for a motor which is slowing down as specified with the deceleration stop method (224.0).

Motor Capacity	Default	Units [encoder pulse]	Conversion to Rotational Speed
50 W to 750 W	17	pulse/160 µs	50 [rpm]
1 kW to 2 kW	22	pulse/200 µs	

Prerequisite Deceleration stop: Method (224.0) = 1 (Short brake) or 2 (Quick stop)
& Deceleration stop: Release conditions (224.1) = 1

Related To No. 224.0, No. 224.1, No. 226.0

No. 228.0	Deceleration stop: Operating time (upon control power error)	Range	Default	Characteristics
		0 to 16,383	(See below)	COMM STOP 0 100 – 2 BYTE

Function Use

Set Deceleration stop time in the event an alarm condition due to a AC Supply loss.

Motor Capacity	Default	Units	Converted to Time
50 W to 750 W	62	160 µs	10 [ms]
1 kW to 2kW	52	200 µs	

Prerequisite Deceleration stop: Switch (upon AC Supply loss) (224.2) = 1 (Enable)

Related To No. 224.2

No. 229.0	Quick stop: Smoothing filter - Moving average counter	Range	Default	Characteristics
		1 to 1,000	25	COMM STOP 0 100 – 2 BYTE

Function Use

This item defines the moving average count of the speed command smoothing filter while the motor is making a quick stop.

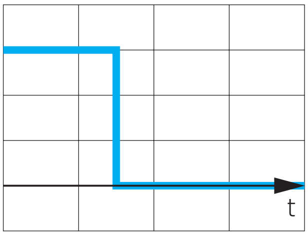
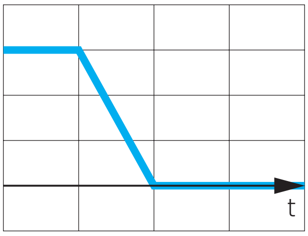
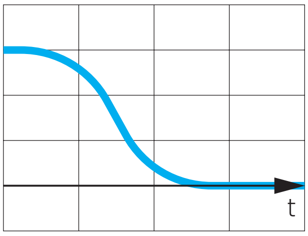
The larger the parameter value, the smoother acceleration/deceleration is and the slower the response.

Motor Capacity	Delay Time Calculation Formula	
50 W to 750 W	0.16 [ms]	× (moving average count) = delay time
1 kW to 2 kW	0.2 [ms]	

The positioning will take as long as the delay time specified above, set this item within the range acceptable to the equipment.

Prerequisite	Quick stop: Smoothing filter switch (225.2) = 1 (Enable)
Related To	No. 225.2, No. 239.0

Waveforms for each combination of enable/disable Deceleration Stop and Smoothing Filter.

Deceleration Stop	Disable	Enable	Enable
Smoothing Filter	Disable	Disable	Enable
Command waveform			

No. 232.1	Deceleration stop: Status during coast to stop	Settings	Default	Characteristics
		0, 1	0	COMM STOP A B – 2 BYTE

Function Use

Select on or off for deceleration stop status during coast to stop.

Settings	Deceleration stop status
0	OFF (not consider as deceleration stop) As soon as the servo status becomes OFF, the motor brake release (MBRK) becomes open and the motor brake becomes engaged. With the configuration of No.224.3 (upon servo off) and No.233.3 (upon alarm on), the emergency stop brake release signal (DBRK) immediately turns off and the emergency stop brake becomes engaged.
1	ON (consider as deceleration stop) When the servo state becomes OFF, the deceleration stop status becomes ON. MBRK remains closed and the motor brake remains disengaged until the deceleration stop status becomes OFF. With the configuration of No.224.3 (upon servo off) and No.233.3 (upon alarm on), the emergency stop brake release (DBRK) will remain ON and the emergency stop brake will remain disengaged until the deceleration stop status becomes OFF.

☞ 3 Preparation Timing Diagrams

No. 232.2	Quick stop: Short brake operation after a stop	Settings	Default	Characteristics
		0, 1	0	COMM STOP B – 2 BYTE

Function Use

Enable/Disable short braking after a quick stop.

Settings	Short braking
0	Enable
1	Disable

Prerequisite Deceleration stop: Method (when servo off) (224.0) = 2 (Quick stop)

No. 232.3	Deceleration stop: Brake engagement - Timing	Settings	Default	Characteristics
		0, 1	0	COMM STOP B – 2 BYTE

Function Use

Set the timing for the brake to be engaged in a brake-equipped motor.

(That is, set the timing to open MBRK (Motor Brake Release))

Settings	Timing
0	When the deceleration stop status is off, or the motor rotation speed becomes lower than the setting of **Deceleration stop: Cancellation speed** (227.0)
1	When the deceleration stop status is off, or the motor rotation speed becomes lower than the setting of **Deceleration stop: Brake engagement - Rotation speed** (235.0), or the braking time reaches the value of **Deceleration stop: Brake engagement - Delay time** (234.0).

Related To No. 234.0, No. 235.0

☞ 3 Preparation Timing Diagrams

No. 233.0	Deceleration Stop: Method (when alarm is on)	Settings	Default	Characteristics
		0 to 7	2	COMM STOP A B – 2 BYTE

Function Use

Select a deceleration stop method in case of alarm while motor is in motion.

Each alarm group uses a different stop method. (*1)

Settings	Stop method		
	Group ①	Group ② (*2), ③ , ④	Group ⑤
0	F RUN	F RUN	F RUN
1	D STOP	D STOP	D STOP
2	F RUN	S STOP	S STOP
3	D STOP	S STOP	S STOP
4	F RUN	F RUN	P STOP
5	D STOP	D STOP	P STOP
6	F RUN	S STOP	P STOP
7	D STOP	S STOP	P STOP

*1) Alarms are categorized into five groups.
*2) When **Deceleration stop: Method** (224.0) = 0 (Disable), the motor will be stopped by the group ① method.
After the amount of time specified by **Deceleration stop: Operating time** (228.0) elapses, the motor will be stopped by the group ① method.

F RUN Coast to stop	P STOP Quick stop	S STOP Short brake	D STOP Emergency stop brake

Alarm No.	Alarm Name and Group	
0	System	④
1	EEPROM data	④
2	Product code	④
4	Overspeed	⑤
5	Speed	⑤
6	Position	⑤
7	Overload	④
8	Command overspeed	⑤
9	Encoder pulse output frequency	④
10	Positioning command overflow ／ Homing failure	⑤
11	Encoder (multi-turn counter overflow)	⑤
12	Overheat	⑤
14	Overvoltage	①
15	Power supply (AC Supply)	⑤
16	Encoder (response data)	③
17	Encoder (no response)	③
18	Encoder (circuitry)	③
19	Encoder (communication)	③
20	Encoder (multi-turn data)	③
21	Encoder (voltage drop)	③
22	Voltage (control power)	②
23	Switch circuitry	①
24	Overcurrent	①
25	Inverter 1	①
26	Inverter 2	①
27	Current sensor	①
28	Encoder overheat)	⑤
29	Voltage drop (inside the drive)	①

5. Parameters

No. 233.3	Deceleration Stop: DBRK output after stopping (when alarm is on)	Settings	Default	Characteristics
		0, 1	0	COMM CTRL A B – 2 BYTE

Function Use

Select the type of idling in case of alarm.

Settings	Idle State
0	F RUN Coast to stop
1	D STOP Emergency stop brake

No. 234.0	Deceleration Stop: Brake engagement - Delay time	Range	Default	Characteristics
		0 to 16,383	0	COMM STOP 0 100 – 2 BYTE

Function Use

Set the delay time between two events: 1) SVON (servo-on) opens while the motor is in motion or an alarm occurs, and 2) the brake becomes engaged.

Motor Capacity	Default	Units	Converted to Time
50 W to 750 W	0	160 µs	0 [ms]
1 kW to 2 kW	0	200 µs	

Prerequisite Timing of brake engagement (232.3) = 1

No. 235.0	Deceleration Stop: Brake engagement - Rotational speed	Range	Default	Characteristics
		0 to 32,767	(See below)	COMM STOP 0 100 – 2 BYTE

Function Use

Set the motor rotational speed to engage the brake when 1) SVON (servo-on) opens while the motor is in motion or 2) an alarm occurs.

Motor Capacity	Default	Units	Converted to rotational speed
50 W to 750 W	17	160 µs	50 [rpm]
1 kW to 2 kW	22	200 µs	

Prerequisite Timing of brake engagement (232.3) = 1

No. 236.0	Quick stop: Extention Time	Range	Default	Characteristics
		0 to 3,125	(See below)	COMM STOP 0 100 – 2 BYTE

Function Use

This item indicates how long the quick stop to be kept active after the deceleration stop complete conditions were met.

It is used to compensate the motor brake response time.

Motor Capacity	Default	Units	Converting to Time
50 W to 750 W	0	160 μs	0 [ms]
1 kW to 2 kW	0	200 μs	

This parameter is valid only when the Deceleration Stop Method is “quick stop” .
This parameter is invalid if the servo turns off while the motor idling.
Use **Servo OFF: Delay time** (237.0) to compensate the motor brake response time when the servo turns off during motor idling.

Prerequisite	Deceleration stop: Method (224.0) = 2 (Quick stop)
Related To	No. 224,0, No. 233.0, No. 237.0

No. 237.0	Servo OFF: Delay time	Range	Default	Characteristics
		0 to 3,125	(See below)	COMM CTRL 0 100 – 2 BYTE

Function Use

This parameter indicates the delay time the motor excitation off after the servo-on signal (SVON) turns off.

By adjusting the timing to end motor excitation after the motor brake is engaged, brake-equipped axes such as vertical axis can be prevented from roll back.

Motor Capacity	Default	Units	Converting to Time
50 W to 750 W	0	160 μs	0 [ms]
1 kW to 2 kW	0	200 μs	

Related To	No. 238.0

No. 238.0	Brake release: Delay time	Range	Default	Characteristics
		0 to 3,125	(See below)	COMM CTRL 0 100 – 2 BYTE

Function Use

This item indicates the delay time of the motor brake release signal (MBRK) ON after the motor excitation starts.

By adjusting the timing to release the brake after the motor excitation starts, brake-equipped axes such as vertical axis can be prevented from roll back.

Motor Capacity	Default	Units	Converting to Time
50 W to 750 W	25	160 μs	4 [ms]
1 kW to 2 kW	20	200 μs	

Related To	No. 237.0

No. 239.0	Quick stop: Deceleration time	Range	Default	Characteristics
		0 to 100	0 [ms]	COMM STOP 0 100 – 2 BYTE

Function Use

This item indicates decelerating time after a quick stop.

Set the time-length for speed command to change from 1,000 [rpm] to 0 [rpm].

Related To	No. 224.0, No. 232.2, No. 236.0

5. Parameters

No. 257.0	Absolute system Select	Settings	Default	Characteristics
		0 to 2	0	COMM Z MODE A B ⏻ 2 BYTE

Function Use

Select either Absolute system or Incremental system.

Settings	System	Multi-rotation counter Overflow detection
0	Incremental	-
1	Absolute	disable
2	Absolute	enable

Using this parameter in absolute systems

- Setting ” 2” (this is the usual setting)
  Exceeding the encoder absolute value range of -4,294,967,296 to 4,294,967,295 (±32,767 multi-turn data) will result in Alarm No.11 (encoder multi-turn counter overflow).
  If this happens, correct the command such that motion will be kept within the absolute value range.

- Setting “1”
  Use this setting when absolute value of single-turn is needed for continuous turns only in one direction. Exceeding the encoder absolute value range will result in a position that is significantly off from the position specified by next command.
  Set Pulse Paired Ratio, so that the single-turn angle can be accurately detected with sufficient resolution even outside of the range.

No. 259.0	Encoder: Overheat detection switch	Settings	Default	Characteristics
		0 to 2	0	COMM ALM A B - 2 BYTE

Function Use

Select operation when overheat of the encoder is detected.

Settings	Output
0	No output
1	Warning output
2	Alarm output

No. 259.1	Encoder: Battery voltage drop detection switch	Settings	Default	Characteristics
		0, 1	0	COMM ALM A B - 2 BYTE

Function Use

Select operation when encoder battery voltage drop is detected.

Settings	Output
0	No output
1	Warning output

No. 267.0	Encoder: Overheat detection - Value	Range	Default	Characteristics
		0 to 127	85 [℃]	COMM ALM 0 100 – 2 BYTE
Function Use	Set the value to detect overheat of the encoder. (for reference only)			
Related To	No. 259.0			

No. 268.0	Encoder: Battery voltage drop detection - Value	Range	Default	Characteristics
		0 to 100	24 [0.1 V]	COMM ALM 0 100 – 2 BYTE
Function Use	Set the value to detect voltage drop of the encoder.			
Related To	No. 259.0			

<table>
<tr><td rowspan="2">No. 272.1</td><td rowspan="2">Encoder pulse output:
Rotational direction</td><td>Settings</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0, 1</td><td>0</td><td>COMM CTRL A B ⏻ 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the rotational direction of encoder pulse output.
This indicates the direction of counting pulses in ccw rotations.
<table>
<tr><th>Settings</th><th>In CCW rotation</th></tr>
<tr><td>0</td><td>count down</td></tr>
<tr><td>1</td><td>count up</td></tr>
</table></td></tr>
<tr><td>Related To</td><td colspan="4">No. 276.0, No. 278.0</td></tr>
</table>

5. Parameters

		Range	Default	Characteristics
No. 276.0	Encoder pulse output: Pulse ratio (numerator)	1 to 65,535	1,000 [pulse/rev]	COMM CTRL 0 100 ⏻ 4 BYTE
No. 278.0	Encoder pulse output: Pulse ratio (denominator)	1 to 65,535	8,000 [pulse/rev]	

Function Use

Set the encoder pulse output ratio with these two parameters.

Where the pulse count per rotation of host command and the pulse count per rotation of the motor do not agree,

(numerator) = (single-turn pulse count of host command) /4
(denominator) = (single-turn pulse count of the motor) /4=32,768

$$\frac{\boxed{276.0}}{\boxed{278.0}} = \frac{\text{host command pulse count per rotation}}{\text{motor pulse count per rotation}} = \frac{\text{host command pulse count per rotation } \mathbf{/\ 4}}{\text{motor pulse count per rotation } \mathbf{/\ 4}}$$

Example Settings Units: [pulse/rev]

A Host Command Pulse count per rotation	B Numerator No. 276.0	C (①× 1/4) Denominator No. 278.0
16,384	4,096	32,768 (=131,072 (*) / 4)
10,000	2,500	
4,096	1,024	
4,000	1,000	

*) 131,072 is the pulse count per rotation of the motor.
The setting range of the ratio derived from these two parameters is 1/32,768 to 1.

The default setting values are assumed 16,384 pulses of the host command pulse number per a rotation.

If the Z-phase pulse width is too narrow to be measured accurately by the host controller, decrease this encoder pulse ratio or decrease the number of rotations to increase the pulse width.
PLC normally requires approximately 1 ms pulse width.

$$\text{pulse width[ms]} = 2 \times \frac{60 \times 1{,}000}{\text{number of rotations [rpm]}} \times \frac{1}{\text{the paired-pulse ratio} \times 2^{17}}$$

Remark

- Use these parameters within the max output frequency of 4 Mpps.
- Note that [Encoder output resolution] × [(Numerator)/(Denominator)] has to be a multiple of 4.

Related To

No. 34.0, No. 36.0, No. 272.1, No. 276.0, No. 278.0

No. 285.0	Encoder pulse output: Error detection - Frequency upper limit	Range	Default	Characteristics
		25 to 1,125	1,125 [kHz]	COMM ALM 0 100 – 2 BYTE
Function Use	Set the upper limit of the encoder pulse output frequency. Select an appropriate value according to the signal input specification from the host controller.			
Related To	No. 286.0			

No. 286.0	Encoder pulse output: Error detection - Delay time	Range	Default	Characteristics
		0 to 2,000	0 [ms]	COMM ALM 0 100 – 2 BYTE
Function Use	Set the detection delay time of encoder pulse output error.			
Related To	No. 285.0			

<table>
<tr><td rowspan="2">No. 288.0</td><td rowspan="2">Analog torque:
Input filter (numerator)</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 65,535</td><td>16,000</td><td rowspan="2">TRQ CTRL 0 100 – 2 BYTE</td></tr>
<tr><td>No. 289.0</td><td>Analog torque:
Input filter (denominator)</td><td>1 to 65,535</td><td>65,535</td></tr>
<tr><td>Function Use</td><td colspan="4">Select values such that the <u>low-pass filter constant</u> will suppress the noise component of the Analog Torque Command input.

$$\text{low-pass filter constant} = \frac{\boxed{288.0}}{\boxed{289.0}}$$

<table>
<tr><th>Setting</th><th>Noise Resistance</th><th>Command Response</th></tr>
<tr><td>Smaller</td><td>Stronger</td><td>Slower</td></tr>
<tr><td>Larger</td><td>Weaker</td><td>Faster</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">Analog torque: Input filter switch (302.1) = 1 (Enable)</td></tr>
<tr><td>Remark</td><td colspan="4">The ratio of No.288.0 (numerator) to No.289.0 (denominator) must be below 1.
Filtering will not take effect if the ratio is 1.</td></tr>
<tr><td>Related To</td><td colspan="4">No. 302.1</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 290.0</td><td rowspan="2">Analog torque:
Input gain (numerator)</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 65,535</td><td rowspan="2">(See below)
[0.1 %]</td><td rowspan="2">TRQ CTRL 0 100 – 2 BYTE</td></tr>
<tr><td>No. 291.0</td><td>Analog torque:
Input gain (denominator)</td><td>1 to 65,535</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the gain of analog torque command input.

With these two parameters, you can adjust the gain of the host controller.
The motor torque is max when (numerator)/(denominator)=1 and analog command voltage (± 10 V) input.

$$\text{command Input Gain} = \frac{\boxed{290.0}}{\boxed{291.0}}$$

The figures in the table below are applicable for both numerator and denominator.

<table>
<tr><th colspan="2">MA, MM, and MH Series</th></tr>
<tr><th>Motor Capacity</th><th>No. 290.0, and No. 291.0 Default</th></tr>
<tr><td>50 W</td><td>3,500</td></tr>
<tr><td>100 W</td><td>3,500</td></tr>
<tr><td>200 W</td><td>3,100</td></tr>
<tr><td>400 W</td><td>3,000</td></tr>
<tr><td>750 W</td><td>3,000</td></tr>
<tr><td>1 kW</td><td>3,300</td></tr>
<tr><td>1.5 kW</td><td>3,200</td></tr>
<tr><td>2 kW</td><td>3,100</td></tr>
</table>

<table>
<tr><th colspan="2">MX, MY, and MZ Series</th></tr>
<tr><th>Motor Capacity</th><th>No. 290.0, and No. 291.0 Default</th></tr>
<tr><td>50 W</td><td>3,500</td></tr>
<tr><td>100 W</td><td>3,400</td></tr>
<tr><td>200 W</td><td>3,100</td></tr>
<tr><td>400 W</td><td>3,100</td></tr>
<tr><td>750 W</td><td>2,900</td></tr>
<tr><td>1 kW</td><td>3,000</td></tr>
</table></td></tr>
</table>

		Range	Default	Characteristics
No. 292.0	Analog torque: CCW torque limit (numerator)	0 to 65,535	(See below) [0.1 %]	TRQ CTRL 0 100 – 2 BYTE
No. 293.0	Analog torque: CCW torque limit (denominator)	1 to 65,535		
Function Use	Set the CCW torque limit of analog torque command.			
Related To	No. 294.0, No. 295.0			

$$\text{CCW torque limit} = \text{Instantaneous maximum torque} \quad \frac{\boxed{292.0}}{\boxed{293.0}}$$

		Range	Default	Characteristics
No. 294.0	Analog torque: CW torque limit (numerator)	0 to 65,535	(See below) [0.1 %]	TRQ CTRL 0 100 – 2 BYTE
No. 295.0	Analog torque: CW torque limit (denominator)	1 to 65,535		
Function Use	Set the CW torque limit of analog torque command.			
Related To	No. 292.0, No. 293.0			

$$\text{CW torque limit} = \text{Instantaneous maximum torque} \quad \frac{\boxed{294.0}}{\boxed{295.0}}$$

Default values of parameters No.292.0, 293.0, 294.0. and 295.0

The figures in the table below are applicable for both numerator and denominator.

MA, MM, and MH Series	
Motor Capacity	Default
50 W	3,500
100 W	3,500
200 W	3,100
400 W	3,000
750 W	3,000
1 kW	3,300
1.5 kW	3,200
2 kW	3,100

MX, MY, and MZ Series	
Motor Capacity	Default
50 W	3,500
100 W	3,400
200 W	3,100
400 W	3,100
750W	2,900
1 kW	3,000

5. Parameters

No. 300.0	Analog torque: Offset value	Range	Default	Characteristics
		− 32,768 to +32,767	0	TRQ CTRL 0 100 – 2 BYTE

Function Use

Adjust this parameter such that analog command value = 0 % when the drive is configured for analog command and input voltage is 0 V.

Setup Procedure

① Use **Analog torque speed limit** (152.0) to set the value of a speed limit to a reasonable rotational speed such as 1,000 rpm.
② Set the analog voltage of the host controller to 0 V.
③ Turn the servo ON.
(If the offset is misaligned, the motor will rotate.)
④ Select a value for the offset observing the torque command value.

Prerequisite	Analog speed command: Offset tuning method (302.2) = 1 (Manual tuning)
Remark	Adjust this parameter with the motor alone. Never adjust it while the motor is installed in any equipment.
Related To	No. 302.2

No. 302.0	Analog torque: Direction of rotation	Settings	Default	Characteristics
		0, 1	1	TRQ CTRL A B – 2 BYTE

Function Use

Specify the rotational direction of analog torque command input.

Settings	Negative Voltage Input	Positive Voltage Input
0	CCW Rotation	CW Rotation
1	CW Rotation	CCW Rotation

No. 302.1	Analog torque: Input filter enable switch	Settings	Default	Characteristics
		0, 1	1	TRQ CTRL ON OFF – 2 BYTE

Function Use

Enable/Disable Analog torque command input filter.

Enable if noise is significant in the analog command.

Settings	Input filter switch
0	Disable
1	Enable

No. 302.2	Analog torque: Offset tuning method	Settings	Default	Characteristics
		0, 1	1	TRQ CTRL AB – 2 BYTE
Function Use	Specify the offset tuning method for Analog Velocity command.			

Settings	Tuning Method	Description
0	Auto Tuning	Automatically adjust the offset value such that torque command=0 % at the input voltage at the time of servo on.
1	Manual Tuning	Manually adjust the offset value such that torque command=0 % at 0 V input voltage.

No. 305.0	Voltage dip Detection: Delay time	Range	Default	Characteristics
		20 to 50,000	80 [ms]	COMM ALM 0 100 – 2 BYTE
Function Use	Set the delay time to the required voltage dip detection time of the AC supply.			
Remark	Detection of a voltage dip will result in Alarm No.15. Set this parameter suitable to your operating conditions.			

<table>
<tr><th rowspan="2">No. 357.0</th><th rowspan="2">Position command filter 3:
Notch frequency</th><th>Range</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>10 to 2,000</td><td>10
[0.1 Hz]</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the notch frequency for Position Command Filter 3.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 3: Type (82.1) = 2 (Notch) or 3 (γ-Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 82.1, No. 358.0, No. 359.0, No. 360.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><th rowspan="2">No. 358.0</th><th rowspan="2">Position command filter 3:
Notch width</th><th>Range</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>128 to 2,048</td><td>512</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the width of notch of Position Command Filter 3.
<table>
<tr><th>Setting</th><th>Notch Width</th></tr>
<tr><td>smaller</td><td>narrower</td></tr>
<tr><td>larger</td><td>wider</td></tr>
</table>
</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 3: Type (82.1) = 2 (Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 82.1, No. 357.0, No. 360.0</td></tr>
</table>

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<table>
<tr><th rowspan="2">No. 359.0</th><th rowspan="2">Position command filter 3:
High frequency gain</th><th>Range</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>50 to 200</td><td>100</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the high frequency gain for Position Command Filter 3.
<table>
<tr><th>Setting</th><th>Effect</th></tr>
<tr><td>50</td><td>x0.25</td></tr>
<tr><td>100</td><td>x1</td></tr>
<tr><td>200</td><td>x4</td></tr>
</table>
Smaller setting value gives better vibration suppression.
Larger setting value gives faster motion.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 3: Type (82.1) = 3 (γ-Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 82.1, No. 357.0, No. 360.0</td></tr>
</table>

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<table>
<tr><th rowspan="2">No. 360.0</th><th rowspan="2">Position command filter 3:
Notch depth</th><th>Range</th><th>Default</th><th>Characteristics</th></tr>
<tr><td>0 to 100</td><td>0</td><td>PLS SUPP 0 100 ⏻ 2 BYTE</td></tr>
<tr><td>Function
Use</td><td colspan="4">Set the depth for Position Command Filter 3.
<table>
<tr><th>Setting</th><th>Notch Depth</th></tr>
<tr><td>0</td><td>complete shutoff of notch frequency input</td></tr>
<tr><td>100</td><td>100 % pass-through</td></tr>
</table>
Smaller setting value gives deeper filter.
Larger setting value gives shallower filter.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position command filter 3: Type (82.1) = 2 (Notch) or 3 (γ-Notch)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 82.1, No. 357.0, No. 358.0, No. 359.0</td></tr>
</table>

☞ 7 Tuning

<table>
<tr><td rowspan="2">No. 363.0</td><td rowspan="2">Position error warning detection:
Value</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 2,147,483,647</td><td>100
[pulse]</td><td>COMM ALM 0 100 – 4 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the value to determine the position error warning level.
The position error warning will be detected when the position error exceeds this parameter value.</td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position error detection: Switch (65.0) = 2 (Warning output), or 3 (Alarm and Warning output)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 65.0, No. 365.0</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 365.0</td><td rowspan="2">Position error warning detection:
Delay time</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 65,535</td><td>(See below)</td><td>COMM ALM 0 100 – 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the delay time to determine the position error warning detection time.
<table>
<tr><th>Motor Capacity</th><th>Default</th><th>Units</th><th>Converted to Time</th></tr>
<tr><td>50 W to 750 W</td><td>250</td><td>160 μs</td><td rowspan="2">40 [ms]</td></tr>
<tr><td>1 kW to 2 kW</td><td>200</td><td>200 μs</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">Position error detection: Switch (65.0) = 2 (Warning output), or 3 (Alarm and Warning output)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 65.0, No. 363.0</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 385.0</td><td rowspan="2">JOG operation:
Acceleration time</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 60,000</td><td>1,000
[ms]</td><td>COMM CTRL 0 100 – 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the acceleration time for JOG operation.
This item indicates the amount of time for a speed command to change from 0 rpm to 1,000 rpm.
With the default setting, it takes the rotational speed 3,000 ms to reach 3,000 rpm.</td></tr>
<tr><td>Related To</td><td colspan="4">JOG operation requires control power supply and the Servo ON signal input from the I/O connector.</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 386.0</td><td rowspan="2">JOG operation:
Deceleration time</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to 60,000</td><td>1,000
[ms]</td><td>COMM CTRL 0 100 – 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the deceleration time for JOG operation.
This item indicates the amount of time for a speed command to change from 1,000 rpm to 0 rpm.
With the default setting, when the motor is rotating at 3,000 [rpm], it takes 3,000 [ms] to stop.</td></tr>
<tr><td>Remark</td><td colspan="4">JOG operation requires control power supply and the Servo ON signal input from the I/O connector.</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 387.0</td><td rowspan="2">JOG operation:
Target speed</td><td>Range</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0 to
Maximum Rotational Speed of Motor</td><td>300
[rpm]</td><td>COMM CTRL 0 100 – 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Set the target speed for JOG operation.
<table>
<tr><th>Motor Model</th><th>Maximum rotational speed [rpm]</th></tr>
<tr><td>MM500, MY500, MM101, MY101, MX201, MZ201, MX401, MZ401, MX751, MZ751</td><td>6,000</td></tr>
<tr><td>MA201, MH201, MA401, MH401</td><td>5,000</td></tr>
<tr><td>MA751, MH751</td><td>4,500</td></tr>
<tr><td>MM102, MH102, MM152, MH152, MM202</td><td>3,000</td></tr>
</table></td></tr>
<tr><td>Remark</td><td colspan="4">JOG operation requires control power supply and the Servo ON signal input from the I/O connector.</td></tr>
</table>

<table>
<tr><td rowspan="2">No. 388.0</td><td rowspan="2">Internal velocity:
Command method</td><td>Settings</td><td>Default</td><td>Characteristics</td></tr>
<tr><td>0, 1</td><td>0</td><td>IN VEL Z MODE A B - 2 BYTE</td></tr>
<tr><td>Function Use</td><td colspan="4">Select the type of Internal Velocity Command.
<table>
<tr><th>Settings</th><th>Method</th></tr>
<tr><td>0</td><td>Zero command</td></tr>
<tr><td>1</td><td>Preset speed command (8 settings)</td></tr>
</table></td></tr>
<tr><td>Prerequisite</td><td colspan="4">The following two settings are necessary.
・Control Mode (2.0) = 1 (Velocity control mode)
・Command Mode (3.0) = 3 (Internal command mode)</td></tr>
<tr><td>Related To</td><td colspan="4">No. 2.0, No. 3.0, No. 390.0, No. 391.0, No. 392.0 to 399.0</td></tr>
</table>

No. 390.0	Internal velocity: Acceleration time	Range	Default	Characteristics
		0 to 60,000	1,000 [ms]	IN VEL CTRL A B - 2 BYTE
Function Use	Set the acceleration time for internal velocity command to change the speed. This item indicates the amount of time for a speed command to change from 0 rpm to 1,000 rpm. With the default setting, it takes the rotational speed 3,000 [ms] to reach 3,000 [rpm].			
Prerequisite	The following three settings are necessary. ・Control Mode (2.0) = 1 (Velocity control mode) ・Command Mode (3.0) = 3 (Internal command mode) ・Internal Velocity: Command Method (388.0) = 1 (Preset speed command)			
Related To	No. 388.0, No. 391.0, No. 392.0 to 399.0			

No. 391.0	Internal velocity: Deceleration time	Range	Default	Characteristics
		0 to 60,000	1,000 [ms]	IN VEL CTRL A B - 2 BYTE
Function Use	Set the deceleration time for internal velocity command to change the speed. This item indicates the amount of time for a speed command to change from 0 rpm to 1,000 rpm. With the default setting, it takes the rotational speed 3,000 [ms] to reach 3,000 [rpm].			
Prerequisite	The following three settings are necessary. ・Control Mode (2.0) = 1 (Velocity control mode) ・Command Mode (3.0) = 3 (Internal command mode) ・Internal Velocity: Command Method (388.0) = 1 (Preset speed command)			
Related To	No. 388.0, No. 391.0, No. 392.0 to 399.0			

5. Parameters

No. 392.0 to No. 399.0	Internal velocity: Preset speed 1 to 8	Range	Default	Characteristics
		0 to Motor max rotational speed	(See below) [rpm]	IN VEL CTRL 0 100 – 2 BYTE

Function Use

Select one of 8 levels for target speed of Internal velocity command input.

Default Units: [rpm]

Parameter No.	Target Speed	Motor Capacity		
		50 W- 750 W		1 kW to 2 kW
392.0	1	500		
393.0	2	1,000		
394.0	3	1,500		
395.0	4	2,000		
396.0	5	2,500		
397.0	6	3,000		
398.0	7	4,000		3,000
399.0	8	Motor Max Rotational Speed (*)		

Combination of Pin No.8, 9, and 10 of I/O connector (CN1)

Target Speed	Pin No. 8 (VCSEL1)	Pin No. 9 (VCSEL2)	Pin No. 10 (VCSEL3)
1	Open	Open	Open
2	Closed	Open	Open
3	Open	Closed	Open
4	Closed	Closed	Open
5	Open	Open	Closed
6	Closed	Open	Closed
7	Open	Closed	Closed
8	Closed	Closed	Closed

Closed : Contact with COM-

Open : No contact with COM-

The direction of rotation (CCW/CW) controls with No.6 pins (VCRUN1) and No.7 pins (VCRUN2) of I/O.

Prerequisite

The following three settings are necessary.

- Control Mode (2.0) = 1 (Velocity control mode)
- Command Mode (3.0) = 3 (Internal command mode)
- Internal Velocity: Command Method (388.0) = 1 (Preset speed command)

Related To

No. 388.0, No. 390.0, No. 391.0

*) Maximum rotational speed of motor

Motor Model	Maximum rotational speed [rpm]
MM500, MY500, MM101, MY101, MX201, MZ201, MX401, MZ401, MX751, MZ751,	6,000
MA201, MH201, MA401, MH401	5,000
MA751, MH751	4,500
MM102, MH102, MM152, MH152, MM202	3,000

		Settings	Default	Characteristics
No. 642.0	Internal position: Operation mode	0, 1	0	IN POS Z MODE A B – 2 BYTE

Function Use

Set the operation mode for Position Control Mode (internal command).

Settings	Operation Mode
0	Point Table
1	Testing (Communication motion)

Prerequisite

The following two settings are necessary.
- Control Mode (2.0) = 0 (Position Control Mode)
- Command Mode (3.0) = 3 (Internal command mode)

Related To No. 2.0, No. 3.0

		Settings	Default	Characteristics
No. 643.0	Internal position: Overflow detection	0, 1	0	IN POS CTRL ON OFF ⏻ 2 BYTE

Function Use

Enable/Disable the multiturn encoder counter overflow detection function for Positioner Drive using ABS value.
This function is a protective measure against absolute position loss of the encoder.

If Internal Position Command exceeds the absolute value range (±1,073,741,823), or shift amount per one command exceeds the range (±2,147,487,647), overflow will be detected, resulting in Alarm No.10.

Settings	Overflow Detection
0	Disable (*1)
1	Enable (*2)

*1) For repeating rotations only in one direction, when you need absolute value of single-turn angle, set **Absolute system** (257.0) =1 (Multi-turn counter overflow detection disabled)

*2) When you set **Absolute system** (257.0) = 2 (Multi-rotation counter overflow detection enabled), Alarm No.11 occurs if multi-turn data exceeds the rated range (±32,767). Select a value for internal position command not larger than the rated value.

"Absolute Value" Operation using Positioner, and Testing

Set this parameter to 0 and the command method for point table to "**relative value**" .
Setting "absolute value" will result in Alarm No.10.
When the setting was changed from 0 to 1, perform homing.

Related To No. 257.0

No. 644.0	Internal position: Point table - Point number output method	Settings	Default	Characteristics
		0 to 2	1	IN POS, CTRL, A B – 2 BYTE

Function Use

Select the output timing for a point number (PM1...3) when using I/O assignment Option1 for Positioner Drive.

Settings	Output timing for Motion Start Point Number
0	Upon motion start
1	Upon motion complete
2	Upon motion start of each point

Prerequisite

The following two settings are necessary.
- Control Mode (2.0) = 0 (Position Control Mode)
- Command Mode (3.0) = 3 (Internal command mode/Option I/O Setting)

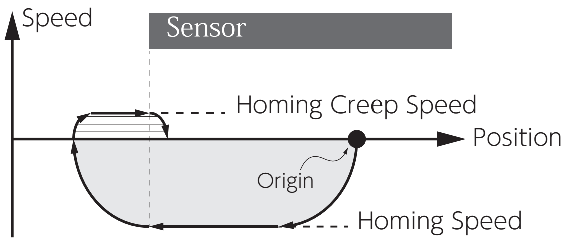
No. 645.0	Homing: Home reference signal selection	Settings	Default	Characteristics
		0 to 2	2	PLS, HOME, A B – 2 BYTE IN POS

Function Use

Select the signal that the home position will be referenced to.

Settings	Reference Signal 1
0	Any user specified position
1	Stopper
2	Home-sensor-front-end (*)

*) Starting point is located on the sensor
Regardless of the **Re-detection of Home position sensor** (645.3) setting, this setting indicates a motion of at first moving backward to a position where homing can be performed.



No. 645.1	Homing: Encoder Z-phase selection	Settings	Default	Characteristics
		0, 1	1	PLS, HOME, ON OFF – 2 BYTE IN POS

Function Use

To add encoder Z-phase as the reference position after the Home Reference Signal is detected, set this parameter to 1.

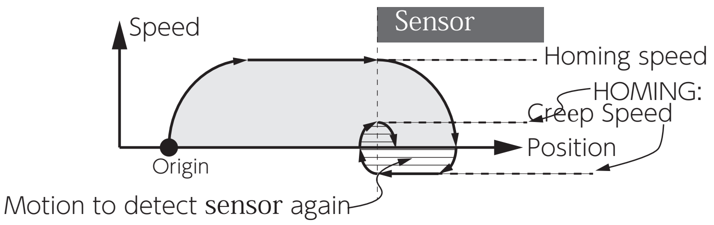
Settings	Encoder Z-phase
0	Disable
1	Enable

No. 645.3	Homing: Re-detection of home position sensor	Settings	Default	Characteristics
		0, 1	0	PLS HOME ON OFF – 2 BYTE

Function Use

Use this parameter, after detecting sensor-front-end, to re-detect the sensor-front-end at a speed specified with the homing creep speed parameter.

Settings	Re-detecting motion
0	Disable
1	Enable



Prerequisite Homing: Home reference signal selection (645.0) : 2 (home sensor-front-end)

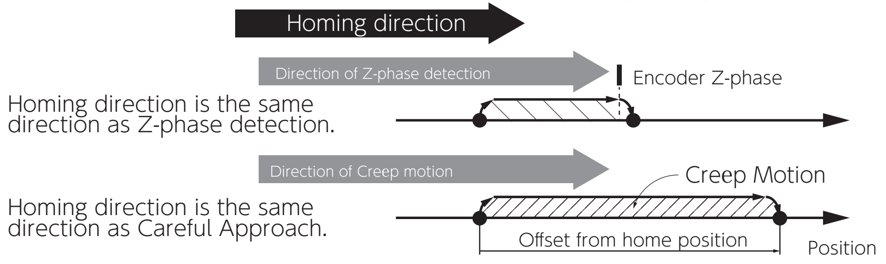
		Settings	Default	Characteristics
No. 646.0	Homing: Direction	0, 1	0	PLS HOME ON OFF - 2 BYTE IN POS

Function Use

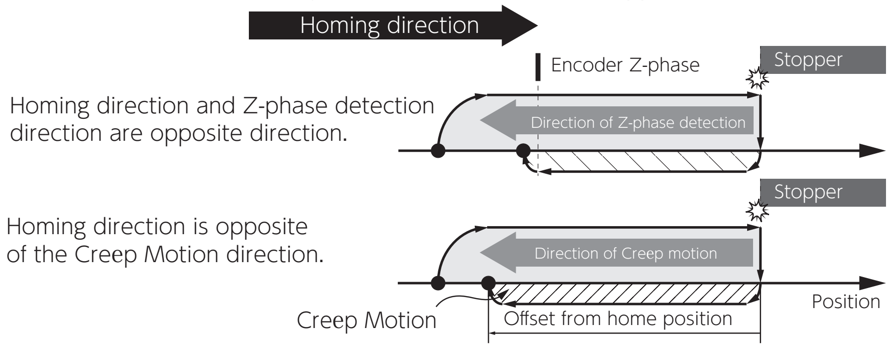
Specify the homing direction.

Settings	Direction of rotation
0	CCW
1	CW

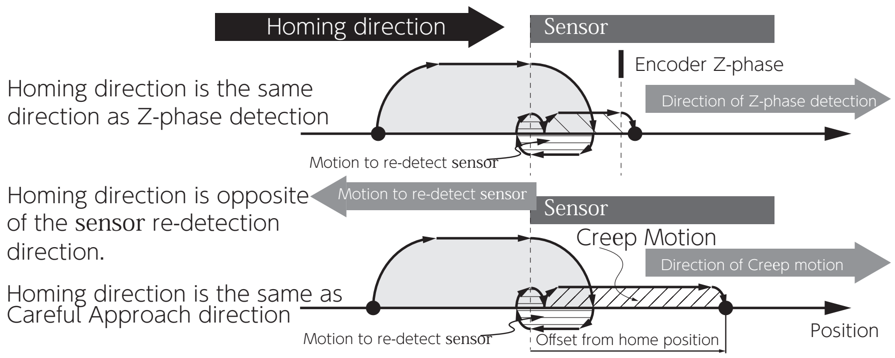
When [HOMING: Home Reference Signal selection (645.0)] = 0 (Any user specified position)



When [HOMING: Home Reference Signal selection (645.0)] =1 (Stopper)



When [HOMING: Home Reference Signal selection (645.0)] = 2 (home sensor-front-end) AND [HOMING: Re-detection of Home position sensor (645.3)] =1 (enable) (*)



*) If the starting point is on the sensor, the motion is automatically in the reverse direction of homing, and then the sensor-front-end is detected upon machine' s leaving the sensor

Related To No. 645.0, No. 645.1, No. 645.3

5. Parameters

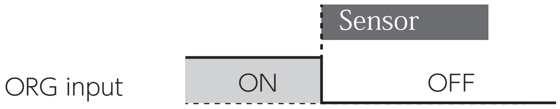
		Settings	Default	Characteristics
No. 646.1	Homing: Sensor polarity	0, 1	0	PLS HOME A B - 2 BYTE

Function Use

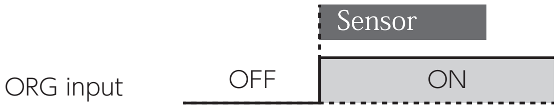
Select the polarity for the home sensor signal input ORG (Pin No.11) of CN1 to detect the sensor-front-end.

Settings	Detection Polarity
0	Detect where ORG=OFF
1	Detect where ORG=ON

■ 0 (Detect where ORG=OFF)



■ 1 (Detect where ORG=ON)



		Settings	Default	Characteristics
No. 646.2	Homing: Timeout enable switch	0, 1	0	PLS HOME ON OFF - 2 BYTE IN POS

Function Use

Enable/Disable Homing Timeout.
This item is a safety measure against collisions.

Settings	Timeout
0	Disable
1	Enable

When the time since homing started exceeds the setting of **Timeout Time** (659.0), Alarm No.10 (internal position command overflow fault / homing failure) is output leading to servo off.

		Settings	Default	Characteristics
No. 646.3	Homing: Point table - Motion of point No.0	0, 1	0	IN POS CTRL A B - 2 BYTE

Function Use

Specify the motion upon PCSTART1 input by selecting Point No.0 with User I/O.

Settings	Motion of Point No.0
0	Homing
1	Motion per Point Table

Use this parameter for homing when the I/O assignments don't include homing input HOME.

		Settings	Default	Characteristics
No. 647.0	Homing: Torque command limit enable switch	0, 1	0	PLS HOME ON OFF – 2 BYTE IN POS

Function Use

Enable/Disable torque command limit during Homing. This item is a safety measure against collisions during Homing.

Settings	Torque Command Limit
0	Disable
1	Enable

Use this parameter for homing when the I/O assignments don't include homing input HOME.

Remark

For Homing by using stopper, this parameter setting does not matter. The torque limit used for press detection will be always the setting of **Homing torque command limit value** (656.0) regardless of this parameter setting.

Related To No. 656.0

		Settings	Default	Characteristics
No. 647.1	Homing: Creep speed enable switch	0, 1	0	PLS HOME ON OFF – 2 BYTE IN POS

Function Use

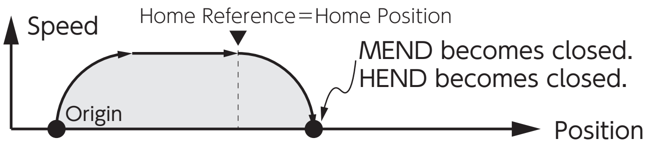
Enable/Disable homing motion after home reference signal detection.

Set to 0 to only detect the home reference signal.
Set to 1 if any motion is intended after the reference signal detection.

Settings	Motion afterwards
0	None
1	Move

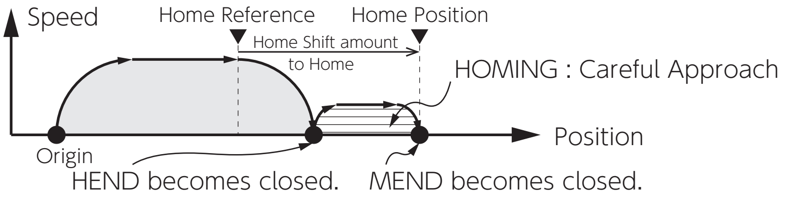
■ 0 (None)

After home reference signal is detected, the motor decelerates to stop and homing completes.



■ 1 (Move)

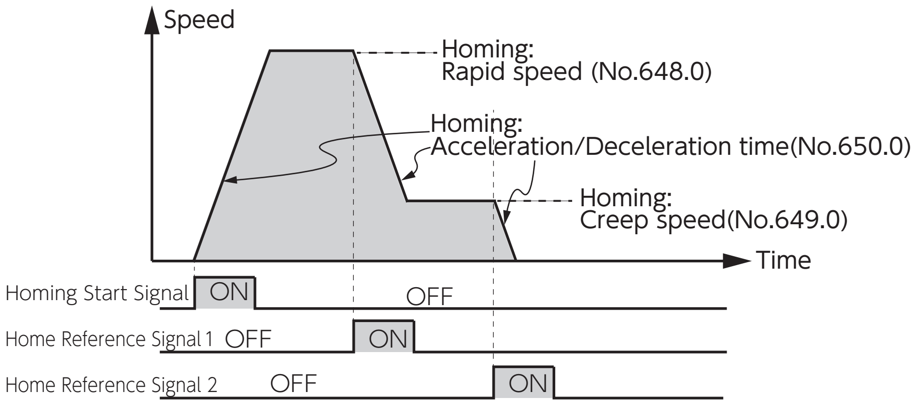
After home reference signal is detected and then the motor decelerates to stop, motion to carefully approach to the home position follows according to the parameter setting.



No. 648.0	Homing: Rapid speed	Range	Default	Characteristics
		1 to Motor max rotational speed	500 [rpm]	PLS HOME 0 100 – 2 BYTE IN POS

Function Use

Specify the speed value for rough approach motion before the home reference signal is detected.



No. 649.0	Homing: Creep speed	Range	Default	Characteristics
		1 to Motor max rotational speed	10 [rpm]	PLS HOME 0 100 – 2 BYTE IN POS
Function Use	Specify the speed for careful approach after the home signal is detected. To improve accuracy to detect the home reference signal, select a lower speed.			
Prerequisite	Homing: Creep speed switch (647.1) : 1 (Move)			
Related To	No. 645.0, No. 647.1, No. 648.0			

No. 650.0	Homing: Acceleration/Deceleration time	Range	Default	Characteristics
		0 to 5,000	30 [ms]	PLS HOME 0 100 – 2 BYTE IN POS
Function Use	Set Acceleration/Deceleration Time for homing. This item indicates time amount for a speed to change 1,000 rpm. Applies to **Rapid Speed** (648.0) and **Creep Speed** (649.0)			
Remark	If the load is more than 10 times of inertia ratio, set this parameter to a value larger than the default. Otherwise, vibration may occur.			

No. 651.0	Homing: Amount of home position shift	Range	Default	Characteristics
		0 to 1,000,000,000	0 [command pulse]	PLS HOME 0 100 – 4 BYTE IN POS
Function Use	Use this parameter to set shift amount from home signal or encoder Z-phase to home.			
Related To	No. 646.0			

		Range	Default	Characteristics
No. 653.0	Homing: Home position data	-1,000,000,000 to +1,000,000,000	0 [command pulse]	PLS HOME 0 100 - 4 BYTE IN POS
Function Use	This parameter value overwrites the home coordinate (ABS position feedback value) upon Homing complete.			

		Range	Default	Characteristics
No. 655.0	Homing: Time to detect press stopper	5 to 1,000	100 [ms]	PLS HOME 0 100 - 2 BYTE IN POS
Function Use	This parameter defines the torque command limiting time, which is a time amount for home to be detected after the stopper was pressed.			
Related To	No. 645.0, No. 647.0			

		Range	Default	Characteristics
No. 656.0	Homing: Torque command limit value	10 to 3,000	500 [0.1 %]	PLS HOME 0 100 - 2 BYTE IN POS
Function Use	This parameter defines the ratio of torque command limit value (during homing) to the rated torque. The parameter is used as a safety measure against collisions during Homing. It is a torque command limit value in Homing by using stopper.			
Prerequisite	Homing: Home Reference Signal selection (645.0) = 1 (Stopper) or Torque command limit switch (647.0) = 1 (Enable)			
Related To	No. 645.0, No. 647.0			

		Range	Default	Characteristics
No. 657.0	Homing: Z-phase disabled distance	0 to 1,000,000,000	0 [command pulse]	PLS HOME 0 100 - 4 BYTE IN POS
Function Use	Set the shift amount between a detection position of home signal and a starting position of z-phase detection.			

		Range	Default	Characteristics
No. 659.0	Homing: Timeout time	0 to 60,000	60,000 [10 ms]	PLS HOME 0 100 - 2 BYTE IN POS
Function Use	Set the timeout time for homing. This is a safety measure in case of fault during homing.			
Prerequisite	Timeout Switch (646.2) = 1 (Disable)			
Related To	No. 646.2			

5. Parameters

		Settings	Default	Characteristics
No. 720.0 No. 740.0 to No. 1020.0	Internal Position: Point table Command method (*)	0, 1	0	IN POS CTRL ON OFF – 2 BYTE

Function Use

Select the command method for point table.

Settings	Command Method	Position to be set
0	Absolute value	Target position
1	Relative value	Shift amount from the current position to the target position

		Settings	Default	Characteristics
No. 720.1 No. 740.1 to No. 1020.1	Internal Position: Point table Operation (*)	0, 1	0	IN POS CTRL A B – 2 BYTE

Function Use

Select the Running Motion of Point Table

Settings	Running Motion
0	Single
1	Continuous

		Settings	Default	Characteristics
No. 720.3 No. 740.3 to No. 1020.3	Internal Position: Point table Enable/Disable (*)	0, 1	0	IN POS CTRL ON OFF – 2 BYTE

Function Use

Enable/Disable Point Table.

Settings	Enable/Disable
0	Disable The point number assigned “disable” is not executed and any subsequent point numbers assigned “enable” are executed.
1	Enable The point number assigned “enable” is executed

		Range	Default	Characteristics
No. 722.0 No. 742.0 to No. 1022.0	Internal Position: Point table Position (*)	− 1,073,741,823 to +1,073,741,823	0 [command pulse]	IN POS CTRL 0 100 – 4 BYTE

Function Use

Set the target position in Point Table.

*) See the Point Table Parameter List to look up a point number and its corresponding parameter numbers.

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		Range	Default	Characteristics
No. 724.0 No. 744.0 to No. 1024.0	Internal Position: Point table Rotational speed (*)	0 to Maximum Rotational Speed of Motor	0 [rpm]	IN POS CTRL 0 100 – 4 BYTE
Function Use	Set the motor rotational speed for the Point Table.			

		Range	Default	Characteristics
No. 726.0 No. 746.0 to No. 1026.0	Internal Position: Point table Acceleration time (*)	0 to 5,000	30 [ms]	IN POS CTRL 0 100 – 2 BYTE
Function Use	Set the acceleration time for the Point table. This item indicates the amount of time for a speed command to change from 0 [rpm] to 1,000 [rpm]. In the default setting, it takes 90 [ms] for the rotational speed to change from 0 [rpm] to 3,000 [rpm].			

		Range	Default	Characteristics
No. 727.0 No. 747.0 to No. 1027.0	Internal Position: Point table Deceleration time (*)	0 to 5,000	30 [ms]	IN POS CTRL 0 100 – 2 BYTE
Function Use	Set the deceleration time for the Point Table. This item indicates the amount of time for a speed command to change from 0 [rpm] to 1,000 [rpm]. In the default setting, it takes 90 [ms] for the rotational speed to change from 3,000 [rpm] to 0 [rpm].			

		Range	Default	Characteristics
No. 728.0 No. 748.0 to No. 1028.0	Internal Position: Point table Dwell time (*)	0 to 20,000	1 [ms]	IN POS CTRL 0 100 – 2 BYTE
Function Use	Set the dwell time for the Point Table. Dwell time is the wait time for the next Point-Table motion to be executed after a Point-Table motion is complete.			

		Range	Default	Characteristics
No. 729.0 No. 749.0 to No. 1029.0	Internal Position: Point table Positioning completion (*)	0 to 32,767	20 [encoder pulse]	IN POS CTRL 0 100 – 4 BYTE
Function Use	Set the range for positioning complete by the Point table.			

*) See the Point Table Parameter List to look up a point number and its corresponding parameter numbers.

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5. Parameters

3. Point Table Parameter List

To configure point table data by using RS-485 Communications, refer to the cross table of point table items and their corresponding parameter numbers.

Point No.	Position [command pulse]	Rotational speed [rpm]	Acceleration time [ms]	Deceleration time [ms]	Command method [-]	Dwell time [ms]	Operation [-]	Positioning completion [encoder pulse]	Enable /Disable [-]
0	No. 722.0	No. 724.0	No. 726.0	No. 727.0	No. 720.0	No. 728.0	No. 720.1	No. 729.0	No. 720.3
1	No. 742.0	No. 744.0	No. 746.0	No. 747.0	No. 740.0	No. 748.0	No. 740.1	No. 749.0	No. 740.3
2	No. 762.0	No. 764.0	No. 766.0	No. 767.0	No. 760.0	No. 768.0	No. 760.1	No. 769.0	No. 760.3
3	No. 782.0	No. 784.0	No. 786.0	No. 787.0	No. 780.0	No. 788.0	No. 780.1	No. 789.0	No. 780.3
4	No. 802.0	No. 804.0	No. 806.0	No. 807.0	No. 800.0	No. 808.0	No. 800.1	No. 809.0	No. 800.3
5	No. 822.0	No. 824.0	No. 826.0	No. 827.0	No. 820.0	No. 828.0	No. 820.1	No. 829.0	No. 820.3
6	No. 842.0	No. 844.0	No. 846.0	No. 847.0	No. 840.0	No. 848.0	No. 840.1	No. 849.0	No. 840.3
7	No. 862.0	No. 864.0	No. 866.0	No. 867.0	No. 860.0	No. 868.0	No. 860.1	No. 869.0	No. 860.3
8	No. 882.0	No. 884.0	No. 886.0	No. 887.0	No. 880.0	No. 888.0	No. 880.1	No. 889.0	No. 880.3
9	No. 902.0	No. 904.0	No. 906.0	No. 907.0	No. 900.0	No. 908.0	No. 900.1	No. 909.0	No. 900.3
10	No. 922.0	No. 924.0	No. 926.0	No. 927.0	No. 920.0	No. 928.0	No. 920.1	No. 929.0	No. 920.3
11	No. 942.0	No. 944.0	No. 946.0	No. 947.0	No. 940.0	No. 948.0	No. 940.1	No. 949.0	No. 940.3
12	No. 962.0	No. 964.0	No. 966.0	No. 967.0	No. 960.0	No. 968.0	No. 960.1	No. 969.0	No. 960.3
13	No. 982.0	No. 984.0	No. 986.0	No. 987.0	No. 980.0	No. 988.0	No. 980.1	No. 989.0	No. 980.3
14	No. 1002.0	No. 1004.0	No. 1006.0	No. 1007.0	No. 1000.0	No. 1008.0	No. 1000.1	No. 1009.0	No. 1000.3
15	No. 1022.0	No. 1024.0	No. 1026.0	No. 1027.0	No. 1020.0	No. 1028.0	No. 1020.1	No. 1029.0	No. 1020.3

6 Operation

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3. Velocity Control Mode 10

1. Analog Velocity Command 10
2. Internal Velocity Command. 13

4. Torque Control Mode 15

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1. Configuring Operating Mode

The drive is operated with any of the seven operating modes which are combinations of Control Mode and Command Mode. Configure parameters No.2.0 and No.3.0.

( ) The numeric values in the parentheses represent parameter settings.

Control Mode (No2.0)	Command Mode (No.3.0)	Command Input Signal Format
Position Control (0 : Default)	**Pulse Train Command (1 : Default)** In this operating mode, position commands are issued from the host controller with pulse input. ☞ Page 6–	· Differential · 24 V open collector · 5 V open collector
	Internal Speed Command (3) An operating mode used in the Positioner Drive function that enables you to execute positioning command preset in the drive with I/O operation from the host controller. Point table operation ☞ Page 18–	· I/O operation
Velocity Control (1)	**Analog Velocity Command (2)** In this operating mode, speed commands are issued from the host controller with analog voltage input. ☞ Page 10–	· Analog voltage
	Internal Speed Command (3) This type of operating mode moves the machine according to the speed preset in the drive with I/O input from the host controller. ☞ Page 13–	· I/O operation
Torque Control (2)	**Analog Torque Command (2)** In this operating mode, torque commands are issued from the host controller with analog voltage input. ☞ Page 15–	· Analog voltage

⚠ CAUTION

Before performing wiring to each drive or motor, verify that all power sources are shut off.

All wiring work must be performed by certified electricians.

Before applying power to each drive or motor, be sure that wiring has been performed correctly.

1. Related to Parameter

The following are the parameters that must be configured for all operating modes.

Common

COMM MODE CTRL LIMIT

Name			No.	P.
Control mode			2.0	5-34
Command mode			3.0	5-34
Operation mode			9.0	5-35
Warning latch time			12.0	5-36
Alarm output timing			13.0	5-36
Torque command limit	Switch		144.0	5-62
	Value 1		147.0	5-63
	Value 2		148.0	5-63
Torque limit output			144.1	5-63
Servo OFF: Delay time			237.0	5-75
Brake release: Delay time			238.0	5-75
Absolute system			257.0	5-76
Encoder pulse output	Rotational direction		272.1	5-77
	Command pulse ratio	Numerator	276.0	5-78
		Denominator	278.0	5-78

Warning/Error Detection

COMM PLS ALM

Name		No.	P.
Position error Error detection	Switch	65.0	5-41
	Value	87.0	5-51
	Delay time	89.0	5-51
Position error Warning detection	Value	363.0	5-85
	Delay time	365.0	5-85
Speed error Error detection	Switch	65.1	5-41
	Value	90.0	5-51
	Delay time	91.0	5-51
Encoder pulse output Error detection	Frequency upper limit	285.0	5-79
	Delay time	286.0	5-79
Encoder Overheat detection	Switch	259.0	5-76
	Value	267.0	5-77
Encoder Battery Voltage drop detection	Switch	259.1	5-76
	Value	268.0	5-77
Voltage Dip Detection	Delay time	305.0	5-83

RS-485 Communications

COMM COM

Name	No.	P.
Switch	8.0	5-35
Address	4.0	5-34
Communication speed	6.0	5-34
Stop bit	6.1	5-35
Parity	6.2	5-35
Minimum response time	11.0	5-35

Drive Limit Switch Input

COMM PLS CTRL

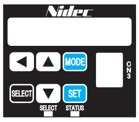
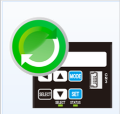
Name	No.	P.
Setup	67.0	5-43
Deceleration method	67.1	5-43
Idling status	67.2	5-43
Retaining position error counter	67.3	5-43

Deceleration Stop

COMM STOP

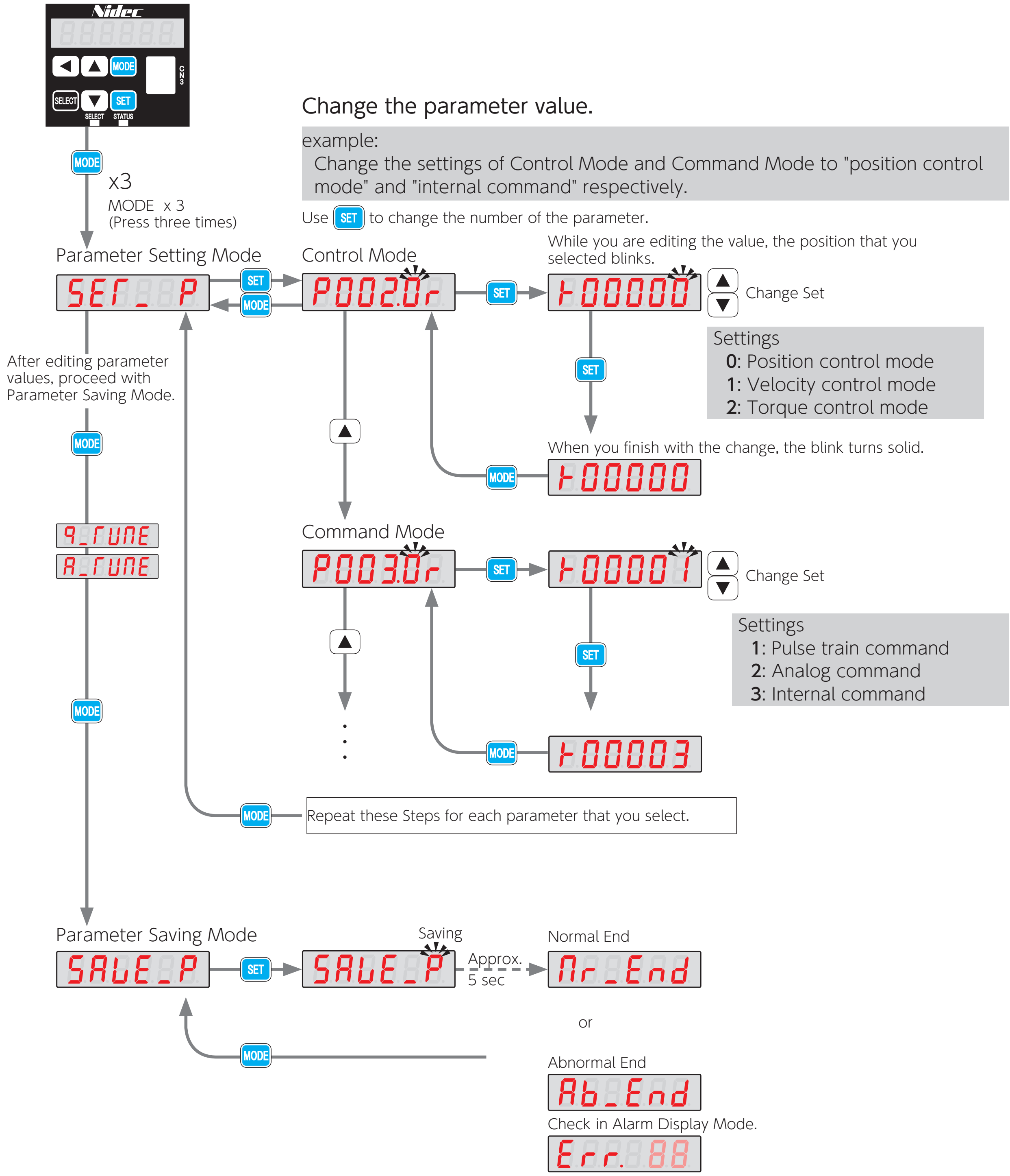
Name		No.	P.
Upon Servo Off	Method	224.0	5-68
	DBRK output after stopping	224.3	5-69
When alarm is on	Method	233.0	5-73
	DBRK output after stopping	233.1	5-74
Release conditions		224.1	5-68
Operating time		226.0	5-70
Cancellation speed		227.0	5-70
Upon AC Supply loss	Switch	224.2	5-69
	Operating time	228.0	5-70
Torque command limit		151.0	5-64
Status during coast to stop		232.1	5-71
Short brake operation after a stop		232.2	5-72
Motor Brake engagement	Timing	232.3	5-72
	Delay time	234.0	5-74
	Rotational speed	235.0	5-74

For each operating mode, its supporting parameters must be configured. For details, refer to the subsequent sections describing each operation mode.

Parameter Tuning Methods	
	Use the Setup Panel at the front of the drive for tuning.
	Use the setup software Digitax SF Connect for tuning. Install it on the user-supplied computer.

2. Configuring Parameters

Using the Setup Panel



Change the parameter value.

example:
Change the settings of Control Mode and Command Mode to "position control mode" and "internal command" respectively.

Use SET to change the number of the parameter.

While you are editing the value, the position that you selected blinks.

When you finish with the change, the blink turns solid.

Settings
- **0**: Position control mode
- **1**: Velocity control mode
- **2**: Torque control mode

Settings
- **1**: Pulse train command
- **2**: Analog command
- **3**: Internal command

After editing parameter values, proceed with Parameter Saving Mode.

Repeat these Steps for each parameter that you select.

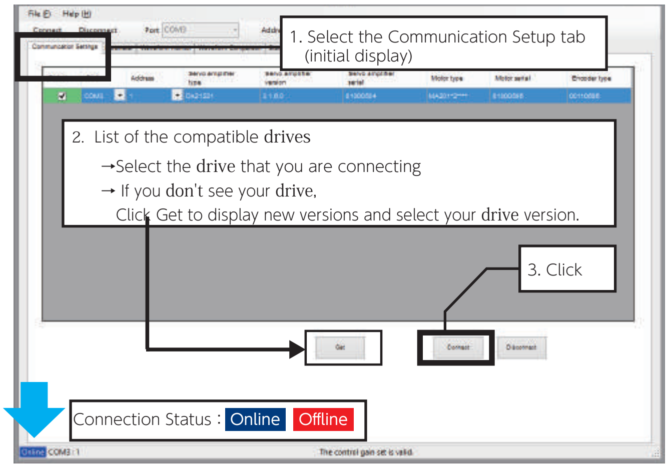
Check in Alarm Display Mode.

Save the parameter settings in Parameter Saving mode to the drive. If you shut down the drive without saving them, the changes will not take effect.

Using Digitax SF Connect

Step1 Start

Double-click on



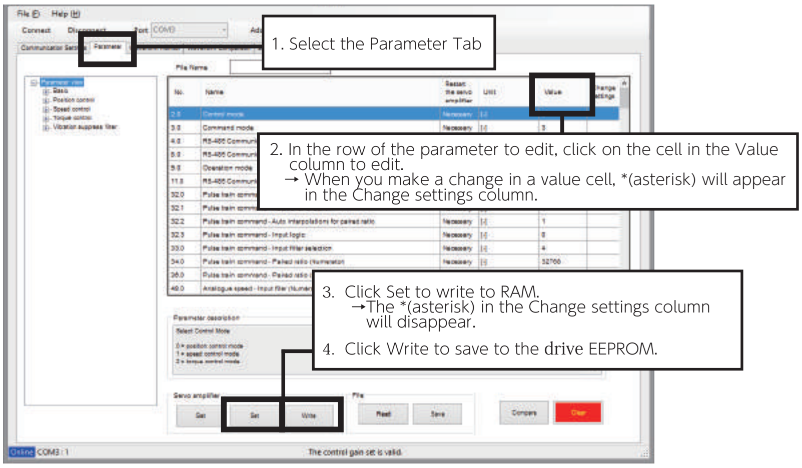
1. Select the Communication Setup tab (initial display)

2. List of the compatible drives
→Select the drive that you are connecting
→ If you don't see your drive,
Click Get to display new versions and select your drive version.

3. Click

Connection Status : Online Offline

Step2 Set parameters



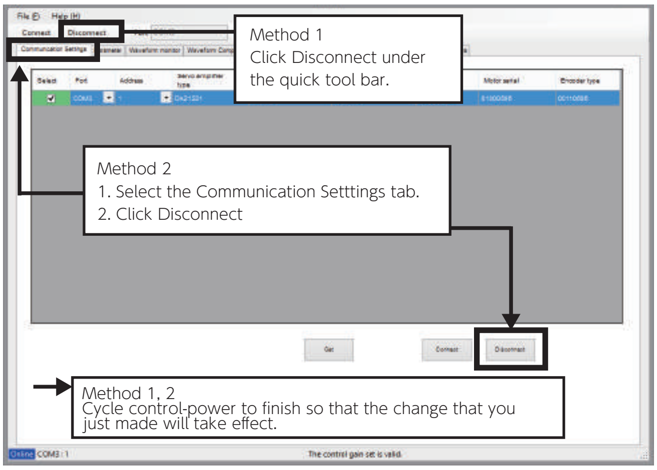
1. Select the Parameter Tab

2. In the row of the parameter to edit, click on the cell in the Value column to edit.
→ When you make a change in a value cell, *(asterisk) will appear in the Change settings column.

3. Click Set to write to RAM.
→The *(asterisk) in the Change settings column will disappear.

4. Click Write to save to the drive EEPROM.

Step3 Finish



Method 1
Click Disconnect under the quick tool bar.

Method 2
1. Select the Communication Setttings tab.
2. Click Disconnect

Method 1, 2
Cycle control-power to finish so that the change that you just made will take effect.

2. Position Control Mode

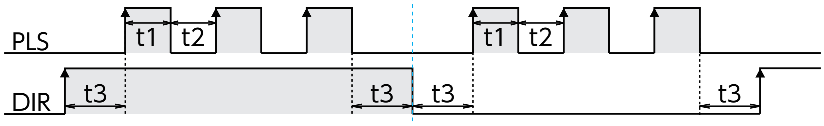
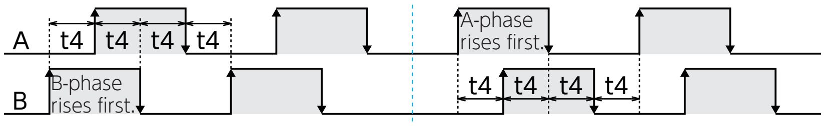
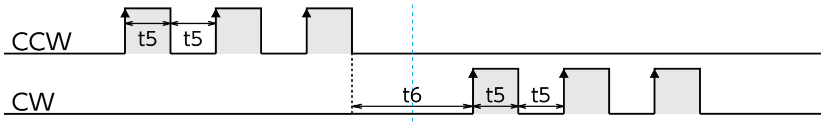
1. Pulse Train Command

Required Parameters

Set the operating mode with the following parameters.

Parameter No.	Name	Setting
2.0	Control Mode	**0**: Position Control Mode (Default)
3.0	Command Mode	**1**: Pulse Train Command Mode (Default)
32.0	Input pulse form (*)	Select one. **0**: Pulse and direction (PLS & DIR) (Default) **1**: Quadrature phase difference pulse (A-Phase & B-Phase) **2**: Input in positive or negative pulse (CCW & CW)
33.0	Input Filter	Helps to reduce possible malfunctions caused by noise. You must configure this parameter in the case of command input by open collector. Default: 4 (150 ns) ☞ 5 Settings, 9 Appendices
34.0	Paired Pulse Ratio (Numerator)	32,768 (Default : 1,000 [pulse/rev])
36.0	Paired Pulse Ratio (Denominator)	Set to [pulse count of the host controller output] divided by 4 Default : 1,000 [pulse/rev]

*) Pulse command input form (see the table above) and Minimum Time Interval (see the table below).

Parameters No32.0	Positive direction command	Negative direction command
0 (Default) Pulse and Direction (PLS & DIR)		
1 Quadrature phase Difference pulse (A-Phase & B-phase)		
2 Positive or Negative pulse (CCW & CW)		

Input pulse signal	Maximum command pulse frequency	Minimum time interval [μs]					
		t1	t2	t3	t4	t5	t6
Differential	4 Mpps	0.125	0.125	2.5	0.25	0.125	0.125
Open collector	200 kpps	2.5	2.5	2.5	2.5	2.5	2.5

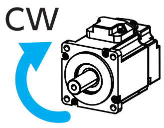
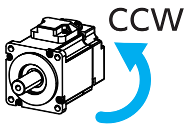
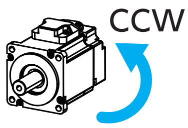
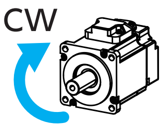
The amount of time needed for rising or falling edge of the command pulse input signal must be 0.1 μs or below. The number of pulses is counted at the rising edge (from low level to high level).
The input logic can be changed with Parameter No.32.3.

Optional Parameters

The following parameters are optional. Configure them, as necessary.

Name		Description	Parameter No.
Pulse Train Command	Direction of Rotation	See below	32.1
	Input Logic	Select the pulse train input logic Default : 1 (Negative logic)	32.3
Positioning Complete	Determination Method	Specify the conditions for Positioning Complete ☞ 5 Settings	64.0
	Detection Criteria (Range)		68.0
	Detection Criteria (Speed)		69.0
	Detection Criteria (Command input)		70.0
	Detection Time Delay		71.0

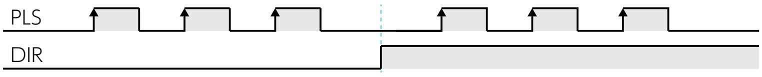
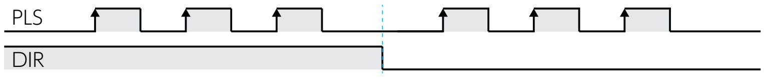
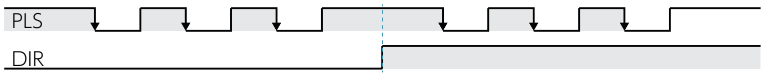
Configuration of Parameter No.32.1 and Rotational Direction of the Motor

Parameter No.32.1	Command pulse from the controller	
	Positive direction command	Negative direction command
0		
1 (Default)		

Input Pulse Form and Parameter Setting

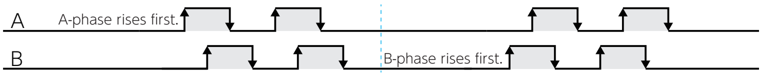
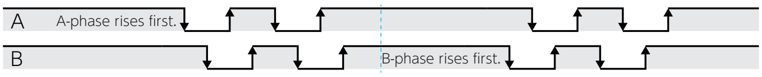
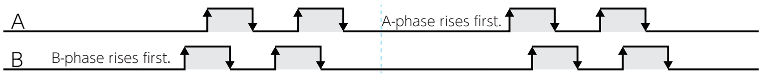
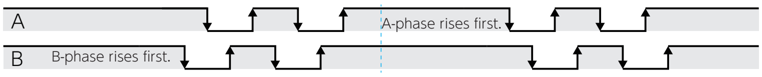
The command pulse is counted at the rising edge in the positive logic and the falling edge in the negative logic.

Pulse and Direction（PLS & DIR）（No.32.0 = 0）

Parameter No.32.1	Parameter No.32.3	Command input waveform CCW　CW
0	0 (Default)	
	1	
1 (Default)	0 (Default)	
	1	

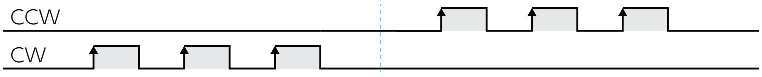
- Changing the setting of Parameter No.32.3 will reverse the direction signal (DIR) logic.
- Change the direction signal (DIR) when PLS is LOW where No.32.3=0 and PLS is HIGH where No.32.3=1.

Quadrature phase Difference pulse（A-Phase & B-phase）（No.32.0 = 1）

Parameter No.32.1	Parameter No.32.3	Command input waveform CCW　CW
0	0 (Default)	
	1	
1 (Default)	0 (Default)	
	1	

- No direction signal logic change by Parameter No.32.3.

Positive or Negative pulse（CCW & CW）（No.32.0 = 2）

Parameter No.32.1	Parameter No.32.3	Command input waveform CCW　CW
0	0 (Default)	
	1	
1 (Default)	0 (Default)	
	1	

2. Position Control Mode

Precautions for Testing

❗	Before applying power to each drive or motor, be sure that all wiring has been performed properly.	⚠ ⚠ ⚠ ⚠
	Set the parameters correctly before testing.	⚠ ⚠
	Check motor motion first with no machine connected.	⚠ ⚠
	For a brake-equipped motor, be sure to disengage the brake before driving the motor.	⚠

Testing Procedure

Step	Operation
Step 1	Verify that wiring has been performed correctly.
Step 2	Turn on the control power to the drive.
Step 3	Turn on the AC Supply to the drive.
Step 4	Connect the SVON pin on CN1 connector to COM- to turn the servo on.
Step 5	Input the position command pulse from the host controller in low frequency, and run the motor at low speed (around100 rpm). Be sure that the actual rotational direction of the motor agrees with the direction setting. Verify that stopping the command pulse does stop the motor.
Step 6	After ensuring correct direction of actual motion, increase the frequency of position command pulse gradually and check motor motion. If vibration occurs, increase the inertia ratio.

☞ 8 Troubleshooting

3. Velocity Control Mode

1. Analog Velocity Command

Required Parameters

Start testing only after configuring the parameters.

Set the operating mode.

Parameter No.	Name	Setting
2.0	Control Mode	**1**: Velocity Control mode (Default: 0 Position control mode)
3.0	Command Mode	**2**: Analog command (Default: 1 Pulse train command)

Optional Parameters

The following parameters are optional. Configure them as necessary.

Name			Explanation	Parameter No.
Offset	Adjustment		Adjust the offset, such that the motor speed becomes 0 rpm when the command input is 0 V.	62.2
	Value			60.0
Direction of Rotation			Select CCW or CW. (*3)	62.0
Input Filter	Enable Switch		Apply this parameter to filter the noise component of input command voltage.	62.1
	Numerator			48.0
	Denominator			49.0
Input gain	Numerator		Set the rotational speed at max command input voltage (± 10 V). (*1)	50.0
	Denominator			51.0
Speed limit	CCW	Numerator	Set the speed limit for CCW rotations. (*2)	52.0
		Denominator		53.0
	CW	Numerator	Set the speed limit for CW rotations. (*2)	54.0
		Denominator		55.0
Smoothing Filter	Enable Switch		Apply this filter to reduce the variance of the motor speed.	77.0
	Moving Average Time			78.0

☞ 5 Settings

*1) Example of Input Gain Configuration

Input Gain is configured with the following two parameters:
Numerator (No.50.0): desired max rotational speed
Denominator (No.51.0): max rotational speed of the motor

Example of setting the max command input voltage (±10 V) to 3,000 [rpm] for the motor with 5,000 [rpm] max rotational speed.

Parameter No.	Setting [rpm]
50.0	3,000
51.0	5,000

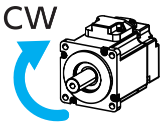
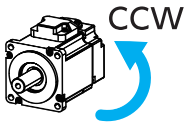
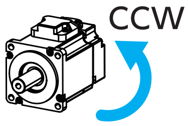
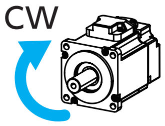
*2) Example of Speed Limit Configuration

Speed limit is configured with the following two parameters:
Numerator (CCW: No.52.0, CW: No.54.0): desired max rotational speed limit
Denominator (CCW: No.53.0, CW: No.55.0): max rotational speed of the motor

Example of setting the max rotational speed limit to 3,000 [rpm] for the motor of 5,000 [rpm] max rotational speed.

Direction of Rotation	Parameter No.	Setting [rpm]
CCW	52.0	3,000
	53.0	5,000
CW	54.0	3,000
	55.0	5,000

*3) Configuration of Parameter No.62.0 and Rotational Direction of the Motor

Parameter No.62.0	Input Analog Command Voltage	
	Positive Voltage	Negative Voltage
0		
1 (Default)		

3. Velocity Control Mode

Precautions for Testing

❗	Before applying power to each drive or motor, be sure that all wiring has been performed properly.	⚠ ⚠ ⚠ ⚠
	Set the parameters correctly before testing.	⚠ ⚠
	Check motor motion first with no machine connected.	⚠ ⚠
	For a brake-equipped motor, be sure to disengage the brake before operating the motor.	⚠

Testing Procedure

Step	Operation
Step 1	Verify that wiring has been performed correctly.
Step 2	Turn on the control power to the drive.
Step 3	Turn on the AC Supply to the drive.
Step 4	Connect the SVON pin of CN1 connector to COM- to turn the servo on.
Step 5	Input the analog velocity command voltage with a low voltage to run the motor at a low speed. Be sure that the actual rotational direction of the motor agrees with the direction setting. Verify that the motor speed changes depending on the input voltage.
Step 6	After ensuring correct direction of actual motion, increase the command voltage gradually and check motor motion. Verify that the rotational speed has reached the specified speed. If vibration occurs, increase the inertia ratio.

2. Internal Velocity Command

Required Parameters

Start testing only after configuring the parameters.

Set the operating mode.

Parameter No.	Name	Setting
2.0	Control Mode	1: Velocity Control Mode (Default: 0 Position control mode)
3.0	Command Mode	3: Internal Command (Default: 1 Pulse train command)
388.0	Internal Velocity: Command Method	1: Preset Speed Command (8 settings) (Default: 0 Zero command)

Optional Parameters

The following parameters are optional. Configure them as necessary.

Name		Explanation	Parameter No.
Acceleration Time		amount of time for speed command to increase the speed from 0 [rpm] to 1,000 [rpm] Default: 1,000 [ms]	390.0
Deceleration Time		amount of time for the speed command to decrease the speed from 1,000 [rpm] to 0 [rpm] Default: 1,000 [ms]	391.0
Speed 1 to 8		Target speed Default: See below	392.0 to 399.0
Smoothing Filter	Enable Switch	Apply this filter to reduce the speed variation of the motor. Default : 77.0 = 0 (Disable) 78.0 = 100 [ms}	77.0
	Moving Average Time		78.0

Parameter No.	Target Speed	Setting (Default) [rpm]		
		50 W to 750 W	1 kW	1 kW to 2 kW
392.0	1	500		
393.0	2	1,000		
394.0	3	1,500		
395.0	4	2,000		
396.0	5	2,500		
397.0	6	3,000		
398.0	7	4,000		3,000
399.0	8	Motor Max Rotational Speed (*)		

*) ☞ 5 Setting

3. Velocity Control Mode

Precautions for Testing

Before applying power to each drive or motor, be sure that all wiring has been performed properly.

Set the parameters correctly before testing.

Check motor motion first with no machine connected.

For a brake-equipped motor, be sure to disengage the brake before operating the motor.

Testing Procedure

Step	Operation
Step 1	Verify that wiring has been performed correctly.
Step 2	Turn on the 24 VDC control power to the drive.
Step 3	Turn on the AC Supply to the drive.
Step 4	Connect the SVON pin of CN1 connector to COM- to turn the servo on.
Step 5	Select one of target speeds with open/closed combinations of VCSEL1, VCSEL2, and VCSEL3, and turn either VCRUN1 or VCRUN2 ON. The motor will rotate accordingly. Refer to the following “Motor Rotational Direction” and “Speed Settings” to operate the motor. Be sure that the actual rotational direction of the motor agrees with your direction setting. Verify that has the rotational speed has reached your speed setting. If vibration occurs, increase the inertia ratio.

RUN Operation and Rotational Direction of the Motor

Motor Rotational Direction	Operation VCRUN1	VCRUN2
CCW	Closed	Open
CW	Open	Closed
Stop	Open	Open
Stop	Closed	Closed

Closed : Contact with COM-

Open : No contact with COM-

Speed Settings

Target Speed	VCSEL1 CN1 Pin N o.8	VCSEL2 CN1 Pin N o.9	VCSEL3 CN1 Pin N o.10
1	Open	Open	Open
2	Closed	Open	Open
3	Open	Closed	Open
4	Closed	Closed	Open
5	Open	Open	Closed
6	Closed	Open	Closed
7	Open	Closed	Closed
8	Closed	Closed	Closed

4. Torque Control Mode

1. Analog Torque Command

Required Parameters

Set the parameters before testing.
Set the operating mode.

Parameter No.	Name	Setting
2.0	Control Mode	**2**: Torque Control Mode (Default: 0 Position control mode)
3.0	Command Mode	**2**: Analog Command (Default: 1 Pulse train command)

Optional Parameters

The following parameters are optional. Configure them as necessary.

Name			Explanation	Parameter No.
Offset	Adjustment		Adjust the offset, such that the motor torque command becomes 0 [0.1 %] when the command input is 0 V.	302.2
	Value			300.0
Direction of Rotation			Select the CCW or CW. (*3)	302.0
Input Filter	Enable Switch		Apply this parameter to filter the noise component of input command voltage.	302.1
	Numerator			288.0
	Denominator			289.0
Input Gain	Numerator		Set the torque at the max command input voltage (± 10 V). (*1)	290.0
	Denominator			291.0
Torque Limit	CCW	Numerator	Set the torque limit during CCW rotation. (*2)	292.0
		Denominator		293.0
	CW	Numerator	Set the torque limit during CW rotation. (*2)	294.0
		Denominator		295.0
Speed Limit			Set the speed limit.	152.0

☞ 5 Settings

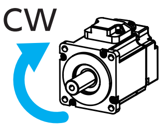
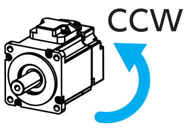
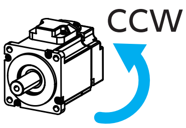
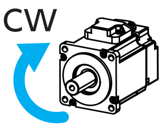
*1) Example of Input Gain Configuration
Input Gain is configured with the following two parameters:
Numerator (No.290.0): desired max torque
Denominator (No.291.0): max torque of the motor
Example: the parameter settings (for a motor with the 300 % max torque) to 100 % at the max command

Parameter No.	Setting [Unit : 0.1 %]
290.0	1,000
291.0	3,000

*2) Example of Torque Limit Configuration
Torque Limit is configured with the following two parameters:
Numerator (CCW: No.292.0, CW: No.294.0): desired torque limit
Denominator (CCW: No.293.0, CW: No.295.0): max torque limit of the motor
Example: Setting the max torque limit to 100 % for the motor of the 300 % max torque

Direction of Rotation	Parameter No.	Setting [Unit : 0.1 %]
CCW	292.0	1,000
	293.0	3,000
CW	294.0	1,000
	295.0	3,000

*3) Configuration of Parameter No.302.0 and Rotational Direction of the Motor

Parameter No.302.0	Input Analog Command Voltage	
	Positive Voltage	Negative Voltage
0		
1 (Default)		

4. Torque Control Mode

Precautions for Testing

❗	Before applying power to each drive or motor, be sure that all wiring has been performed properly.	⚠ ⚠ ⚠ ⚠
	Set the parameters correctly before testing.	⚠ ⚠
	Check motor motion first with no machine connected.	⚠ ⚠
	For a brake-equipped motor, be sure to disengage the brake before operating the motor.	⚠

Testing Procedure

Step	Operation
Step 1	Verify that wiring has been performed correctly.
Step 2	Turn on the control power to the drive.
Step 3	Turn on the AC Supply to the drive.
Step 4	Set [Analog torque: Speed limit (No.152)] to a sufficiently small value (around 500 [rpm]).
Step 5	Connect the SVON pin of CN1 connector to COM- to turn the servo on.
Step 6	Set [Analog torque: Speed limit (No.152)] to the value to be used in actual operation.
Step 7	Input the analog torque command voltage with a low voltage to run the motor with a low torque. Be sure that the actual rotational direction of the motor agrees with the direction setting. Verify that the motor speed changes according to the input voltage.
Step 8	After ensuring safety for actual motion, increase the command voltage gradually and check motor motion.

5. Position Control Mode

1. Internal Position Command (Point Table)

Internal Position Command is used for the Positioner Drive function.
This function enables you to preset data for the Point Table in the drive and set up Point Numbers that you want to execute with I/O input from the host controller. When the start signal is input, positioning starts based on the user-selected Point No.

Positioner Drive

The Positioner Drive is a function for positioning operation based on I/O commands issued by the host controller such as PLC.
Homing can be performed in the user-equipment in which Digitax SF is installed.
The Point Table stores motion patterns and Digitax SF Connect is used for the Point Table setup. Testing the Positioner operation can be done using Digitax SF Connect

1. Configuring Parameters

☞ Page 19 Required Parameters

2. Creating Point Table and Testing

To enable Positioner Drive, set the point table parameters. Use Digitax SF Connect for the point table configuration.

☞ Page 20 Creating Point Table

Test the point table operation with Digitax SF Connect before operation with user I/O.

☞ Digitax SF Connect Users Guide

3. Operation by User I/O

You can select a motion pattern from five typical motion patterns.

☞ Page 26 Operation by User I/O

Precautions

1. In case of the following, the motion started by the point table will be stopped and the remaining commands will be canceled.
   - The servo turns off.
   - Clear Position error Counter is executed.
     (When Clear Position error Counter is executed, the motor will make a quick stop.)

2. The motor moves according to the point table settings at the start time of Positioner operation. The current motion is not affected by any changes made to the point table in the middle of the motion.

Required Parameters

1. Configuring Parameters

Set the operating mode.

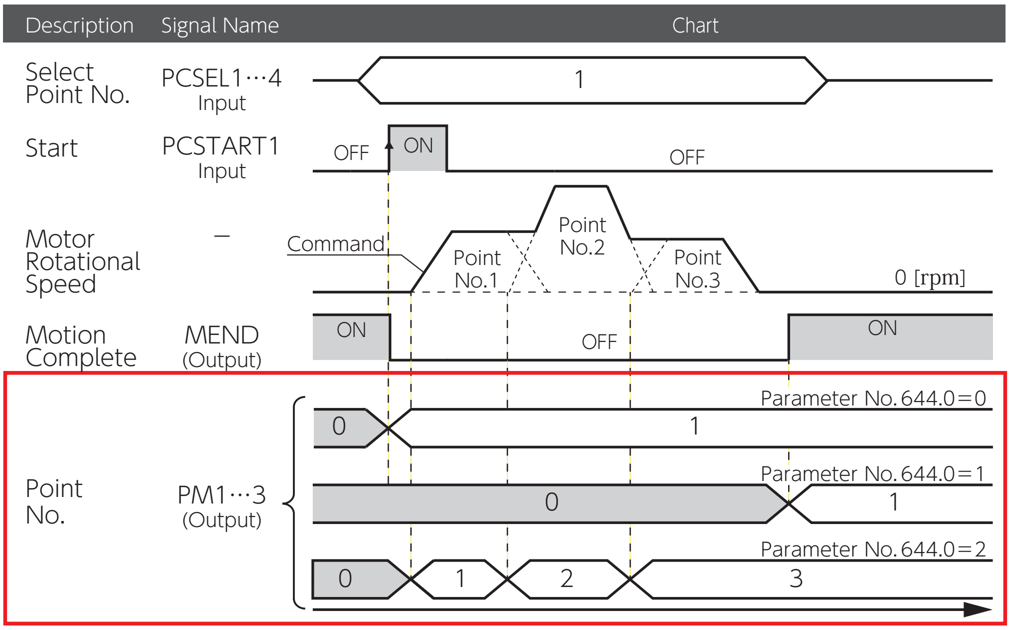
Parameter No.	Name	Setting
2.0	Control Mode	**0**: Position Control Mode
3.0	Command Mode	**1**: Pulse train command **3**: Internal Command
9.0	Operation Mode (*1)	0: Using I/O input 1: Using Digitax SF Connect
642.0	Internal Position Operation Mode	0: Point Table
643.0	Internal Position Overflow Detection	1: Enable overflow detection (Default)
644.0	Internal Position Point No. Output Method	Set up this parameter when the I/O setting type is "Option 1". (*2) Otherwise, no need to be configured.

*1) The setting is 0 (I/O Operation) upon drive power on.
You can set this item only with Digitax SF Connect not on the Setup Panel.

*2) You can specify output timing of subsequent point numbers upon motion complete.
The point number output format is illustrated at the bottom of the timing diagram below.

Example: Point Table Setting and Timing Diagram of the Point No. Output

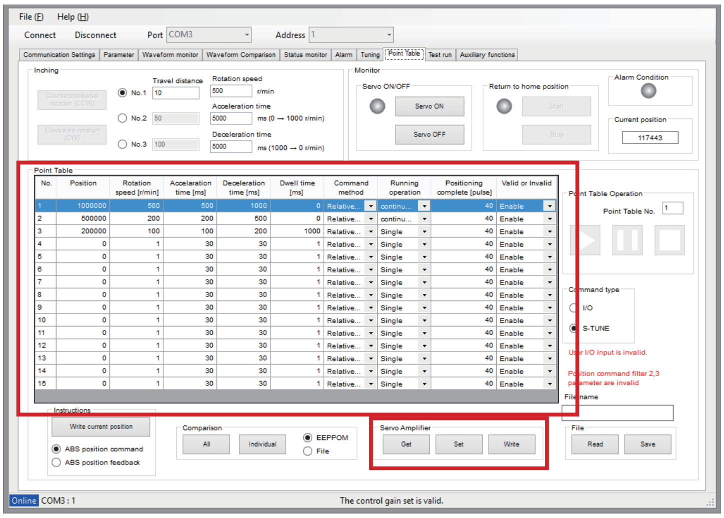
Point No.	Running Operation	Dwell Time
1	continuous	0
2	continuous	0
3	single	(any value)



Creating Point Table

Set the following items for the point table. Use Digitax SF Connect for editing point table. Set and Write the point table you created to the drive.

☞ Digitax SF Connect Users Manual



Port COM3
Address 1

Travel distance
● No.1 10
○ No.2 50
○ No.3 100

Rotation speed 500 r/min
Acceleration time 5000 ms (0 → 1000 r/min)
Deceleration time 5000 ms (1000 → 0 r/min)

Current position 117443

Point Table

No.	Position	Rotation speed [r/min]	Accelaration time [ms]	Deceleration time [ms]	Dwell time [ms]	Command method	Running operation	Positioning complete [pulse]	Valid or Invalid
1	1000000	500	500	1000	0	Relative...	continu...	40	Enable
2	500000	200	200	500	0	Relative...	continu...	40	Enable
3	200000	100	100	200	1000	Relative...	Single	40	Enable
4	0	1	30	30	1	Relative...	Single	40	Enable
5	0	1	30	30	1	Relative...	Single	40	Enable
6	0	1	30	30	1	Relative...	Single	40	Enable
7	0	1	30	30	1	Relative...	Single	40	Enable
8	0	1	30	30	1	Relative...	Single	40	Enable
9	0	1	30	30	1	Relative...	Single	40	Enable
10	0	1	30	30	1	Relative...	Single	40	Enable
11	0	1	30	30	1	Relative...	Single	40	Enable
12	0	1	30	30	1	Relative...	Single	40	Enable
13	0	1	30	30	1	Relative...	Single	40	Enable
14	0	1	30	30	1	Relative...	Single	40	Enable
15	0	1	30	30	1	Relative...	Single	40	Enable

Point Table No. 1

○ I/O
● S-TUNE

User I/O input is invalid.

Position command filter 2,3 parameter are invalid

● ABS position command
○ ABS position feedback

● EEPPOM
○ File

Online COM3 : 1
The control gain set is valid.

Item	No.	Range	Units
		(fixed)	[-]
Description	This item indicates the point number specified by I/O command. By default, Homing is assigned to Point No.0. The point table has 15 points. If you are not using the Homing function, Point No.0 becomes available and the table can have 16 points. When the type of I/O assignments is “Option 1” , the motion (No.646.3) corresponding to Point No.0 is set to 1 (point table motion).		

Item	Position	Range	Units
		− 1,073,741,823 to + 1,073,741,823	[encoder pulse]
Description	If Relative is selected as the Command method, The position data will determine the shift amount. A positive value indicates CCW rotation, a negative value indicates CW rotation If Absolute is selected as Command method, The position data will determine the target position. This value corresponds to ABS Position Command value (Status No.74). Related to: Internal position: Overflow detection (No.643.0)		

5. Position Control Mode

Item	Rotation speed	Range	Units
		1 to max rotational speed	[rpm]
Description	Set the motor rotational speed during the Positioner operation. Set this item to a speed no higher than the max rotational speed of the motor.		

Item	Acceleration time	Range	Units
		0 to 5,000	[ms]
Description	Set this item to amount of time for the rotational speed to increase from 0 rpm to 1,000 rpm.		

Item	Deceleration time	Range	Units
		0 to 5,000	[ms]
Description	Set this item to amount of time for the rotational speed to decrease from 1,000 rpm to 0 rpm.		

Item	Dwell time	Range	Units
		0 to 20,000	[ms]
Description	Set the wait time after Positioning Complete per the selected Point No. Motion after the dwell time elapses “Single” Motion: MEND will be ON. “Continuous” Motion: the motion per the next point number will start. If Running Motion is “Continuous” and the dwell time is set to 0, the motion will be according to the speed specified by point numbers, one after another continuously. If the dwell time is set to 0, the acceleration/deceleration setting in the first point number selected upon CW start PCSTART1 ON will be applied, and the acceleration/deceleration time settings of subsequent point numbers will be discarded. ☞ Page 23 Positioning Complete		

Item	Command method	Range	Units
		Relative, Absolute	[-]
Description	Absolute: the setting of Position will be the shift amount from the current position to the target position. Relative: the setting of Position will be the target position.		

5. Position Control Mode

Item	Running operation	Setting	Units
		Continuous, Single	[-]

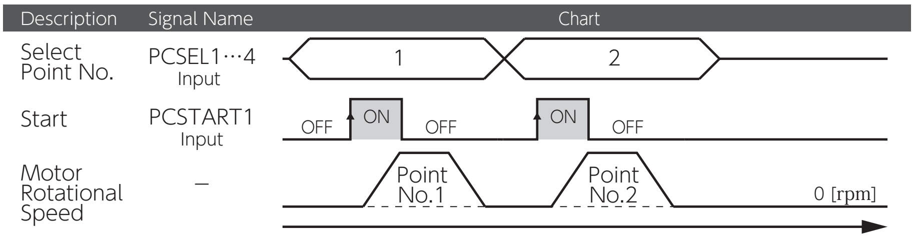
Description

Configuring Running Motion in the Point Table enables you to execute a series of continuous positioning motion and continuous speed changes.

☞ Page 24 Valid or Invalid

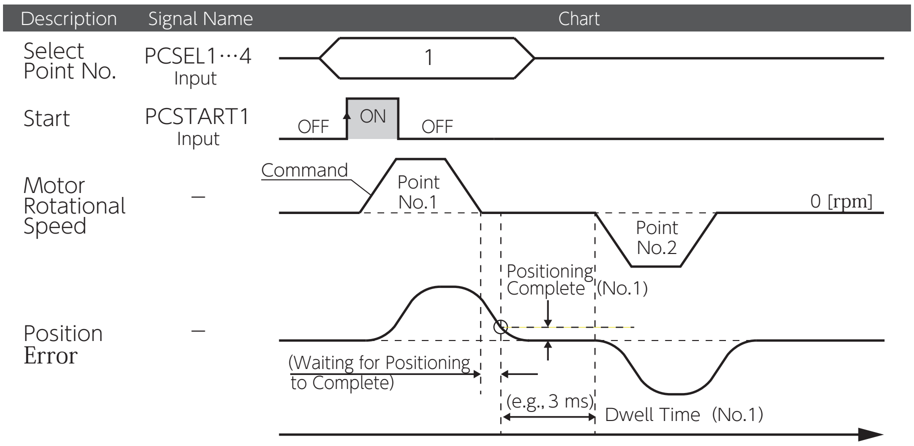
Single: After the motion specified by this point number is complete, the subsequent point numbers will not be executed.

Example: Point No.1 and 2 are set to “Single” .

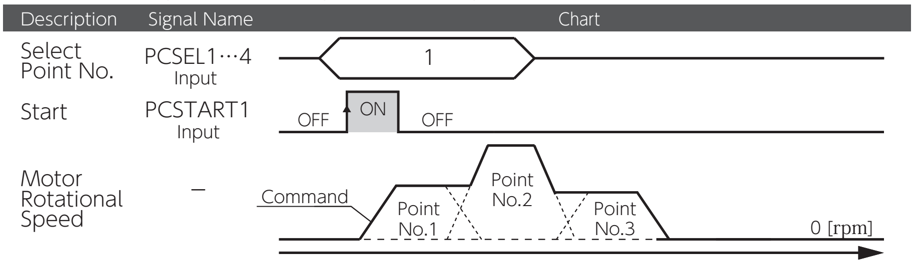


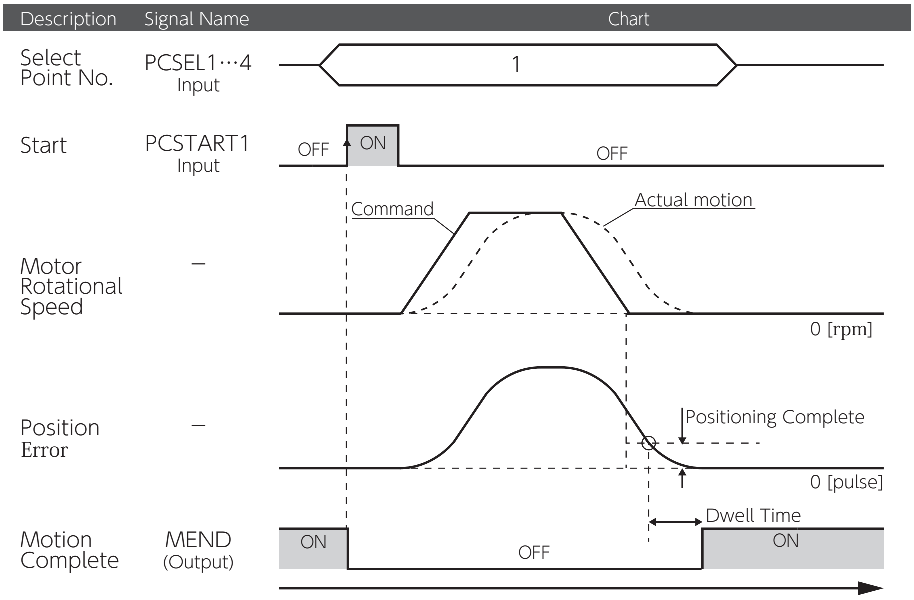
Continuous: the subsequent point number(s) will be executed.

Example If Running Motion = continuous and Dwell Time = 1 or above (for example, 3ms), then positioning will be executed according to each point. The drive will wait for the target position to be reached, then apply the dwell time, and will then start the next motion



Example If Running Motion = continuous and Dwell Time = 0, the motor will not stop and the rotational speed will change continuously.



Item	Positioning complete	Range	Units
		0 to 32,767	[pulse]
Description	**Set a position error threshold to determine whether or not positioning is complete.** After the motion specified by the point number has been complete, when the position error falls in the range set by this parameter and then the Dwell time elapses, the MEND (motion end) signal turns ON. Timing Diagram (Positioning complete and Dwell time) 		

Item	Valid or Invalid	Setting	Units
		Enable, Disable	[-]

Description

This Parameter indicates whether motion per a point number is enabled or disabled.

Setting

Disable:

The motion per the point number will not be executed and any subsequent point numbers that are enabled will be executed.

Enable:

The motion per the point number will be executed.

If you start with a point number that is "disabled" ,

The first subsequent point number that is "enabled" will be executed.

If a "disabled" point number is specified while one motion is being executed,

Motion per the "disabled" point number will not be executed and motion per the first "enabled" point number among the subsequent ones will be executed.

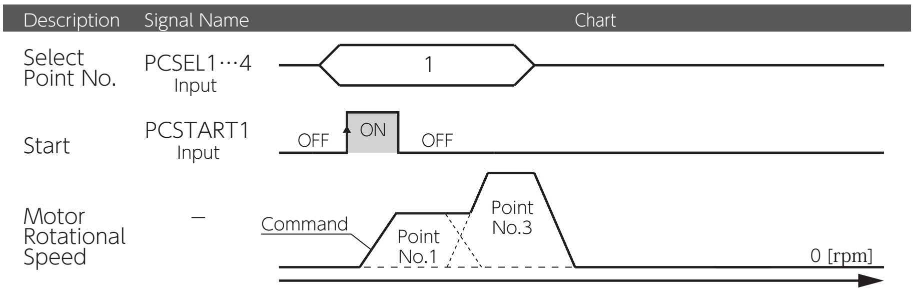
If Dwell time = "0" for a point number assigned "continuous"

The rotational speed will change continuously per "enabled" point numbers before/after the "disabled" point number.

Here is an example.

With the Point Table settings below, if you specify Start signal input to Point No. "1" , Point No. 2 won' t be executed and Point No. 1 and 3 will be continuously executed.

Point No.	Running operation	Dwell Time	Enable/Disable
1	continuous	0	Enable
2	continuous	(optional)	Disable
3	single	(optional)	Enable



TIP

For a point number with "enable" to be the last motion, set Running Motion = "single" . Otherwise (i.e. "continuous" setting to the last point number), its "enable" setting will keep the motion end signal (MEND) off and the next motion instruction will be not be executed. If this happens, do one of the following.

With User I/O

Turn the servo off or input Clear Position error Counter.

With Digitax SF Connect

Turn the servo off or click the STOP button.

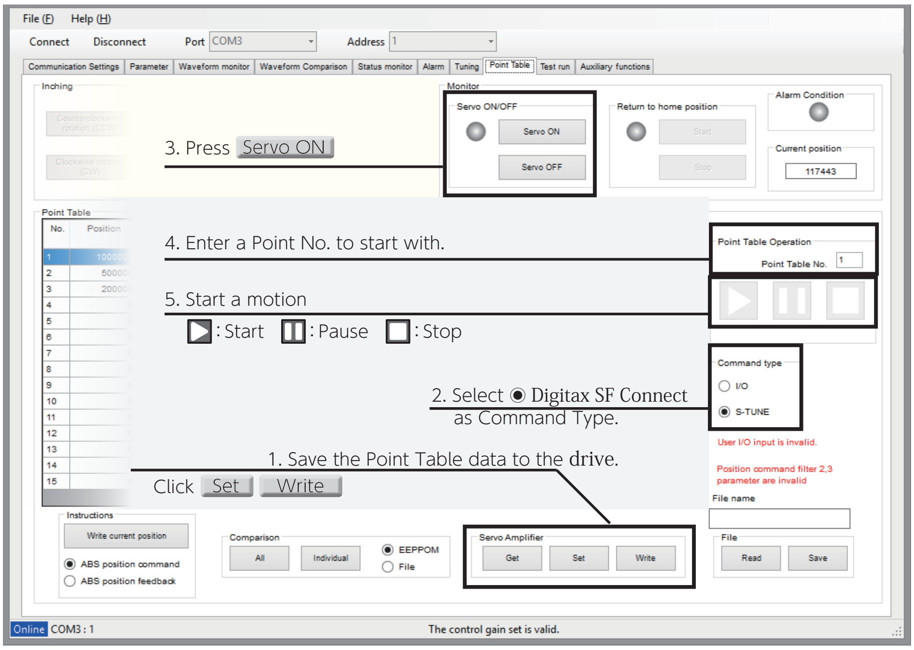
5. Position Control Mode

Precautions for Testing

❗	Before applying power to each drive or motor, be sure that wiring has been performed correctly.	⚠⚠⚠⚠
	Set the parameters correctly before testing.	⚠⚠
	Check motor motion first with no machine connected.	⚠⚠
	For a brake-equipped motor, be sure to disengage the brake before driving the motor.	⚠

Testing

Using Digitax SF Connect, check motion per the point table that you created.



3. Press Servo ON

4. Enter a Point No. to start with.

5. Start a motion

▶ : Start ⏸ : Pause ☐ : Stop

2. Select ● Digitax SF Connect as Command Type.

1. Save the Point Table data to the drive.

Click Set Write

User I/O input is invalid.

Position command filter 2,3 parameter are invalid

The control gain set is valid.

☞ Digitax SF Connect Users Guide

5. Position Control Mode

Operation by User I/O

Refer to the corresponding pages of the following five typical motion patterns to set up a point table.

Motion Pattern		Refer to
Single-motion positioning		Page 28
Continuous positioning motion		Page 29
Continuous speed changes	One-direction motion	Page 30
	Opposite direction motion	Page 31
Press motion		Page 32

Procedure (Positioner operation by User I/O input)

Step	Description	Explanation
Step 1	Check if ready to start.	Check if MEND is closed. If it' s open, wait.
Step 2	Select Point No.	Input PCSEL1...4 to specify a Point No. to execute.
Step 3	Starting Positioner operation	Wait for at least 10ms after PCSEL1-4 input, and then change PCSTART1 from open to closed. Start driving the system according to the command per the point number specified. (*)
Step 4	Check command execution	Wait till MEND becomes open. When MEND is open, change PCSTART1 back to open.
Step 5	Check Operation Complete	Verify with MEND that the motion command execution is complete. MEND turning from open to closed indicates that the operation is complete.

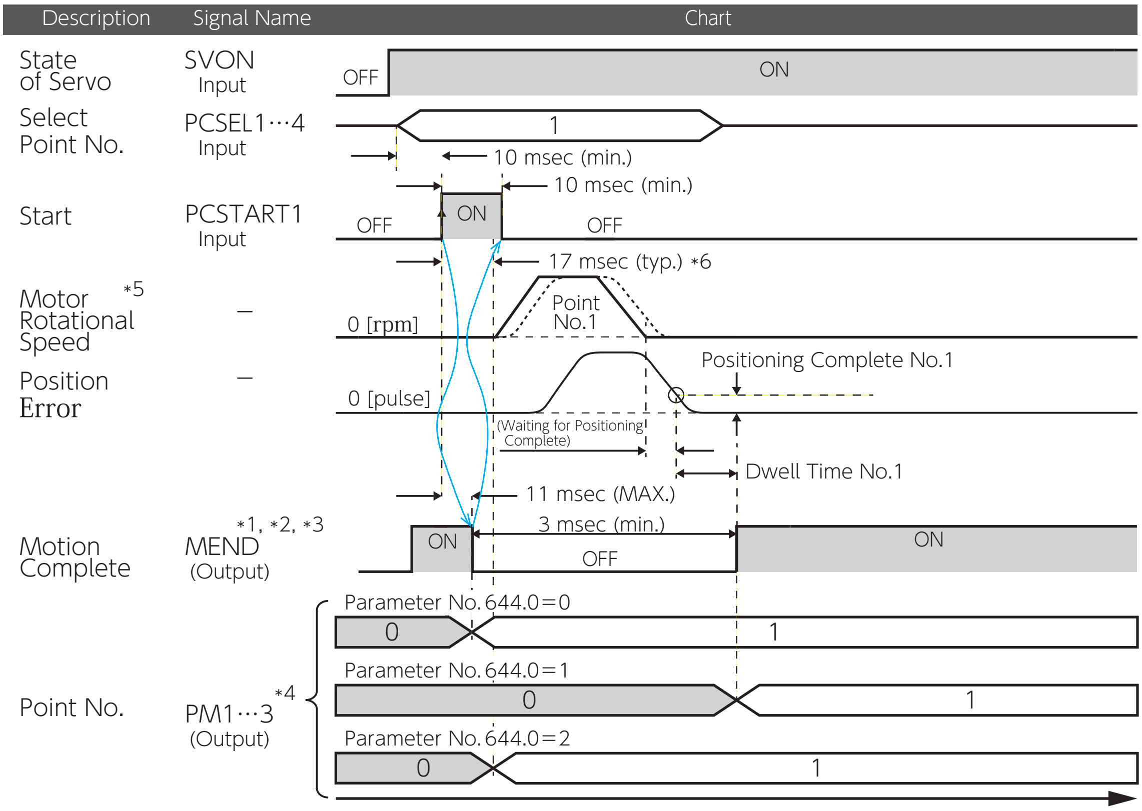
*) For more information about user I/O operation, refer to the timing diagrams shown in the operation examples.

Timing Diagram and Point Table Items

Create a point table entry for each motion command. Refer to the following timing diagram for single-motion.

Example of Point Table Setting (Single-Motion)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	5,000	300	100	150	1	Relative	single	(any value)	enable



*1) If you want to check the motion end signal (MEND) with the User I/O output "MEND/T-LIMIT" , turn T-LIMIT output OFF, by parameter configuration and TLSEL1 OFF.

☞ 4 Connections　User I/O

*2) The MEND output is OFF at Servo OFF.

*3) The PCSTART1 input is ignored when MEND output is OFF.

*4) This is enabled at the User I/O setting Option 1.
The Point No. output method depends on the [Point No. Output Method (No644.0)] setting at the time of PCSTART1 input.

*5) Any changes made to the point table setting during a motion will not be applied to the motion.

*6) The startup timing depends on other conditions.

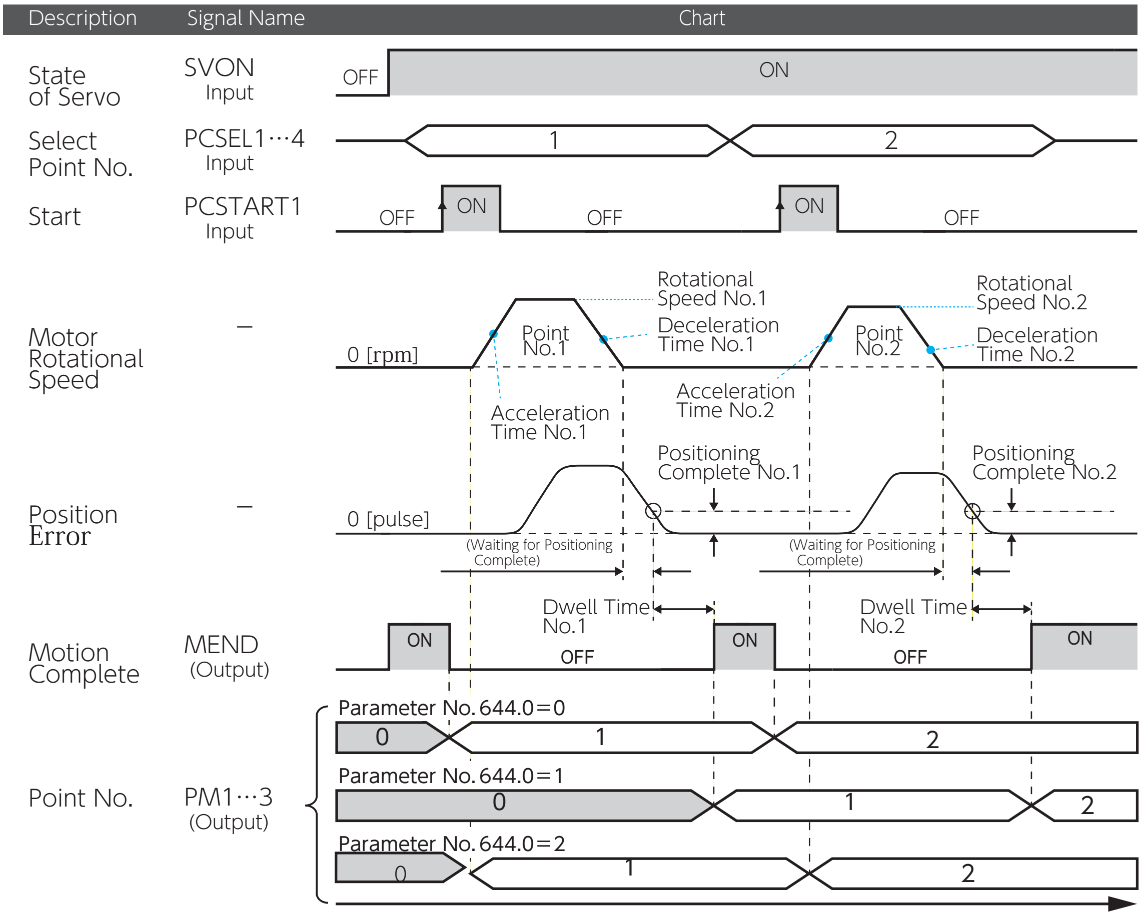
5. Position Control Mode

Example of Operation 1 Single-Motion Positioning

Motor motion stops when motion per a selected point number ends if its Running Motion setting = single.

Example of Point Table Setting (Single-Motion Positioning)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	5,000	300	100	150	100	Absolute	**Single**	20	enable
2	3,000	200	100	100	50	Relative	**Single**	20	enable



Example of Operation 2　Continuous Positioning Motion

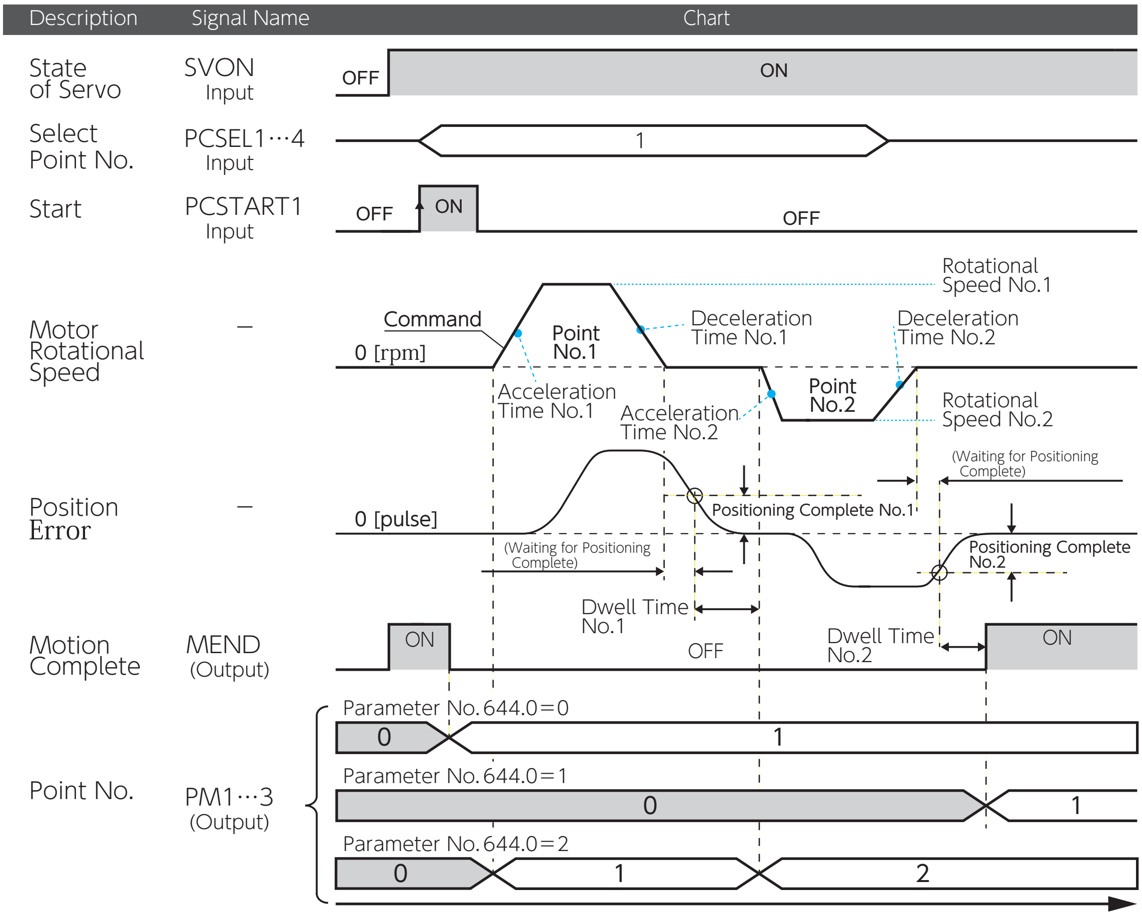
This procedure executes a series of positioning motion following the point numbers in order. Set Running Motion of “enabled” point numbers to “continuous” , and specify the first point number for turning on the CW drive signal PCSTART1.

For this motion group, set Dwell Time = 1 ms or higher.

Example of Point Table Setting (Continuous Positioning Operations)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	5,000	300	100	150	**100**	Absolute	continuous	20	enable
2	-6,000	200	100	100	**50**	Relative	Single	20	enable

For the last “enabled” point number, set Running Motion = “single” .
the acceleration/deceleration setting of the first point number that is selected upon CW start PCSTART1 ON will be applied, and the settings of subsequent point numbers will be discarded.



Example of Operation 3 Continuous Speed Changes (Positioning in One Direction)

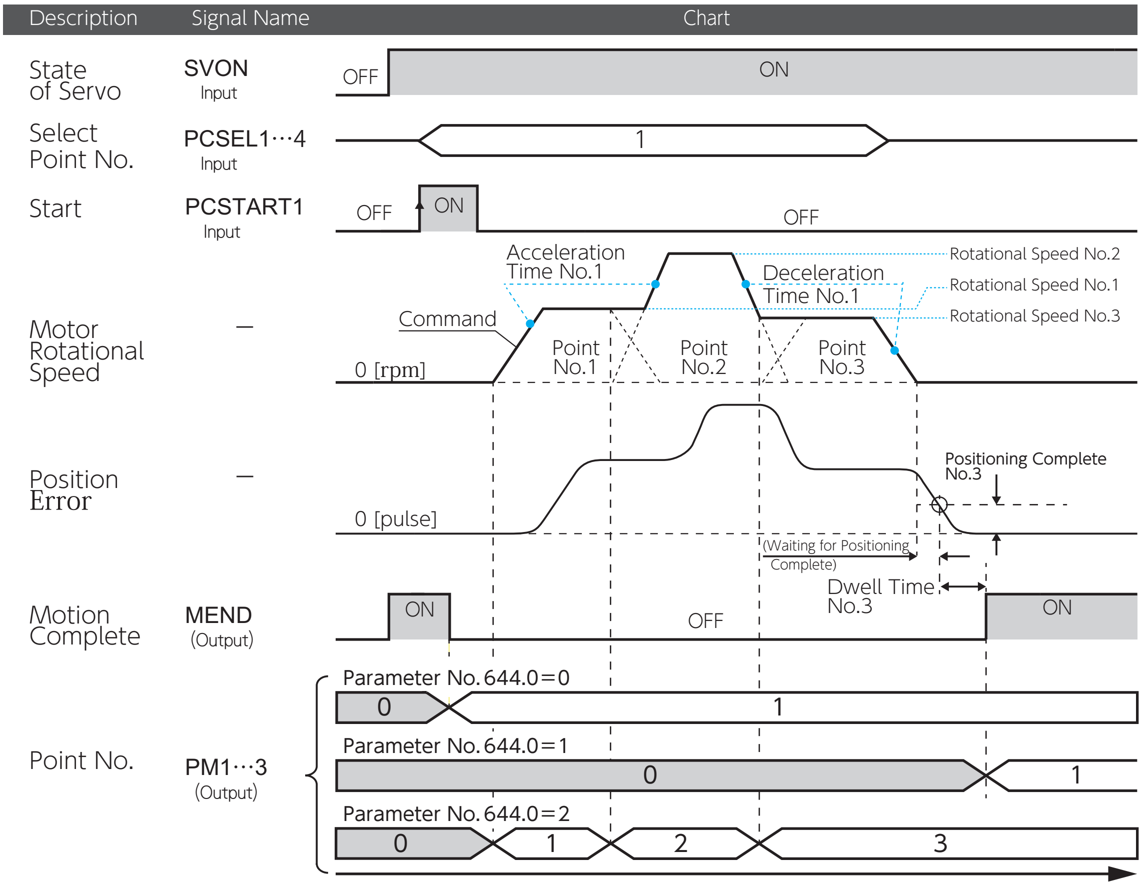
This procedure executes a series of positioning motion following the point numbers in order. Motion instructions per point numbers are executed with no interruptions and the rotational speed changes continuously. Positioning motion will continue up to (not including) the point number whose Running Motion is “single” .
Set Running Motion of all enabled point numbers to “continuous” , and specify the first point number for turning on CW drive signal PCSTART1.

For this motion group, set Dwell Time = 1 ms.

Example of Point Table Setting (for motion with continuous speed changes in one direction)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	5,000	200	100	200	0	Relative	**continuous**	20	enable
2	3,000	300	(disable)	(disable)	0	Relative	**continuous**	20	enable
3	2,000	100	(disable)	(disable)	20	Relative	**Single**	20	enable

For the last enabled point number, set Running Motion = “single” .
If Dwell Time = 0, the acceleration/deceleration setting of the first point number that is selected upon CW start PCSTART1 ON will be applied, and the settings of subsequent point numbers will be discarded.



Example of Operation 4 Continuous Speed Changes (Positioning in the Opposite Direction)

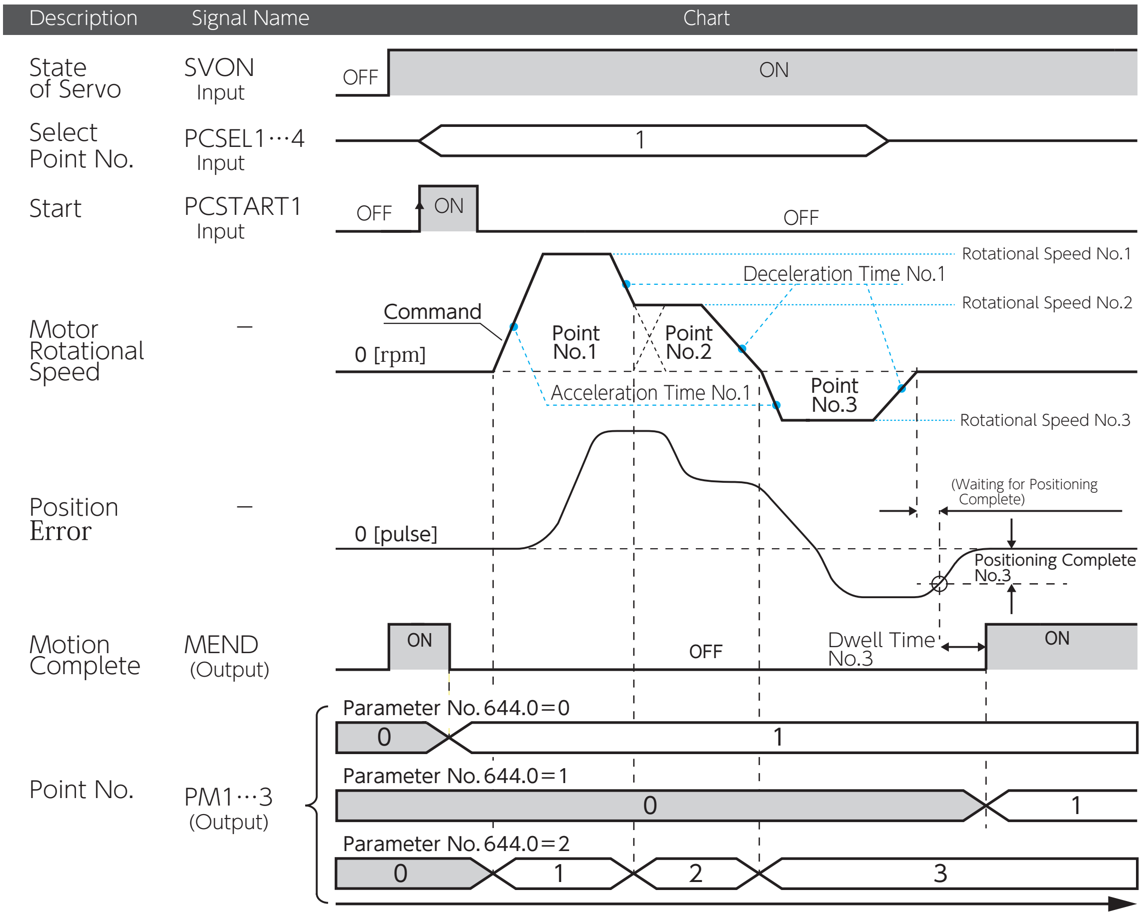
This procedure executes a series of positioning motion following the point numbers in order. Motion instructions per point numbers are executed with no interruptions and the rotational speed changes continuously. Positioning motion will continue up to (not including) the point number whose Running Motion is “single” .
Set Running Motion of all enabled point numbers = “continuous” , and specify the first point number for turning on CW drive signal PCSTART1.

For this motion group, set Dwell Time = 0 ms.

Example of Point Table Setting (for motion with continuous speed changes in reverse direction)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	5,000	300	100	200	0	Relative	**continuous**	20	enable
2	3,000	200	(disable)	(disable)	0	Relative	**continuous**	20	enable
3	-4,000	100	(disable)	(disable)	20	Relative	**single**	20	enable

For the last enabled point number, set Running Motion = “single” .
The acceleration/deceleration setting of the first point number that is selected upon CW start PCSTART1 ON will be applied, and the settings of subsequent point numbers will be discarded.



5. Position Control Mode

Example of Motion 5 Press Motion

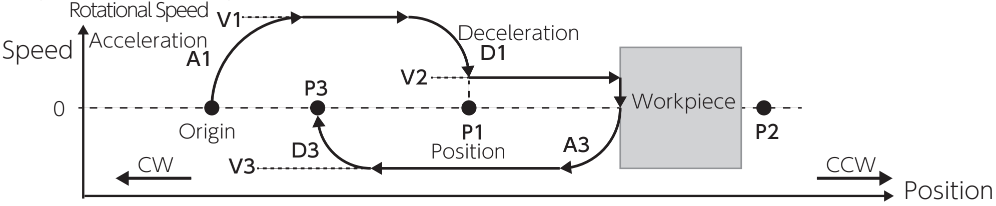
This operation involves motion to approach a workpiece at high speed, then execute a press motion to the workpiece after changing the values of speed and torque.
You can use this type of operation only when User I/O is the Optional I/O Configurations.

Set the following parameters.

Name		Explanation	Parameter No.
Torque command limit	Switch	Set to **1** (enable).	144.0
	Value 1	Set the torque limit value for motion of approaching the workpiece at high speed and leaving the workpiece.	147.0
	Value 2	Set the torque command limit to be applied at the time of press-to-workpiece motion.	148.0
Torque limiting output		**2**: Set [Torque command limit: Value 2 (No.148.0)] = Enable	144.1
Position Error Detection	Switch	Enable/Disable the function to detect position error.	65.0
	Value	To let the detection function work, set a value larger than the distance between the target location of press motion and the workpiece.	87.0
	Delay time	Specify how long a position error waits to be output after position error exceeds the [Position error detection: Value (No.87.0)] setting.	89.0
Speed Error Detection	Switch	Enable/Disable the function to detect speed error.	65.1
	Value	Specify at what speed error value the error is to be detected.	90.0
	Delay time	Specify how long a speed error waits to be output after the speed error exceeds the [Speed error detection: Value (No.90.0)] setting.	91.0
Point Table Point Number Output Method		Set to **2**: output the point number at its motion start.	644.0

☞ 5 Settings

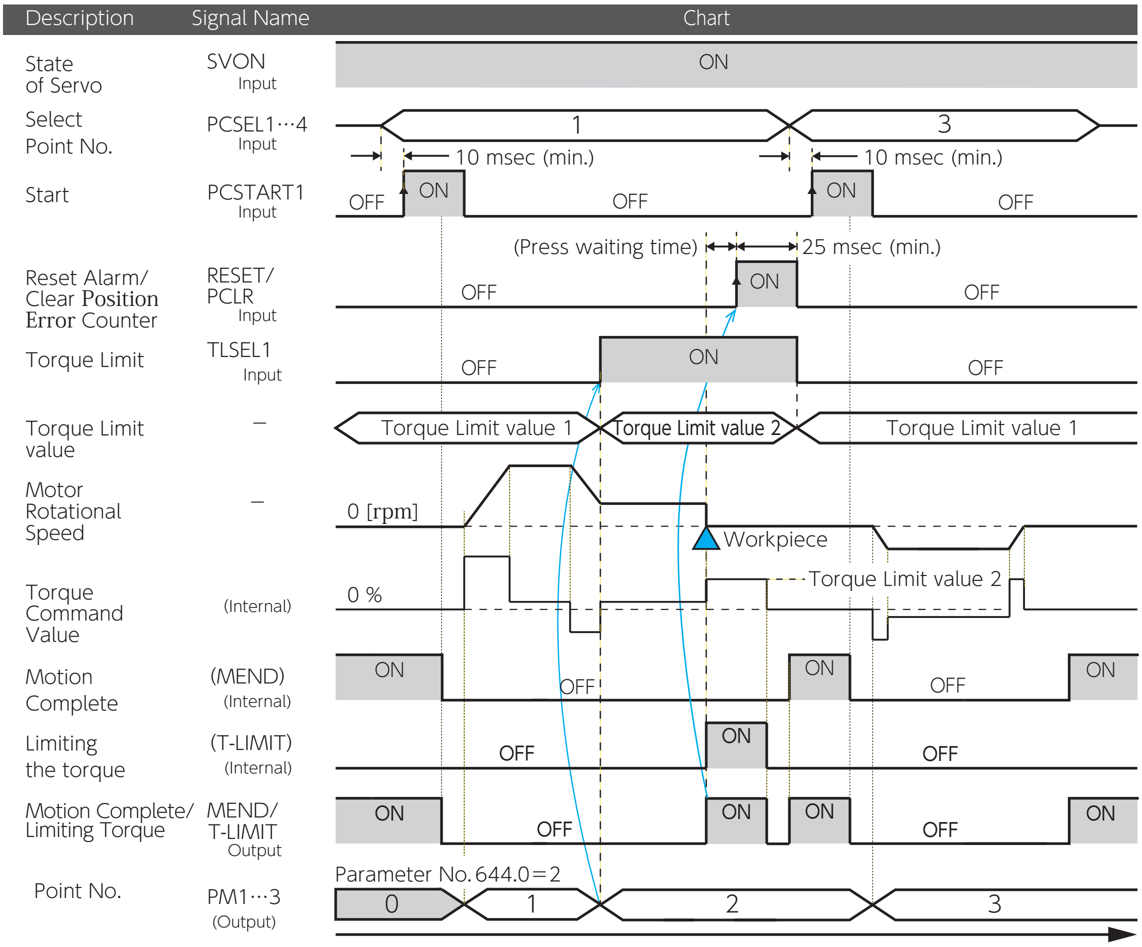
The following example illustrates Point Table settings with Point No.1 (P1) for motion of approaching a workpiece, Point No.2 (P2) for motion of pressing the workpiece, Point No.3 (P3)for motion of parting from the workpiece.



Example of Point Table Setting (Press Motion)

No.	Position	Rotational Speed [rpm]	Acceleration Time [ms]	Deceleration Time [ms]	Dwell Time [ms]	Command Method	Running Motion	Positioning Complete [pulse]	Enable/ Disable
1	(P1)	(V1)	(A1)	(D1)	0	Absolute	continuous	0	enable
2	(P2)	(V2)	(disable)	(disable)	(disable)	Absolute	Single	0	enable
3	(P3)	(V3)	(A3)	(D3)	(any value)	Absolute	Single	(any value)	enable

P1: Specify the target location with high-speed approach.
V1: Specify the speed of approaching to the workpiece.
P2: Specify the location across the workpiece.
V2: Specify the speed of pressing the workpiece.
P3: Destination



Procedure for Press Motion

Step	Operation
Step 1	**Check if ready to start.** Open TLSEL1 and select Torque Limit 1 as torque limit value. Verify that MEND/T-LIMIT is closed. Wait if it' s open. ☞ Page 24 Valid or Invalid
Step 2	**Select Point No.** Input the point number for approach-to-workpiece motion to PCSEL1...3. (Point No.1 in this example)
Step 3	**Start Point Table Motion** Wait for at least 10 ms after input of PCSEL1...3, and then change the PCSTART1 status from open to closed. The motion starts per the setting of the point number specified.
Step 4	**Check command execution** Wait until MEND/T-LIMIT becomes open. If it' s open, reset PCSTART1 to open.
Step 5	**Verity the start Point No.** Verify the point number that was started by the PM1...3 input. When the point number of Press motion is output (No.2 in this example), close TLSEL1, and select Torque Limit Value 2 as the torque limit value.
Step 6	**Check Torque Limit Status** Check the torque limit status with MEND/T-LIMIT and wait until it becomes closed.
Step 7	**Clear Position Error Counter** After MEND/T-LIMIT becomes closed, wait for the desired press time, then close RESET/PCLR to execute Clear Position Error Counter. Wait for at least 25 ms after RESET/PCLR, input, and then reset RESET/PCLR to open.
Step 8	**Check if ready to start.** Open TLSEL1 and select Torque Limit 1 as the torque limit value. Verify that MEND/T-LIMIT is closed.
Step 9	**Select Point No.** Input a point number for the leaving-workpiece motion to PCSEL1…3. (No.3 in this example)
Step 10	**Start Point Table Motion** Wait for at least 10 ms after input of PCSEL1...3, and then change the PCSTART1 status from open to closed. Motion starts according to the specified Point No. settings.
Step 11	**Check command execution** Wait until the MEND/T-LIMIT becomes open. If it' s open, change PCSTART1 back to open.
Step 12	**Check Operation Complete** Verify with MEND/ T-LIMIT that the motion command execution is complete. MEND/T-LIMIT turning from open back to closed indicates that the motion is complete.

2. Homing

Homing is an operation to align the relative position in the drive parameters and the actual mechanical position of the machine. When you are using the Positioner function of the drive, perform homing, as necessary.

In incremental systems:

homing is necessary every time the system is powered on.

In absolute systems:

encoder data is retained by the backup battery. Once you perform homing at the time of installation, homing is unnecessary at power on even after the control power turns off.

☞ 9 Appendices Absolute System

■ Homing Methods

User I/O input	Page 36
Digitax SF Connect	Page 37

■ Types of Homing

There are three patterns of homing.
Select the parameters to set depending on the motion patterns that you need for homing.

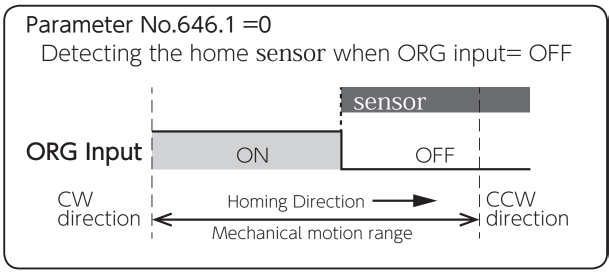
User-Specified Position	Page 40
Press (Stopper)	Page 42
Home Sensor (*)	Page 44

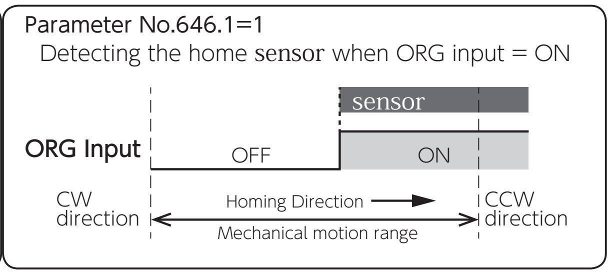
*) To perform Homing by using Home Sensor, use I/O input. Digitax SF Connect does not support Homing with Home Sensor.

Precautions

Homing based on home position sensor front-end

Install the home position sensor at the machine-end. Set [HOMING: Movement direction (No.646.0)] to the direction of moving from the front of the sensor towards the sensor-front-end.
Setting the homing direction to the leaving-sensor direction (to the left of sensor below) may result in a collision to the machine end.


Parameter No.646.1 =0
Detecting the home sensor when ORG input= OFF


Parameter No.646.1=1
Detecting the home sensor when ORG input = ON

If you changed the command paired-pulse ratio value,

perform homing again after saving the parameters and power cycling.

If you execute Homing by using encoder Z-phase,

configure the start point of Z-phase detection not close to motor Z-phase. Otherwise, the detection position of Z-phase may become inconsistent. The Z-phase position can be checked by the position where the "encoder single-turn data" becomes 0.

If any of the following occur during the homing motion,

homing will be interrupted resulting in a Homing Incomplete state.

- Servo turns off.
- Clear Position Error Counter is executed. When Clear Position Error Counter is executed, the motor will make a quick stop.
- Drive Limit Switch Input is active and Clear Position Error Counter is executed.

Homing with User I/O Input

Required Parameters

Set the operation mode.

Parameter No.	Name	Setting
2.0	Control Mode	**0**: Position Control Mode
3.0	Command Mode	**3**: Internal Command Mode
9.0	Operation Mode (*)	**0**: I/O input **1**: Digitax SF Connect
642.0	Internal Position Operation Mode	**0** : Point Table

*) Operation Mode (No.9.0) = 0 (I/O) upon drive power on.
The Setup Panel does not support display or setup of Operation Mode.

Step	Operation
Step 1	**Set Homing related parameter values** Set the values of Homing Speed, Homing Creep Speed, and Homing Acceleration/Deceleration Time.
Step 2	**Check if Homing can be started.** Check if MEND is closed. If it' s open, wait.
Step 3	**Specify the Point Number (in the standard I/O setting only)** Open all four of PCSEL1…4 to specify Point No.0. (This step is not necessary for the Option I/O setting.)
Step 4	**Start Homing motion** Verify that MEND is closed in a servo-on state, and then start Homing. If MEND is open in a servo-on state, the start command will not be accepted. In Standard I/O Setting Close PCSTART1 input. (at least 10 ms after Step 3) In Option I/O Setting Set HOME to closed. (at least 10 ms after Step 3)
Step 5	**Check Command Execution** Wait for MEND to become open. Open PCSTART or HOME after verifying that MEND is open.
Step 6	**Check Operation Complete** Use MEND to see if the motion command execution is complete. MEND turning from open to closed indicates that the motion is complete.
Step 7	**Check Homing Complete** After the motion is complete, use HEND to see if Homing is complete. HEND turning from open to closed indicates that the homing procedure is complete.

5. Position Control Mode

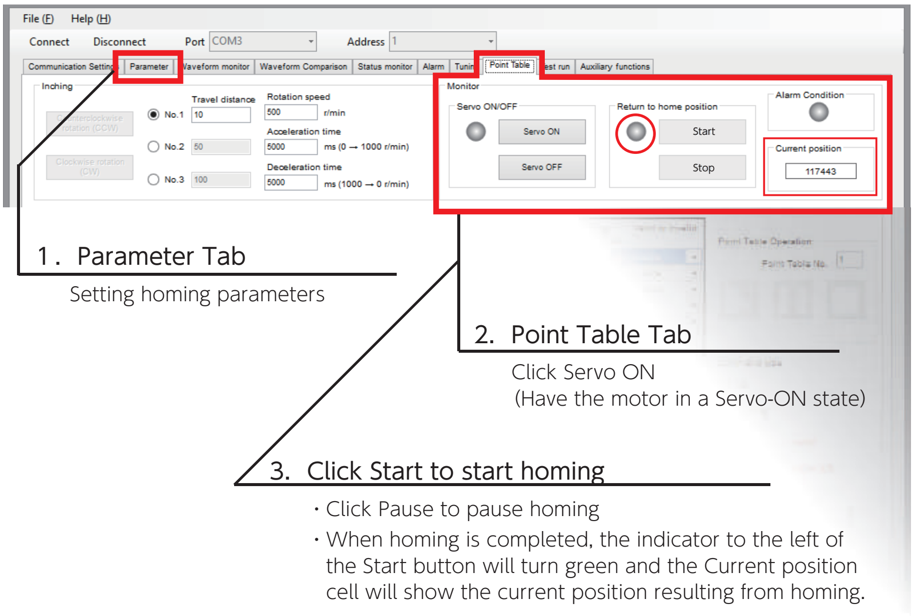
Homing with Digitax SF Connect

Required Parameters

Set the operation mode.

Parameter No.	Name	Setting
2.0	Control Mode	**0**: Position Control Mode
3.0	Command Mode	**3**: Internal Command Mode
9.0	Operation Mode (*)	**0**: I/O input **1**: Digitax SF Connect
642.0	Internal Position Operation Mode	**0**: Point Table

*) Operation Mode (No.9.0) = 0 (I/O) upon drive power on.
The Setup Panel does not support display or setup of Operation Mode.



Port COM3
Address 1

● No.1 Travel distance 10
○ No.2 50
○ No.3 100

Rotation speed 500 r/min
Acceleration time 5000 ms (0 → 1000 r/min)
Deceleration time 5000 ms (1000 → 0 r/min)

Current position 117443

Point Table No. 1

1. Parameter Tab

Setting homing parameters

2. Point Table Tab

Click Servo ON
(Have the motor in a Servo-ON state)

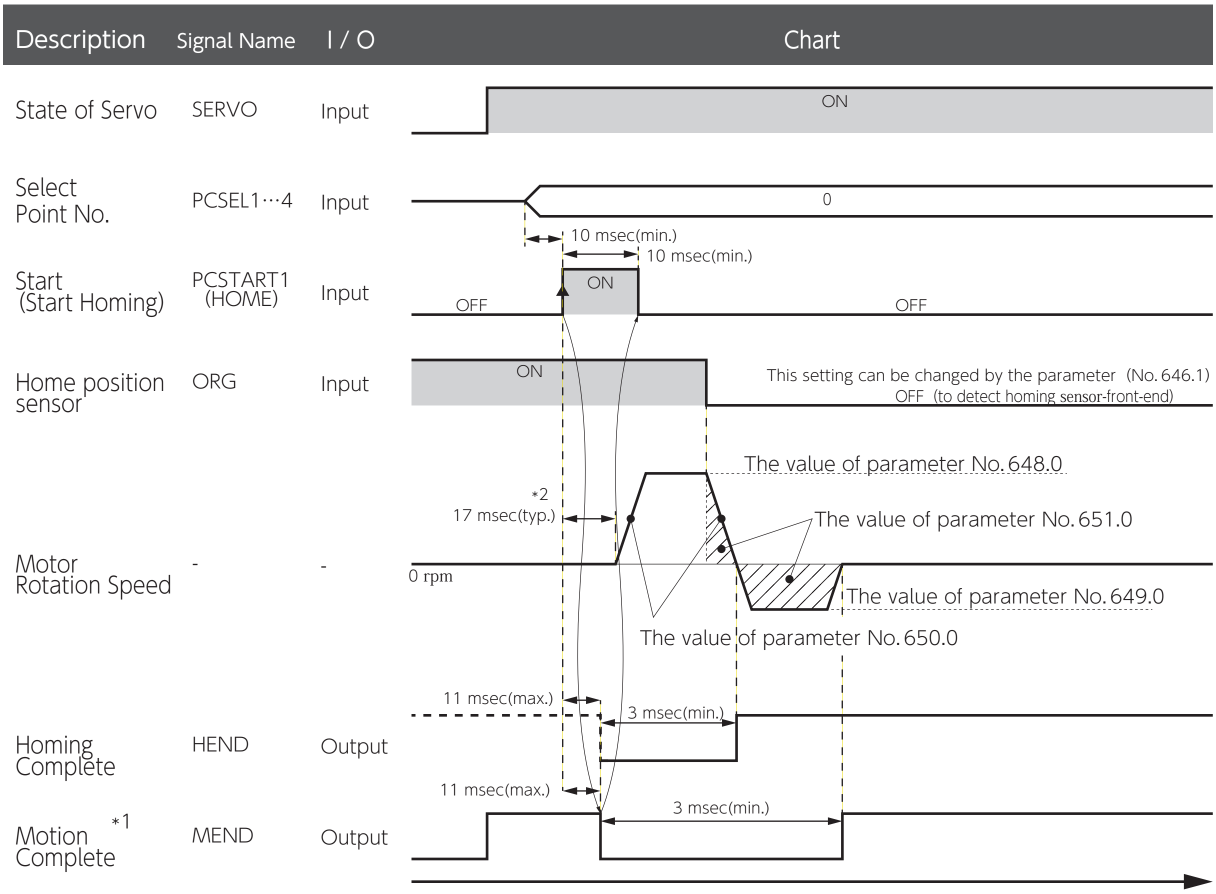
3. Click Start to start homing

- Click Pause to pause homing
- When homing is completed, the indicator to the left of the Start button will turn green and the Current position cell will show the current position resulting from homing.

5. Position Control Mode

Timing diagram

The following illustrates how to perform Homing with User I/O Input. Homing based on home-sensor-front-end is used in the example below.



*1) If you want to check the operation end signal (MEND) with the User I/O output “MEND/T-LIMIT” , turn T-LIMIT output OFF, by parameter configuration and TLSEL1 OFF.

*2) The startup timing depends on other conditions.

Types of Homing Motion

Homing movement comprises two segments: Rough Approach and Careful Approach. Specify the motion type by configuring multiple parameters differently.

Homing = **Rough Approach** (Lunge motion) + **Careful Approach** (Creep motion)

Rough Approach (Lunge motion)

Indicates a motion type to detect the stopper or the sensor. Configure this part of homing so that homing will be as accurate as possible in the second segment of homing.

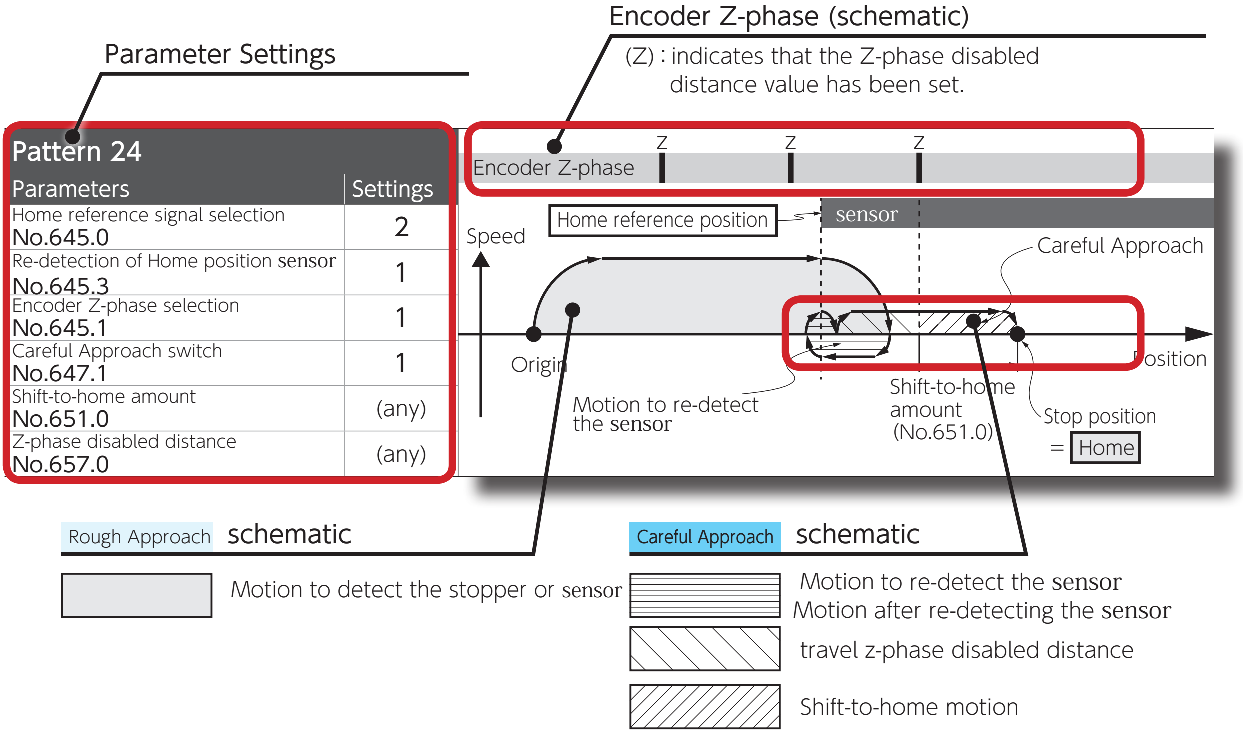
Careful Approach (Creep motion)

Indicates a motion type to approach the home position slowly and accurately after the detection of stopper, sensor or base signal.

This motion group includes the following:

- motion to detect Z-phase
- travel over the Z-phase disabled distance
- movement from the base to home after base signal detected.
- motion to detect the sensor again
- motion after re-detecting the sensor

How to read homing motion patterns



Pattern 24

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	(any)

Homing Based on User-Specified Position (No.645.0=0)

This operation indicates the type of homing based on the starting point.

This type of homing operation enables you to specify any position as the home position without turning the servo on, for example, by manually moving the machine to any desired home position. In addition, this method enables the encoder z-phase to be detected without involving stopper or sensor

This type of homing does not involve the Rough Approach motion group.

Set the following related parameters.

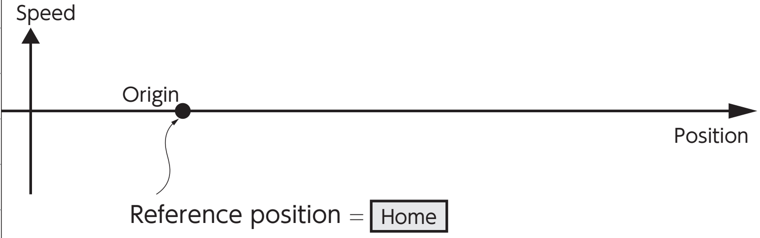
Group	Name	Parameter No.
Homing Overall	Home reference signal selection (arbitrary position, stopper, sensor)	645.0 (*)
	Movement direction	646.0
	Acceleration/Deceleration time (Common in Rough approach speed and Careful approach speed)	650.0
	Home position data	653.0
Careful approach	Careful approach switch	647.1 (*)
	Encoder Z-phase Selection	645.1 (*)
	Z-phase disabled distance	657.0 (*)
	Careful approach speed	649.0
	Amount of position shift to home (travel distance from base signal or z-phase to home)	651.0
Common	Internal Position - Motion of Point No.0	646.3
	Homing: Torque command limit	647.0
	Homing: Timeout Switch	646.2
	Homing: Timeout Time	659.0

*) Parameters to define the homing pattern

Refer to the patterns from 1 to 6 below to set the parameters.

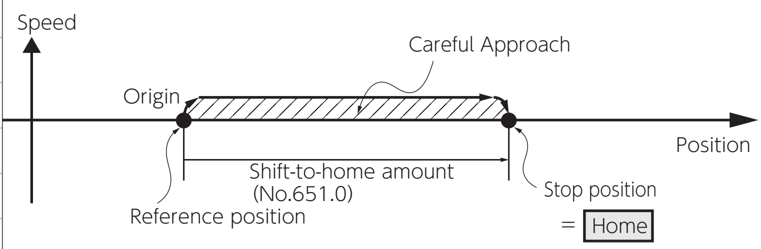
Pattern 1

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	0
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



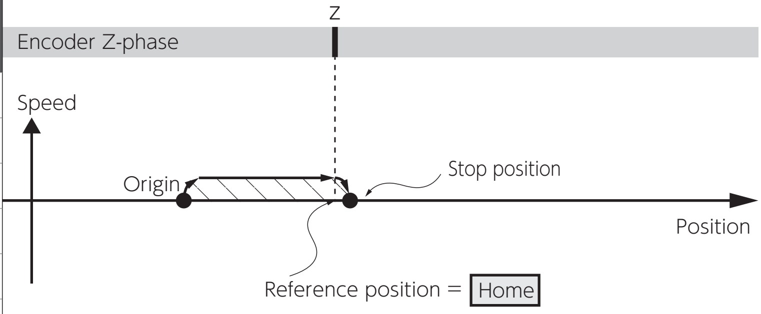
Pattern 2

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



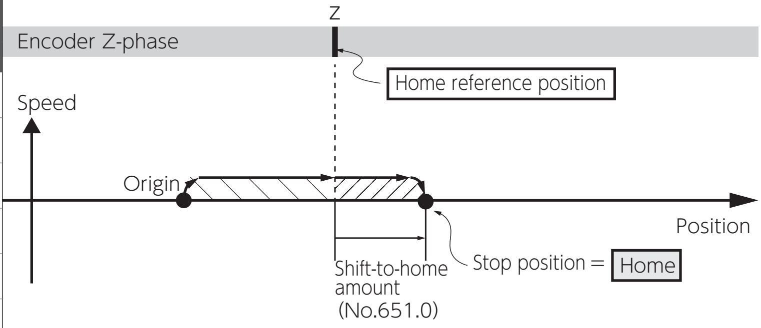
Pattern 3

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



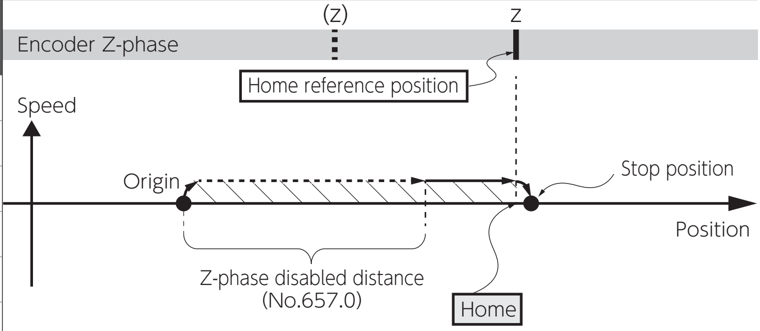
Pattern 4

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



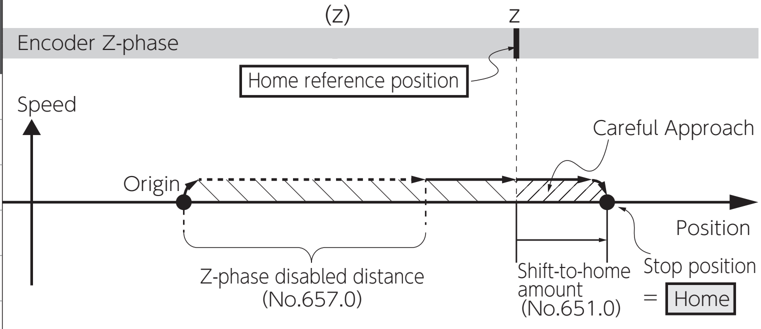
Pattern 5

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	(any)



Pattern 6

Parameters	Settings
Home reference signal selection No.645.0	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	(any)



Homing based on Press (Stopper) (No.645.0=1)

This operation indicates the type of homing based on the stopper position.

You can use this type of homing by setting the home based on the position of the stopper being pressed per the motor movement.
There are three options to define home” (after detection of stopper pressed motion): 1) stopper position, 2) encoder z-phase, 3) user-specified position shifted from stopper or z-phase.

Set the following parameters related to this type of homing.

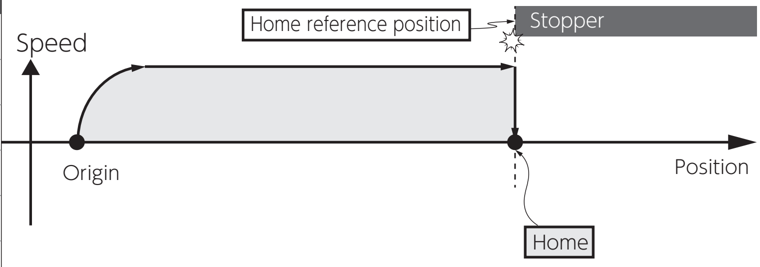
Group	Name	Parameter No.
Homing Overall	Home reference signal selection (arbitrary position, stopper, sensor)	645.0 (*)
	Movement direction	646.0
	Acceleration/Deceleration time (Common in Rough approach speed and Careful approach speed)	650.0
	Home position data	653.0
Rough approach	Rough approach speed	648.0
	Stopper pressed detection time	655.0
	Torque command limit: Value	656.0
Careful approach	Careful approach switch	647.1 (*)
	Encoder Z-phase Selection	645.1 (*)
	Z-phase disabled distance	657.0 (*)
	Careful approach speed	649.0
	Amount of position shift to home (travel distance from base signal or z-phase to home)	651.0 (*)
Common	Internal Position: Motion of Point No.0	646.3
	Homing: Torque command limit	647.0
	Homing: Timeout Switch	646.2
	Homing: Timeout Time	659.0

*) Parameters to define the homing patterns

Refer to the patterns 7 to 12 to configure the parameters.

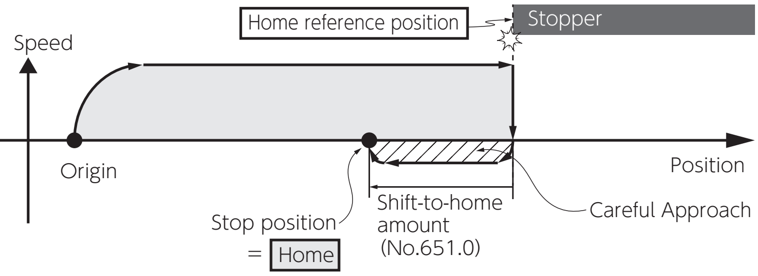
Pattern 7

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	0
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



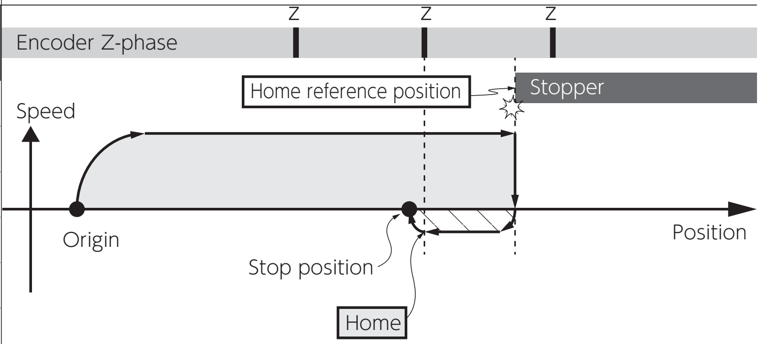
Pattern 8

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



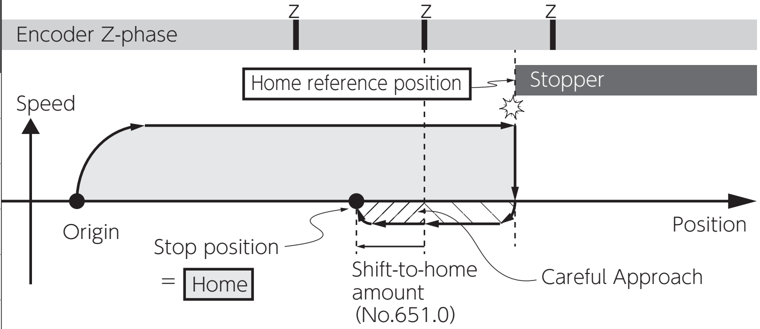
Pattern 9

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



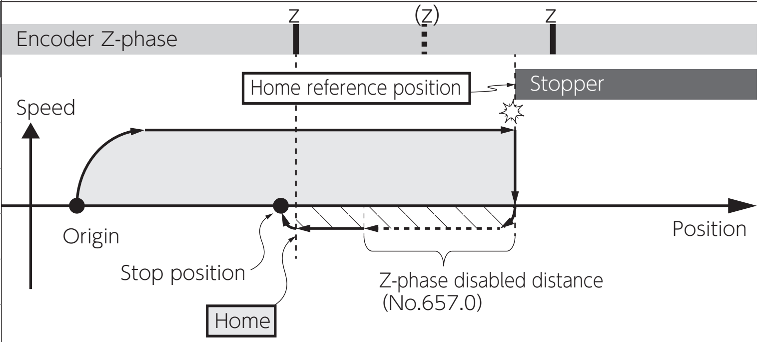
Pattern 10

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



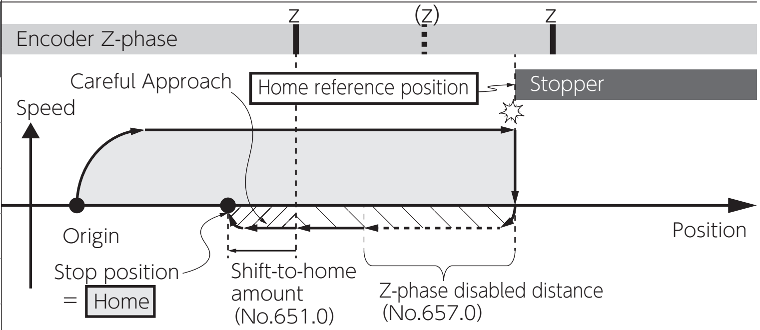
Pattern 11

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	(any)



Pattern 12

Parameters	Settings
Home reference signal selection No.645.0	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	(any)



Homing Based on Home Sensor (no sensor re-detection) (No.645.0=2, No.645.3=0)

This operation indicates the type of homing based on the home position sensor.

no detection of the sensor-front-end after the first detection

You can use this type of homing to set the point of machine passing the sensor as the home base. There are three options for what to be set as "home" (after detection of passing the sensor): 1) sensor position, 2) encoder z-phase, 3) any position shifted from sensor or z-phase.

Set the following parameters related to this homing method.

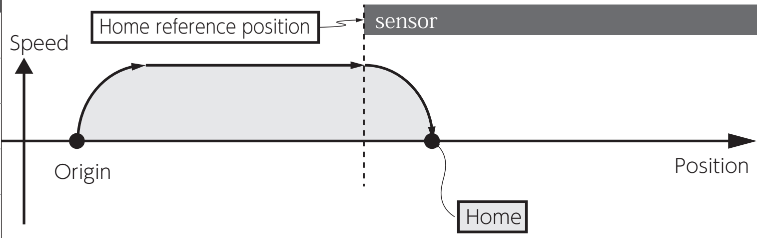
Group	Name	Parameter No.
Homing Overall	Home reference signal selection (arbitrary position, stopper, sensor)	645.0 (*)
	Movement direction	646.0
	Acceleration/Deceleration time (Common in Rough approach speed and Careful approach speed)	650.0
	Home position data	653.0
Rough approach	Sensor polarity	646.1
	Rough approach speed	648.0
Careful approach	Careful approach switch	647.1 (*)
	Encoder Z-phase Selection	645.1 (*)
	Z-phase disabled distance	657.0 (*)
	Re-detection of home position sensor	645.3 (*)
	Careful approach speed	649.0
	Amount of position shift to home (travel distance from base signal or z-phase to home)	651.0 (*)
Common	Internal Position: Motion of Point No.0	646.3
	Homing: Torque command limit	647.0
	Homing: Timeout Switch	646.2
	Homing: Timeout Time	659.0

*) Parameters to define the homing patterns

Refer to the patterns from 13 to 18 below to set the parameters.

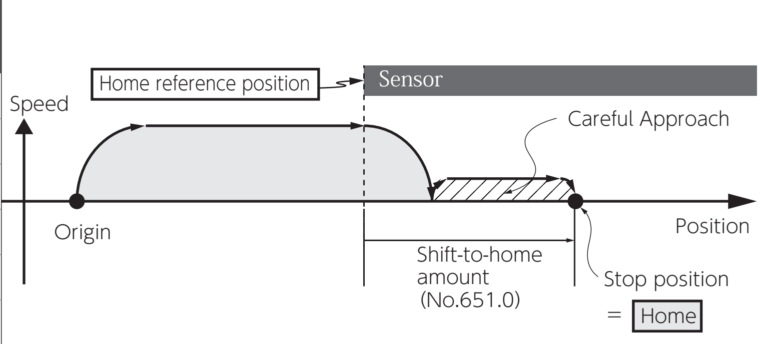
Pattern 13

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	0
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



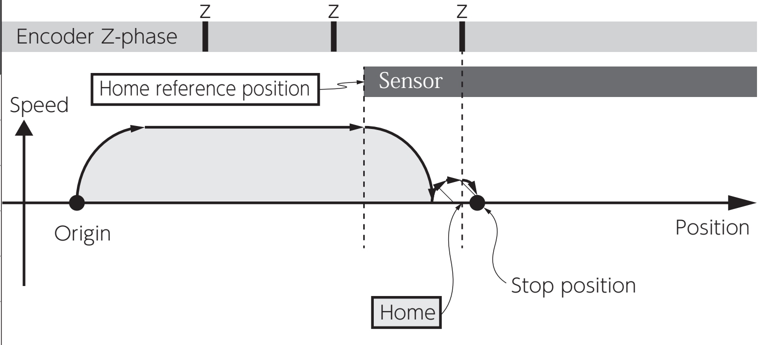
Pattern 14

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



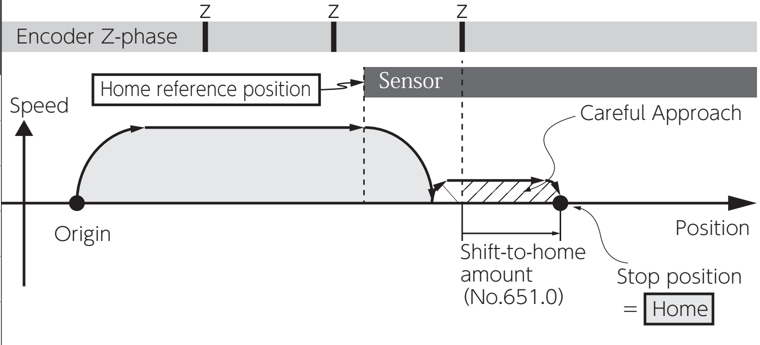
Pattern 15

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



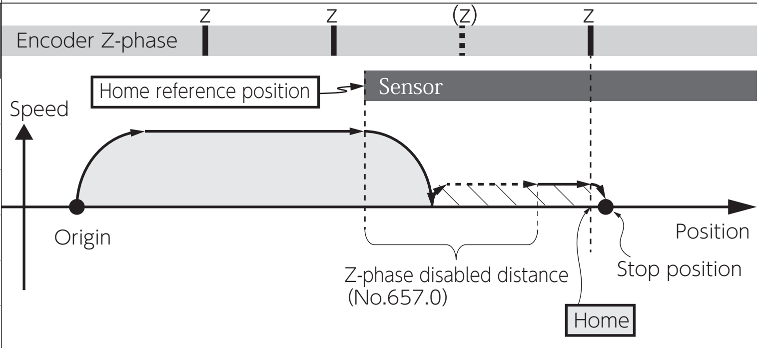
Pattern 16

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



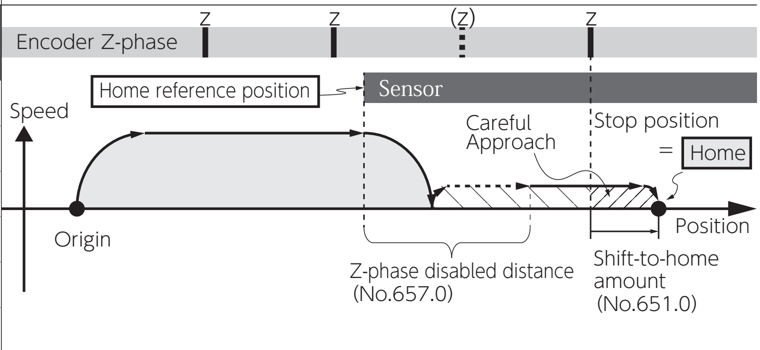
Pattern 17

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	(any)



Pattern 18

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	0
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	(any)



Homing Based on Home Sensor (with sensor to be re-detected) (No.645.0=2, No.645.3=1)

This operation indicates the type of homing based on the home position sensor.

another detection of the sensor-front-end after the first detection

You can use this homing type to set the point of machine passing the sensor as the home base. Re-detection of the sensor improves the accuracy in setting the home position.
There are three options to define "home" (after detection of passing-sensor position): 1) sensor position, 2) encoder z-phase, 3) any position shifted from sensor or z-phase.

Set the following parameters related to this homing method.

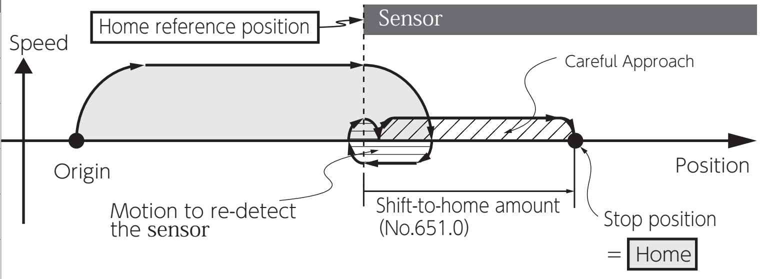
Group	Name	Parameter No.
Homing Overall	Home reference signal selection (arbitrary position, stopper, sensor)	645.0 (*)
	Movement direction	646.0
	Acceleration/Deceleration time (Common in Rough approach speed and Careful approach speed)	650.0
	Home position data	653.0
Rough approach	Sensor sensor polarity	646.1
	Rough approach speed	648.0
Careful approach	Careful approach switch	647.1 (*)
	Encoder Z-phase Selection	645.1 (*)
	Z-phase disabled distance	657.0 (*)
	Re-detection of Home position	645.3 (*)
	Sensor careful approach speed	649.0
	Amount of position shift to home (travel distance from base signal or z-phase to home)	651.0
Common	Internal Position: Motion of Point No.0	646.3
	Homing: Torque command limit	647.0
	Homing: Timeout Switch	646.2
	Homing: Timeout Time	659.0

*) Parameters to define the homing patterns

Refer to the patterns 19 to 24 to configure the parameters.

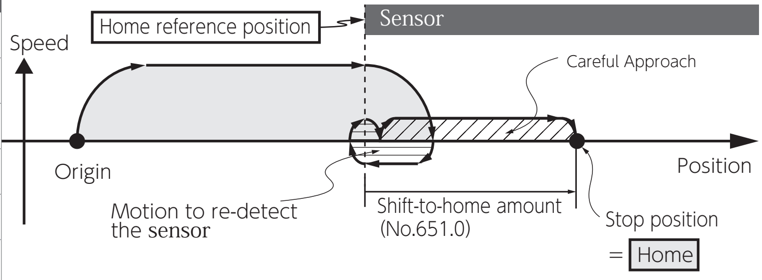
Pattern 19

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	0
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



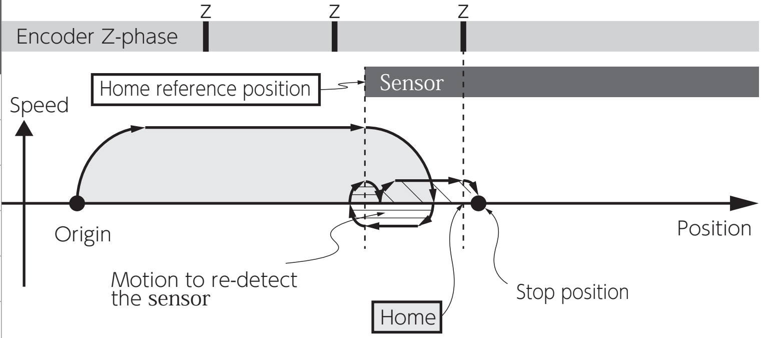
Pattern 20

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	0
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



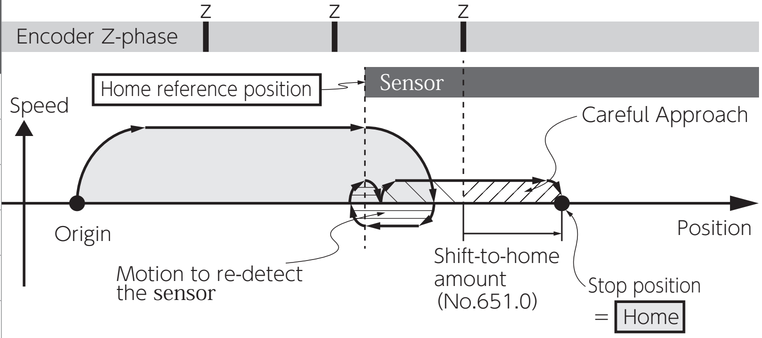
Pattern 21

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	0



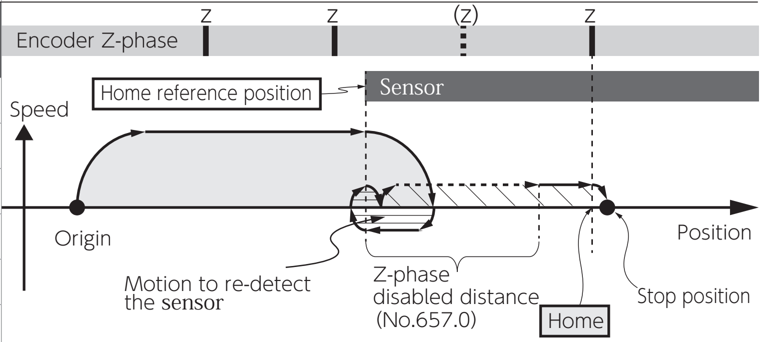
Pattern 22

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	0



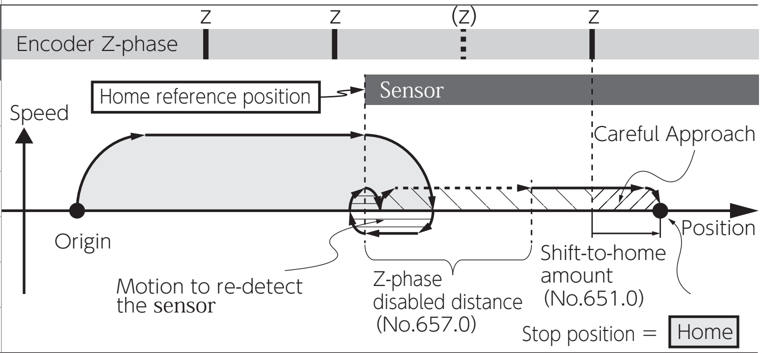
Pattern 23

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	0
Z-phase disabled distance No.657.0	(any)



Pattern 24

Parameters	Settings
Home reference signal selection No.645.0	2
Re-detection of Home position sensor No.645.3	1
Encoder Z-phase selection No.645.1	1
Careful Approach switch No.647.1	1
Shift-to-home amount No.651.0	(any)
Z-phase disabled distance No.657.0	(any)



MEMO

7 Tuning

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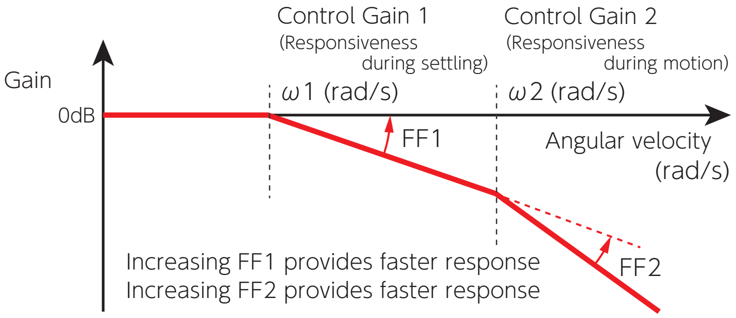
1. Introduction

1. Overview

The goal of drive tuning is having good control over the motor and optimizing equipment performance in responding to commands from the host controller.
The position control method employs two degrees of freedom with the model-matching control. This method enables you to adjust command response and transient response independently without compromising the stability of your equipment.
Digitax SF is a servo system that does not let overshooting and undershooting happen when the equipment inertia ratio is set appropriately.
Digitax SF features response models with two cutoff frequencies: ω 1 (Control Gain 1) and ω 2 (Control Gain 2)



Response model for position control and two cutoff frequencies

Code	EFFECT
ω 1 Control Gain 1	Responsiveness at settling Increasing this item will reduce the position error at settling (after command ends).
ω 2 Control Gain 2	Responsiveness during operation Increasing this item will reduce the position error during operation (while command being input).
FF1 FF Compensation 1	Command compensation for ω 1 Increasing this item will improve the ω 1 response.
FF2 FF Compensation 2	Command compensation for ω 2 Increasing this item will improve the ω 2 response.

The relation between cutoff frequencies and control gain parameters.

- Position loop gain (*1) : $\frac{\omega 1 \omega 2}{\omega 1 + \omega 2}$
- Velocity loop gain (*2) : $\omega 1 + \omega 2$

---

*1) Position loop gain It is equivalent to the "Kp" in a P-PI control.
*2) Velocity loop gain It is equivalent to the "Kv" in a P-PI control.

1. Introduction

Control Gain Set

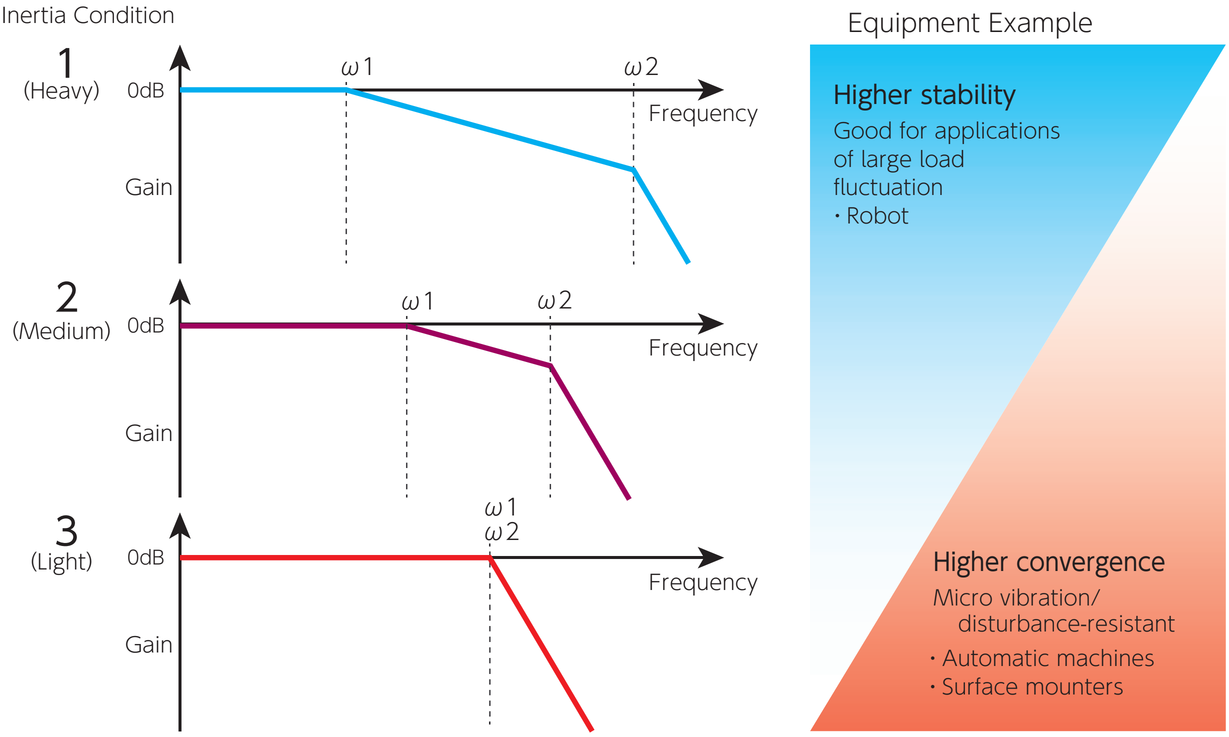
The following prearranged sets of parameters for each control mode enable you to perform tuning easily.(*)

*) If the [Torque command filter: Low-pass filter auto setting (160.2)] is set to 1(auto setting ON), "Torque command filter: Low-pass filter" will be included in the gain set.

Control Mode	Parameter Set
Position Control Mode PLS IN POS	Control Gain 1, Control Gain 2, Integral Gain
Velocity Control Mode VEL IN VEL	Control Gain 1, Integral Gain

Inertia Condition

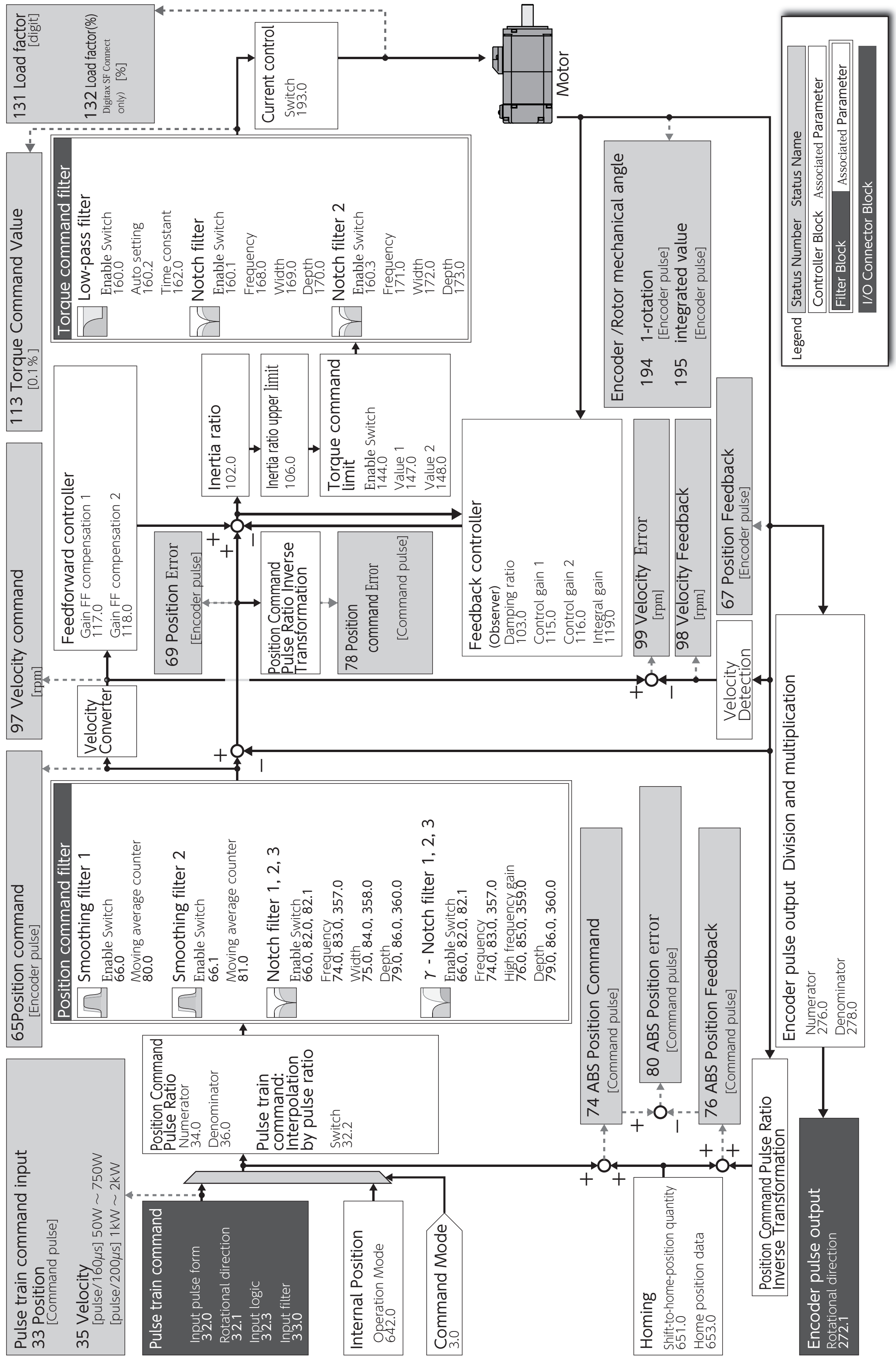
Digitax SF features three response models to support a variety of equipment. Three models are different in ratios of Control Gain 1 (ω 1) and Control Gain 2 (ω 2) and you can select the one suitable to the stability and convergence of your equipment.



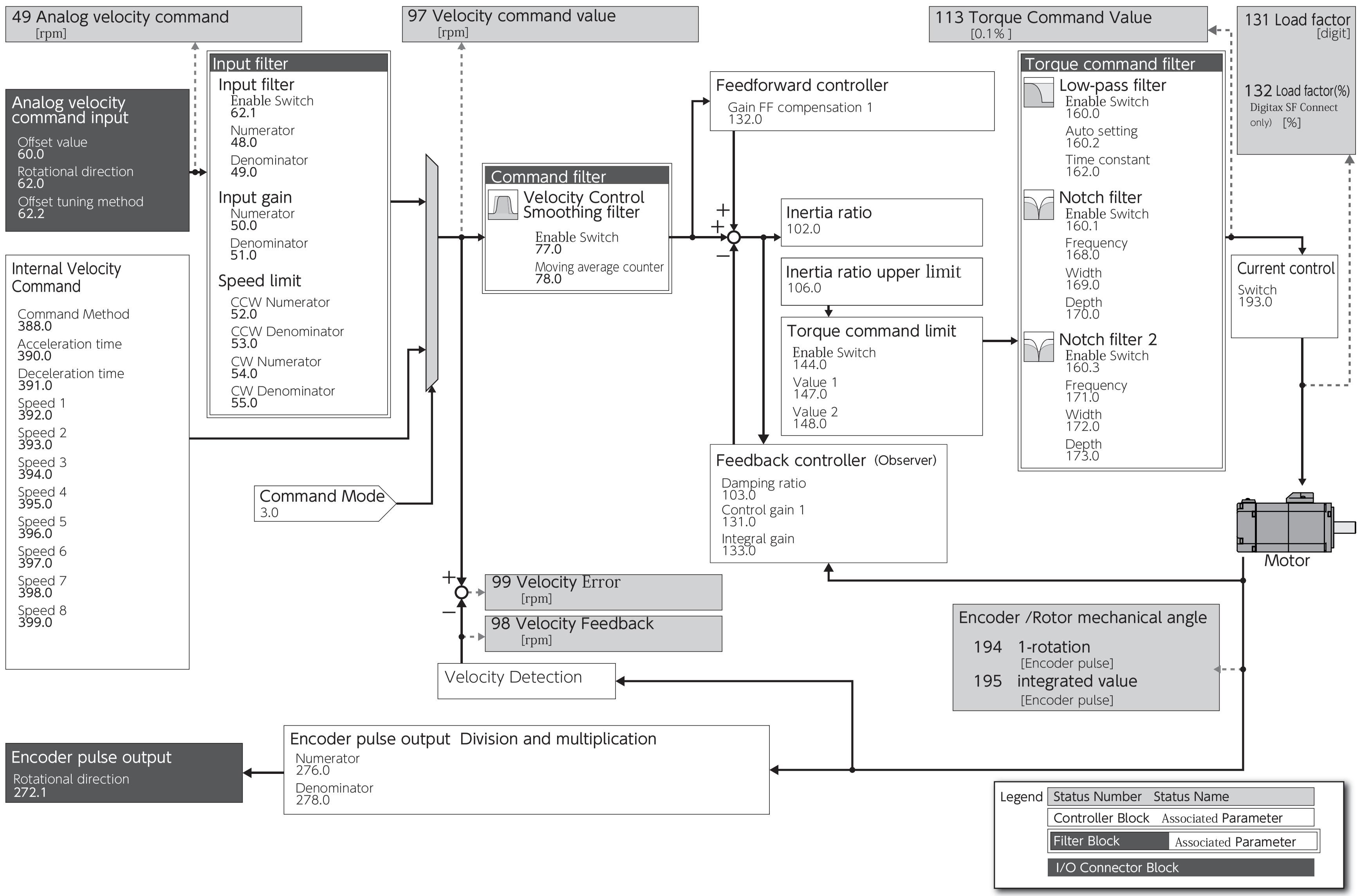
1. Introduction

2. Control Block Diagram

Position Control Mode

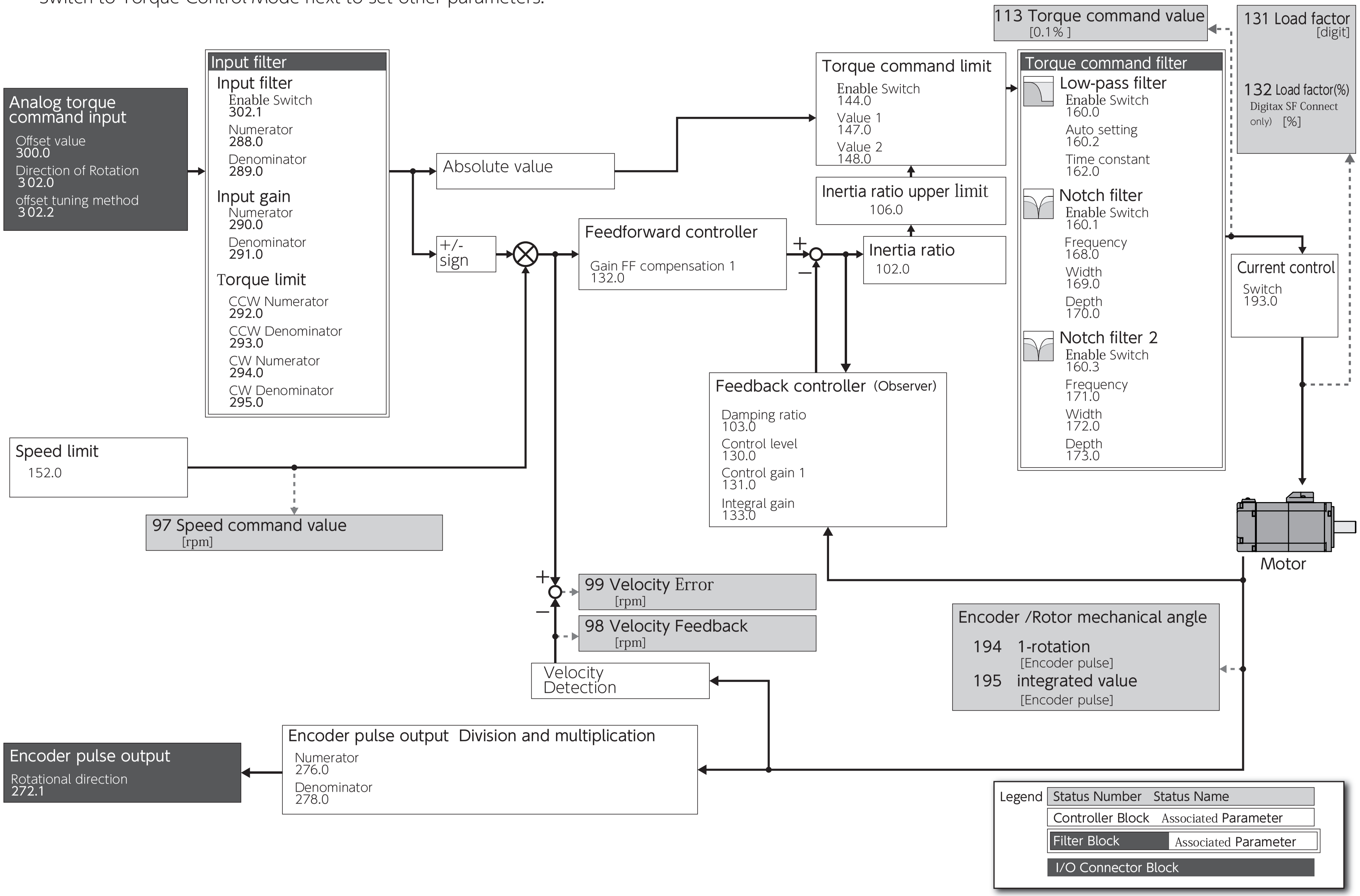


Velocity Control Mode



Torque Control Mode

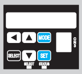
Set the tuning parameters in Speed Control Mode first.
Switch to Torque Control Mode next to set other parameters.



2. Tuning Procedure

❗	Before getting started with tuning, be sure to implement safety measures such as hazard prevention, quick stop and impact mitigation measures.	⚠ ⚠ ⚠
❗	When operating the servo motor for tuning, start with acceleration/ deceleration speeds slower than your target speed. Ensure safety first, then gradually increase the speed and perform tuning each time.	
🚫	While tuning with Digitax SF Connect, do not use the Setup Panel.	
🚫	While tuning with the Setup Panel, do not operate the motor with Digitax SF Connect.	

For optimal performance of drive functions and features, the parameters to the drive need to be configured. Wrong parameter settings will cause unexpected behaviours or difficulties in controlling the motor. Please read the instruction manuals very carefully to figure out the settings that will best suit your operational conditions

Step	Operation	
1	Verify that all wiring has been performed properly.	
2	Turn on the control power to the drive.	
3	Turn on the AC supply to the drive.	
4	To turn the servo ON, connect the SVON pin on the CN1 connector to COM-.	
5	Operate the motor at lower speeds according to the command pulse from the host controller.	
6	Start tuning with one of the following methods.	
		Use the setup support software Digitax SF Connect. Install it on a user-supplied computer.
		Use the Setup Panel at the front of the drive.

Any of the following may interrupt proper performance of Quick Tuning or Auto Tuning.
The inertia ratio is less than 3 or above 20. (*1)
The load inertia is fluctuating.
Machine rigidity is extremely low.
Non-linear characteristics such as backlash exist.
The speed is low (800 rpm or lower). (*2)
The acceleration or deceleration speed is moderate (around 2,000 rpm/s).
The torque is extremely large or small.
In those situations, set the inertia ratio manually based on calculated values.

*1） When a too big load inertia is connected, the estimated inertia ratio value will be restricted by the upper limit value determined by the upper limit value of the inertia ratio (106.0).

*2) Proper tuning may not be possible in the case of 300 rpm or below.

2. Tuning Procedure

1. Overview

Position Control Mode

Stage 1 Quick Tuning	**Setting the Inertia ratio and Optimizing Control Gain Set** The inertia ratio value is entered by the user if known or can be estimated as part of auto-tuning. The control gain set will be automatically adjusted according to the auto estimate of inertia ratio. This method does not generate noise caused by any conflict between the inertia ratio and the gain set. ☞ Page 9 Quick Tuning on Digitax SF Connect ☞ Page 14 Quick Tuning on Setup Panel
Stage 2 Final Tuning Performed by Digitax SF Connect)	**Optimizing the settling time and error** **Suppressing vibration and noise** After Quick Tuning was performed, you might need further adjustments for some of the parameters individually. Final Tuning will improve responsiveness, settling time, and degree of freedom to achieve optimal performance of equipment. ☞ Page 12 Final Tuning: position control mode

Velocity Control Mode

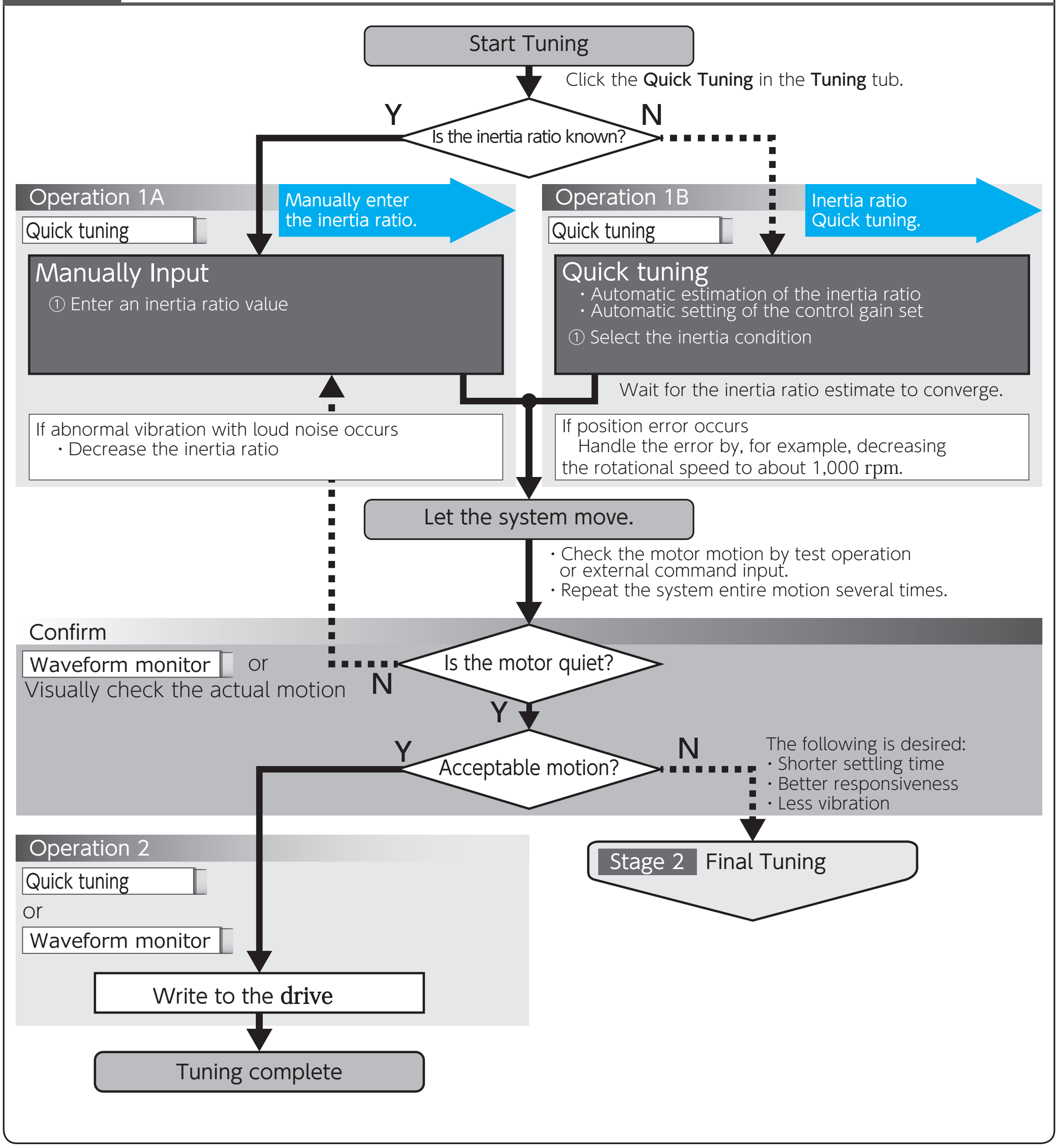
Stage 1 Auto Tuning	**Setting the Inertia ratio and Optimizing Control Gain Set** The inertia ratio value is entered by the user if known or can be estimated as part of auto-tuning. You can select one of the control gain sets according to your equipment. Auto estimated inertia ratio will be applied. ☞ Page 17 Auto Tuning on Digitax SF Connect ☞ Page 22 Auto Tuning on Setup Panel
Stage 2 Final Tuning Performed by Digitax SF Connect	**Optimizing the settling time and error** **Suppressing vibration and noise** After Auto Tuning was performed, you might need further adjustments for some of the parameters individually. Final Tuning will improve responsiveness, settling time, and degree of freedom to achieve optimal performance of equipment. ☞ Page 20 Final Tuning: Velocity control mode

2. Tuning Procedure

2. Position Control Mode

Quick Tuning with Digitax SF

Stage 1 Setting the Inertia ratio and Optimizing Control Gain Set



Click the **Quick Tuning** in the **Tuning** tub.

① Enter an inertia ratio value

- Automatic estimation of the inertia ratio
- Automatic setting of the control gain set

① Select the inertia condition

Wait for the inertia ratio estimate to converge.

If abnormal vibration with loud noise occurs
- Decrease the inertia ratio

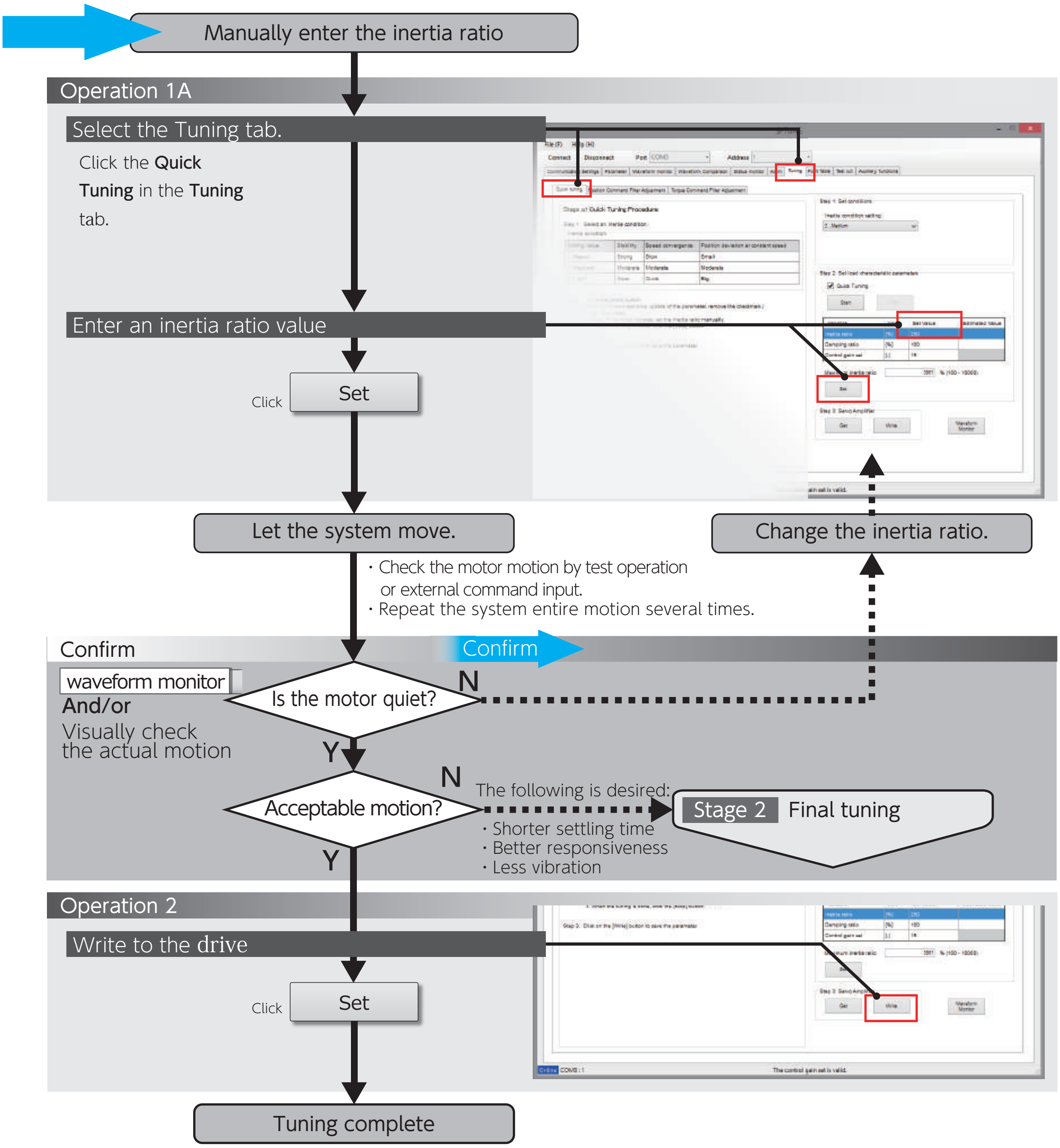
If position error occurs
Handle the error by, for example, decreasing the rotational speed to about 1,000 rpm.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

The following is desired:
- Shorter settling time
- Better responsiveness
- Less vibration

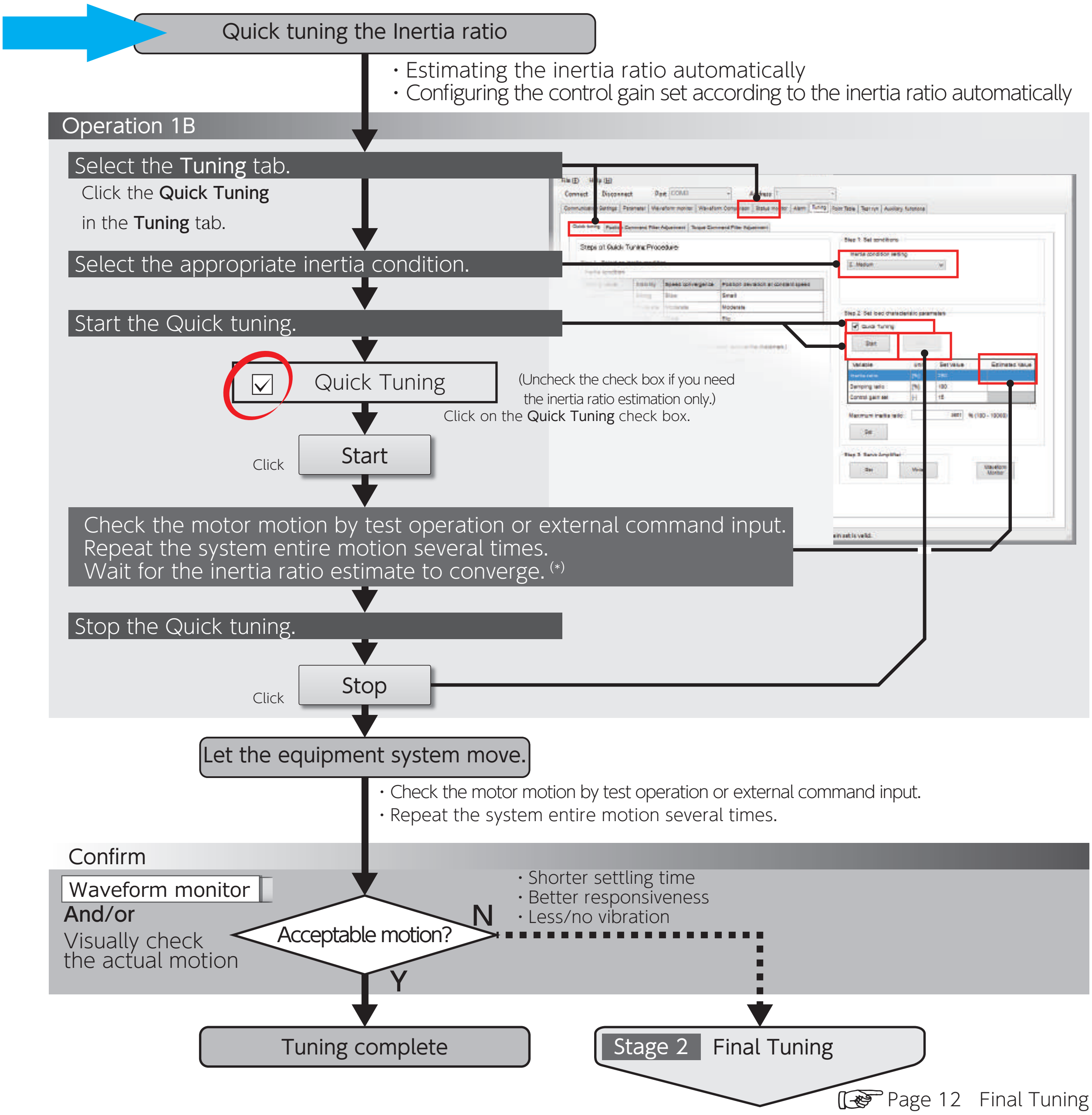
2. Tuning Procedure

Quick Tuning on Digitax SF Connect: Operation 1A



Quick Tuning on Digitax SF Connect: Operation 1B

PLS IN POS VEL IN VEL TRQ



Quick tuning the Inertia ratio

- Estimating the inertia ratio automatically
- Configuring the control gain set according to the inertia ratio automatically

Operation 1B

Select the **Tuning** tab.

Click the **Quick Tuning** in the **Tuning** tab.

Select the appropriate inertia condition.

Start the Quick tuning.

☑ Quick Tuning

(Uncheck the check box if you need the inertia ratio estimation only.)

Click on the **Quick Tuning** check box.

Click Start

Check the motor motion by test operation or external command input. Repeat the system entire motion several times. Wait for the inertia ratio estimate to converge. (*)

Stop the Quick tuning.

Click Stop

Let the equipment system move.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

Confirm

Waveform monitor
And/or
Visually check the actual motion

Acceptable motion?

N
- Shorter settling time
- Better responsiveness
- Less/no vibration

Y

Tuning complete

Stage 2 Final Tuning

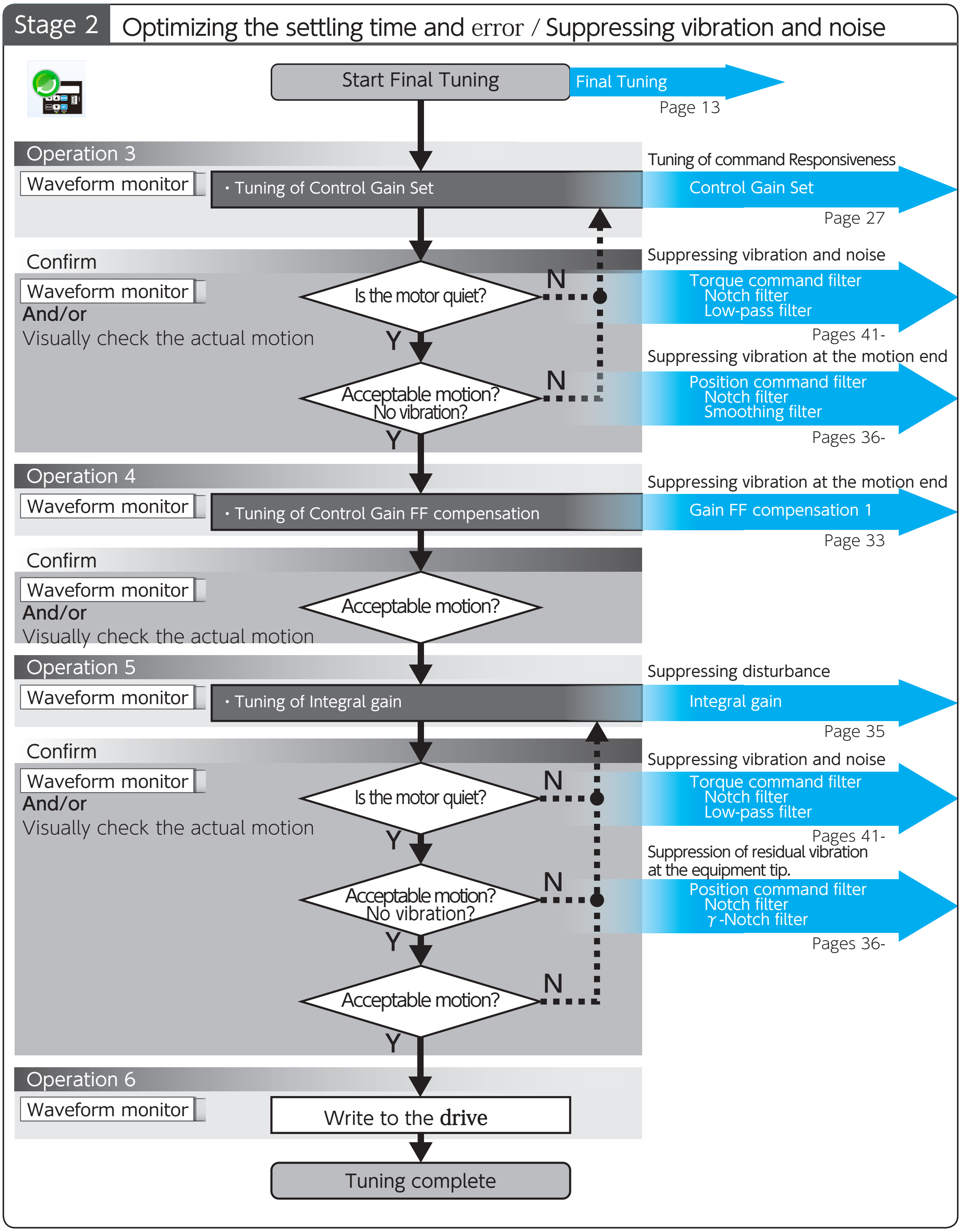
☞ Page 12 Final Tuning

*) Extremely large load may cause vibration. In such a case, decrease the parameter setting of Tuning: Control gain set - Tuning constant (121.0).

Make sure to click on [Stop] to finish Quick Tuning.

Starting Final Tuning Mode while Quick Tuning is still in process will make the tuning difficult because of inertia ratio changes.

Final Tuning: Position Control Mode



Final Tuning

Start Final Tuning

Operation 3, 4, and 5

Change Control Gain Set

Click Set

Let the equipment system move. (*)

Change Gain FF Compensation

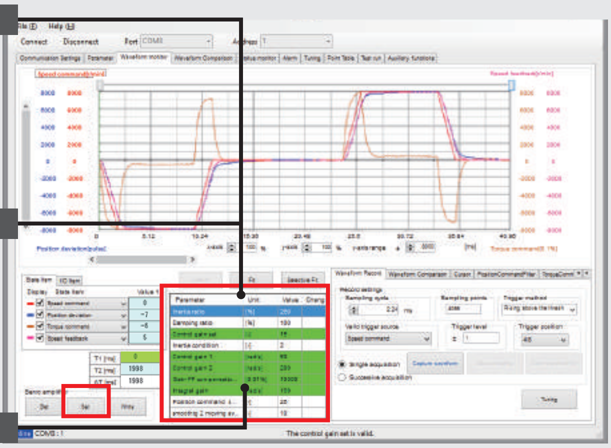
Click Set

Let the equipment system move. (*)

Change Integral Gain

Click Set

Let the equipment system move. (*)



*) ・Check the motor motion by test operation or external command input.
・Repeat the system entire motion several times.

Confirm

Waveform monitor
And/or
Visually check the motion etc.

Acceptable motion?

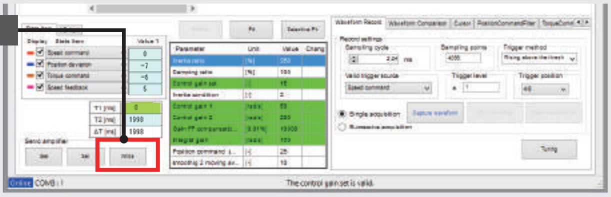
N → Confirm: Torque command filter (Pages 41-), Position command filter (Pages 36-)

Y

Operation 6

Write to the drive

Click Write

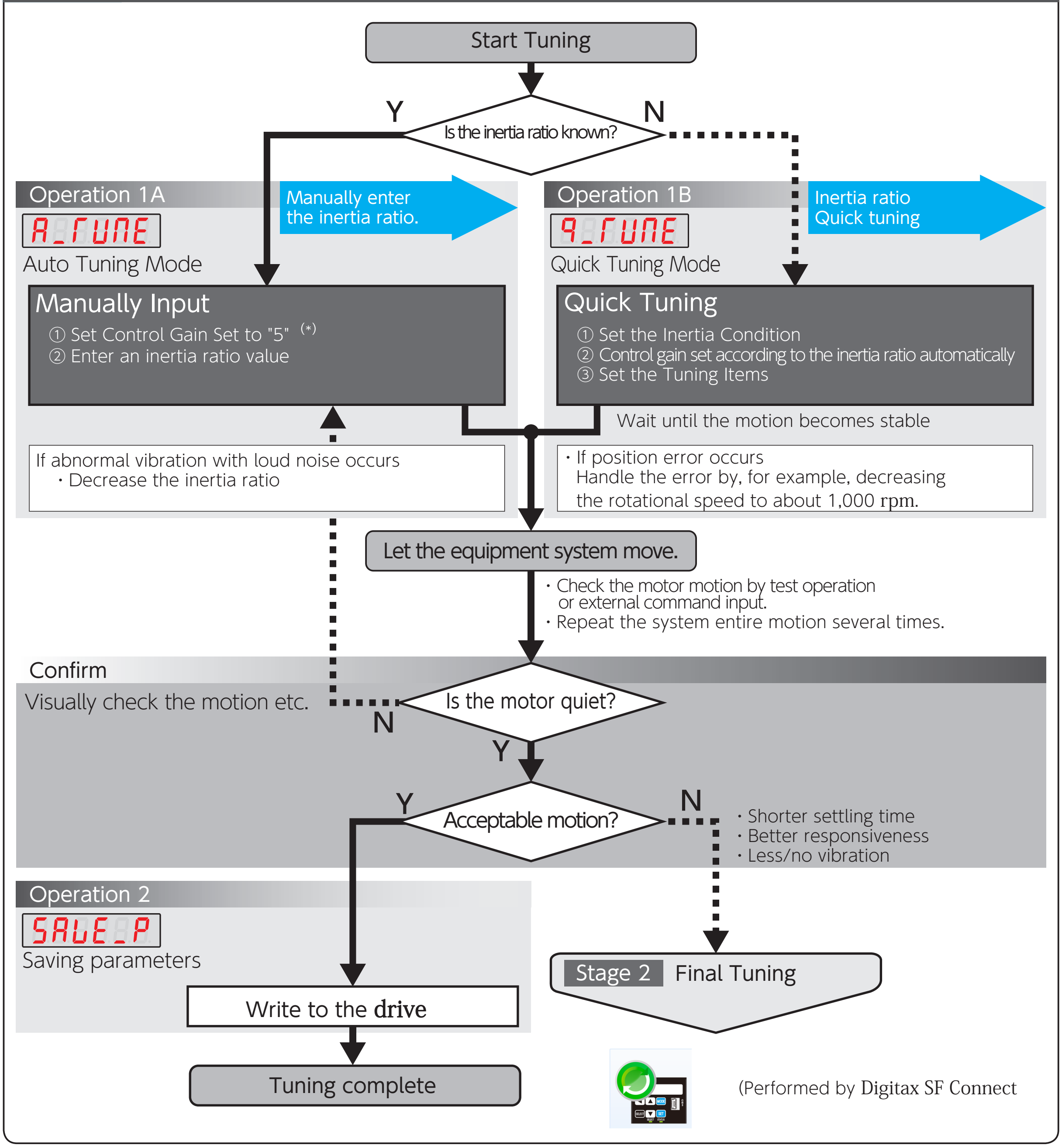


Tuning complete

2. Tuning Procedure

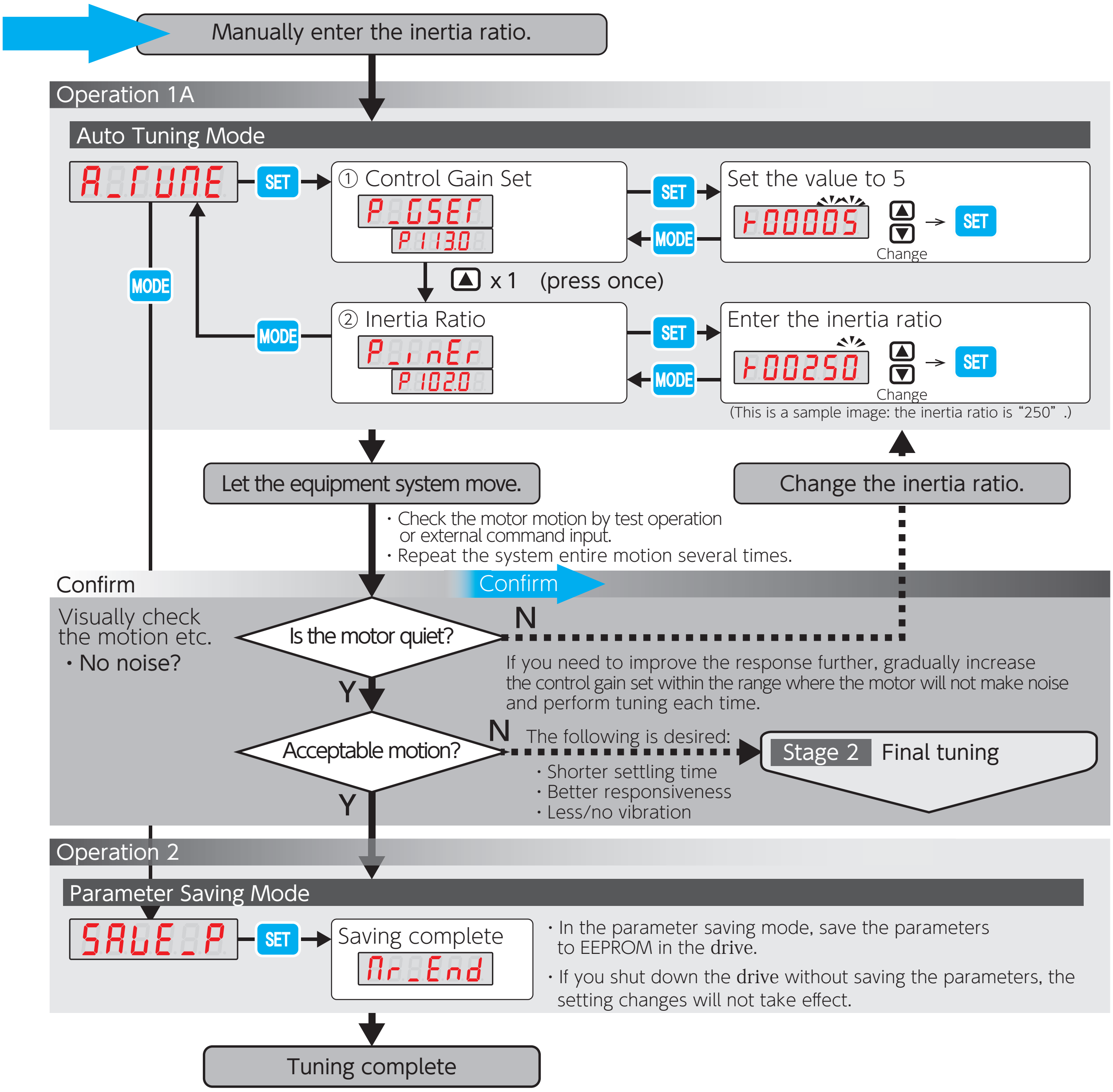
Quick Tuning on Setup Panel

Stage 1 Setting the Inertia ratio and Optimizing Control Gain Set



*) Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations and low noise.

Quick Tuning on Setup Panel: Operation 1A



- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

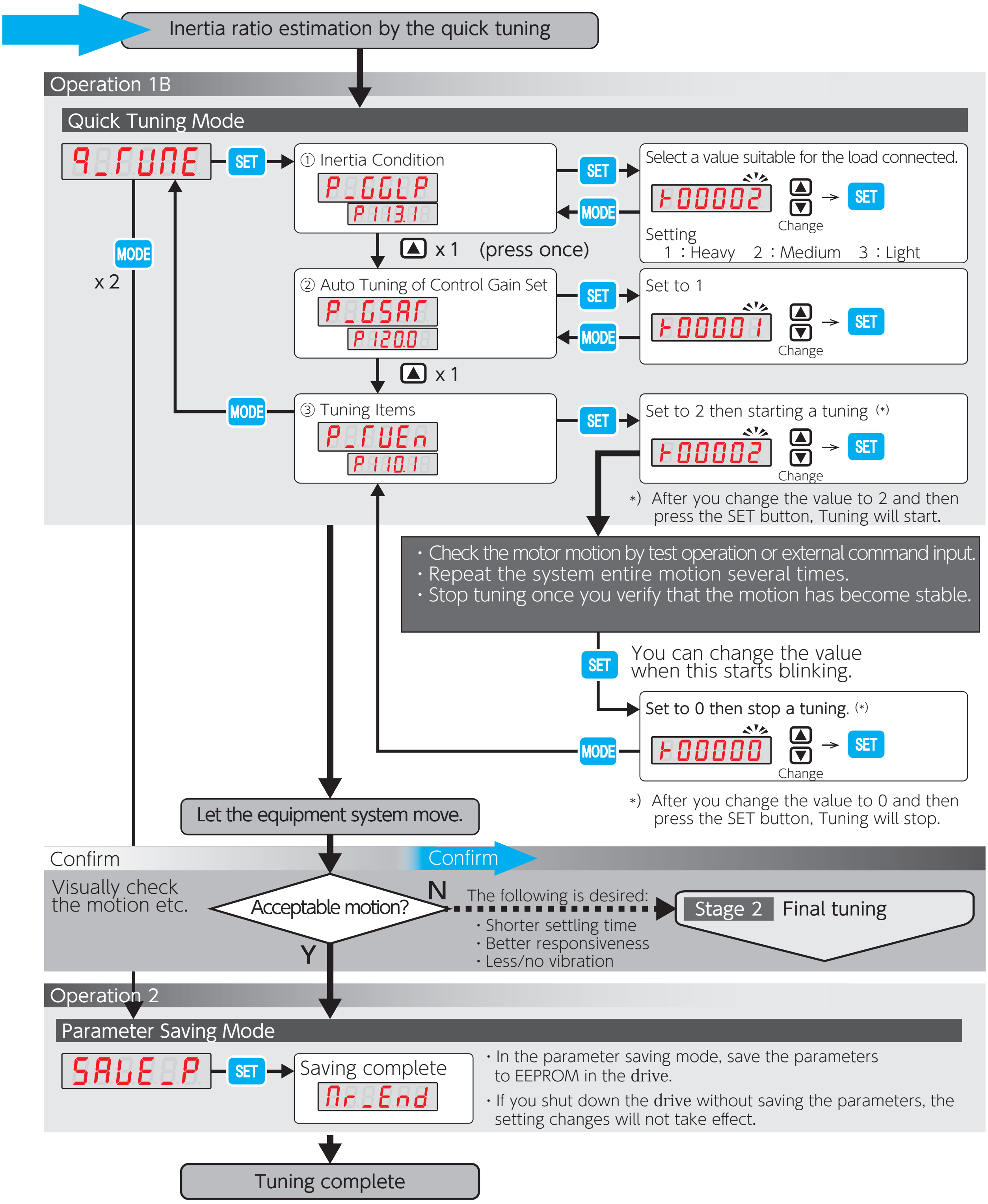
If you need to improve the response further, gradually increase the control gain set within the range where the motor will not make noise and perform tuning each time.

The following is desired:
- Shorter settling time
- Better responsiveness
- Less/no vibration

- In the parameter saving mode, save the parameters to EEPROM in the drive.
- If you shut down the drive without saving the parameters, the setting changes will not take effect.

2. Tuning Procedure

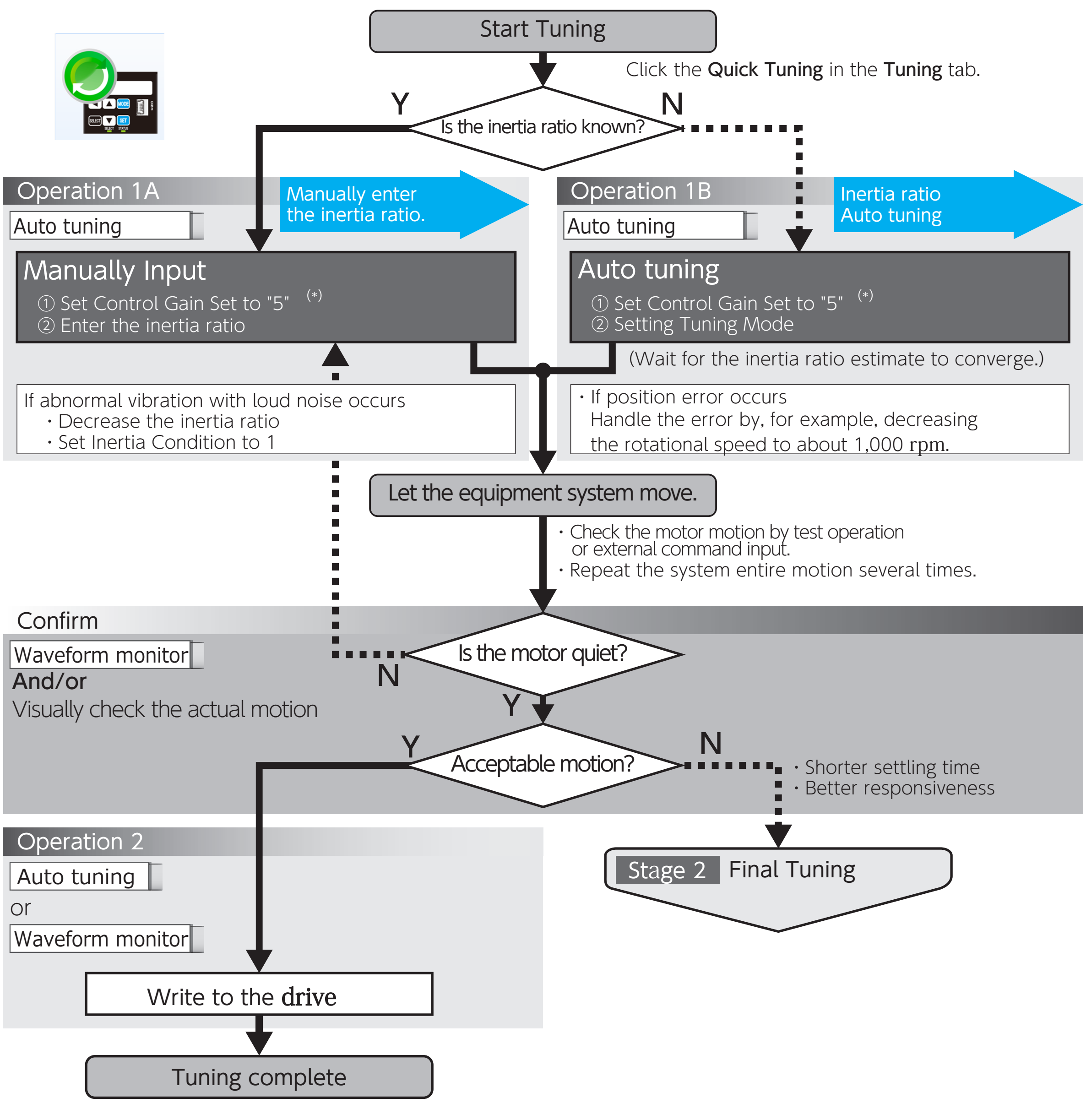
Quick Tuning on Setup Panel: Operation 1B



3. Velocity Control Mode

Auto Tuning on Digitax SF Connect

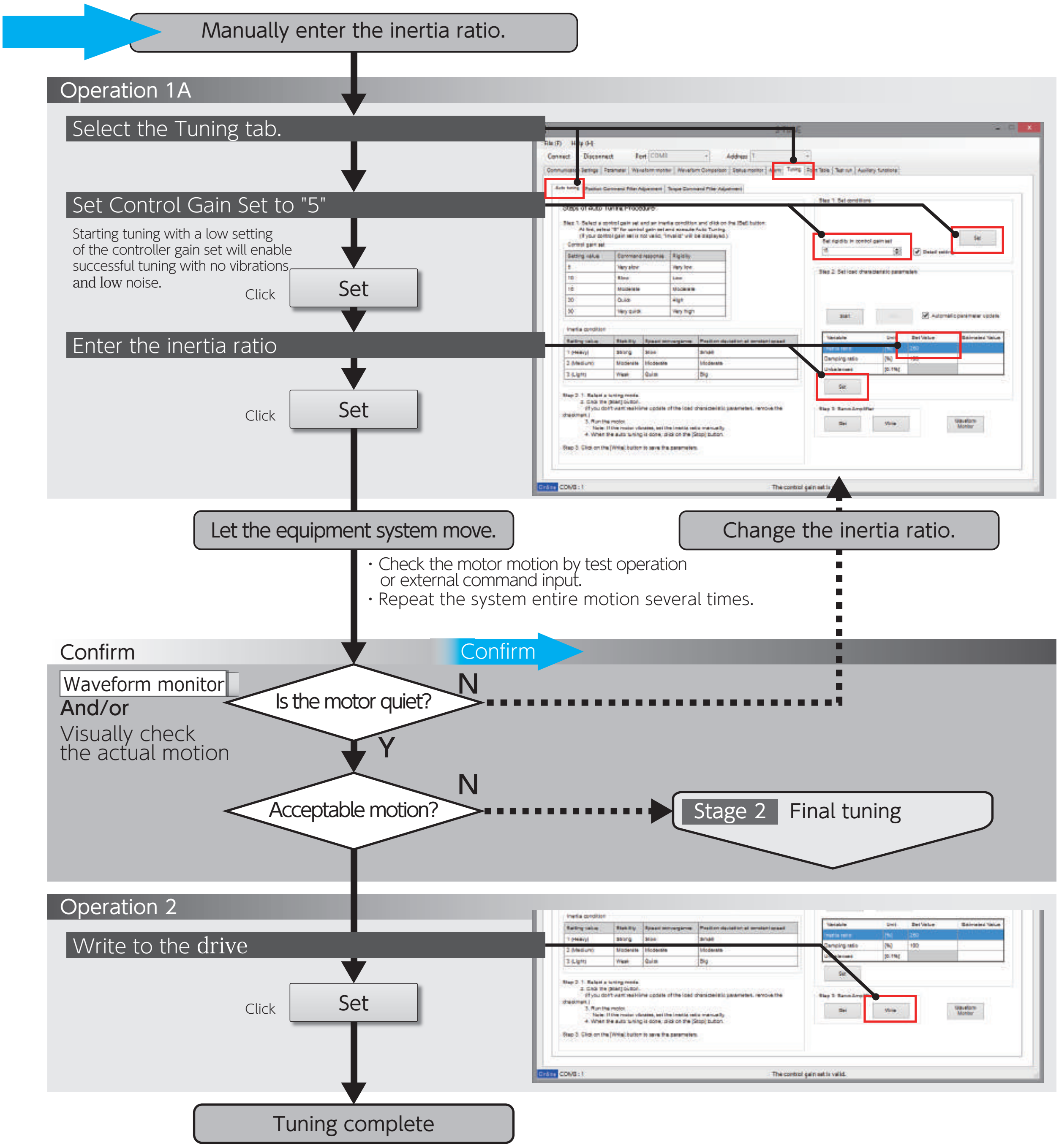
Stage 1 Setting the Inertia ratio and Optimizing Control Gain Set



*) Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations low noise

2. Tuning Procedure

Auto Tuning on Digitax SF Connect: Operation 1A



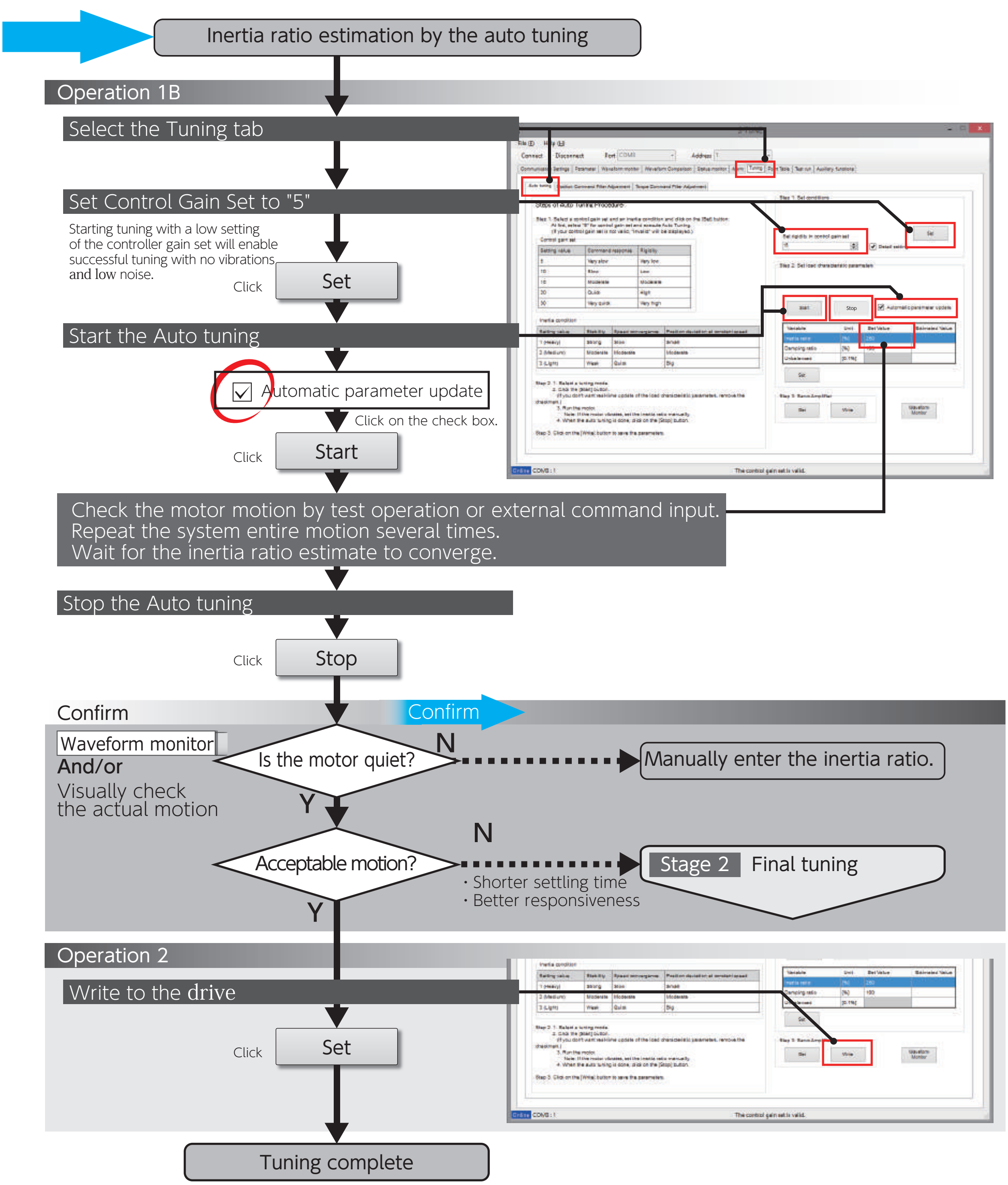
Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations and low noise.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

2. Tuning Procedure

Auto Tuning on Digitax SF Connect: Operation 1B

PLS IN POS VEL IN VEL TRQ



Inertia ratio estimation by the auto tuning

Operation 1B

Select the Tuning tab

Set Control Gain Set to "5"

Starting tuning with a low setting of the controller gain set will enable successful tuning with no vibrations and low noise.

Click Set

Start the Auto tuning

☑ Automatic parameter update

Click on the check box.

Click Start

Check the motor motion by test operation or external command input.
Repeat the system entire motion several times.
Wait for the inertia ratio estimate to converge.

Stop the Auto tuning

Click Stop

Confirm

Waveform monitor
And/or
Visually check the actual motion

Is the motor quiet? N → Manually enter the inertia ratio.

Y

Acceptable motion? N → Stage 2 Final tuning

- Shorter settling time
- Better responsiveness

Y

Operation 2

Write to the drive

Click Set

Tuning complete

Make sure to click on [Stop] to finish Auto Tuning.

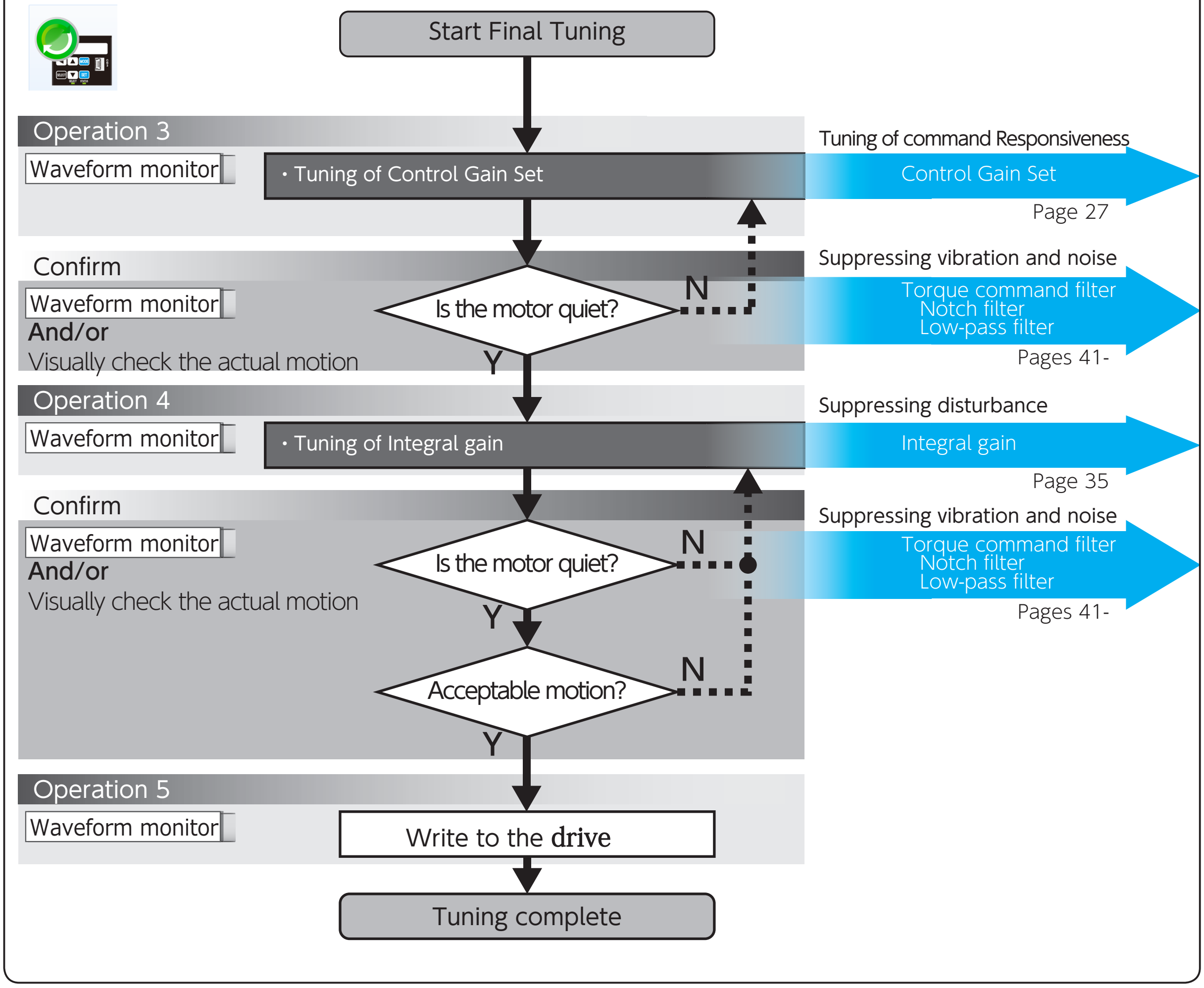
Starting Final Tuning Mode while Auto Tuning is still in process will make the tuning difficult because of inertia ratio changes.

2. Tuning Procedure

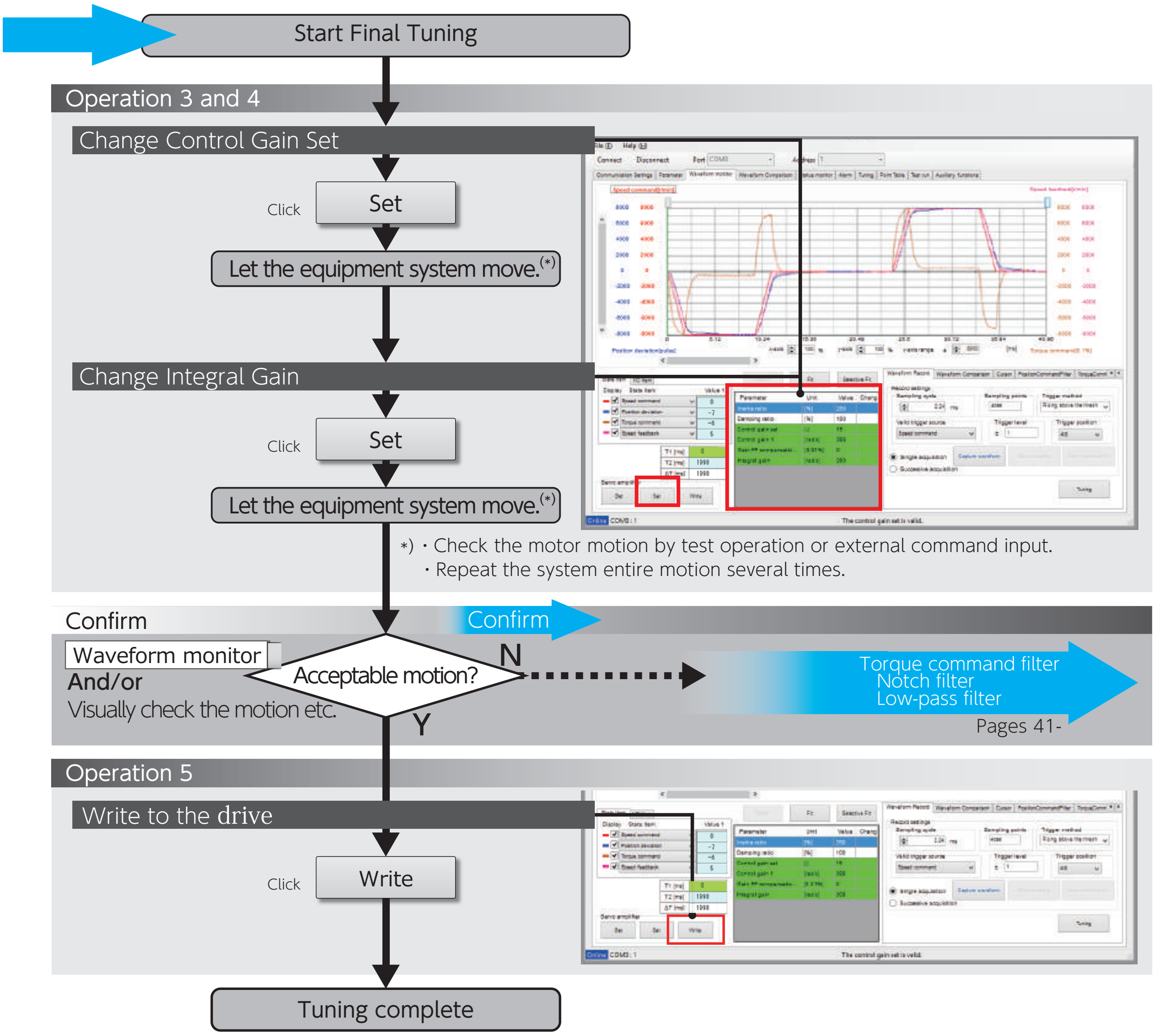
Final Tuning: Velocity Control Mode

PLS POS VEL VEL TRQ

Stage 2 Optimizing the settling time and error / Suppressing vibration and noise

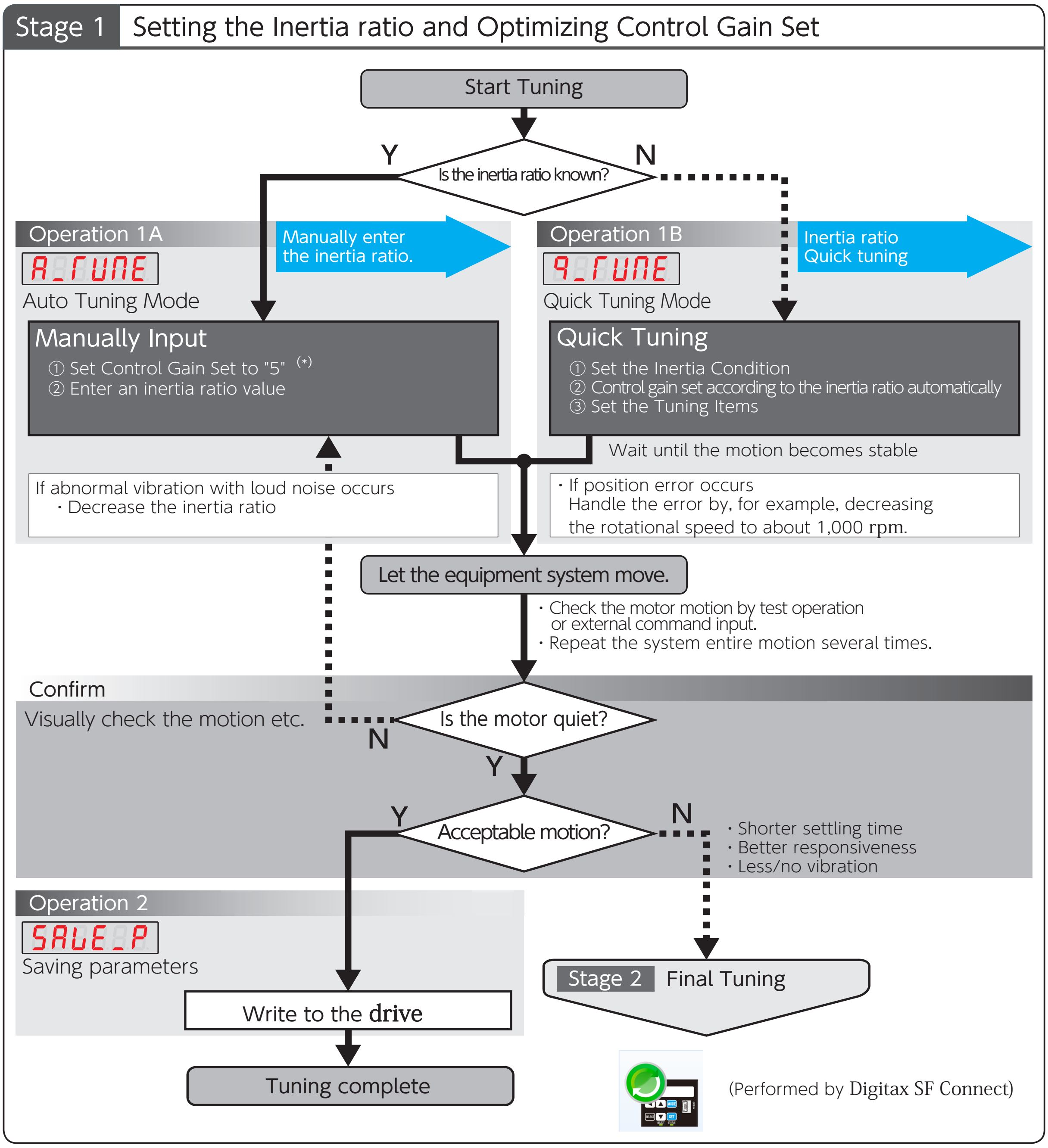


Final Tuning



*) ・Check the motor motion by test operation or external command input.
・Repeat the system entire motion several times.

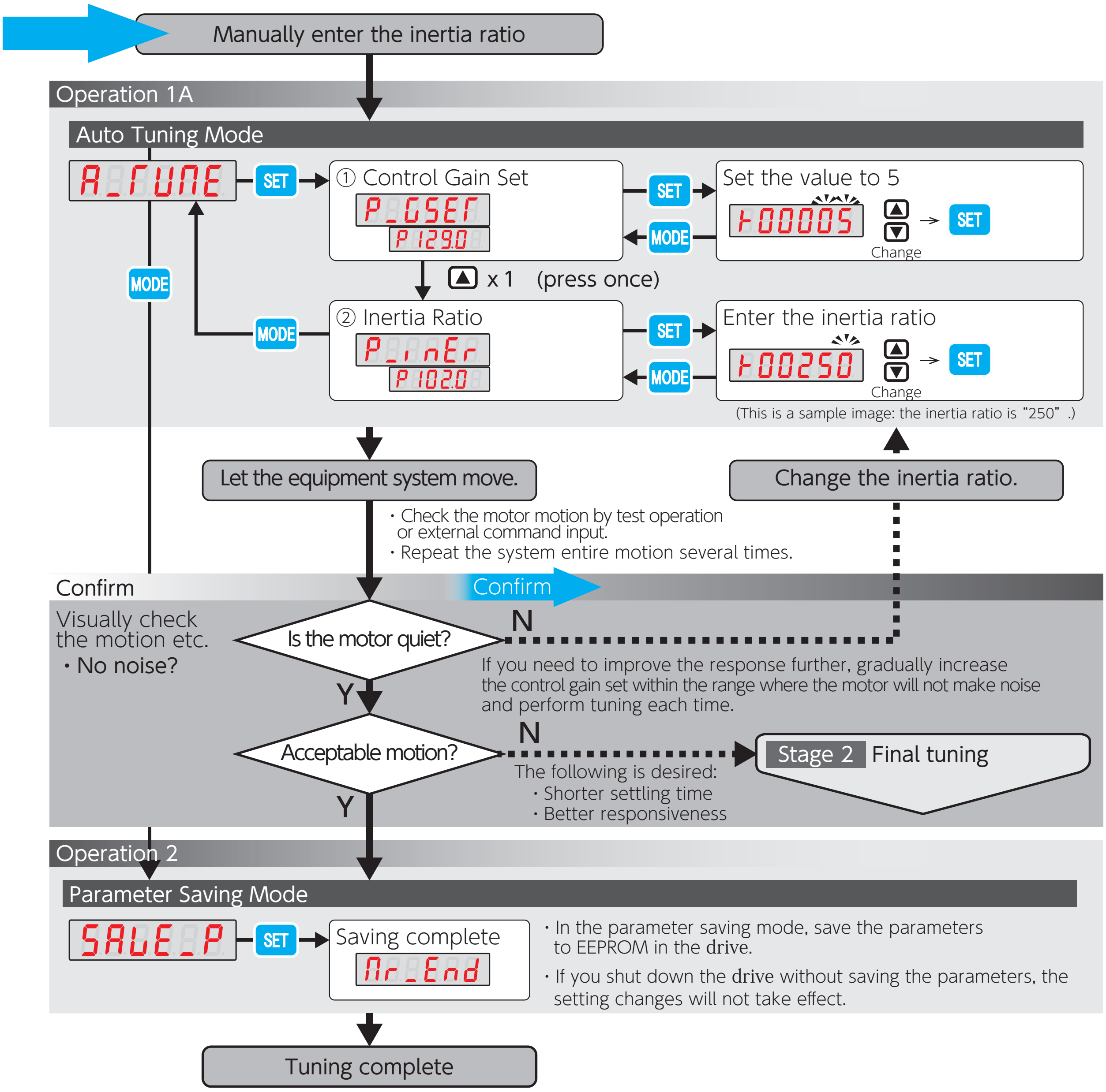
Auto Tuning on Setup Panel



*) Starting tuning with the lowest setting of the controller gain set will provide successful tuning with no vibrations and low noise.

2. Tuning Procedure

Auto Tuning on Setup Panel: Operation 1A



- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.

Visually check the motion etc.
- No noise?

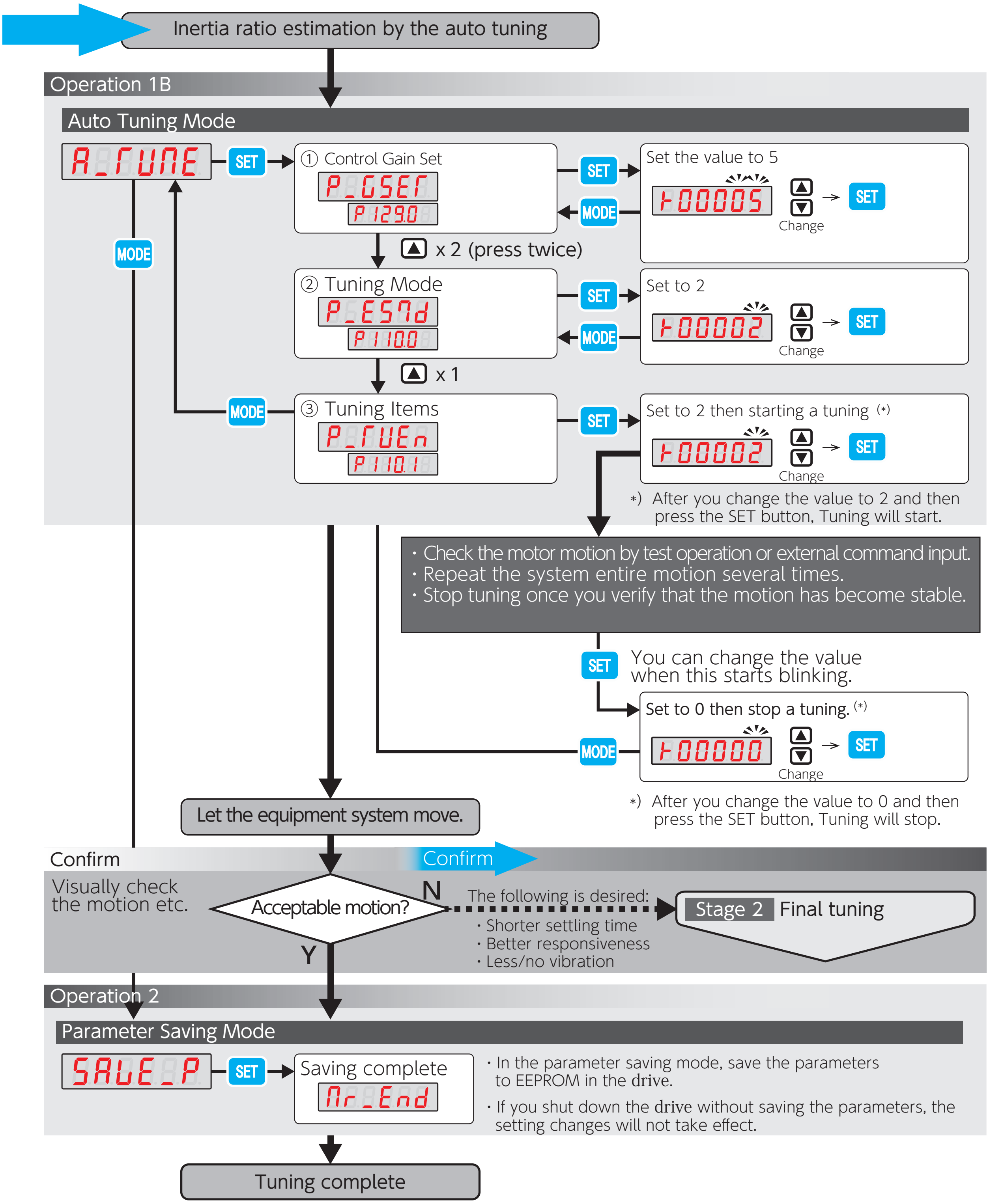
If you need to improve the response further, gradually increase the control gain set within the range where the motor will not make noise and perform tuning each time.

The following is desired:
- Shorter settling time
- Better responsiveness

- In the parameter saving mode, save the parameters to EEPROM in the drive.
- If you shut down the drive without saving the parameters, the setting changes will not take effect.

2. Tuning Procedure

Auto Tuning on Setup Panel: Operation 1A



*) After you change the value to 2 and then press the SET button, Tuning will start.

- Check the motor motion by test operation or external command input.
- Repeat the system entire motion several times.
- Stop tuning once you verify that the motion has become stable.

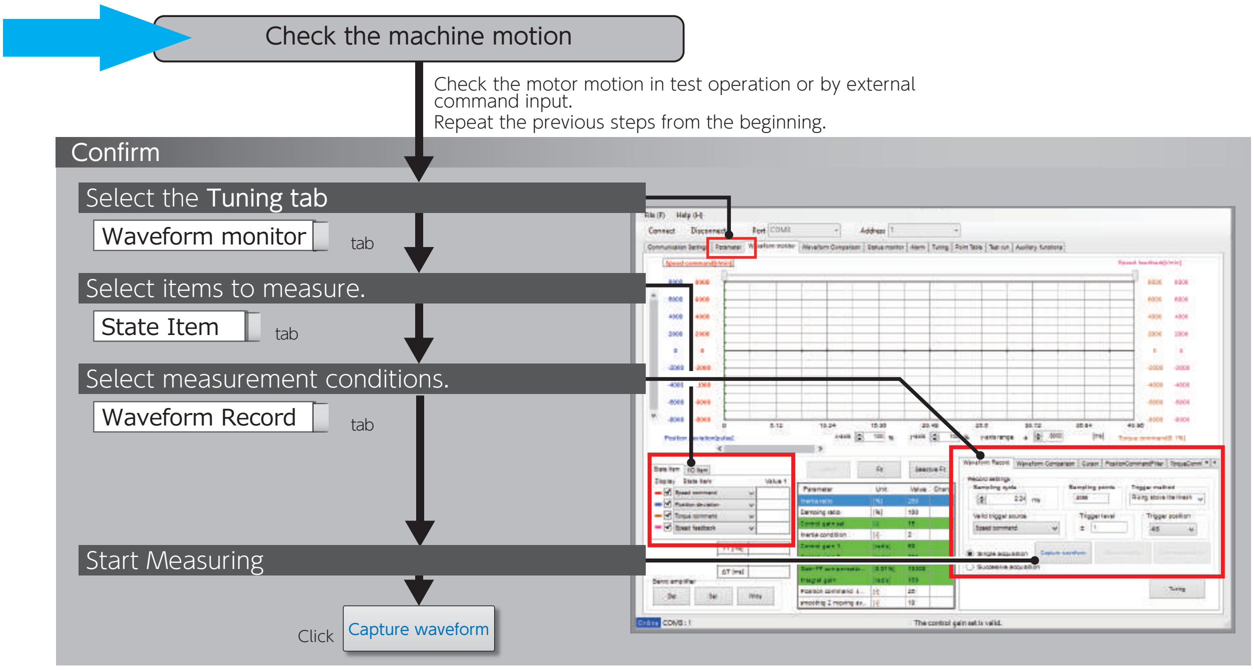
You can change the value when this starts blinking.

*) After you change the value to 0 and then press the SET button, Tuning will stop.

The following is desired:
- Shorter settling time
- Better responsiveness
- Less/no vibration

- In the parameter saving mode, save the parameters to EEPROM in the drive.
- If you shut down the drive without saving the parameters, the setting changes will not take effect.

Confirm



Check the machine motion

Check the motor motion in test operation or by external command input.
Repeat the previous steps from the beginning.

Confirm

Select the Tuning tab

Waveform monitor tab

Select items to measure.

State Item tab

Select measurement conditions.

Waveform Record tab

Start Measuring

Click Capture waveform

3. Tuning Parameters

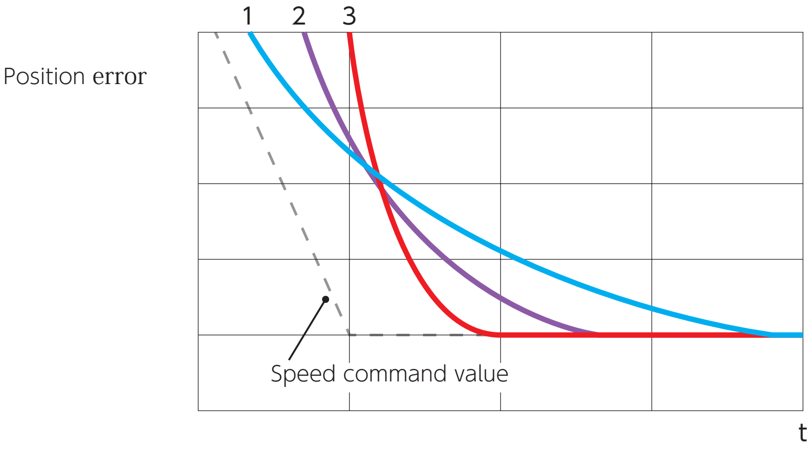
1. Tuning

Inertia Condition

PLS IN POS VEL IN VEL TRQ

Function	To make the tuning operation easier, select the inertia condition suitable to your equipment. The inertia conditions that you select will determine the Control Gain 1-2 combination and their ratio.
Parameter 113.1	Position Control Mode: Inertia conditions
Tuning Tip	Prioritize either stability or convergence according to the load and rigidity of your equipment. Be aware of the trade-off between stability and convergence.

Settings	Intended Use	Effect
1	heavy-load, high fluctuation equipment low-rigid equipment robot arms etc.	Better Stability ↕ Better Convergence
2 (Default)	(moderate setting) general transport machines	
3	light-load equipment equipment that demands high-speed operation or settling-required	



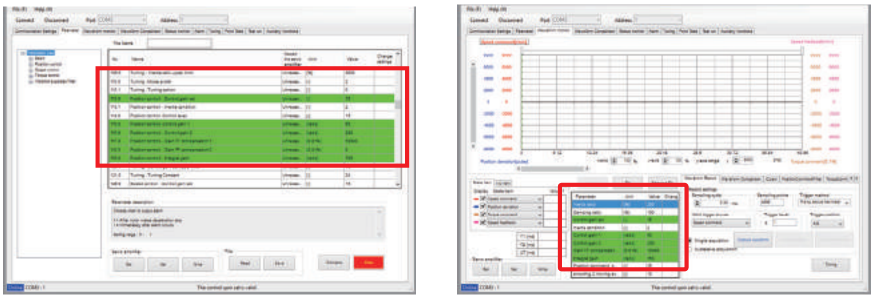
Difference in convergence characteristics depending on the inertia condition settings

Control Gain Set

PLS IN POS VEL IN VEL TRQ

Function	With this parameter, a set of the tuning parameters can be set all at once.(*1) Increasing the value of this parameter will improve the command response, position deviation during motion, settling time, and control rigidity.		
Parameter Set	113.0 (Position Control Mode)	Control level	114.0
		Control Gain 1	115.0
		Control Gain 2	116.0
		Integral gain	119.0
		Torque command filter: Low-pass filter time constant (*2)	162.0
	129.0 (Velocity Control Mode)	Control level	130.0
		Control Gain 1	131.0
		Integral gain	133.0
		Torque command filter: Low-pass filter time constant (*2)	162.0
Remark	Too high a setting will cause noise. When increasing the value, check the resulting operation to avoid oscillation or vibration.		
Tuning Tip	• Set the value to 5 first to fix the inertia ratio. • Gradually increase the setting value while watching the motion. If noise occurs, use a notch filter or decrease the low-pass filter setting. ☞ Page 42 Torque Command Filter: Notch filter ☞ Page 43 Torque Command Low-Pass Filter		

*1) In the Digitax SF Connect parameters grouped in the control gain set are highlighted in green.



*2) This is when Low-pass filter auto Setting (160.2) = 1 (auto setting ON)

Control gain set settings	Command Responsiveness	Rigidity	Settling Time	Noise
5	slow	low	long	unlikely
10	↑ ↓	↑ ↓	↑ ↓	↑ ↓
15 (Default)				
20				
30	quick	high	short	likely

Under the Auto Tuning tab, tick the detail setup box, and then select from 1-46 one by one.

3. Tuning Parameters

Mode Switch

PLS IN POS VEL IN VEL TRQ

Function	Change the mode based on the direction of the load inertia and whether offset load is present or not.		
Parameter 110.0	Settings	Mode	Balanced load or unbalanced load
	1	Standard Mode	Balanced load (horizontal motion)
	2 (Default)	Unbalanced Load Mode	Unbalanced load such as gravity is present
Remark	Use the Unbalanced Load Mode even for the case of balanced load (horizontal-axis motion).		
Prerequisite	Position Control Mode, Velocity Control Mode		

Tuning Items

PLS IN POS VEL IN VEL TRQ

Function	Setting the item(s) to be estimated during tuning.		
Parameter 110.1	Settings (Tuning)	Estimate items	
		Inertia ratio	Damping ratio
	0 (Tuning Stop) (Default)	Do not estimate	Do not estimate
	1 (Tuning Start)	Estimate	
	2 (Tuning Start)		Estimate
Prerequisite	Position Control Mode, Velocity Control Mode		

2. Final Tuning

Inertia Ratio

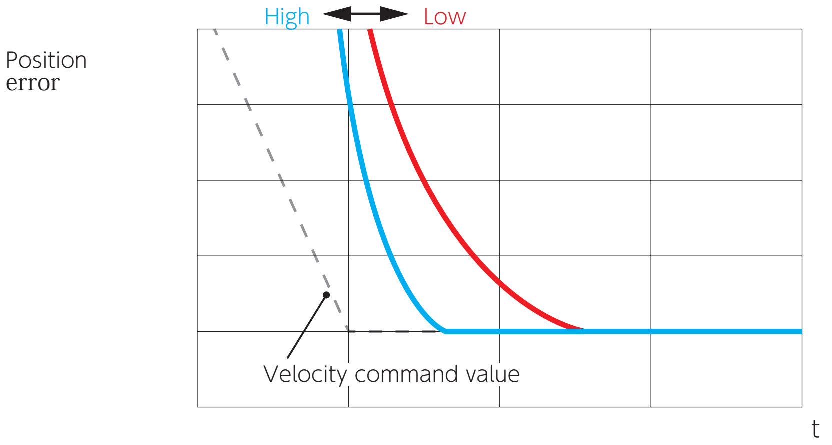
PLS IN POS VEL IN VEL TRQ

Function	Set the ratio of the load inertia to the rotor inertia of the motor. This item represents the ratio of the motor axis moment of inertia to the load moment of inertia. The inertia ratio used in Digitax SF includes the motor rotor inertia (=100%). Example: inertia ratio 200% = motor rotor inertia 100% + output axis load 100% inertia ratio 1100% = motor rotor inertia 100% + output axis load 1000% $\text{Inertia ratio} = \dfrac{\text{(load inertia)} + \text{(Rotor inertia)}}{\text{(Rotor inertia)}} \times 100\ [\%]$
Parameter 102.0	Default: 250 [%]
	Setting range: 100–10,000
Remark	Settings that are not right for the equipment will cause noise or vibration.
Tuning Tip	Start with setting a correct inertia ratio which will make your tuning easier. The auto estimate of inertia ratio during Quick Tuning will be capped by the **upper limit** (106.0). If the estimated value of the inertia ratio is higher than the upper limit, manually enter the estimated value after suppressing the vibration and noise with a notch filter first. Select the best inertia condition and set the **control gain set** (113.0, 129.0) to 5 to perform the quick-tuning and auto-tuning. In case of vibrations at settling, perform damping adjustment and perform tuning again. Because this tuning must be performed under the condition where the inertia can be estimated, we recommend that you obtain the ratio estimate in test operation.

Position Control Mode: Control Gain 1

PLS IN POS VEL IN VEL TRQ

Function	Increasing this parameter value will reduce the position error after the command becomes zero. Increase when the convergence of the position error at settling is not good.	
Parameter 115.0	Default:	50 [rad/s]
	Setting range:	5–1,000
Remark	Select a value no higher than **Position Control Mode: Control Gain 2** (116.0). Set a value smaller than the value of **Control Gain 2** (116.0). Making a change to any of the following will also change other tuning parameters (such as Control Gain 2) to the prearranged parameter set all at once. ・**Control Gain Set** (113.0) ・**Inertia conditions** (113.1) ・**Control Level** (114.0)	
Tuning Tip	Increasing this parameter setting will improve the settling time in cases when increasing the control gain set or control level does not resolve poor convergence of position error, or noise is too much that the control gain set or control level cannot be increased.	

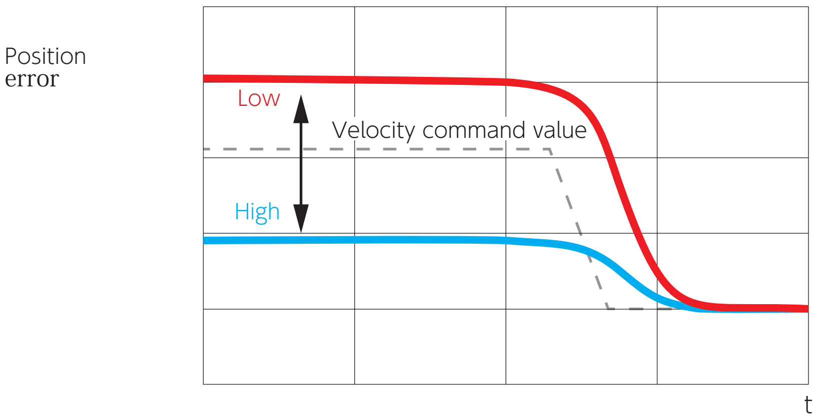


Differences in Position Error Convergence

Position Control Mode: Control Gain 2

PLS IN POS VEL IN VEL TRQ

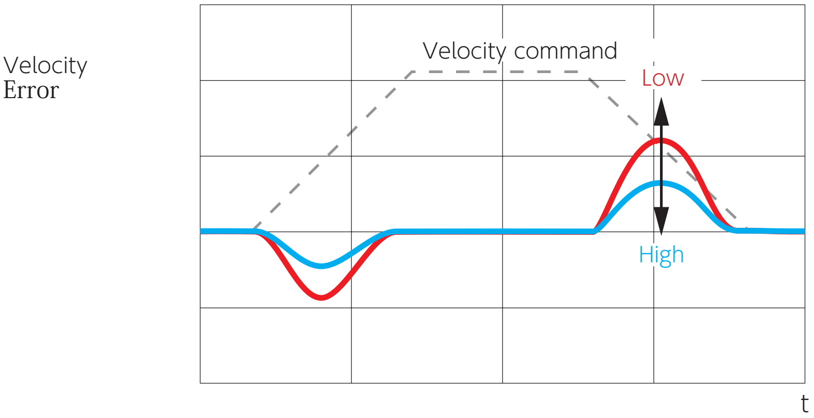
Function	Increasing this parameter value will reduce the position error during command input. Increasing the parameter value provides faster command response; however, too large a value may result in noise.
Parameter 116.0	Default: 200 [rad/s]
	Setting range: 80–5,000
Remark	Set a value larger than the value of **Control Gain 1** (115.0). To reduce position errors after the command becomes zero, increase the value of **Control Gain 1** (115.0). The tuning parameters such as the **Control gain 1** will be changed to the group of the preset value depending on changing the following parameters. ・**Control gain set** (113.0) ・**Inertia conditions** (113.1) ・**Control level** (114.0)
Tuning Tip	Use this parameter when the load inertia or the load fluctuation is large. The responsiveness will be improved and the movement will be smoother. Noise Solutions ① Use **Torque command filter: Notch filter** (such as 160.1). ② Lower **Torque command filter: Low-pass filter constant** (162.0). ③ Lower **Integral gain** (119.0). When no improvement has been seen if these ① , ② , and ③ method had been performed, please decrease the 116.0 value.



Differences in Position error Convergence

Velocity Control Mode: Control Gain 1

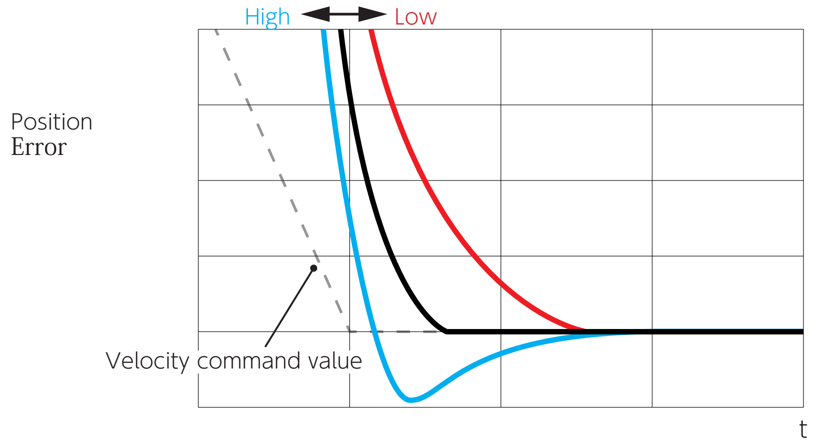
Function	Increasing this parameter value will reduce the velocity error during the acceleration /decelaration. Increasing the parameter value provides faster command response; however, too large a value may result in noise.
Parameter 131.0	Default: 399 [rad/s] Setting range: 100–6,000
Remark	Making a change to any of the following will also change other tuning parameters (such as **Gain FF Compensation 1**) to the prearranged parameter set all at once. ・**Control gain set** (129.0) ・**Control level** (130.0)
Tuning Tip	Use this parameter when the load inertia or the load fluctuation is large. The responsiveness will be improved and the movement will be smoother. Noise Solutions ① Use **Torque command filter: Notch filter** (such as 160.1). ② Lower **Torque command filter: Low-pass filter constant** (162.0). ③ Lower **Integral gain** (133.0) When no improvement have been seen if these ①, ②, and ③ method had been performed, please decrease the 131.0 value.



Differences in Velocity Error Convergence

Position Control Mode: Gain FF Compensation 1

Function	This parameter will improve the responsiveness at a low gains setting. Set the Feed Forward Compensation Rate (velocity) with respect to **Control Gain 1** (115.0) for Position Control Mode. Using this parameter is effective to shorten the settling time.
Parameter 117.0	Default: 10,000 [0.01%] Setting range: 0–15,000
Remark	Adjust this item after setting the following: **Control Gain Set** (113.0) **Control Level** (114.0) **Control Gain 1** (115.0) **Control Gain 2** (116.0) Guideline for Tuning If the inertia ratio is right, setting this parameter to 10,000 will not cause overshooting nor undershooting.
Tuning Tip	· Set the following before adjusting this parameter: **Inertia ratio** (102.0), **Control gain set** (113.0), **Control level** (114.0), **Control Gain 1** (115.0), and **Control Gain 2** (116) · Setting this parameter too low will result in undershooting. Target the value which would make the settling time shorter. · Too high a value of this parameter will result in overshooting. Set relatively a moderate value. Inertia condition Coarse tuning amount 1: increment by 10 2: increment by 100

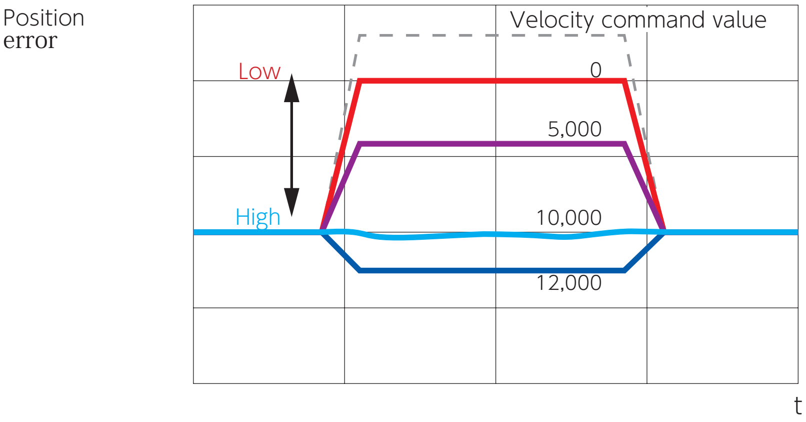


Differences in Position Error Convergence

3. Tuning Parameters

Position Control Mode: Gain FF Compensation 2

Function	Increasing this parameter value will reduce the position running error of the motor at a constant speed. Raise the value of this item only after reducing the position error, by using **Gain FF Compensation 1** (117.0) at settling.	
Parameter 118.0	Default:	0 [0.01%]
	Setting range:	0–15,000
Remark	If this parameter value is above 10,000, the position error will start appearing appearing in a negative range. When the command resolution is low, increasing this parameter value will result in louder running sound.	
Tuning Tip	With a right inertia ratio setting, setting this parameter to 10,000 minimizes the position error . Noise Solutions Adjusting **Filter 4: Smoothing 2- Moving average counter** (81.0) may reduce the noise.	



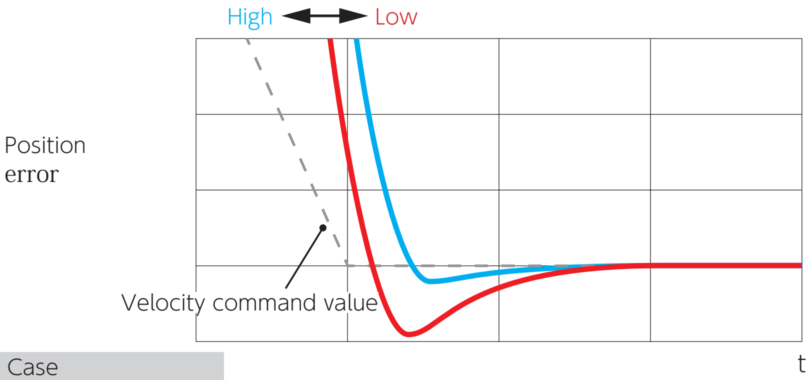
Differences in Position Error Convergence

Integral Gain

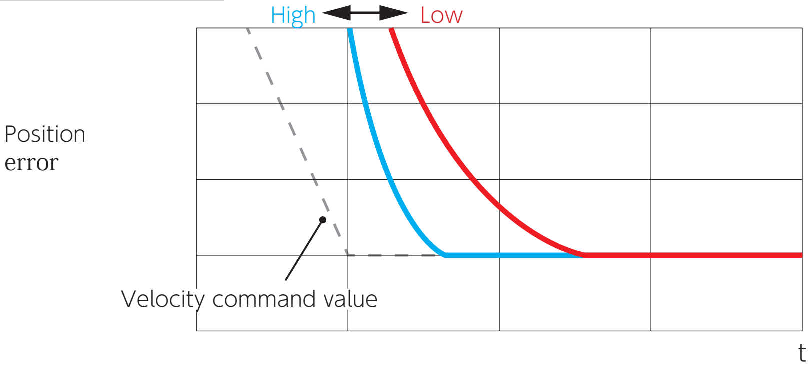
PLS IN POS VEL IN VEL TRQ

Function	Set the Integral Gain. Increasing the integral gain will improve poor convergence due to friction and load fluctuation at settling and reduce the position error. This will result in rigid and sensitive motions.		
Parameter 119.0	Position Control Mode	Default :	160 [rad/s]
		Setting range :	45–5,000
Parameter 133.0	Velocity Control Mode	Default :	300 [rad/s]
		Setting range :	45–5,000
Remark	This parameter will reset to the default if the Control Gain Set is changed. Too high an integral gain will cause noise. Adjust the value within the range of no noise to achieve your desired responsiveness.		
Tuning Tip	Adjust the integral gain after setting the **control level** (or adjust Control Gain 1 and 2 each) and FF compensation. Noise Solutions ① **Use Torque command filter: Notch filter** (such as 160.1) ② Decrease the value of **Integral Gain**. If noise occurs, decrease the setting of this parameter or apply a torque command notch filter. ☞ Page 42 Torque Command Notch Filter		

Overshooting Case



Undershooting Case



Differences in Position Error Convergence

3. Tuning Parameters

3. Position Command Filter

Optimizing the settling time and error / Suppressing vibration and noise

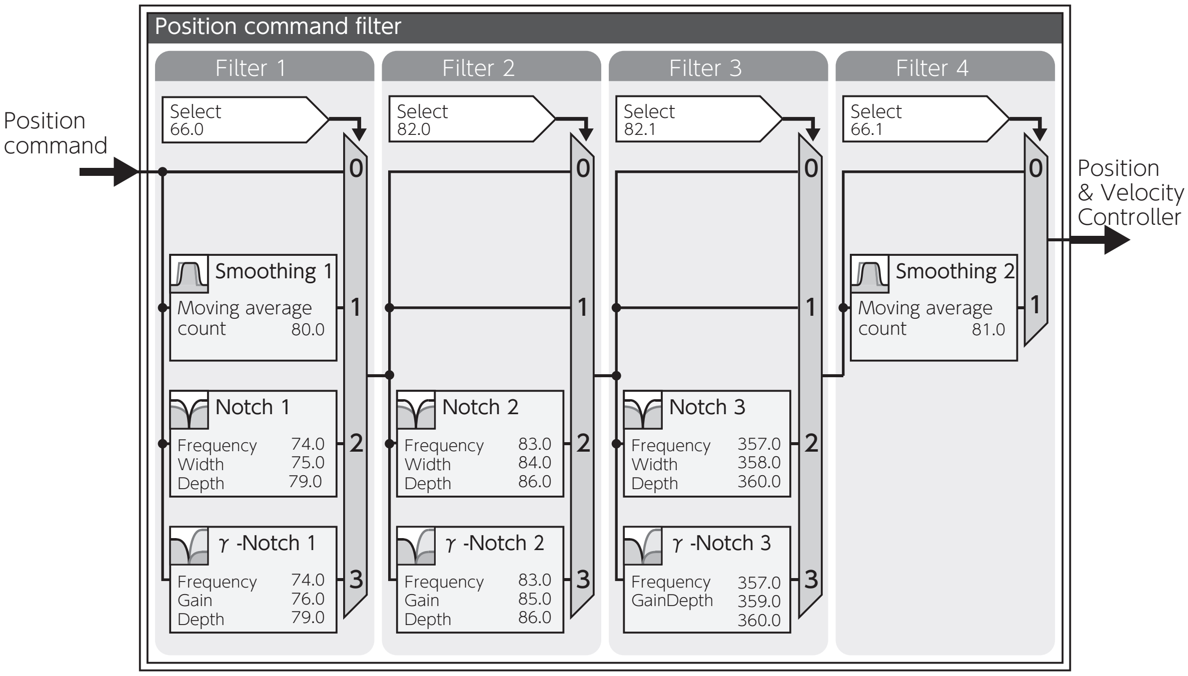
Check the following before using Position command filter
- The command from the host controller is correct.
- The equipment is installed firmly and properly.
- The gain parameters such as inertia ratio are correctly set.
- The command smoothing filters 2 (and 1) are set.
- Vibration is now unlikely to occur thanks to the decreased integral gain.

Filter	Overview	Refer to
Smoothing	**Position Command Smoothing Filter** Effective in smoothing the position command and suppressing vibration at the time of positioning.	38

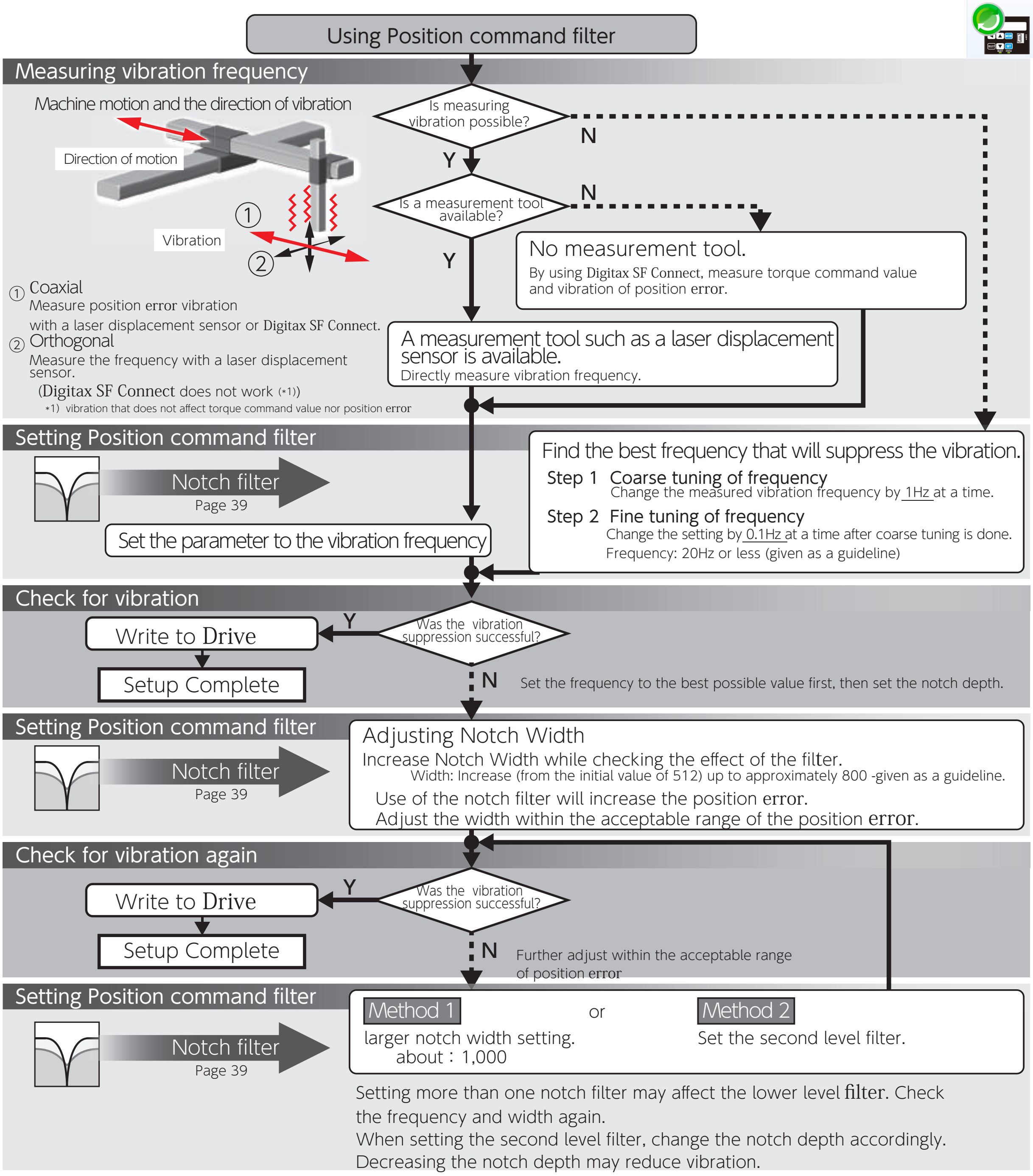
Apply the following notch filters if the machine end point is still vibrating after sufficient tuning was performed and the smoothing filter was set.

Filter	Overview	Refer to
Notch	**Position Command Notch filter** Effective in suppressing vibration of mechanical systems where the vibration does not appear in the torque output waveform. When compared to the command smoothing filter, the position command filter is more effective in reducing the absolute position error (Status No.80).	37 39
γ -Notch	**Position Command γ -Notch Filter** Effective in suppressing vibration of mechanical systems where the vibration does not appear in the torque output waveform. This filter has flexibility of changing the gain setting in the range higher than notch frequencies. This item will reduce the position error impacted by use of notch filer.	37 40

Up to four levels of Position command filter are available.



Block Diagram of Position Command Filter (Details)



Using Position command filter

Measuring vibration frequency

Machine motion and the direction of vibration

① Coaxial
Measure position error vibration
with a laser displacement sensor or Digitax SF Connect.

② Orthogonal
Measure the frequency with a laser displacement sensor.
(Digitax SF Connect does not work (*1))

*1) vibration that does not affect torque command value nor position error

No measurement tool.
By using Digitax SF Connect, measure torque command value and vibration of position error.

A measurement tool such as a laser displacement sensor is available.
Directly measure vibration frequency.

Setting Position command filter

Set the parameter to the vibration frequency

Find the best frequency that will suppress the vibration.

Step 1 Coarse tuning of frequency
Change the measured vibration frequency by 1Hz at a time.

Step 2 Fine tuning of frequency
Change the setting by 0.1Hz at a time after coarse tuning is done.
Frequency: 20Hz or less (given as a guideline)

Check for vibration

Set the frequency to the best possible value first, then set the notch depth.

Setting Position command filter

Adjusting Notch Width
Increase Notch Width while checking the effect of the filter.
Width: Increase (from the initial value of 512) up to approximately 800 -given as a guideline.
Use of the notch filter will increase the position error.
Adjust the width within the acceptable range of the position error.

Check for vibration again

Further adjust within the acceptable range of position error

Setting Position command filter

Method 1	or	Method 2
larger notch width setting. about : 1,000		Set the second level filter.

Setting more than one notch filter may affect the lower level filter. Check the frequency and width again.
When setting the second level filter, change the notch depth accordingly.
Decreasing the notch depth may reduce vibration.

【application】 Setting Position command filter

In case setting the notch filter alone is not enough to suppress vibration
Set γ－Notch Filter (*2)

*2) Set the high-frequency gain to a lower value.
Note that decreasing the gain will tend to cause a position error trip.

Position Command Smoothing Filters 1 and 2

Function	The smoothing filters smooth the position command and suppress vibrations.			
Parameter	Position command filter 1: Type Select	66.0	Default:	0
			Setting range:	0–3
	Position command filter 4: Switch Select	66.1	Default:	1
			Setting range:	0–1
	Position command filter 1: Smoothing 1 -Moving average counter	80.0	Default:	25 (less than 750 W) 20 (over 1 kW)
			Setting range:	1–6,250
	Position command filter 4: Smoothing 2 -Moving average counter	81.0	Default:	10
			Setting range:	1–1,250
Remark	Before setting any of the parameters, wait for at least 3 secs after the motor stops and then set it while the command pulse is not being input. Changing the parameter setting during pulse input or with presence of residual pulse could cause shift in position. The larger setting will result in longer command time delay.			

Tuning Tip

- Set **Position command filter 1: Type** (66.0) and **Position command filter 4: Switch** (66.1) to “1” . (*)
- Measure the vibration frequency on the torque command waveform or position error , and set **Position command filter 1 (and 4): Smoothing 1 (and 2) -Moving average count** (80.0 (and 81.0) to the value derived from the vibration frequency.

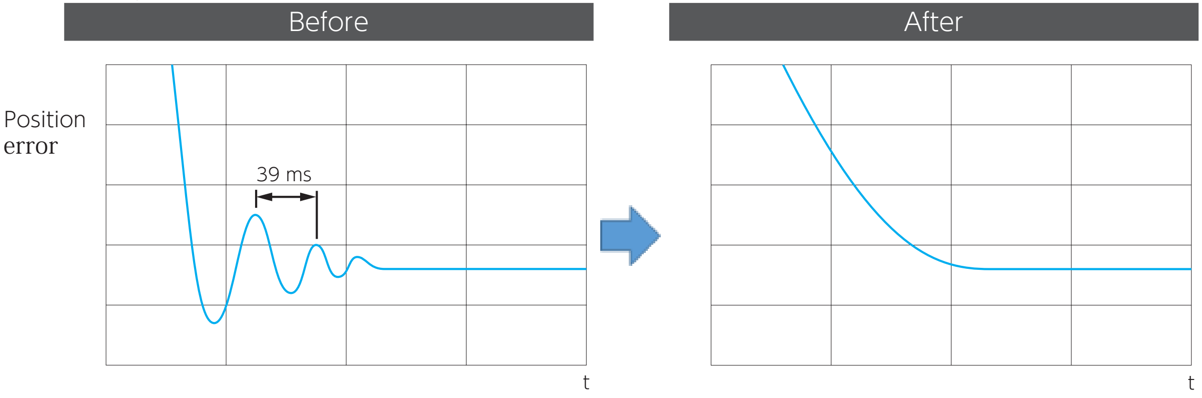
Calculation formula:

Motor Output Capacity	Moving Average Count Derived from Vibration Frequency	
50 W to 750 W	6,250	× (vibration frequency[s]) = parameter value
1 kW to 2 kW	5,000	

In the example below, when the vibration frequency is 39 ms, the average count = 6,250 x 0.039 = 242; the delay time will be 39 ms.

☞ 5 Setting List of Parameters

Example: 50 W to 750 W

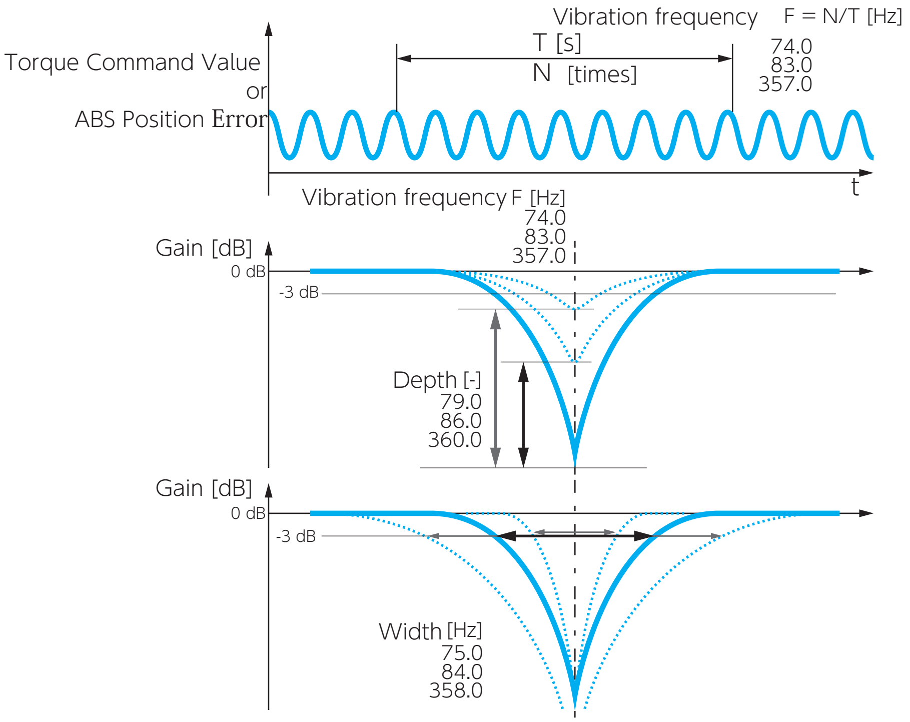


Effect of Smoothing Filter

Position Command Notch Filter

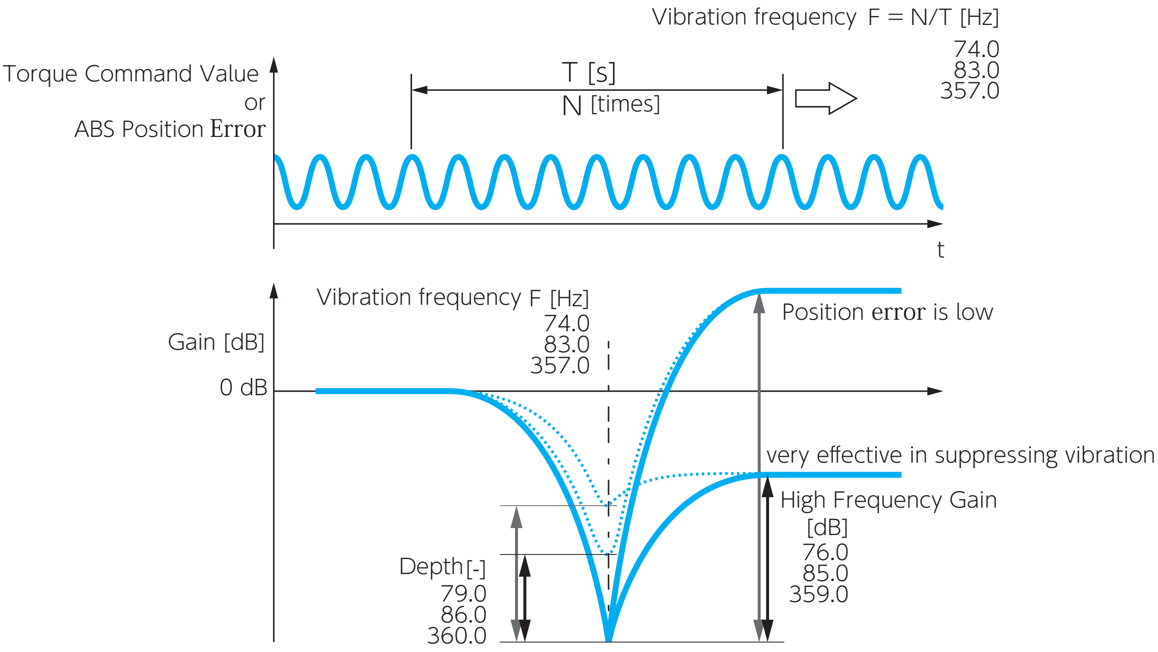
PLS IN POS VEL IN VEL TRQ

				Filter 1	Filter 2	Filter 3
Function	Apply this filter if the machine end point is still vibrating after sufficient tuning was performed and the smoothing filter was applied. Has vibration suppression effect on mechanical systems where the vibrations don’t appear in the torque output waveform. When compared to the command smoothing filter, the position command filter is more effective in reducing the absolute position error(Status No.80).					
Parameter	Frequency	Default:	10 [0.1 Hz]	74.0	83.0	357.0
		Setting range:	10–2,000			
	Width	Default:	512	75.0	84.0	358.0
		Setting range:	128–2,048			
	Depth	Default:	0	79.0	86.0	360.0
		Setting range:	0–100			
Remark	Increasing the notch width will make the position error large. Too large a notch width or setting the second level notch filter will result in better vibration suppression; however, the position error will be larger. Set this filter within the acceptable range of position error.					
Tuning Tip	Check the following before applying the filter ・The command from the host controller is reasonable ・The equipment is installed firmly and properly. ・The gain parameters such as inertia ratio are properly set. ・The command smoothing filters 2 (and 1) are set. ・The integral gain has been decreased and vibrations are unlikely to occur. Start the equipment operation and apply the vibration frequency (measured at the equipment end) to the notch frequency. If the vibration cannot be suppressed, increase the notch width (by 800 as a rough standard). To reduce the position error during operation, increase the notch depth. ☞ 5 Setting List of Parameters					



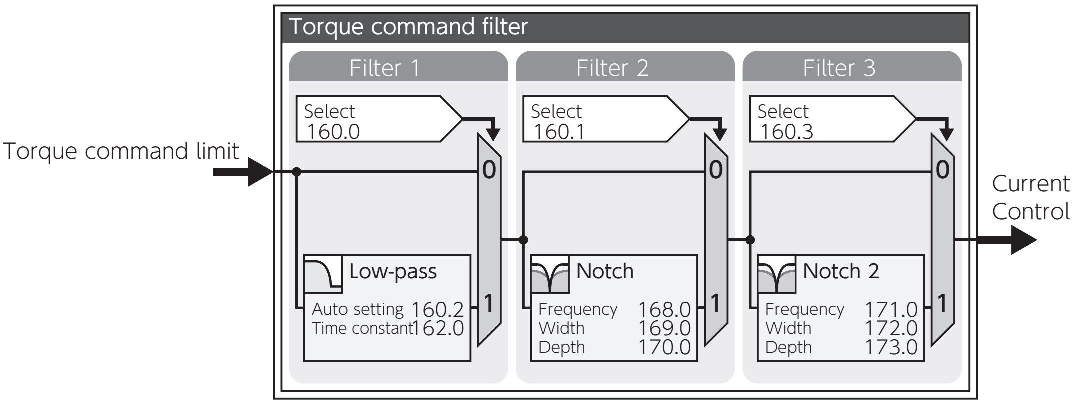
Position Command γ -Notch Filter

Function	Use this filter, if the machine end point is still vibrating even after applying a notch filter in addition to sufficient tuning and a smoothing filter. This filter has vibration suppression effect on mechanical systems where the vibrations don' t appear in the torque output waveform. It has flexibility of changing the gain setting in a range higher than notch frequency. Use this filter when it's expected that using a notch filter will reduce the position error.
Remark	Increasing the high frequency gain too much may result in noise. Decreasing the high frequency gain too much will tend to cause position error trip. Set this filter within the acceptable range.
Tuning Tip	Check the following before applying the filter ・The command from the host controller is reasonable ・The equipment is installed firmly and properly. ・The gain parameters such as inertia ratio are properly set. ・The command smoothing filter 2 and 1 are set. ・The integral gain has been decreased and vibrations are unlikely to occur. Start the equipment operation and apply the vibration frequency (measured at the equipment end) to the notch frequency. To reduce the position error, gradually increase the high frequency gain setting. To reduce the position error during operation, increase the notch depth. ☞ 5 Setting List of Parameters



4. Torque Command Filter

Filter	Overview	Refer to
Notch	**Torque Command Filter: Notch Filter** This filter is effective in removing vibration elements from torque command and suppressing noise and vibration.	42
Low-pass	**Torque Command Low-Pass Filter** This filter is effective in smoothing the position command and suppressing vibration at the time of positioning.	43

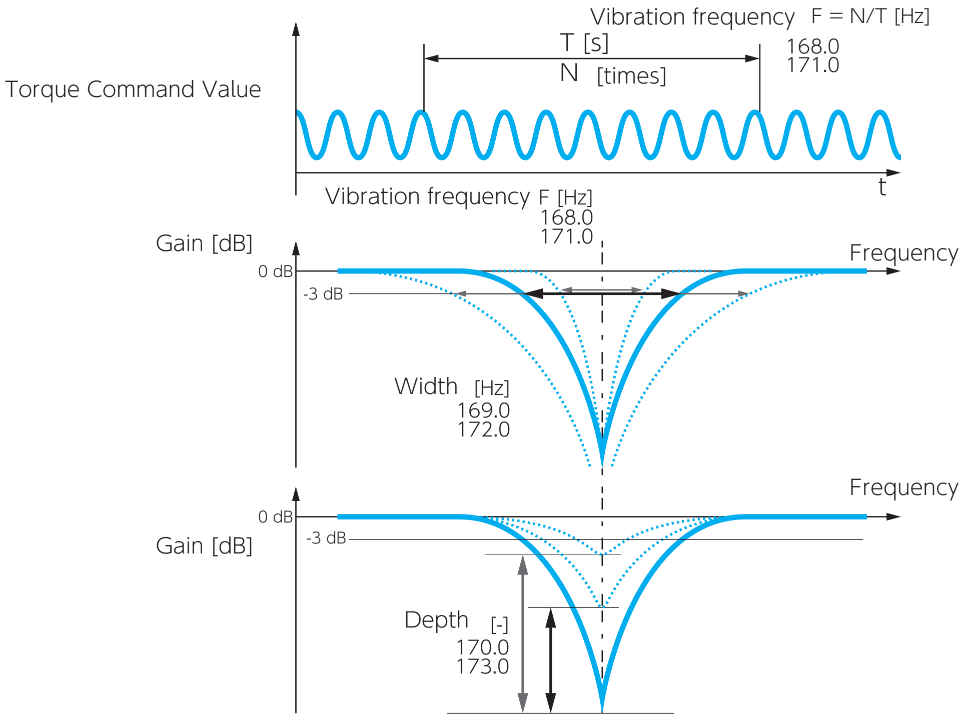


Block Diagram of Torque Command Filter with Details

Torque Command Filter: Notch Filter

PLS POS VEL VEL TRQ

Function	This filter is effective in suppressing noise and vibrations by removing vibration factors from the torque command.					
Parameter	Notch filter				Filter	Filter 2
	Switch	Default:	0		160.1	160.3
		Settings:	0–1			
	Frequency	Default:	2,500 [Hz]		168.0	171.0
		Setting range:	0–2,500			
	Width	Default:	8		169.0	172.0
		Setting range:	1–16			
	Depth	Default:	0		170.0	173.0
		Setting range:	0–256			
Remark	Set this item only after the machinery is installed properly. Unless the equipment is installed correctly, the filter performance will be sub-optimal.					
Tuning Tip	Set **Notch filter switch** (160.1) =1(enable) and set the value of **Notch filter frequency** (168.0) to be a vibration frequency. Calculate the vibration frequency using the waveform of, for example, the torque command when vibration is occurring. In the case of multiple vibration frequencies, set the second level notch filter. Alternatively, use this filter together with the **low-pass filter** (160.0, 160.2, 162.0) or increase **Notch filter - Width** (169.0). If applying the notch filter cannot stop resonant vibrations due to considerable machinery rattles, increase **Notch filter- Depth** (170.0) to 50,100,150 and so on, so that the actual notch depth will be shallower. ☞ 5 Setting List of Parameters					



Torque Command Low-Pass Filter

PLS IN POS VEL IN VEL TRQ

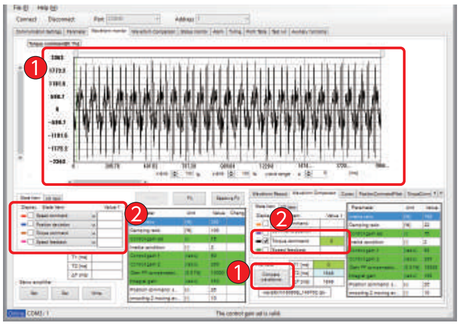
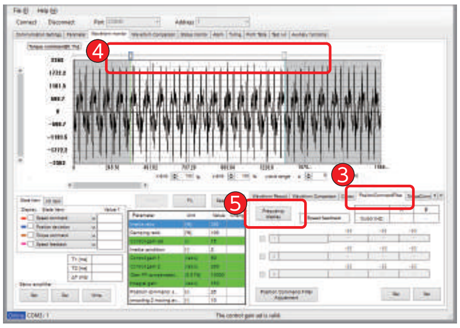
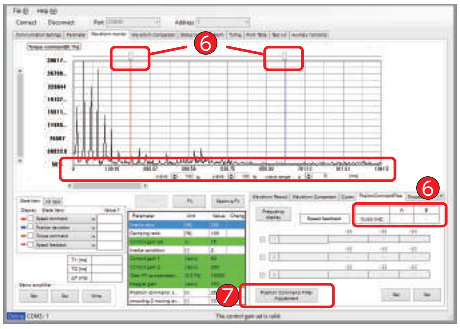
<table>
<tr><td>Function</td><td colspan="4">Setting a relatively large value may suppress vibrations.</td></tr>
<tr><td rowspan="6">Parameter</td><td rowspan="2">Switch</td><td rowspan="2">160.0</td><td>Default:</td><td>1</td></tr>
<tr><td>Settings:</td><td>0–1</td></tr>
<tr><td rowspan="2">Auto setting</td><td rowspan="2">160.2</td><td>Default:</td><td>0</td></tr>
<tr><td>Settings:</td><td>0–1</td></tr>
<tr><td rowspan="2">Time constant</td><td rowspan="2">162.0</td><td>Default:</td><td>0 [0.01 ms/rad] (less than 100 W)
10 [0.01 ms/rad] (over 200 W)</td></tr>
<tr><td>Setting range:</td><td>0-65,535</td></tr>
<tr><td>Remark</td><td colspan="4">Setting a larger value means getting closer to the control range of the response model: another type of vibration will occur.</td></tr>
<tr><td>Tuning Tip</td><td colspan="4">
Set **Torque command filter: Notch filter switch** (160.1) =1 (enable).
A rough estimate of possible max value for the filter can be obtained as follows.

$$\frac{(0.1 \text{ to } 0.2)}{\max(\ (\omega1+\omega2)\ ,\ \omega_q\ )} \text{ [s] or below}$$

<table>
<tr><th></th><th colspan="2">Position Control Mode</th><th colspan="2">Velocity Control Mode</th></tr>
<tr><td>ω 1</td><td>Control Gain 1</td><td>115.0</td><td>Control Gain 1</td><td>131.0</td></tr>
<tr><td>ω 2</td><td>Control Gain 2</td><td>116.0</td><td>-</td><td>-</td></tr>
<tr><td>ω q</td><td>Integral Gain</td><td>119.0</td><td>Integral Gain</td><td>133.0</td></tr>
</table>

☞ 5 Setting List of Parameters
</td></tr>
</table>

4. Using Digitax SF Connect to Measure Vibration Frequency (FFT)

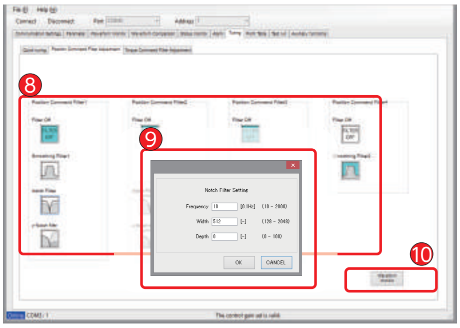
① Load the waveforms measured or waveform data saved to display. (The example shown on the right is saved waveform data.) ② Select a parameter of which the vibration frequency is to be investigated. Mark the check box to display the waveform.	
③ Select Position Command Filter or Torque Command Filter ④ Select a range to investigate vibration frequency. If the position command filter or torque command filter is selected, the second cursor location of the chart will be determined based on the 1st cursor location such that the display range will contain 2^{nd} sample points. ⑤ Click Frequency display . The x-axis unit will be changed from time [ms] to frequency [Hz]. The display unit of the graph in the range between the 1st and 2nd cursors will be converted to frequency.	
When the x-axis unit on the graph is switched to frequency, the cursor colors will change. The table will show the frequency in red on column A and blue on column B. ⑥ Read the peak value by using the cursor. ⑦ Click on Position Command Filter Adjustment or Torque Command Filter Adjustment) This will take you to the filter setup window under the tuning tab where a filter can be set.	

4. Using Digitax SF Connect to Measure Vibration Frequency (FFT)

⑧ Click on the icon for the filter that you want to set.
Up to four levels of the position command filters and three levels of torque command filters are available.

⑨ Set the filter parameters.
For the notch filter, enter the vibration frequency measured.

⑩ Click on [Waveform monitor] to return to the waveform monitor.

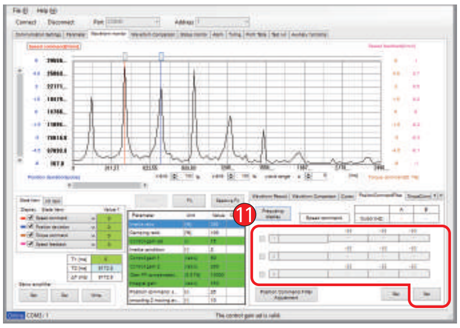


Notch Filter Setting
Frequency 10 [0.1Hz] (10 - 2000)
Width 512 [-] (128 - 2048)
Depth 0 [-] (0 - 100)

The filter that you just set will be shown on the list.

⑪ Unchecking the check box will switch the effect of the filter ON/OFF

Switch on to verify the filter effect. Switching off will not lose the filter parameter.



Tip for Notch Filter Setup

When you are setting a notch filter, use the initial value for the notch width and check the effect first. After setting the notch filter, start the equipment, verify the filter effect, and lower the notch frequency gradually. Measure the waveforms to find the best filter conditions such as frequency, width, and depth. The notch frequency varies depending on the equipment

MEMO

8 Troubleshooting

1. Checking Warnings and Alarms 2
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  1. List of Alarms 8
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Problem 5 (Positional disturbance)............................ 22
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1. Checking Warnings and Alarms

Warnings and alarm numbers can be viewed on the Setup Panel or Digitax SF Connect. When an alarm and a warning occur at the same time, the alarm will be displayed first. For
possible cause and remedy, check the warning or alarm list.
The alarm history keeps up to ten alarms including the current one. (*)

*) Alarm No.22 (control power supply error) and Warning numbers are not logged in the alarm history.

The alarm numbers and the cumulative run time (in hours) up to the time of alarm are logged.

An alarm reults in a drive trip and the motor will stop.
A warning does not result in a drive trip, motion continues but the warning state is entered.

Note: The drive version can be checked with Digitax SF Connect.

☞ Digitax SF Connect Instruction Manual

1. Using the Setup Panel

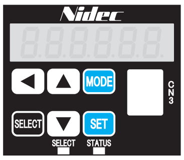
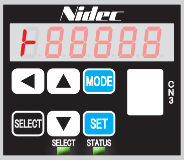
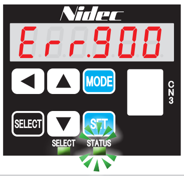
When a warning occurs, the drive STATUS LED blinks green. In addition, the Setup Panel will automatically display the corresponding warning No. Err.988

When an alarm occurs, the drive STATUS LED changes from solid green to solid red. In addition, the Setup Panel will automatically display the alarm No. Err.88

Note that the above does not happen in the following modes: Parameter Setting Mode, Quick Tuning Mode, Auto Tuning Mode, Parameter Saving Mode, and Auxiliary Function Mode. In these cases, press MODE to switch to Alarm Display Mode.

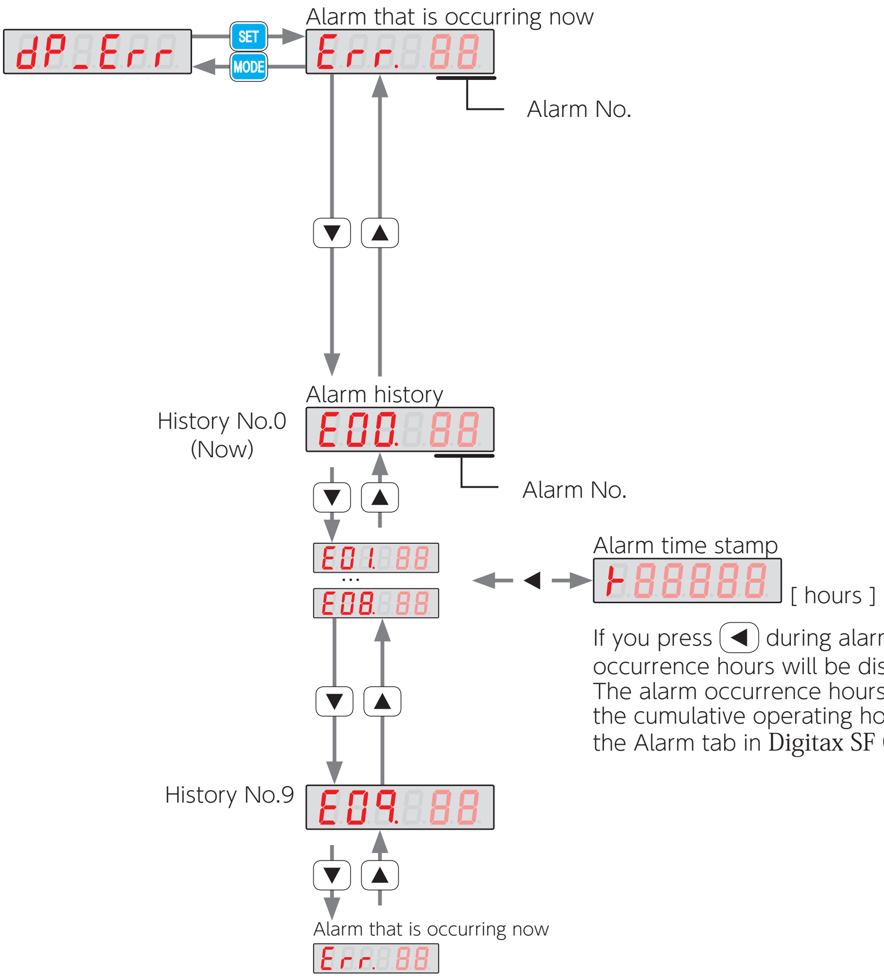
Status Display Mode will be suppressed / disabled while an alarm or warning is occurring.
Press ▲▼ to check other warnings and alarms.

☞ 5 Settings Setup Panel

STATUS LED	Meaning	Symptom
Off 	The drive is not ON.	The control power (24 VDC) is not supplied. Or the drive has not been started.
Solid Green 	Normal no warnings/alarms	Drive is operating normally.
Blinking Green 	Abnormal warning occurring	Warning is occurring
Solid Red 	Abnormal alarm occurring	Alarm is occurring

1. Checking Warnings and Alarms

Checking the Alarm History on the Setup Panel



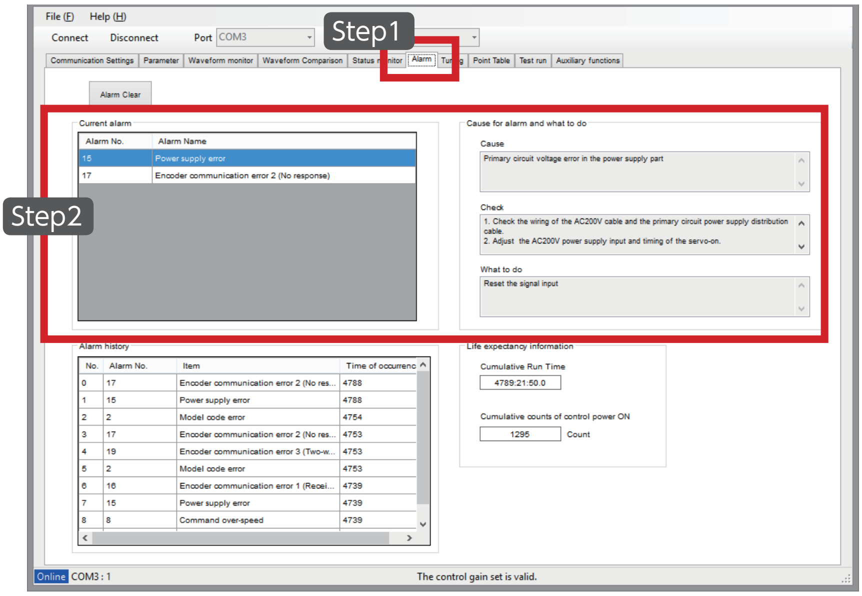
If you press ◀ during alarm log display, alarm occurrence hours will be displayed.
The alarm occurrence hours are as same as the cumulative operating hours displayed under the Alarm tab in Digitax SF Connect.

1. Checking Warnings and Alarms

2. Using Digitax SF Connect

Turn on the 24 VDC control power to the drive and start Digitax SF Connect.
For information on the warning/alarm, check “Alarm currently occurring” under the [Alarm] tab.
If you are not sure what to do, contact the supplier with the alarm number and its description for help.

☞ Digitax SF Connect Instruction Manual



Port: COM3

Current alarm

Alarm No.	Alarm Name
15	Power supply error
17	Encoder communication error 2 (No response)

Cause for alarm and what to do

Cause: Primary circuit voltage error in the power supply part

Check:
1. Check the wiring of the AC200V cable and the primary circuit power supply distribution cable.
2. Adjust the AC200V power supply input and timing of the servo-on.

What to do: Reset the signal input

Alarm history

No.	Alarm No.	Item	Time of occurrenc
0	17	Encoder communication error 2 (No res...	4788
1	15	Power supply error	4788
2	2	Model code error	4754
3	17	Encoder communication error 2 (No res...	4753
4	19	Encoder communication error 3 (Two-w...	4753
5	2	Model code error	4753
6	16	Encoder communication error 1 (Recei...	4739
7	15	Power supply error	4739
8	8	Command over-speed	4739

Life expectancy information

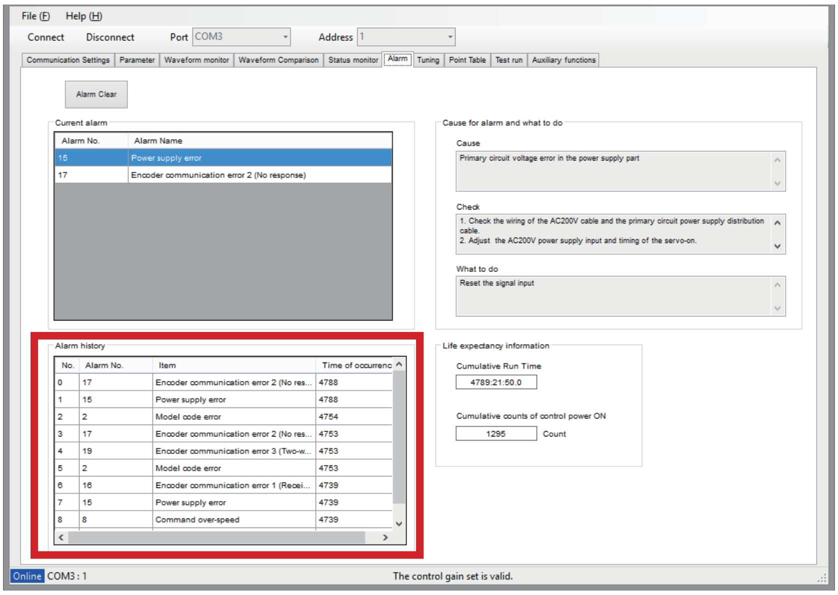
Cumulative Run Time: 4789:21:50.0

Cumulative counts of control power ON: 1295 Count

Online COM3 : 1 The control gain set is valid.

Step 1. Select the Alarm tab in Digitax SF Connect.
Step 2. See [Current alarm] and [Cause for the alarm] and [What to do] windows for details.

Checking the Alarm History in Digitax SF Connect



Port: COM3 Address: 1

Current alarm

Alarm No.	Alarm Name
15	Power supply error
17	Encoder communication error 2 (No response)

Cause for alarm and what to do

Cause: Primary circuit voltage error in the power supply part

Check:
1. Check the wiring of the AC200V cable and the primary circuit power supply distribution cable.
2. Adjust the AC200V power supply input and timing of the servo-on.

What to do: Reset the signal input

Alarm history

No.	Alarm No.	Item	Time of occurrenc
0	17	Encoder communication error 2 (No res...	4788
1	15	Power supply error	4788
2	2	Model code error	4754
3	17	Encoder communication error 2 (No res...	4753
4	19	Encoder communication error 3 (Two-w...	4753
5	2	Model code error	4753
6	16	Encoder communication error 1 (Recei...	4739
7	15	Power supply error	4739
8	8	Command over-speed	4739

Life expectancy information

Cumulative Run Time: 4789:21:50.0

Cumulative counts of control power ON: 1295 Count

Online COM3 : 1 The control gain set is valid.

The alarm history area shows a list of the alarms.

2. Warnings and Remedies

1. Warning Output

There are 4 ways to output warnings.

1. I/O

While a warning is being output, the user I/O WARN1 (warning) becomes closed.

☞ 4 Connections Descriptions CN1 connector signals

2. Setup Panel Output

During warning output, the warning number will appear on the Setup Panel.

Warning No.	Warning Description
Err.900	Encoder overheat detection
Err.901	Encoder battery voltage drop error detection
Err.902	Emergency stop
Err.903	Encoder communication warning
Err.904	Excessive position error

3. RS-485 Communication

Warning status output with the RS-485 communication.

☞ 9 Appendices Status Display

4. Digitax SF Connect

Select the Alarm tab in Digitax SF Connect.
See [Current alarm] and [Alarm history] windows for details.

☞ Digitax SF Connect Instruction Manual

2. Warning Details

Warning No.	900	Encoder overheat detection
Symptom and Possible Cause	The temperature inside the absolute encoder has exceeded the temperature value specified by **Encoder: Overheat detection - Value** (267.0). An alarm can be output in place of the warning.	
Remedy	Reduce the ambient temperature and improve thermal radiation conditions. Check the setting of **Encoder: Overheat detection - Value** (267.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector CN1.	

Warning No.	901	Encoder battery voltage drop error detection
Symptom and Possible Cause	The battery voltage of the absolute encoder has dropped below the voltage set by **Encoder: Battery voltage drop detection - Value** (268.0).	
Remedy	Replace the battery in the absolute encoder. Check the **Encoder: Battery voltage drop detection - Value** (268.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector CN1.	

Warning No.	902	Emergency stop
Symptom and Possible Cause	The E-STOP control terminal digital input is open.	
Remedy	Close the E-STOP control terminal digital input Check for proper I/O connections.	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector CN1.	
Related To	9 Appendices Functions Emergency Stop	

2. Warnings and Remedies

Warning No.	903	Encoder communication warning
Symptom and Possible Cause	Failed to obtain ABS encoder temperature and battery voltage data.	
Remedy	Check for wire disconnection or loose connection of pins. Keep the cable length no longer than 20 m. Check for noise interference. → Use a shielded twist-pair cable. → Keep the encoder cable away from the motor power cable. → Connect Ground/Earth FG firmly. → Use ferrite core for the motor power cable and encoder cable. If any of the above didn' t resolve the issue, please contact the supplier.	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector CN1.	

Warning No.	904	Excessive position error
Symptom and Possible Cause	The position error consecutively exceeded the setting of **Position error warning detection: Value** (363.0) and the setting of **Position error warning detection: Delay time** (365.0).	
Remedy	Adjust the tuning parameters. Check the command from the host controller. Check the wiring. Verify that the brake is released. Verify that the motor is not in a torque limit state per torque command limit. Check the settings of **Position error warning detection: Value** (363.0) and **Position error warning detection: Delay time** (365.0).	
Reset Method	After eliminating the cause, then input RESET signal to the RESET terminal on the connector CN1.	

3. Alarms and Remedies

1. List of Alarms

Alarm No.	Alarm Name	Refer to page
0	System	9
1	EEPROM data	9
2	Product code	9
4	Overspeed	9
5	Speed	10
6	Position	10
7	Overload	11
8	Command overspeed	11
9	Encoder pulse Output frequency	12
10	Positioning command overflow /Homing failure	12
11	Encoder (multi-turn counter overflow)	12
12	Overheat	12
14	Overvoltage	13
15	Power supply (AC Supply)	13
16	Encoder (received data)	14
17	Encoder (no response)	14
18	Encoder (circuit)	14
19	Encoder (communication)	14
20	Encoder (multi-turn data)	14
21	Encoder (voltage drop)	15
22	Voltage (control power)	15
23	Switch circuit	15
24	Overcurrent	15
25	Inverter 1	16
26	Inverter 2	16
27	Current sensor	16
28	Encoder (overheat)	16
29	Voltage drop (inside the drive)	16

3. Alarms and Remedies

2. Alarm Details

Alarm No.	0	System
Symptom and Possible Cause	Error in the control circuit The control circuit CPU is not operating normally.	
Remedy	Please contact the supplier of the drive	
Reset Method	⏻	

Alarm No.	1	EEPROM data
Symptom and Possible Cause	Error during writing of Parameters	
Remedy	Check the interface cable and re-write the parameters.	
Reset Method	RST	

Alarm No.	2	Product code
Symptom and Possible Cause	Unable to read the product code The drive-motor pairing was wrong. The encoder cable was not connected to the drive correctly. (This includes wiring disconnection)	
Remedy	Check the motor-drive pairing. Check the encoder cable connections.	
Reset Method	⏻	

Alarm No.	4	Overspeed
Symptom and Possible Cause	The motor rotational speed exceeded the rated maximum rotational speed. The command from the host controller was not appropriate. There were residual pulses due to drive limit switch input or other reasons.	
Remedy	Adjust the Tuning parameters. Check the command. Verify that the location of the limit sensor hasn' t shifted.	
Reset Method	RST	

Alarm No.	5	Speed
Symptom and Possible Cause	Position control/Speed control error The command was not appropriate. The load was too heavy and could not keep up with the command speed. **Speed error detection: Value** (90.0) was not appropriate.	
Remedy	Check the command from the host controller. Adjust the tuning parameters. Check the setting of **Speed error detection: Value** (90.0). Verify that the brake is released. Verify that the motor is not in a torque limit state per torque command limit.	
Reset Method	RST	

Alarm No.	6	Position
Symptom and Possible Cause	Position Control Error The acceleration time was too short There was wrong connection or disconnection of the motor power cable or encoder cable. **Position error detection: Value** (87.0) was not appropriate.	
Remedy	Adjust the tuning parameters. Check the command from the host controller. Check the wiring. Check the setting of **Position error detection: Value** (87.0). Verify that the brake is disengaged. Verify that the motor is not in a torque limit state per torque command limit.	
Reset Method	RST	

RST RESET Signal	⏻ Control-power cycle	CLR CLEAR Encoder
① Eliminate the cause. ② input RESET signal to the RESET terminal on the connector CN1.	① Eliminate the cause. ② Cycle control-power.	① Eliminate the cause. ② Execute CLEAR Encoder ③ Cycle control-power. After power cycle, perform Homing.

Alarm No.	7	Overload
Symptom and Possible Cause	Immediately after the operation started 1. The motor did not move at all. 2. The motor moved a little. 3. An alarm occurred after the motor started moving. During operation 4. An alarm occurred at the same point of the motion profile. The acceleration time was too short The motor was not accelerating when the alarm occurred. (The machine collided with some object.) 5. The motor capacity was too small (i.e. the load was too large) 6. The vibration was significant upon alarm occurrence. 7. Tuning parameters or command(s) were not appropriate. (The motor changed its rotational direction abruptly) 8. Noise was generated.	
Remedy	Executing overloaded motion continuously may burnout the motor. 1. Check the motor power cable connections. 3. Verify that the user-selected motor capacity is appropriate. Verify that the brake is disengaged. Verify that the deceleration ratio is appropriate. 4. During Acceleration - Check the acceleration time, torque wave form and load ratio. Not During Acceleration - Verify that there are no obstacles inside the work area of the equipment. 5. Check the torque waveforms and load ratio. Check the inertia ratio. Increase the motor capacity. Install a decelerator 6.7 Adjust the Tuning parameters. Verify that there are no commands to cause a sudden change in the motor rotational direction. Configure moderate commands, for example, use command smoothing filter. 8. Configure countermeasures for noise such as a notch filter or low-pass filter.	
Reset Method	RST	

Alarm No.	8	Command overspeed
Symptom and Possible Cause	The position control input exceeded the max rotational speed. The command from the host controller was not appropriate.	
Remedy	Check the **Pulse train command: Ratio** (34.0 and 36.0). Check the commands from the host controller.	
Reset Method	RST	

3. Alarms and Remedies

Alarm No.	9	Encoder pulse - Output frequency error
Symptom and Possible Cause	The frequency of the encoder pulse output exceeded 4 Mpps.	
Remedy	Check the numerator and denominator settings in the **Encoder pulse output: Pulse ratio** (276.0 and 278.0). Check the settings of **Encoder pulse output: Error detection - Frequency upper limit** (285.0) and **Encoder pulse output: Error detection - Delay time** (286.0).	
Reset Method	⏻	

Alarm No.	10	Positioning command overflow /Homing failure
Symptom and Possible Cause	External position command exceeded the absolute value range of ± 1,073,741,823. The shift amount per one of the commands exceeded the ± 2,147,483,647 range. Homing failed and timed out.	
Remedy	Select a value different from the current setting of **Internal Position: Overflow detection** (643.0). Adjust the parameters such that the shift amount will be within the ± 1,073,741,823 range. Adjust the shift amount of Positioner motion, inching and test each one. Adjust the Homing related parameters.	
Reset Method	RST	

Alarm No.	11	Encoder(multi-turn counter overflow)
Symptom and Possible Cause	Multi-turn data of the encoder has exceeded the ± 32,767 range.	
Remedy	Check the setting of **Absolute system** (257.0). Verify that the multi-turn motion amount is within the ± 32,767 range.	
Reset Method	⏻	

Alarm No.	12	Overheat
Symptom and Possible Cause	The control circuit temperature has exceeded the upper limit.	
Remedy	Check the drive's installation method and environment. Lower the ambient temperature to below the rating.	
Reset Method	RST	

Alarm No.	14	Overvoltage
Symptom and Possible Cause	The power supply to the control components has exceeded the drive circuit limits.	
Remedy	If the alarm occurs only during deceleration By using the Setup Panel or Digitax SF Connect, check the regeneration status, which tells you if a braking resistor is necessary. If necessary, install a braking resistor. Check the motion patterns of commands. Use a command filter and gradually decrease the speed. If the alarm occurs regardless of deceleration Verify that the AC Supply is within specification. Check for voltage changes while the whole system is operating.	
Reset Method	RST	

Alarm No.	15	Power supply (AC Supply)
Symptom and Possible Cause	The AC Supply voltage is abnormally high or low. The AC Supply was not present. The AC Supply was not within the input range. The power supply fluctuated and exceeded the rated range. SVON signal was input without AC supply being present. Anomaly of the regenerative control circuit operating time lasted longer than a specific amount of time. Regeneration ON status too long	
Remedy	If the alarm occurred between servo on and operation startup Verify that the AC Supply is connected to the drive. Check the AC supply. Check the timing of AC Supply input and SVON signal input. If the alarm occurred during motor operation Check for no voltage fluctuations due to the whole system operation. Provide enough power supply so that the system experiences no voltage fluctuations. If the alarm occurs during deceleration Check the regenerative voltage warning signal on the Setup Panel or Digitax SF Connect. If a regenerative voltage warning occurs, install a braking resistor. Check the motion patterns directed by commands. Gradually decrease speeds by using a command smoothing filter.	
Reset Method	RST	

RST RESET Signal	⏻ Control-power cycle	CLR CLEAR Encoder
① Eliminate the cause. ② input RESET signal to the RESET terminal on the connector CN1.	① Eliminate the cause. ② Cycle control-power.	① Eliminate the cause. ② Execute CLEAR Encoder ③ Cycle control-power. After power cycle, perform Homing.

3. Alarms and Remedies

Alarm No.	16	Encoder (received data)
Symptom and Possible Cause	Encoder data changed rapidly for a short period of time.	
Alarm No.	17	Encoder (no response)
Symptom and Possible Cause	Encoder communications were disconnected.	
Alarm No.	19	Encoder (communication)
Symptom and Possible Cause	The initial communication with the encoder failed.	
Alarm No.	20	Encoder (multi-turn data)
Symptom and Possible Cause	Absolute encoder data changed rapidly for a short period of time. At the time of starting, the encoder failed to receive multi-turn data internally.	
Remedy	Check for wire disconnection or loose connection of pins. Keep the cable length no longer than 20 m. Check for noise interference. → Use a shielded twist-pair cable. → Keep the encoder cable away from the motor power cable. → Connect Ground/Earth FG firmly. → Use ferrite core for motor power cable and encoder cable. If any of the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	⏻	

Alarm No.	18	Encoder (circuit)
Symptom and Possible Cause	The battery voltage of the absolute encoder dropped or the battery became disconnected. (Alarm No.21 is output in this case) The encoder temperature has exceeded the specification and output data has become abnormal. Anomaly of the encoder itself has been detected.	
Remedy	If you are using an absolute system Replace the battery, connect it, and initialize the encoder. If you are not using an absolute system Check whether the encoder temperature is within specification. If any of the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	🖥 ⏻	

Alarm No.	21	Encoder (voltage drop)
Symptom and Possible Cause	The battery voltage dropped. The battery became disconnected. It was the first start-up after the battery was connected.	
Remedy	Check for low battery voltage. Check for loose battery cable. Initialize the encoder.	
Reset Method	⏻	

Alarm No.	22	Voltage (control power)
Symptom and Possible Cause	The control power supply dropped.	
Remedy	Check the control power supply. Check for insufficient control power supply capacity. Check the wiring of user I/O connector 24 V (Pin 1 and Pin 2). This alarm may be output at the same time as other alarms such as Alarm No.15 (Power supply). Check all the alarms that are occurring. This alarm will not remain in the alarm history.	
Reset Method	RST	

Alarm No.	23	Switch circuit
Symptom and Possible Cause	Control circuit has failed.	
Remedy	Please contact the supplier of the drive.	
Reset Method	RST	

Alarm No.	24	Overcurrent
Symptom and Possible Cause	Anomaly of motor control current inside of the drive has been detected.	
Remedy	Check the motor power cable. → Grounding fault → Wiring mistake in the motor power cable connection Check the Tuning parameters and motor motion patterns. → Increase the acceleration/deceleration time of command. → Enable/Disable Position command filter 1 and 4 (66.0, 66.1, 80.0, and 81.0). Allow motor motion by disengaging the brake or removing from the stopper. Check the encoder cable. → Connection (bad connection) → Use a twist-pair cable If any of the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	RST	

3. Alarms and Remedies

Alarm No.	25	Inverter 1
Symptom and Possible Cause	Anomaly in the control circuit has been detected.	
Alarm No.	**26**	**Inverter 2**
Symptom and Possible Cause	Anomaly in the control circuit has been detected. SERVO ON timed out.	
Remedy	Check the motor power cable. → Grounding fault → Wiring mistake in motor power cable connections If any of the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	RST	

Alarm No.	27	Current sensor
Symptom and Possible Cause	The ambient temperature of the current sensor was high. Anomaly of the current sensor has been detected.	
Remedy	Check the installation method and environment. If any of the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	RST	

Alarm No.	28	Encoder (overheat)
Symptom and Possible Cause	The encoder PCB temperature has reached the upper limit.	
Remedy	Check the installation method and environment of the motor. Decrease the ambient temperature of the motor below the specification.	
Reset Method	RST	

Alarm No.	29	Voltage drop (inside the drive)
Symptom and Possible Cause	The control power voltage (5 VDC) inside the drive has dropped.	
Remedy	Verify that there is no short-circuit in encoder cable connections. If the above didn' t resolve the issue, please contact the supplier of the drive.	
Reset Method	RST	

4. Troubleshooting

Check the following if the drive does not start and the motor does not rotate although no alarm is output.

Problem	Symptom	Refer to
Problem 1 No display on the Setup Panel	Control power (24 VDC) is being supplied, but the Setup Panel does not light up.	18

Problem	Symptom	Refer to
Problem 2 No current flows to the motor	The Setup Panel shows, but the servo cannot be enabled.	19

Problem	Symptom	Refer to
Problem 3 No motor rotation	The motor does not rotate although the servo is on.	20

Problem	Symptom	Refer to
Problem 4 Unstable motor motion	The motor motion is unstable.	21

Problem	Symptom	Refer to
Problem 5 Positional disturbance	Positional disturbance occurs.	22

Problem	Symptom	Refer to
Problem 6 Vibration and abnormal noise	The motor causes vibration or abnormal noise.	23

4. Troubleshooting

Problem 1 (No display on the Setup Panel)

Control power (24 VDC) is being supplied, but the Setup Panel does not light up.

Cause	Remedy
The controller power 24 VDC is not connected to the user I/O connector.	Connect the 24 VDC to the user I/O connector. Connect the 24 VDC to Pin 1 and Pin 3 and GND to Pin 2 and Pin 12 respectively.
Loose user I/O connector	Connect the user I/O connector firmly.
The control power voltage is low.	Check the control power supply voltage capacity.
The drive has failed.	Please contact the supplier of the drive.

4. Troubleshooting

Problem 2 (No current flows to the motor)

The Setup Panel shows, but the servo cannot be enabled.

Cause	Remedy
The servo on signal (SVON) is not being input.	Input the SVON signal of the host connector to the user I/O connector.
The AC Supply is not present. (Alarm No.15 is displayed)	Verify that CHARGE LED is on. If it is off, verify that the AC supply connections are not loose, and the voltage is present.
The motor power connector is loose.	Connect the Motor Power connector firmly.
The drive has failed.	Please contact the supplier of the drive.

4. Troubleshooting

Problem 3 (No motor rotation)

The servo is on, but the motor does not rotate.

Cause	Remedy
The parameters are not set correctly.	Check the parameters required for the control mode that you are using. ☞ 6 Operations
Command from the host controller is not correctly input.	Check the command from the host controller. Use Digitax SF Connect to measure the waveforms of Pulse Train Command Input (position) or Analog Velocity Command Input and verify that normal commands are input. Check the parameters such as pulse ratio. It is possible that the motor is rotating very slowly.
The command input pins of user I/O connector are not connected correctly.	Check for correct I/O connections. ☞ 4 Connections
No command input is allowed.	Open HOLD and COM- pins of the user I/O.
Torque command limit is not set correctly.	Verify that **Torque command limit: Value 1 and Value 2** (147.0, 148.0) are set correctly.
CCW/CW drive limit switch input is enabled.	If CCW/CW drive limit switch input is not required, set **Drive limit switch input: Setup** (67.0) to 0 (disable). If it is enabled and required, connect both CCWL and CWL pins of the user I/O connector with either "COM- " or "closed" each.

4. Troubleshooting

Problem 4 (Unstable motor motion)

The motor does rotate, but motion is unstable.

Cause	Remedy
Ground/Earth FG and GND are not connected correctly.	Connect Ground/Earth FG and GND correctly.
Speed/Position commands are unstable.	On the waveform monitor in Digitax SF Connect, check the command from the host controller. Check for proper connection of the I/O connector.
Tuning is incomplete.	Adjust the parameters.
The motor rotates with no host command input.	In Position Control Mode Set **Pulse train command: Input filter** (33.0) to an appropriate value. In Velocity Control Mode Adjust **Analog velocity: Offset value** (60.0). In Torque Control Mode Adjust **Analog torque: Offset value** (300.0)

4. Troubleshooting

Problem 5 (Positional disturbance)

The motor does rotate, but position disturbance occurs.

Cause	Remedy
The command signal has electrical noise present.	In Position Control/Pulse Train Command Set **Pulse train command Input filter** (33.0) to an appropriate value. Check the following three items. 1. Status No.33 (Pulse Train Command Input (position) agrees with the host controller output. 2. Status No.65 “Position command” and Status No.67 “Position feedback” agree. 3. (Status No.67) x (**Encoder pulse ratio** (276.0/278.0) = (Position feedback from the host control device) If the above do not solve the problem, take countermeasures for noise. Connect Ground/Earth FG correctly. Adjust **Pulse train command: Input filter** (33.0) Select a shielded twist-pair wire for the I/O cable. For the encoder cable, select a shielded twisted-pair wire of no longer than 20m.
The position error is not converging.	Verify that Status No.65 (Position command value) and Status No.67 (Position feedback) agree. If not, adjust the tuning parameters.
The host controller is not obtaining encoder Z-phase correctly.	Check the command from the host controller. Use Digitax SF Connect to measure the waveforms of Status No.33 “Pulse Train Command Input (position)” or Status No.49 “Analog Velocity Command Input” to verify that a normal command is input. Verify that the host controller is obtaining Z-phase correctly. If the Z-phase pulse width is too small, increase the pulse width by using the **Encoder pulse ratio** (276.0/278.0) As a rule of thumb, a pulse width of 1 ms or above is required for PLC.
Output pulse frequency of the host controller is above the upper limit.	Verify that the output pulse frequency of the host controller such as PLC is not above the upper limit.
A resistor is installed in the pulse output circuit of the host controller (PLC).	**Verify that there is no built-in resistor in the pulse output terminal.** The output resistor of the host controller and the input resistor of servo drive being connected in series prevents correct command signal from being input to the drive.

4. Troubleshooting

Problem 6 (Vibration and abnormal noise)

The motor is experiencing vibration or abnormal noise.

Cause	Remedy
Tuning parameter settings are not appropriate.	Set the Control Gain 1, Control Gain 2, Integral Gain to lower values. Especially for very rigid equipment such as ball screws, set the **Current control gain** (193.0) to 1 if noise occurs at servo-on stop. ☞ 7 Tunings
Loose Mechanical Couplings	Check the installation of the motor, decelerator, couplings, and so on.
Noise interference is occurring.	Check the length or shield of each cable. Separate the high voltage cable such as motor power cable from the signal cable such as encoder cables. Avoid parallel cable runs
The equipment and the motor are resonating.	For low-frequency vibration, adjust the position command smoothing filter. For high-frequency vibration, adjust the low-pass filter or notch filter.
Motor load is substantially large (*) (Alarm No.7 is displayed)	Set the inertia condition parameter to "Heavy" Keep adjusting the Position Command Smoothing Filter to smooth the command until the vibration at the time of acceleration becomes eliminated. Set the **Inertia ratio** (102.0) to 3,000. To stabilize the motion, increase Integral gain value according to Control Gain 1 and Control Gain 2.
The current pairing of drive and motor is not right.	Check the motor model code under "Communication Settings" tab in Digitax SF Connect. In case of incompatibility, clear the parameters saved in EEPROM and change the motor.

*) This problem may occur in a low-rigidity case such as belt drive if the load inertia ratio is over 30 times.

MEMO

9 Appendices

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1. Absolute System

1. Overview

By using the absolute system, you do not have to perform Homing after cycling power.

Preparations

To configure an absolute system, prepare the following items.

①.A motor equipped with absolute-encoder and a drive that supports absolute system.

② A backup battery

③ An absolute encoder Cable

☞ Page 4 Backup Batteries

☞ Page 6 Absolute Encoder Cable

Checking the model code

Select the model code that support absolute systems.

Motor Product Code：

MX 201 N 2 S A ＊＊

Encoder	
Code	Specifications
N	17 bit (Incremental)
A	17 bit (Absolute)

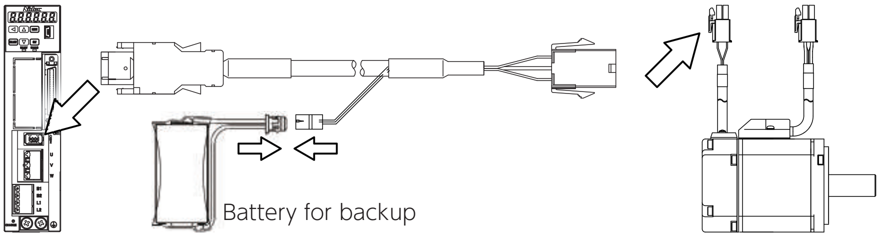
2. System Configuration

Connection Method

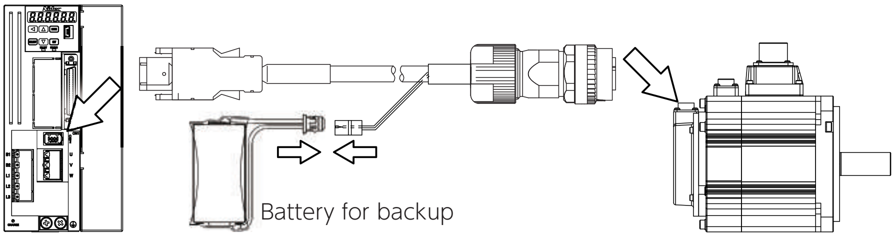
1. To ensure safety, isolate the AC Supply and the control power first, and then connect the absolute encoder cable.
   ☞ Refer to the figure below.
2. Be sure of the right connecting polarity, and connect the backup battery correctly.
   ☞ Page 4 Backup Batteries
3. After connecting the battery, secure the battery to the absolute encoder cable by using a cable tie.
   ☞ Page 5 Securing the battery
4. Initialize the absolute encoder.
   ☞ Page 7 Initialing Absolute Encoder

Cable and Battery Connections

Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



1. Absolute System

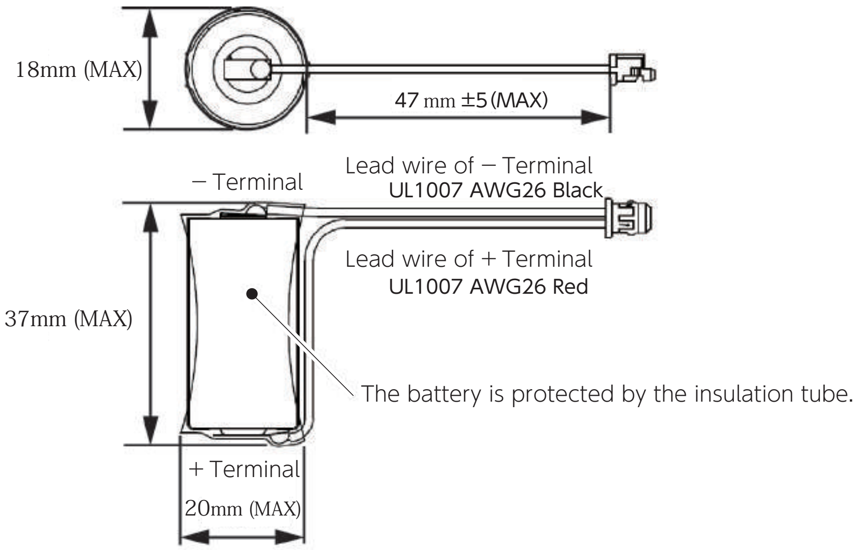
3. Backup Battery

Recommended Specifications

Item	Specifications	Remark
Model Code	CR17335E-R-CH3	Manufactured by FDK (*) Series battery : CR17335E-R
Nominal Voltage	3.0 V	–
Nominal Capacity	1,600 mAh	Nominal capacity is determined at the voltage of 2.0 V when the battery was discharged at a standard current level under the 23 ℃ environment.
Maximum Continuous Discharge Current	500 mA	Under the 23 ° C environment
Dimensions	See the figure below.	
Exterior	Insulation tubing	–
Terminal	Housing : DF3-2S-2C Contact : DF3E-2428SCFC Lead wire : UL 1007 AWG26 Red (+)、Black (—)	Connector: Hirose Electric
Mass	17 g	
Temperature Range	Operating temperature : − 40 ℃ to +70 ℃	No condensation
Recommended Storage Conditions	Temperature : 10 ℃ to 30 ℃ Humidity : 60 % RH or less	–

*) This is a primary lithium battery. Do not try to charge it, or it may explode.

Dimensions



1. Absolute System

Precautions for Battery Storage and Installation

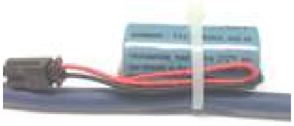
Avoid places subject to any of the following:

- Direct sunlight, rain drops
- Corrosive atmosphere, oil mist, or iron powder
- Poor ventilation or high humidity
- Dirt or dust
- Vibration
- Impact to the installed battery

Securing the Battery

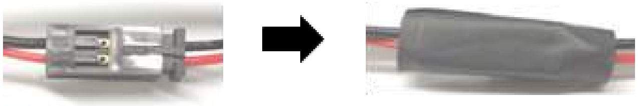
1. Securing the Battery

Secure the battery to the cable, for example, using a cable tie.
We recommend using a cable tie tensioning tool.
Holding strength of the cable tie should be 11.6 to 44.2 [N].



2. Protecting the Battery Connector Part

Protect the exposed part of the battery connector terminal with a heat shrink tube.



Replacing the Battery

When the battery voltage drops, Alarm No.21 (Encoder voltage drop) occurs. In this case, you need to replace the battery with a new one.

<u>When replacing the battery, be sure to keep the control power (24 V) of the drive ON.</u> Otherwise, you will lose the multi-turn data and need to perform homing again.

⚠ CAUTION

- Be careful not to connect the battery the wrong way round.
- Do not attempt to disassemble the battery.
- Do not short circuit the battery.
- Never attempt to charge the recommended battery.

Disposal of Batteries

Dispose of used batteries according to local government regulations.

1. Absolute System

4. Absolute Encoder Cable

Recommended Products

You can purchase recommended cables from your supplier

☞ 3 Preparation

1. Absolute System

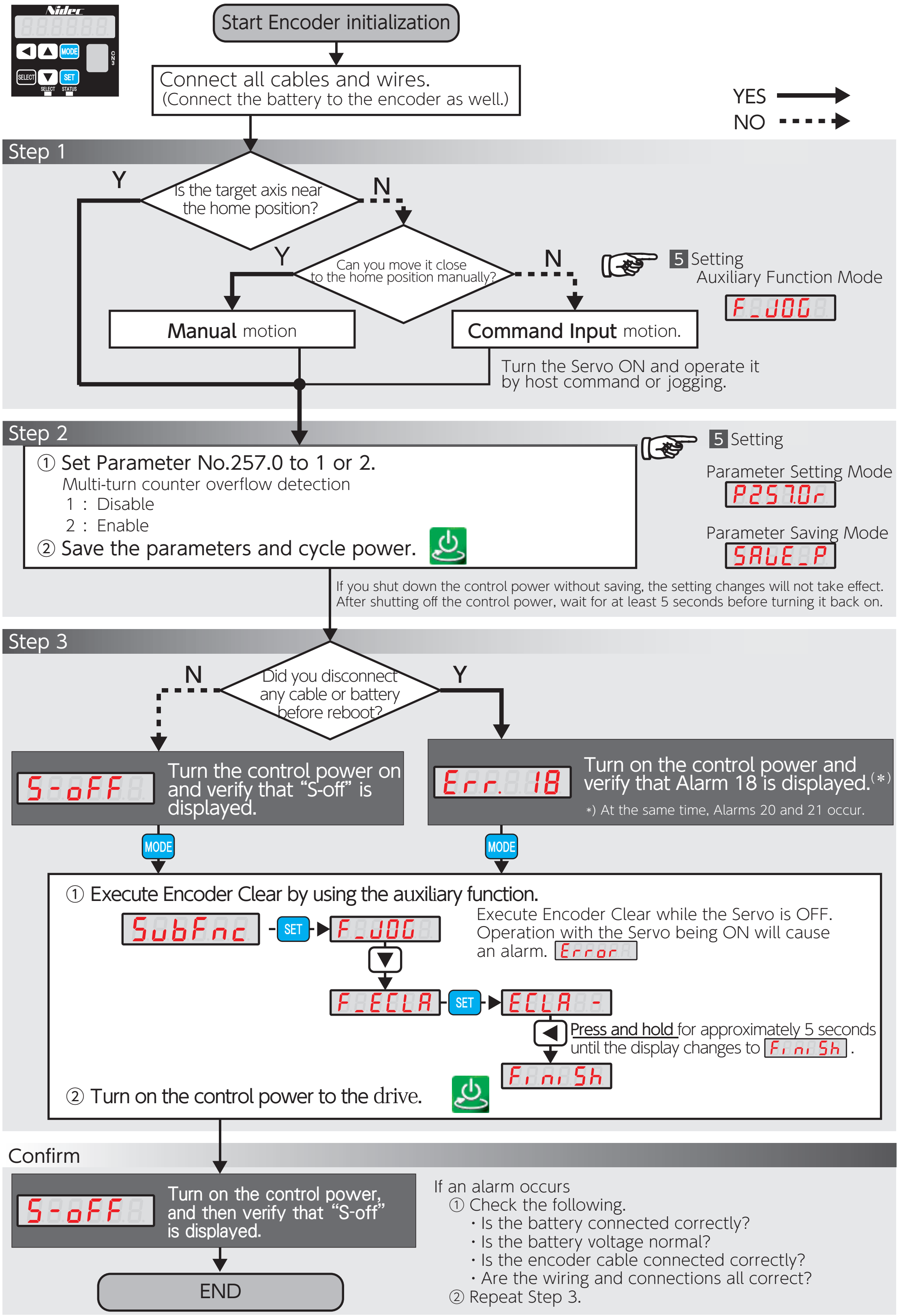
5. Initializing Absolute Encoder

When using an absolute system for the first time or using it after replacing the motor, you need to initialize the encoder.
Use the Encoder Clear function by using the Setup Panel or Digitax SF Connect to initialize the encoder. And then restart your drive.

Only multi-turn data will be initialized and single-turn absolute data will not.

!	Initialize the absolute encoder before performing homing.	⚠ ⚠

Initializing Encoder with Setup Panel



Start Encoder initialization

Connect all cables and wires.
(Connect the battery to the encoder as well.)

Step 1

Is the target axis near the home position?

Can you move it close to the home position manually?

Manual motion

Command Input motion.

Turn the Servo ON and operate it by host command or jogging.

5 Setting
Auxiliary Function Mode

Step 2

① Set Parameter No.257.0 to 1 or 2.
Multi-turn counter overflow detection
1 : Disable
2 : Enable

② Save the parameters and cycle power.

5 Setting
Parameter Setting Mode
Parameter Saving Mode

If you shut down the control power without saving, the setting changes will not take effect.
After shutting off the control power, wait for at least 5 seconds before turning it back on.

Step 3

Did you disconnect any cable or battery before reboot?

Turn the control power on and verify that “S-off” is displayed.

Turn on the control power and verify that Alarm 18 is displayed.(*)

*) At the same time, Alarms 20 and 21 occur.

① Execute Encoder Clear by using the auxiliary function.

Execute Encoder Clear while the Servo is OFF. Operation with the Servo being ON will cause an alarm.

Press and hold for approximately 5 seconds until the display changes to FinISh.

② Turn on the control power to the drive.

Confirm

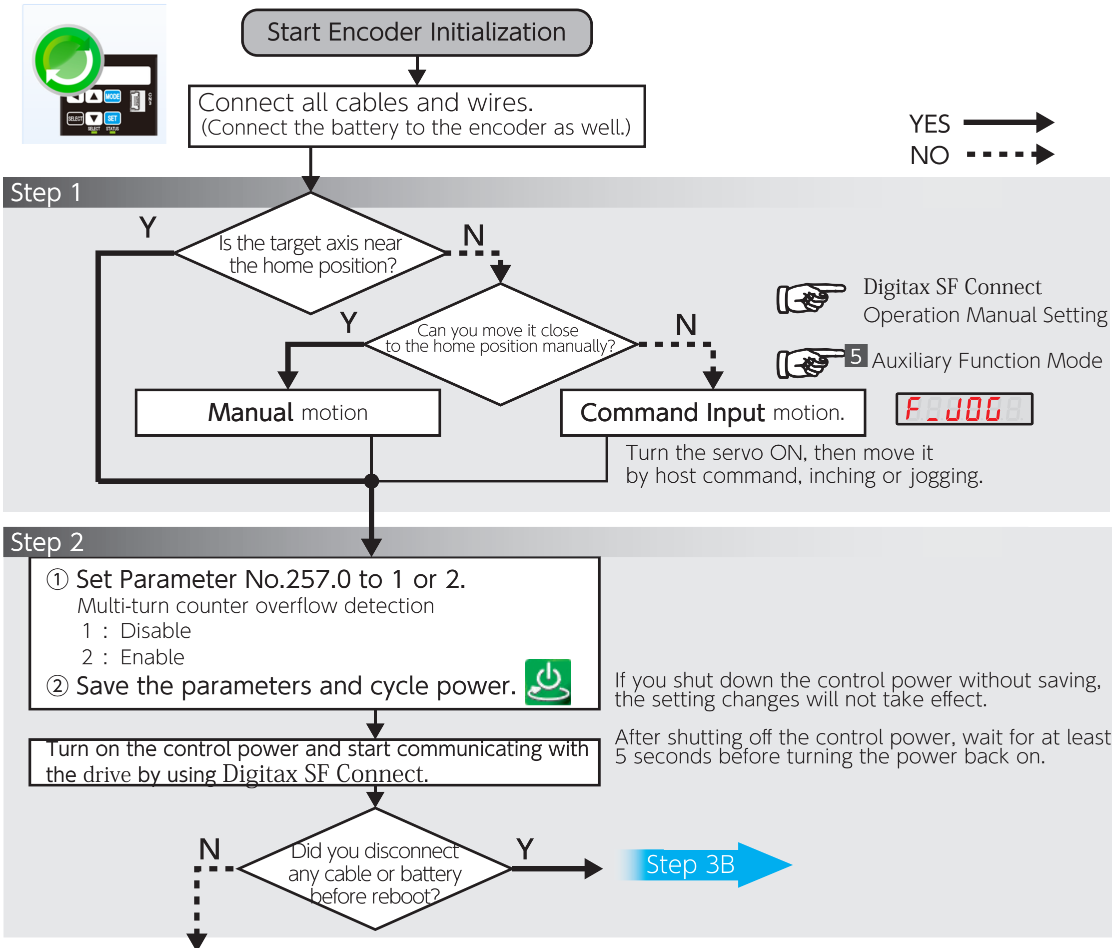
Turn on the control power, and then verify that “S-off” is displayed.

END

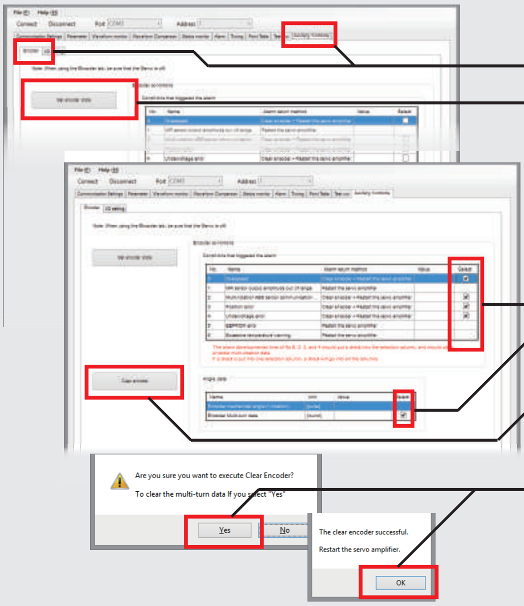
If an alarm occurs
① Check the following.
- Is the battery connected correctly?
- Is the battery voltage normal?
- Is the encoder cable connected correctly?
- Are the wiring and connections all correct?

② Repeat Step 3.

Initializing Encoder with Digitax SF Connect



Step 3A



Are you sure you want to execute Clear Encoder?
To clear the multi-turn data if you select "Yes"

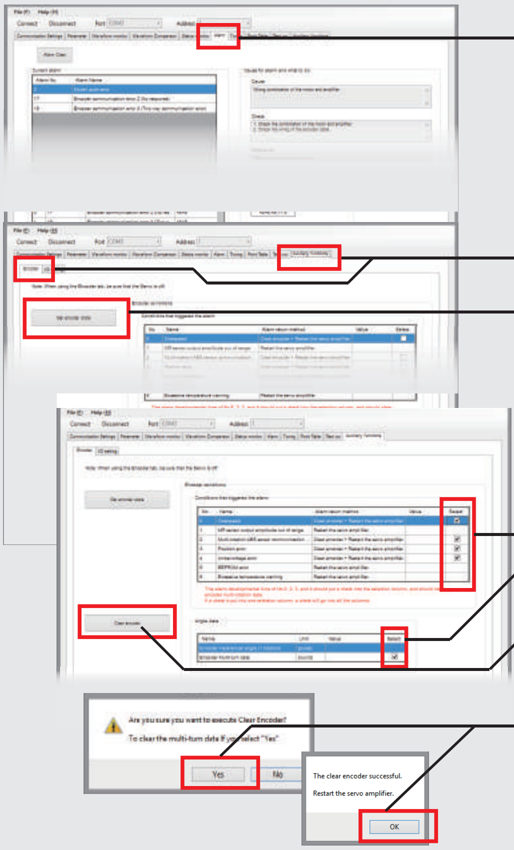
The clear encoder successful.
Restart the servo amplifier.

1. Under the Auxiliary function tab, click Encoder
2. Click on Get Encoder Status.
3. Check one of the boxes.
4. Click the Clear encoder button.
   Until checking the boxes, the Clear encoder button does not work.
5. Click Yes.
6. Cycle the control power.

Confirm

Initializing Encoder with Digitax SF Connect (continued)

Step 3B



Are you sure you want to execute Clear Encoder?
To clear the multi-turn data If you select "Yes"

The clear encoder successful.
Restart the servo amplifier.

1. Under the Alarms tab, check the following alarms that are occurring.

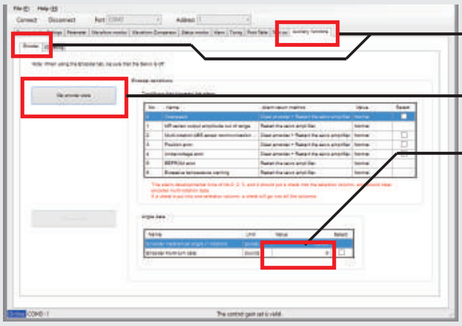
No. 18	Encoder error (circuit)
No. 20	Encoder error (multi-turn data)
No. 21	Encoder error (voltage drop)

The Setup Panel on the amplifier displays Err. 18.

2. Under the Auxiliary functions tab, select Encoder.
3. Click on Get Encoder Status.
4. Check one of the boxes.
5. Click Clear encoder.
   Until checking the boxes, the encoder clear button does not work.
6. Click Yes.
7. Cycle the control power.

Confirm

Turn on the control power and start communicating with the drive by using Digitax SF Connect.



1. Under the Auxiliary functions tab, select Encoder.
2. Click on Show Encoder Status.
3. Verify that this value is 0.

If an alarm occurs
① Check the following.
- Is the battery connected correctly?
- Is the battery voltage normal?
- Is the encoder cable connected correctly?
- Are the wiring and connections all correct?

② Repeat Step 3.

END

6. Obtaining Absolute Data

You can check the encoder absolute data using RS-485 Communications or Digitax SF Connect.

Checking Absolute Data using RS-485 Communication

The RS-485 communications enable the host controller to obtain absolute data from the drive. To use RS-485 communications, set the following parameters.
Use the Setup Panel or Digitax SF Connect for the parameter setup.

Communications Manual: RS-485

RS-485 Communications	Parameter No.	Description
Communication Address	4.0	Set the address for RS-485 Communication. The initial value: 1 Range: 1…32
Communication Switch	8.0	Enable or disable RS-485 Communication. Select “1” .
Minimum response time	11.0	Adjust response timing from the drive. Adjust it to satisfy the communication specification of the host controller. The initial value: 3 [ms] Range: 0…255 [ms]

Example of communication commands to obtain absolute data

Transmit data (*) : 24 01 00 11 00 C3 0A 94
Response data : 26 01 80 11 □□ □□ □□ □□ ○○ ○○

absolute data
unit: encoder pulse
the number of bytes in data: 4 bytes (unsigned)
an error detection segment.

*) This example is a command sent to the drive at Address 1.
If the command is sent to another drive at an address other than Address 1, the error detection segment in the command is different from this example.

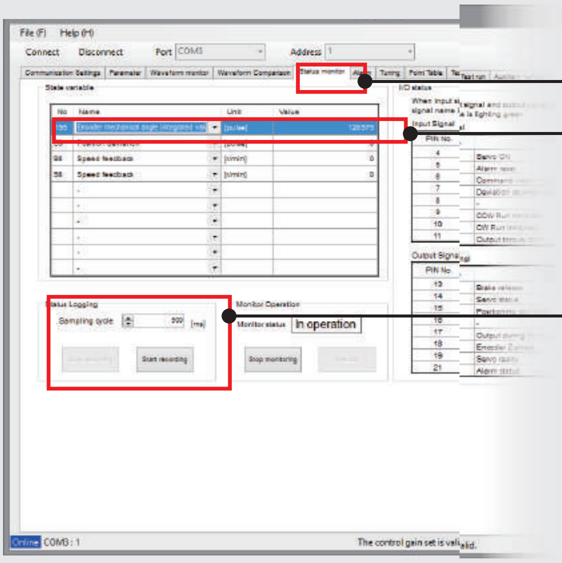
Communications Manual: RS-485

Page 26 Encoder/Rotor mechanical angle (integrated value) in List of Status Variables

Get Absolute Data by Using Digitax SF Connect

Start Digitax SF Connect and start communicating with the drive.

Use the【Status monitor】tab.



1. Display the Status monitor view.

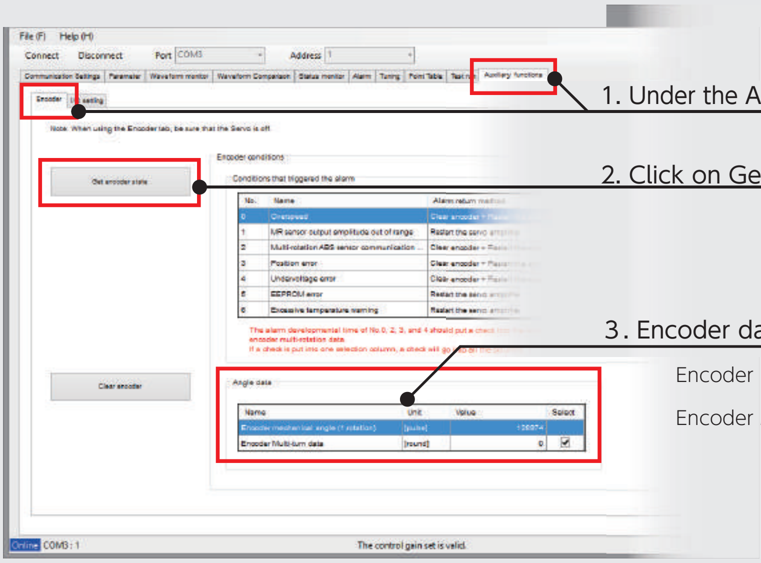
2. Select Encoder/Rotor mechanical angle (integrated value)

Encoder mechanical angle (integrated value) ··· Ⓐ
(=Absolute data)

3. Set the sampling cycle, and then click Start recording.

Data capture continues until you click Stop recording.

Use the【Auxiliary functions】tab.



1. Under the Auxiliary functions tab, select Encoder.

2. Click on Get Encoder Status.

3. Encoder data is displayed.

Encoder mechanical angle (1 rotation) ··· Ⓑ

Encoder Multi-turn data ··· Ⓒ

The formula to calculate the absolute data

Below is the formula to derive absolute data (Encoder mechanical angle (integrated value))。

$$\boxed{\text{Ⓐ} = \text{Ⓑ} + \text{Ⓒ} \times 2^{17}}$$

Ⓐ: Encoder mechanical angle (integrated value)
(=Absolute data)

Ⓑ: Encoder mechanical angle (1 rotation)

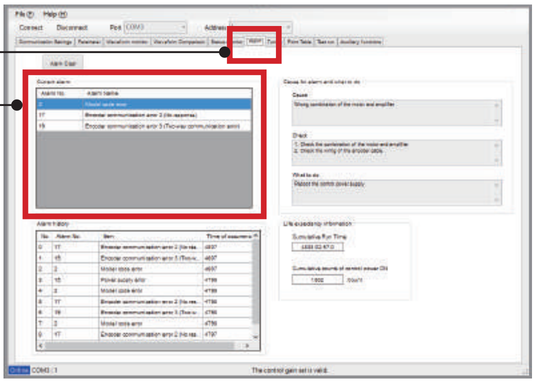
Ⓒ: Encoder Multi-turn data

1. Absolute System

Alarm

By using Digitax SF Connect, you can check alarms that have occurred when using an absolute system.

These alarms cannot be cleared by Alarm Reset or cycling the control power. To reset alarms, execute ENCODER CLEAR at the Auxiliary functions tab, and then cycle the control power.



1. Click on the Alarms tab.
2. Check the alarms that are occurring.

Alarm No.	Alarm Description	Symptoms and Remedy
11	Encoder (multi-turn counter overflow)	· Multi-turn data of the encoder has exceeded the specification. · Check the value of **Absolute system** (257.0). · Verify that rotational data is no higher than 32,767 rotations.
18	Encoder (circuit)	· Anomaly of the encoder itself. · Check the alarm details. ☞ Page 14 Encoder Alarms
20	Encoder (multi-turn data)	· Multi-turn data being reset. · Check for the encoder cable connection problems such as poor pin contact. · Take noise countermeasures. For example, separate the motor power cable from the encoder cable.
21	Encoder (voltage drop)	· Multi-turn data being reset due to low battery voltage. · Check for low battery voltage and loose connection of the battery cable. · Initialize the encoder.

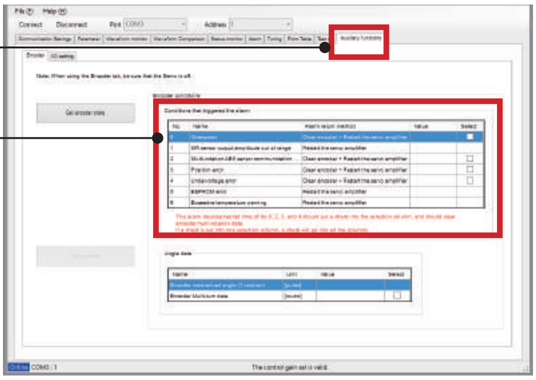
1. Absolute System

Encoder Alarms

Use Digitax SF Connect to check alarms from the encoder. In case of alarm numbers 18, 20, or 21, you can check the details under the Auxiliary Functions tab in Digitax SF Connect.
These alarms cannot be cleared by Alarm Reset or cycle the control power. To reset alarms, execute ENCODER CLEAR, and then cycle the control power.
If cycling power does not solve the problem, please contact the supplier

1. Click on the Auxiliary Functions Tab.

2.Check alarms that are occurring.



No.	Name	Description of Symptom
0	Speed error	Multi-turn sensor error occurred during backup, or speed error occurred upon the control power on.
1	Angle sensor output Amplitude error	Abnormal amplitude of Angle sensor output amplitude.
2	Multi-turn ABS sensor communication error	Could not obtain multi-turn data during Initialisation after power up.
3	Position error	The single-turn sensor value and multi-turn sensor value do not agree because of faulty sensor; the encoder position data is unreliable.
4	Voltage drop error	Relevant only to absolute encoders. The supply voltage fell below the rated voltage range upon the control power OFF.
5	EEPROM error	The saved data in EEPROM is corrupted.
6	Overheat warning	The temperature of the encoder board exceeded the user-specified temperature.
7	Battery voltage drop warning	The battery voltage (*1) dropped below the user-specified value.

*) The battery voltage is checked at the time of power turning on and every hour afterwards.
The user-specified voltage is not displayed in Digitax SF Connect.

2. Function

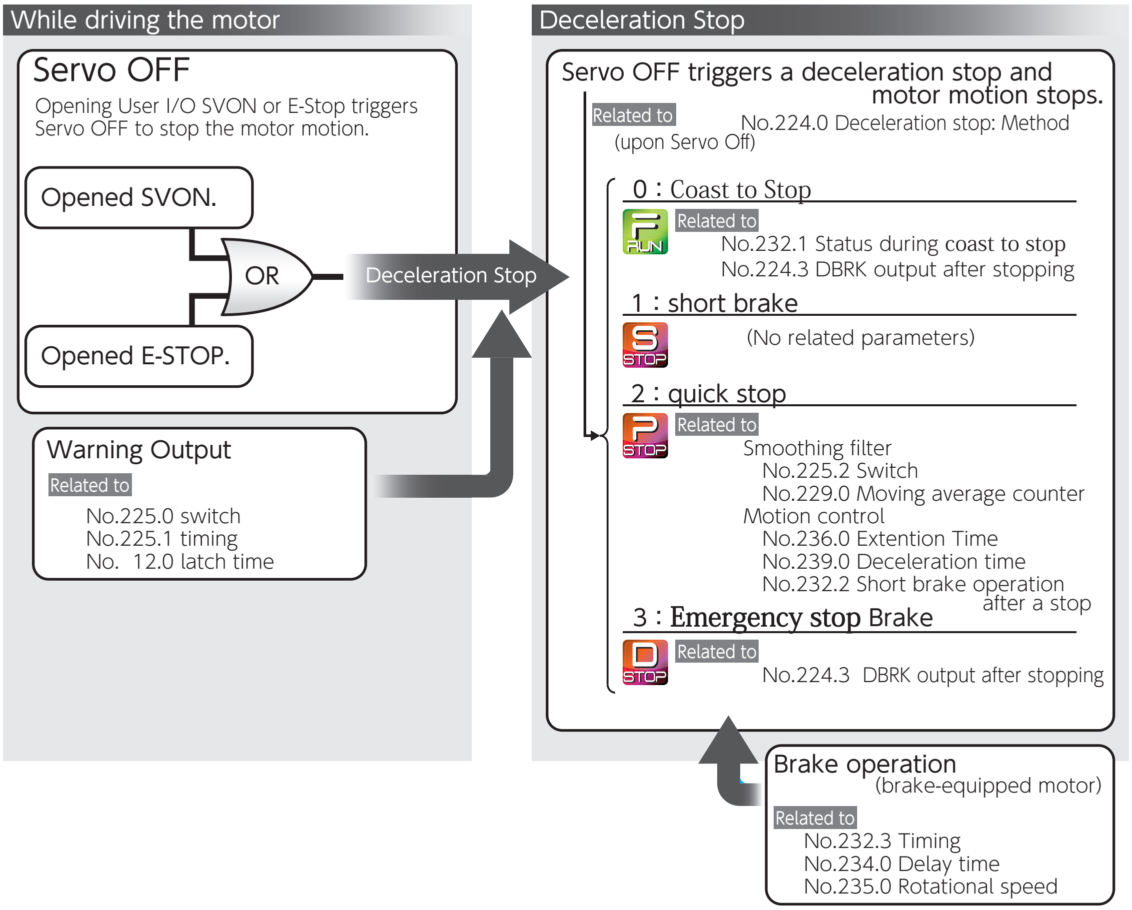
1. Emergency Stop

When you open User I/O E-STOP, Emergency Stop Status becomes ON.
Servo-OFF triggers deceleration stop and motor motion stops.
No alarm is output.
A warning is output by parameter settings. Close E-STOP to cancel Emergency Stop Status to resume motor operation.
The emergency stop function is always enabled regardless parameter settings; however, you need to set related parameters so that a warning is output upon Emergency Stop Status ON.

> If you close E-STOP to turn Emergency Stop Status off while SVON is being input, any command input immediately starts motor motion.

Deceleration Stop Setup

When you open User I/O SVON or E-STOP while operating the motor, the motor makes a deceleration stop according to the method predetermined by parameters.



Servo OFF

Opening User I/O SVON or E-Stop triggers Servo OFF to stop the motor motion.

Opened SVON.

Opened E-STOP.

Warning Output

Related to
No.225.0 switch
No.225.1 timing
No. 12.0 latch time

Servo OFF triggers a deceleration stop and motor motion stops.

Related to (upon Servo Off) No.224.0 Deceleration stop: Method

0 : Coast to Stop
Related to
No.232.1 Status during coast to stop
No.224.3 DBRK output after stopping

1 : short brake
(No related parameters)

2 : quick stop
Related to
Smoothing filter
No.225.2 Switch
No.229.0 Moving average counter
Motion control
No.236.0 Extention Time
No.239.0 Deceleration time
No.232.2 Short brake operation after a stop

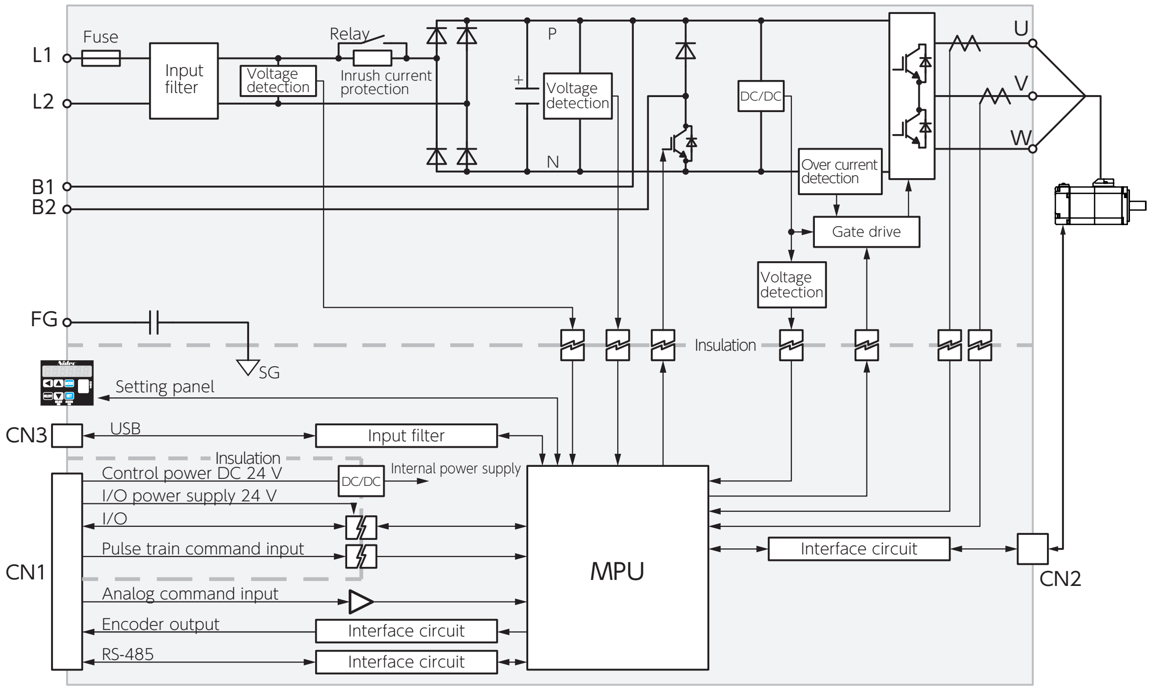
3 : Emergency stop Brake
Related to
No.224.3 DBRK output after stopping

Brake operation (brake-equipped motor)
Related to
No.232.3 Timing
No.234.0 Delay time
No.235.0 Rotational speed

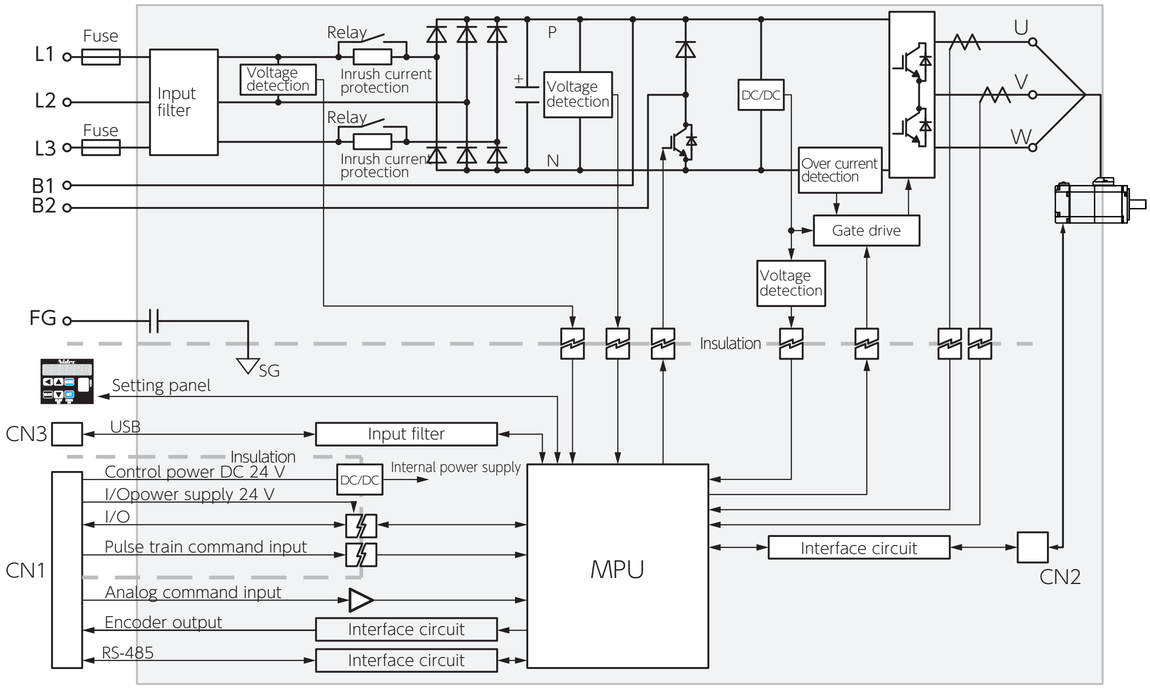
3. Technical Data

1. Drive Circuit System Block Diagram

Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



Drive 50W 100W 200W 400W 750W 1kW 1.5kW 2kW



4. Status Display

1. Introduction

You can see status data by using the Setup Panel, Digitax SF Connect or RS-485 communication.

- For information on how to display status information using the Setup Panel or Digitax SF Connect, refer to **5** Settings

The following communication commands are available for RS-485 communication.

Command Name	Command Code (*)	Description
GET_STATE_VALUE_2	10	The status value specified by a status number is displayed in the 2-byte unit.
GET_STATE_VALUE_4	11	The status value specified by a status number is displayed in the 4-byte unit.

*) Command code is a hexadecimal number.

☞ Communications Manual RS-485

The number in the brackets is hexadecimal.

Status	Alarm	Units	Bytes	Signed
Status No. (Hexadecimal number))	0 (00)	-	4	no
Description	This item indicates the status of the alarm occurring inside of the drive.			
Transmit data	24 01 00 11 00 00 E3 BB			

Example of Transmit Command via RS-485 communication
(Example: When sending a command to the drive of Address 1)

The command example is for reference only.

- Be sure to carefully review **5 Settings** and the Communication Manual – RS-485 communication to become familiar with how to use communications commands.
- Be sure that the data to be written is within the range between the predetermined upper limit and lower limit.

Note

This manual uses the following two types of pulse units to explain status variables.

Unit of Encoder pulse
This unit is pulse count of the drive control block, based on the pulses equivalent to single turn of the motor which is 17-bit. It is a pulse value resulting from division/ multiplication in the drive.

Unit of Command pulse
This unit is based on pulse count corresponding to single turn of the motor in the host controller's perspective.
This is a pre-division/multiplication value.

4. Status Display

2. List of Status Variables

Status Variable	Status No.	Units	☞
Alarm	0	–	19
I/O Status	16	–	20
Warning Output	22	–	21
Control Component Temperature	24	℃	21
Pulse Train Command Input (position)	33	command pulse	21
Pulse Train Command Input (speed)	35	pulse/160 μs (50 W to 750 W) pulse/200 μs (1 kW to 2 kW)	21
Analog Velocity Command	49	rpm	22
Positioning Status	64	–	22
Internal Command Value	65	encoder pulse	22
Position Feedback	67	encoder pulse	22
Position Error	69	encoder pulse	23
ABS Position Command	74	command pulse	23
Absolute Position Feedback	76	command pulse	24
Command Position Error	78	command pulse	24
ABS Position Error	80	command pulse	24
Speed Command Value	97	rpm	24
Speed Feedback	98	rpm	25
Speed Error	99	rpm	25
Torque Command Value	113	0.1 %	25
Load Factor	131	digit	26
Load Factor(%) (*1)	132	%	26
Encoder/Rotor mechanical angle (single-turn value)	194	encoder pulse	26
Encoder/Rotor mechanical angle (integrated value)	195	encoder pulse	26
Encoder Temperature	205	℃	26
Encoder Battery Voltage	206	0.1 V	27
Encoder Communication Retry Count	216	times	27
Encoder Data Error Count	218	times	27
Regeneration Status	228	–	28
AC Supply Voltage	232	0.1 V	28
Logical I/O Input (*2)	288	–	29
Logical I/O Output (*2)	296	–	30
Inertia Ratio Estimate	371	%	31

*1) Digitax SF Connect only
*2) RS-485 communication only

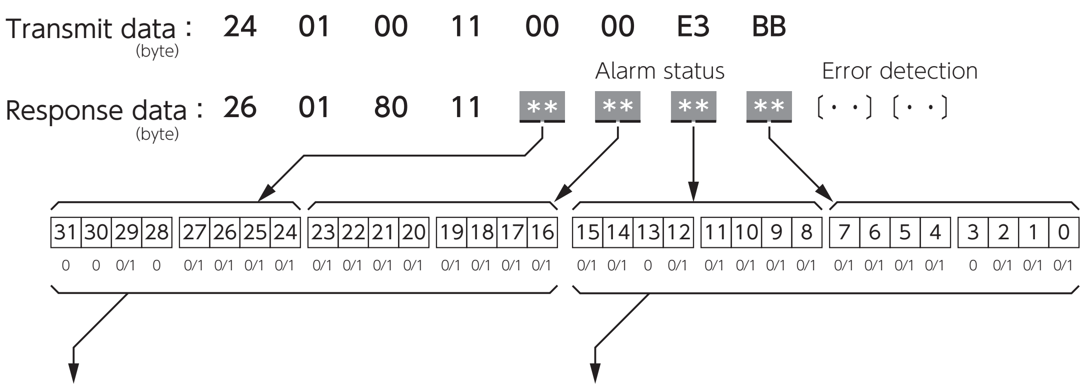
Note: The drive version can be checked in Digitax SF Connect

☞ Digitax SF Connect Operation Manual

3. Details of Each Status Variable

Status	Alarm	Units	Bytes	Signed
Status No. (Hexadecimal number)	0 (00)	-	4 BYTE	no
Description	This item indicates the status of the alarm occurring inside of the drive.			
Transmit data	24 01 00 11 00 00 E3 BB			

Relations between RS-485 Communication Command and Bit Tables



Transmit data : 24 01 00 11 00 00 E3 BB
(byte)

Response data : 26 01 80 11 ** ** ** ** [· ·] [· ·]
(byte)

31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16
0	0	0/1	0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0/1	0/1	0	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0/1	0	0/1	0/1	0/1

16	Encoder (Received data)
17	Encoder (no response)
18	Encoder (circuitry)
19	Encoder (communication)
20	Encoder (multi-turn data)
21	Encoder (voltage drop)
22	Voltage (control power)
23	Switch circuitry
24	Overcurrent
25	Inverter 1
26	Inverter 2
27	Current sensor
28	Encoder error (overheat)
29	Voltage drop (inside the drive)
30	(Reserved)
31	(Reserved)

0	System
1	EEPROM data
2	Product code
3	(Reserved)
4	Overspeed
5	Speed
6	Position
7	Overload
8	Command overspeed
9	Encoder pulse Output frequency
10	Internal Position Command overflow Homing / failure
11	Encoder (multi-turn counter overflow)
12	Overheat
13	(Reserved)
14	Overvoltage
15	Power supply (AC Supply)

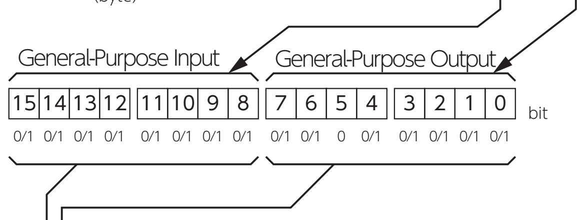
☞ 8 Troubleshooting

4. Status Display

Status	I/O Status	Units	Bytes	Signed
Status No. (Hexadecimal number)	16 (10)	-	2BYTE	no
Description	This item indicates the I/O Status of the CN1 connector. You can check the I/O Status under【waveform monitor】and【status monitor】in Digitax SF Connect 【waveform monitor】・・・displays total value of I/O bits in decimal. 【status monitor】・・・displays I/O bits in binary. Encoder z-phase output (OCZ) is always fixed to 0.			
Transmit data	24 01 00 10 00 10 C6 BA			

Relations between RS-485 Communication Command and Bit Tables

Transmit data : (byte)	24	01	00	10	00	10	C6	BA
					I/O		Error detection	
Response data : (byte)	24	01	80	10	**	**	[・・]	[・・]



Control/ Command Mode		Position					Velocity		Torque
		Pulse Train			Internal		Analog	Internal	Analog
Preset		Standard	Option 1	Option 2	Standard	Option	Standard	Standard	Standard
General-Purpose Output	0	MRBK				PM1	MRBK		
	1	SERVO				PM2	SERVO		
	2	POSIN			MEND	PM3	(Reserved)		
	3	(Reserved)	HEND	WARN1	HEND		(Reserved)		
	4	T-LIMIT	MEND/ T-LIMIT	T-LIMIT		MEND/ T-LIMIT	T-LIMIT		
	5	OCZ (always fixed to 0)							
	6	SRDY		DBRK	SRDY	SERVO	SRDY		
	7	ALM							
General-Purpose Input	8	SVON							
	9	RESET			RESET/PCLR		RESET		
	10	HOLD			RCSTART1		HOLD	VCRUN1	HOLD
	11	PCLR			PCSEL1		(Reserved)	VCRUN2	(Reserved)
	12	(Reserved)	HOME	E-STOP	PCSEL2		(Reserved)	VCSEL1	(Reserved)
	13	CCWL			PCSEL3		CCWL	VCSEL2	CCWL
	14	CWL			PCSEL4	HOME	CWL	VCSEL3	CWL
	15	TLSEL1			ORG	TLSEL1			

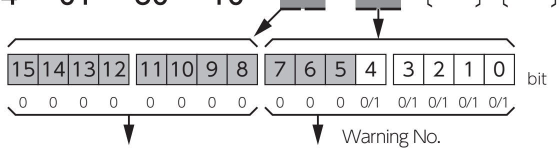
Status	Warning Output	Units	Bytes	Signed
Status No. (Hexadecimal number)	22 (16)	-	2 BYTE	no
Description	The warning detail is returned in a bit field format.			
Transmit data	**24 01 00 10 00 16 A6 7C**			

Relations between Warning Output and Bit Tables

Transmit data (byte) : 24 01 00 10 00 16 A6 7C

Warning status Error detection

Response data (byte) : 24 01 80 10 ** ** 〔・・〕〔・・〕



15～8 (Reserved)

Warning No.

0	900	Encoder overheat detection
1	901	Encoder battery voltage drop detection
2	902	Emergency stop
3	903	Encoder communication warning
4	904	Excessive position Error
7～5		(Reserved)

Status	Control Component Temperature	Units	Bytes	Signed
Status No. (Hexadecimal number)	24 (18)	℃	2 BYTE	yes
Description	Indicates the temperature at the drive control block. Install the drive in a place where the temperature at the control block will not exceed 85 ℃.			
Transmit data	**24 01 00 10 00 18 47 B2**			

Status	Pulse Train Command Input (position)	Units	Bytes	Signed
Status No. (Hexadecimal number)	33 (21)	command pulse	4 BYTE	yes
Description	The pulse count being output from the host controller is returned.			
Transmit data	**24 01 00 11 00 21 D7 F8**			

Status	Pulse Train Command Input (speed)	Units	Bytes	Signed
Status No. (Hexadecimal number)	35 (23)	pulse/160 μs (750 W or less) pulse/200 μs (1 kW to 2 kW)	2 BYTE	yes
Description	The speed value derived from using differentials of Pulse train command (position) at each 160 or 200 μs period is returned. The unit is command pulse.			
Transmit data	**24 01 00 10 00 23 C0 8A**			

Status	Analog Velocity Command	Units	Bytes	Signed
Status No. (Hexadecimal number)	49 (31)	rpm	2 BYTE	yes
Description	Indicates the value of the analog speed command being input to the drive. In Analog Velocity Command mode, by measuring this value (in the waveform data displayed in Digitax SF Connect) and the value of speed error at the same time, you can check the command response and vibration.			
Transmit data	24 01 00 10 00 31 F2 F9			

Status	Positioning Status	Units	Bytes	Signed
Status No. (Hexadecimal number)	64 (40)	-	2 BYTE	no
Description	Indicates whether positioning is completed or not 0: Not completed 1: Completed			
Transmit data	24 01 00 10 00 40 9C 4F			

Status	Internal Command Value	Units	Bytes	Signed
Status No. (Hexadecimal number)	65 (41)	encoder pulse	4 BYTE	yes
Description	Indicates the command value being input to the position loop. This is a value of the pulse command input (position) or a value of internal position command divided/multiplied and smoothed.			
Transmit data	24 01 00 11 00 41 BB 5E			

Status	Position Feedback	Units	Bytes	Signed
Status No. (Hexadecimal number)	67 (43)	encoder pulse	4 BYTE	yes
Description	Indicates the position data of the motor returned from the encoder to the drive.			
Transmit data	24 01 00 11 00 43 9B 1C			

4. Status Display

Status	Position Error	Units	Bytes	Signed
Status No. (Hexadecimal number)	69　(45)	encoder pulse	4 BYTE	yes
Description	Indicates error between the position command and position feedback. This value is important for tuning in position control mode, enabling you to do the following: To check the positioning time—for the position error to settle into your desired range after the pulse train command became 0—and vibration. To adjust gains such that the positioning time will be shorter and vibration will be suppressed, so the specifications for the equipment will be satisfied To check resonant frequency, in case of equipment vibration, by using waveforms of position error or torque limit value. To see whether vibration was suppressed by checking waveforms after specifying the vibration frequency for the following position command filters. · Filter 1 (Smoothing filter 1) Moving average counter (80.0) · Filter 4 (Smoothing filter 2) Moving average counter (81.0)			
Transmit data	24 01 00 11 00 45 FB DA			

Status	ABS　Position Command	Units	Bytes	Signed
Status No. (Hexadecimal number)	74　(4A)	command pulse	4 BYTE	yes
Description	This indicates a position command value based on the home-position offset.			
Transmit data	24 01 00 11 00 4A 0A 35			

4. Status Display

Status	Absolute Position Feedback	Units	Bytes	Signed
Status No. (Hexadecimal number)	76 (4C)	command pulse	4 BYTE	yes
Description	Indicates the absolute position data returned from the encoder to the drive.			
Transmit data	24 01 00 11 00 4C 6A F3			

Status	Command Position Error	Units	Bytes	Signed
Status No. (Hexadecimal number)	78 (4E)	command pulse	4 BYTE	yes
Description	Indicates the Error between a position command value and the feed back position value.			
Transmit data	24 01 00 11 00 4E 4A B1			

Status	ABS Position Error	Units	Bytes	Signed
Status No. (Hexadecimal number)	80 (50)	command pulse	4 BYTE	yes
Description	Indicates the Error between a value of ABS Position Command (Status No.74) and the value of ABS Positioning Feedback (Status No.76).			
Transmit data	24 01 00 10 00 50 B9 4E			

Status	Speed Command Value	Units	Bytes	Signed
Status No. (Hexadecimal number)	97 (61)	rpm	2 BYTE	yes
Description	Indicates the command value being input from the position loop (in Position Control mode) or analog speed command (in Analog Speed Control mode) to the speed loop. While tuning, by measuring this value (waveform data displayed in Digitax SF Connect) and position error (or speed error) at the same time, you can check command response with positioning time and vibration. Verify that no commands with extremely short acceleration/deceleration time are input from the host controller. If a command's acceleration/deceleration time is too short, the motor will be unable to keep up and vibration will easily occur. If you want to set a short acceleration/deceleration time, use a position command smoothing filter.			
Transmit data	24 01 00 10 00 61 A8 0C			

4. Status Display

Status	Speed Feedback	Units	Bytes	Signed
Status No. (Hexadecimal number)	98 (62)	rpm	2 BYTE	yes
Description	Indicates the speed value returned from the encoder to the drive. With this, you can check command response and motor rotational speed.			
Transmit data	24 01 00 10 00 62 98 6F			

Status	Speed Error	Units	Bytes	Signed
Status No. (Hexadecimal number)	99 (63)	rpm	2 BYTE	yes
Description	Error between the speed command and the speed feedback. This item is used in Velocity Control Mode. With this, you can check the error during acceleration/deceleration, and adjust gains so that the value becomes within the desired range for the equipment. If the speed error is too large, make the adjustment with Control Gain 1 first, then Integral Gain next. This item is a reference value In Position Control Mode			
Transmit data	24 01 00 10 00 63 88 4E			

Status	Torque Command Value	Units	Bytes	Signed
Status No. (Hexadecimal number)	113 (71)	0.1 %	2 BYTE	yes
Description	Indicates the value of torque command. The value of 1,000 equals to the rated torque. You can check the torque range during acceleration time and compare to the rated torque and the instantaneous maximum torque. ・RMS torque: Keep this below the rated torque. ・Instantaneous torque: Use the motor such that this will be approximately 80 % of instantaneous peak torque. When the RMS torque command value reaches the instantaneous max torque value (that is, torque saturation), the torque output will be limited and an alarm will occur after the predetermined time will have elapsed. Torque saturation causes slow response. Take countermeasures. For example, ① Set Position command filter. ・Filter 1 (Smoothing filter 1) Moving average counter (80.0) ・Filter 4 (Smoothing filter 2) Moving average counter (81.0) ② Smooth acceleration/deceleration of the command output from the host controller. ③ Install a speed reducer to decrease the inertia ratio. ④ Select a new motor to increase the rotor inertia or increase the capacity to decrease the inertia ratio.			
Transmit data	24 01 00 10 00 71 BA 3D			

Status	Load Factor	Units	Bytes	Signed
Status No. (Hexadecimal number)	131 (83)	digit	2 BYTE	no
Description	Indicates the motor load factor. The value of 1,000 is equivalent to 100% of the rated load. This item becoming 1,440 (120%) is an indicator of overload. Adjust the operating conditions such that this value remains under 1,000. Calculation formula：Motor load factor ［%］ ＝√ (Load factor ［digit］ ×10)			
Transmit data	24 01 00 10 00 71 BA 3D			

Status	Load Factor (%)	Units	Bytes	Signed
Status No. (Hexadecimal number)	132 (-)	%	-	no
Description	The motor load factor is presented in %. (Digitax SF Connect only)			
Transmit data	-			

Status	Encoder/rotor mechanical angle (single-turn value)	Units	Bytes	Signed
Status No. (Hexadecimal number)	194 (C2)	encoder pulse	4 BYTE	no
Description	Indicates single-turn data of the motor. It is presented in 0 – 131,072 (17bit). This value is an absolute value.			
Transmit data	24 01 00 11 00 C2 1A B5			

Status	Encoder/rotor mechanical angle (integrated value)	Units	Bytes	Signed
Status No. (Hexadecimal number)	195 (C3)	encoder pulse	4 BYTE	yes
Description	This indicates multi-turn data of the motor. It is presented as a total of encoder feedback pulses. (Single-turn value) ＋ (2^{17} × Encoder Multi-turn data) This item is the absolute data if you are using an absolute encoder.			
Transmit data	24 01 00 11 00 C3 0A 94			

Status	Encoder temperature	Units	Bytes	Signed
Status No. (Hexadecimal number)	205 (CD)	℃	2 BYTE	yes
Description	Indicates the encoder internal temperature. (for reference only)			
Transmit data	24 01 00 10 00 CD DC 6A			

Status	Encoder battery voltage	Units	Bytes	Signed
Status No. (Hexadecimal number)	206 (CE)	0.1 V	2 BYTE	yes
Description	Indicates the voltage of the encoder backup battery.			
Transmit data	24 01 00 10 00 CE EC 09			

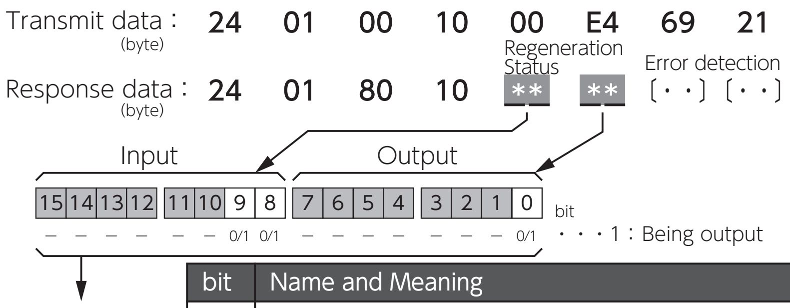
Status	Encoder communication retry times	Units	Bytes	Signed
Status No. (Hexadecimal number)	216 (D8)	times	2 BYTE	no
Description	Indicates the communication retry count upon encoder communication error.			
Transmit data	24 01 00 10 00 D8 9E FE			

Status	Encoder Data Error Counter	Units	Bytes	Signed
Status No. (Hexadecimal number)	218 (DA)	times	2 BYTE	no
Description	Indicates the cumulative count of errors in received encoder data.			
Transmit data	24 01 00 10 00 DA BE BC			

4. Status Display

Status	Regeneration Status	Units	Bytes	Signed
Status No. (Hexadecimal number)	228 (E4)	-	2 BYTE	no
Description	This item indicates the regeneration status of the . Drive power circuit. Setup Panel ☞ 5 Settings Setup Panel Digitax SF Connect 【waveform monitor】displays total value of I/O bits in decimal. 【status monitor】displays I/O bits in binary.			
Transmit data	24 01 00 10 00 E4 69 21			

Relations between RS-485 Communication Command and Bit Tables



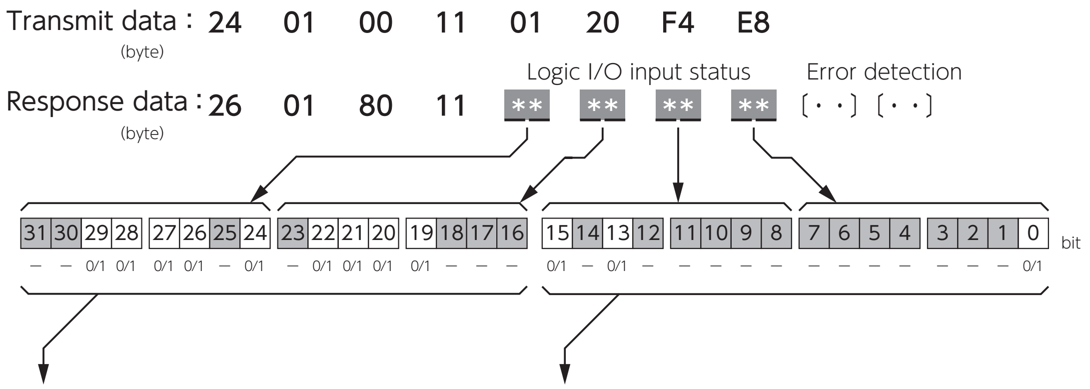
	bit	Name and Meaning	Decimal
Output	0	**Regeneration control output** Indicates the operation status of the regenerative power processing circuit.	0
Input	8	**Regeneration voltage warning** Indicates the voltage has reached the warning level. You need to connect a braking resistor to the drive.	256
	9	**Regeneration voltage threshold** Indicates the voltage has reached the threshold. A power error, Err. 14 or Err. 15, will occur if the braking resistor is not connected.	512

Status	Power Circuit Supply Voltage	Units	Bytes	Signed
Status No. (Hexadecimal number)	232 (E8)	0.1 V	2 BYTE	no
Description	Indicates the power circuit supply voltage (for reference only).			
Transmit data	24 01 00 10 00 E8 A8 AD			

4. Status Display

Status	Logic I/O input	Units	Bytes	Signed
Status No. (Hexadecimal number)	288 (120)	-	4 BYTE	no
Description	Indicates the logic I/O input status inside the drive. (RS-485 Communication only) Use this item while operating the motor with the point table in Internal Position Command mode using RS-485 communication with the host controller. ☞ Communications Manual RS-485			
Transmit data	24 01 00 11 01 20 F4 E8			

Relations between Logic I/O input command and Bit Tables

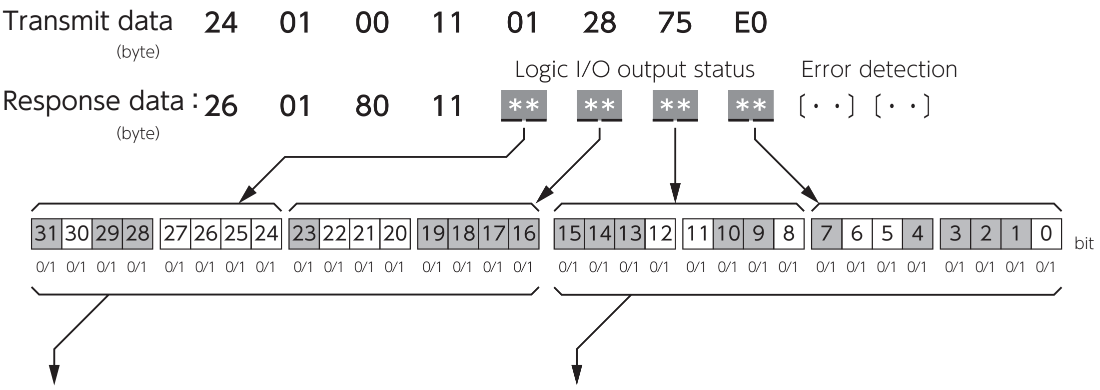


16	(Reserved)	
17		
18		
19	HOME	Homing start
20	ORG	Home position sensor
21	PCPAUSE	Pause
22	PCCANCEL	Cancel
23	(Reserved)	
24	PCSTART1	Start Forward Rotation
25	(Reserved)	
26	PCSEL1	Point No. Select 1
27	PCSEL2	Point No. Select 2
28	PCSEL3	Point No. Select 3
29	PCSEL4	Point No. Select 4
30	(Reserved)	
31		

0	SVON	Servo ON
1	(Reserved)	
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	TLSEL1	Torque Limit
14	(Reserved)	
15	RESET/PCLR	Alarm Reset/Position error Counter Clear

Status	Logic I/O output	Units	Bytes	Signed
Status No. (Hexadecimal number)	296 (128)	-	4 BYTE	no
Description	Indicates the logic I/O output status of the drive. (RS-485 Communication only) Use this during the point table operation in Internal Position Command mode by using RS-485 communication from the host controller. ☞ Communications Manual RS-485			
Transmit data	24 01 00 11 01 28 75 E0			

Relations between Logic I/O output command and Bit Tables



16	(Reserved)	
17	(Reserved)	
18	(Reserved)	
19	(Reserved)	
20	MEND	Motion complete
21	PAUSED	Pause
22	HEND	Homing complete
23	(Reserved)	
24	PM1	Point No. Select 1
25	PM2	Point No. Select 2
26	PM3	Point No. Select 3
27	PM4	Point No. Select 4
28	(Reserved)	
29	(Reserved)	
30	MEND/T-LIMIT	Motion complete/ Torque limiting
31	(Reserved)	

0	POSIN	Positioning complete
1	(Reserved)	
2	(Reserved)	
3	(Reserved)	
4	(Reserved)	
5	SREDY	Servo ready
6	T-LIMIT	Torque Limiting
7	(Reserved)	
8	MBRK	Motor Brake release
9	(Reserved)	
10	(Reserved)	
11	SERVO	Servo status
12	ALM	Alarm OUTPUT
13	(Reserved)	
14	(Reserved)	
15	(Reserved)	

Status	Inertia Ratio Estimate	Units	Bytes	Signed
Status No. (Hexadecimal number)	371 (173)	-	2 BYTE	no
Description	This item indicates the inertia ratio value estimated in auto tuning.			
Transmit data	24 01 00 10 01 73 A9 4E			

5. How to set Pulse train command: Input filter (33.0)

Pulse Train Command Input Filter (No.33.0) is a function to reduce malfunction caused by noise.
Select a value for the pulse width that you want the filter to pass Pulse Train Command input signal.
Pulse Train Command input is open collector, be sure to select the best filter.

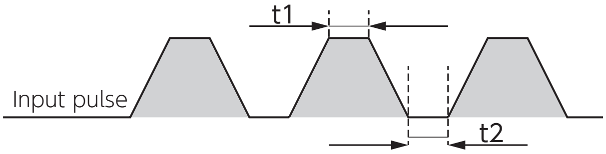
( ) recommended when input

Setting	Passing pulse width [ns]
0	No filter
1	25
2	50 (4 MHz)
3	100
4	150 (2 MHz)
5	200
6	300 (1 MHz)
7	400

Setting	Passing pulse width [ns]
8	600 (500 kHz)
9	800
10	1,000
11	1,200
12	1,600 (250 kHz)
13	2,000
14	2,300
15	3,100

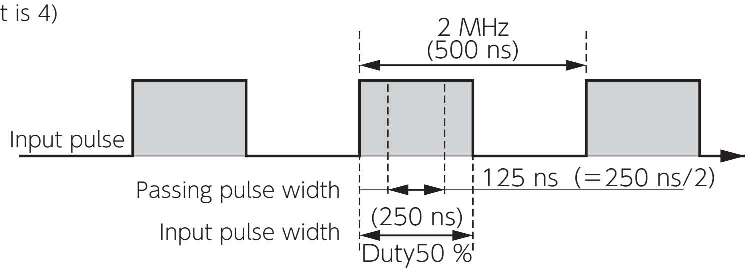
Tip for Filter Setup

- When the input frequency is high, select a small passing pulse width.
- To improve noise resistance, select a larger passing pulse width.



The minimum value of t1 or t2 is the passing pulse width.

- Set the passing pulse width to be 1/3 to 1/2 of the input pulse width.
  Example: Input pulse of 2MHz with 50% duty cycle
  Because the input pulse width is 250ns, set No.33.0 to 3 or 4 so that pulses to pass the filter will be 125ns or less. (The default is 4)



Selecting the best filter value using the pulse frequency by pulse duty cycle matrix

Pulse Frequency \ Duty [%]	50	40	30	20	10
100 kHz	12	11	10	8	6
200 kHz	9	8	7	6	4

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