YASKAWA

AC Servo Drives

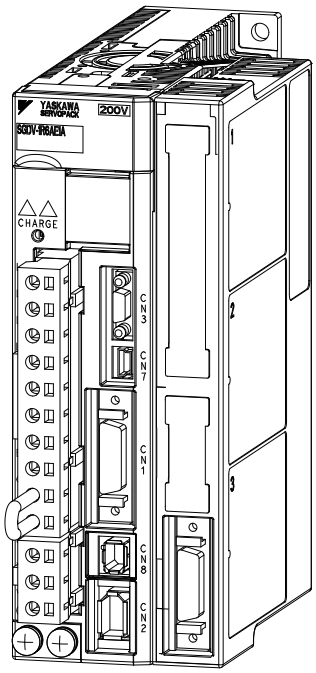
Σ-V Series

USER'S MANUAL

Universal Feedback Module Type 3

Model: SGDV-OFB03A

To properly use the product, read this manual thoroughly and retain for easy reference, inspection and maintenance. Ensure the end user receives this manual.



Checking Products 1

Specifications 2

Hardware Installation 3

Applicable Scope 4

Encoder Interfaces 5

Hall Sensor Signals Interface 6

Set-up Procedure for Fully-closed Loop Control 7

Set-up Procedure for Semi-closed Loop Control 8

Motor and Scale Parameter File 9

SERVOPACK with Semi-closed Loop Control for Rotary Motors 10

SERVOPACK with Semi-closed Loop Control for Linear Motors 11

Error Lists 12

Please check www.yaskawa.eu.com for up-to-date versions.

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About this Manual

This manual describes informations required for designing and maintaining the Universal Feedback Option Module for Σ-V series SERVOPACKs. The Feedback module is available in different versions.
Type 3 of the module supports encoders with A quad B (described in this manual).

Be sure to refer to this manual and perform design and maintenance to select devices correctly.

Keep this manual in a location where it can be accessed for reference whenever required.

■ Description of Technical Terms

The following table shows the meanings of terms used in this manual.

Term	Meaning
Feedback Module	Universal Feedback Option Module for Σ-V series SERVOPACKs.
Cursor	A mark that indicates the input position of data displayed on the digital operator
Servomotor	Σ-V Series SGMJV, SGMAV, SGMEV, SGMGV, SGMSV, or SGMCS (Direct Drive) servomotor Linear Σ Series SGLGW, SGLFW, SGLTW, or SGLC servomotor
SERVOPACK	Σ-V Series SGDV SERVOPACK
Servo Drive	A set including a servomotor and SERVOPACK (i.e., a servo amplifier)
Servo System	A servo control system that includes the combination of a servo drive with a host controller and peripheral devices
Servo ON	When power is being supplied to the servomotor
Servo OFF	When power is not being supplied to the servomotor
Base block	Turning OFF the power by shutting OFF the base current of the IGBT for the current amplifier

■ IMPORTANT Explanations

The following icon is displayed for explanations requiring special attention.

IMPORTANT

- Indicates important information that should be memorized, as well as precautions, such as alarm displays, that do not involve potential damage to equipment.

■ Notation Used in this Manual

- Reverse Symbol Notation

In this manual, the names of reverse signals (ones that are valid when low) are written with a forward slash (/) before the signal name, as shown in the following example:

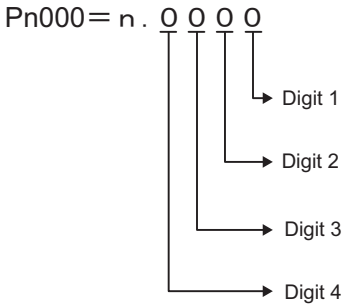
Example

The notation for $\overline{\text{BK}}$ is /BK.

• Parameter Notation

The following two types of notations are used for parameter digit places and settings.

Example



Notation Example for Pn000

Digit Notation		Set Value Notation	
Notation Method	Meaning	Notation Method	Meaning
Pn000.0	Indicates digit 1 of the parameter (Pn000).	Pn000.0 = x or n.□□□x	Indicates that digit 1 of the parameter (Pn000) is x.
Pn000.1	Indicates digit 2 of the parameter (Pn000).	Pn000.1 = x or n.□□x□	Indicates that digit 2 of the parameter (Pn000) is x.
Pn000.2	Indicates digit 3 of the parameter (Pn000).	Pn000.2 = x or n.□x□□	Indicates that digit 3 of the parameter (Pn000) is x.
Pn000.3	Indicates digit 4 of the parameter (Pn000).	Pn000.3 = x or n.x□□□	Indicates that digit 4 of the parameter (Pn000) is x.

■ Manuals Related to the Σ-V Series

Refer to the following manuals as required.

Name	Selecting Models and Peripheral Devices	Ratings and Specifications	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
Σ-V Series Product Catalog (YEU KAEP S800000 42)	✓	✓				
Σ-V Series User's Manual Setup Rotational Motor (SIEP S800000 43)			✓	✓		
Σ-V Series User's Manual Setup Linear Motor (SIEP S800000 44)			✓	✓		
Σ-V Series User's Manual Design and Maintenance Rotational Motor/Analog Voltage and Pulse Train Reference (SIEPS800000 45)		✓	✓	✓		✓
Σ-V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 46)		✓	✓	✓		✓
Σ-V Series User's Manual Design and Maintenance Linear Motor/Analog Voltage and Pulse Train Reference (SIEPS800000 47)		✓	✓	✓		✓
Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-II Communications Reference (SIEP S800000 48)		✓	✓	✓		✓

Name	Selecting Models and Peripheral Devices	Ratings and Specifications	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
Σ-V Series User's Manual Operation of Digital Operator (SIEP S800000 55)				✓	✓	✓
Σ-V Series User's Manual Design and Maintenance Rotational Motor Command Option Attachable Type (SIEP S800000 60)		✓		✓	✓	✓
Σ-V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-III Communications Reference (SIEP S800000 64)		✓	✓	✓		✓
Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-III Communications Reference (SIEP S800000 65)		✓	✓	✓		✓
Σ-V Series User's Manual Design and Maintenance Linear Motor Command Option Attachable Type (SIEP S800000 66)		✓		✓	✓	✓
Σ-V Series Option Module Safety Precautions (YEU TOEP C720829 00)			✓			
Σ-V Series Feedback Option Module Installation Guide (YEU TOEP C720829 03)			✓			
Σ-V Series AC SERVOPACK SGDV Safety Precautions (TOBP C710800 10)	✓		✓			✓
Σ Series Digital Operator Safety Precautions (TOBP C730800 00)						✓
AC SERVOMOTOR Safety Precautions (TOBP C230200 00)			✓			✓

Safety Information

The following conventions are used to indicate precautions in this manual. Failure to heed precautions provided in this manual can result in serious or possibly even fatal injury or damage to the products or to related equipment and systems.

⚠ WARNING	Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.
⚠ CAUTION	Indicates precautions that, if not heeded, could result in relatively serious or minor injury, damage to the product, or faulty operation. In some situations, the precautions indicated could have serious consequences if not heeded.
⃠ PROHIBITED	Indicates prohibited actions that must not be performed. For example, this symbol would be used to indicate that fire is prohibited as follows:
MANDATORY	Indicates compulsory actions that must be performed. For example, this symbol would be used as follows to indicate that grounding is compulsory:

Safety Precautions

These safety precautions are very important. Read them before performing any procedures such as checking products on delivery, storage and transportation, installation, wiring, operation and inspection, or disposal. Be sure to always observe these precautions thoroughly.

⚠ WARNING

- Never touch any rotating motor parts while the motor is running.
  Failure to observe this warning may result in injury.
- Before starting operation with a machine connected, make sure that an emergency stop can be applied at any time.
  Failure to observe this warning may result in injury or damage to the product.
- Never touch the inside of the SERVOPACKs.
  Failure to observe this warning may result in electric shock.
- Do not remove the cover of the power supply terminal block while the power is ON.
  Failure to observe this warning may result in electric shock.
- After the power is turned OFF or after a voltage resistance test, do not touch terminals while the charge indicator is ON.
  Residual voltage may cause electric shock.
- Follow the procedures and instructions provided in this manual for trial operation.
  Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.
- The multi-turn serial data output range for the Σ-V Series absolute position detecting system is different from that of earlier systems with 15-bit and 12-bit encoders. In particular, change the system to configure the Σ Series infinite-length positioning system with the Σ-V Series.
- The multi-turn limit value need not be changed except for special applications.
  Changing it inappropriately or unintentionally can be dangerous.
- If the Multi-turn Limit Disagreement alarm occurs, check the setting of parameter Pn205 in the SERVOPACK to be sure that it is correct.
  If Fn013 is executed when an incorrect parameter value is set, an incorrect value will be set in the encoder. The alarm will disappear even if an incorrect value is set, but incorrect positions will be detected, resulting in a dangerous situation where the machine will move to unexpected positions.
- Do not remove the front cover, cables, connectors, or optional items from the upper front of the SERVOPACK while the power is ON.
  Failure to observe this warning may result in electric shock.
- Do not damage, press, exert excessive force on, or place heavy objects on the cables.
  Failure to observe this warning may result in electric shock, stopping operation of the product, or fire.
- Provide an appropriate stopping device on the machine side to ensure safety.
  The holding brake on a servomotor with a brake is not a braking device for ensuring safety.
  Failure to observe this warning may result in injury.

- Connect the ground terminal according to local electrical codes (100 Ω or less for a SERVOPACK with a 100 V, 200 V power supply, 10 Ω or less for a SERVOPACK with a 400 V power supply).
  Improper grounding may result in electric shock or fire.

- Installation, disassembly, or repair must be performed only by authorized personnel.
  Failure to observe this warning may result in electric shock or injury.
- The person who designs a system using the safety function (Hard Wire Baseblock function) must have full knowledge of the related safety standards and full understanding of the instructions in this manual.
  Failure to observe this warning may result in injury.

■ Storage and Transportation

⚠ CAUTION

- Do not store or install the product in the following locations.
  Failure to observe this caution may result in fire, electric shock, or damage to the product.
  - Locations subject to direct sunlight
  - Locations subject to ambient operating temperatures outside the range specified in the storage/installation temperature conditions
  - Locations subject to humidity outside the range specified in the storage/installation humidity conditions
  - Locations subject to condensation as the result of extreme changes in temperature
  - Locations subject to corrosive or flammable gases
  - Locations subject to dust, salts, or iron dust
  - Locations subject to exposure to water, oil, or chemicals
  - Locations subject to shock or vibration
- Do not hold the product by the cables, motor shaft or detector while transporting it.
  Failure to observe this caution may result in injury or malfunction.
- Do not place any load exceeding the limit specified on the packing box.
  Failure to observe this caution may result in injury or malfunction.
- If disinfectants or insecticides must be used to treat packing materials such as wooden frames, pallets, or plywood, the packing materials must be treated before the product is packaged, and methods other than fumigation must be used.
  Example: Heat treatment, where materials are kiln-dried to a core temperature of 56°C for 30 minutes or more.
  If the electronic products, which include stand-alone products and products installed in machines, are packed with fumigated wooden materials, the electrical components may be greatly damaged by the gases or fumes resulting from the fumigation process. In particular, disinfectants containing halogen, which includes chlorine, fluorine, bromine, or iodine can contribute to the erosion of the capacitors.

■ Installation

⚠ CAUTION

- Never use the product in an environment subject to water, corrosive gases, inflammable gases, or combustibles.
  Failure to observe this caution may result in electric shock or fire.
- Do not step on or place a heavy object on the product.
  Failure to observe this caution may result in injury.
- Do not cover the inlet or outlet ports and prevent any foreign objects from entering the product.
  Failure to observe this caution may cause internal elements to deteriorate resulting in malfunction or fire.
- Be sure to install the product in the correct direction.
  Failure to observe this caution may result in malfunction.
- Provide the specified clearances between the SERVOPACK and the control panel or with other devices.
  Failure to observe this caution may result in fire or malfunction.
- Do not apply any strong impact.
  Failure to observe this caution may result in malfunction.

■ Wiring

⚠ CAUTION

- Be sure to wire correctly and securely.
  Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Do not connect a commercial power supply to the U, V, or W terminals for the servomotor connection.
  Failure to observe this caution may result in injury or fire.
- Securely connect the main circuit power supply terminal screws, control power supply terminal screws, and servomotor connection terminal screws.
  Failure to observe this caution may result in fire.
- Do not bundle or run the main circuit cables together with the input/output signal cables or the encoder cables in the same duct. Keep them separated by at least 30 cm.
  Failure to do so may result in malfunction.
- Use shielded twisted-pair wires or multi-core shielded twisted-pair wires for input/output signal cables and the encoder cables.
- I/O signal cables must be no longer than 3 m, encoder cables must be no longer than 50 m, and control power supply cables for the SERVOPACK with a 400 V power supply (+24 V, 0 V) must be no longer than 10 m.
- Do not touch the power terminals while the charge indicator is ON after turning power OFF because high voltage may still remain in the SERVOPACK.
  Make sure the charge indicator is off first before starting an inspection.
- Observe the following precautions when wiring main circuit terminal blocks of the SERVOPACK.
  - Remove the detachable main circuit terminal blocks from the SERVOPACK prior to wiring.
  - Insert only one main power line per opening in the main circuit terminals.
  - Make sure that no part of the core wire comes into contact with (i.e., short-circuit) adjacent wires.
- Install a battery at either the host controller or the SERVOPACK, but not both.
  It is dangerous to install batteries at both ends simultaneously, because that sets up a loop circuit between the batteries.
- Always use the specified power supply voltage.
  An incorrect voltage may result in fire or malfunction.
- Take appropriate measures to ensure that the input power supply is supplied within the specified voltage fluctuation range. Be particularly careful in places where the power supply is unstable.
  An incorrect power supply may result in damage to the product.
- Install external breakers or other safety devices against short-circuiting in external wiring.
  Failure to observe this caution may result in fire.
- Take appropriate and sufficient countermeasures for each form of potential interference when installing systems in the following locations.
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong electromagnetic fields and magnetic fields
  - Locations subject to possible exposure to radioactivity
  - Locations close to power supplies

  Failure to observe this caution may result in damage to the product.
- Do not reverse the polarity of the battery when connecting it.
  Failure to observe this caution may damage the battery, the SERVOPACK, the servomotor, or cause an explosion.
  Wiring or inspection must be performed by a technical expert.
- Use a 24-VDC power supply with double insulation or reinforced insulation.

■ Operation

⚠ CAUTION

- Always use the servomotor and SERVOPACK in one of the specified combinations.
  Failure to observe this caution so may result in fire or malfunction.
- Conduct trial operation on the servomotor alone with the motor shaft disconnected from the machine to avoid accidents.
  Failure to observe this caution may result in injury.
- During trial operation, confirm that the holding brake works correctly. Furthermore, secure system safety against problems such as signal line disconnection.
- Before starting operation with a machine connected, change the settings to match the parameters of the machine.
  Starting operation without matching the proper settings may cause the machine to run out of control or malfunction.
- Do not frequently turn power ON and OFF.
  Since the SERVOPACK has a capacitor in the power supply, a high charging current flows when power is turned ON. Frequently turning power ON and OFF causes main power devices like capacitors and fuses to deteriorate, resulting in unexpected problems.
- When using JOG operations (Fn002), search operations (Fn003), or EasyFFT operations (Fn206), the dynamic brake function does not work for reverse overtravel or forward overtravel. Take necessary precautions.
- When using the servomotor for a vertical axis, install safety devices to prevent workpieces from falling due to alarms or overtravels. Set the servomotor so that it will stop in the zero clamp state when overtravel occurs.
  Failure to observe this caution may cause workpieces to fall due to overtravel.
- When not using turning-less function, set to the correct moment of inertia ratio (Pn103).
  Setting to an incorrect moment of inertia ratio may cause machine vibration.
- Do not touch the SERVOPACK heatsinks, regenerative resistor, or servomotor while power is ON or soon after the power is turned OFF.
  Failure to observe this caution may result in burns due to high temperatures.
- Do not make any extreme adjustments or setting changes of parameters.
  Failure to observe this caution may result in injury or damage to the product due to unstable operation.
- When an alarm occurs, remove the cause, reset the alarm after confirming safety, and then resume operation.
  Failure to observe this caution may result in damage to the product, fire, or injury.
- Do not use the brake of the servomotor for braking.
  Failure to observe this caution may result in malfunction.
- An alarm or warning may be generated if communications are executed with the host controller during operation using SigmaWin+ or the digital operator.
  If an alarm or warning is generated, the process currently being executed may be aborted and the system may stop.

■ Maintenance and Inspection

⚠ CAUTION

- Do not disassemble the SERVOPACK.
  Failure to observe this caution may result in electric shock or injury.
- Do not change wiring while the power is ON.
  Failure to observe this caution may result in electric shock or injury.
- When replacing the SERVOPACK, resume operation only after copying the previous SERVOPACK parameters to the new SERVOPACK.
  Failure to observe this caution may result in damage to the product.

■ Disposal

⚠ CAUTION
• When disposing of the products, treat them as ordinary industrial waste.

■ General Precautions

Observe the following general precautions to ensure safe application.
• The products shown in illustrations in this manual are sometimes shown without covers or protective guards. Always replace the cover or protective guard as specified first, and then operate the products in accordance with the manual. • The drawings presented in this manual are typical examples and may not match the product you received. • If the manual must be ordered due to loss or damage, inform your nearest Yaskawa representative or one of the offices listed on the back of this manual.

Warranty

(1) Details of Warranty

■ Period of Warranty

The period of warranty for a product that was purchased (hereafter “delivered product”) is one year from the time of delivery to the location specified by the customer or 18 months from the time of shipment from the Yaskawa factory, whichever is sooner.

■ Scope of Warranty

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the period of warranty above. Defects due to the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life are also outside the scope of this warranty.

Failures that occur for any of the following causes are outside the scope of the warranty.

1. Using or handling the product under conditions or in environments not described in product catalogs or manuals, or separately agreed-upon specifications
2. Causes not attributable to the delivered product itself
3. Modifications or repairs not performed by Yaskawa
4. Using the delivered product in a manner in which it was not originally intended
5. Causes that were not foreseeable with the scientific and technological understanding at the time of shipment from Yaskawa
6. Events for which Yaskawa is not responsible, such as natural or human-made disasters

(2) Limitations of Liability

1. Yaskawa shall in no event be responsible for any damage or loss of opportunity to the customer that arises due to failure of the delivered product.
2. Yaskawa shall not be responsible for programming (including parameter settings) or the results of program execution if a programmable Yaskawa product was programmed by the user or by a third party.

(3) Suitability for Use

1. It is the customer’s responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the customer.
3. Consult with Yaskawa to determine whether use in the following applications is acceptable. If use in the application is acceptable, use the product with extra allowance in ratings and specifications, and provide safety measures to minimize hazards in the event of failure.
   - Outdoor use, use involving potential chemical contamination or electrical interference, or use in conditions or environments not described in product catalogs or manuals
   - Nuclear energy control systems, combustion systems, railroad systems, aviation systems, vehicle systems, medical equipment, amusement machines, and installations subject to separate industry or government regulations
   - Systems, machines, and equipment that may present a risk to life or property
   - Systems that require a high degree of reliability, such as systems that supply gas, water, or electricity, or systems that operate continuously 24 hours a day
   - Other systems that require a similar high degree of safety
4. Never use the product for an application involving serious risk to life or property without first ensuring that the required safety has been designed into the system with risk warnings and redundancy, and that the Yaskawa product is properly rated and installed.
5. The circuit examples and other application examples described in product catalogs and manuals are for reference. Check the functionality and safety of the actual devices and equipment to be used before using the product.
6. Read and understand all use prohibitions and precautions, and operate the Yaskawa product correctly to prevent accidental harm to third parties.

(4) Changes to Specifications

The names, specifications, appearance, and accessories of products in product catalogs and manuals may be changed at any time based on improvements and other reasons. When a catalog or a manual is revised, the catalog or manual code is updated and the new catalog or manual is published as a next edition. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Applicable Standards

■ North American Safety Standards (UL)

	Model	UL* Standards (UL File No.)
SERVOPACK	• SGDV	UL508C (E147823)
Servomotor	• SGMJV • SGMAV • SGMEV • SGMGV • SGMSV	UL1004 (E165827)

* Underwriters Laboratories Inc.

Note: Applicable when the Feedback Option Module is attached to the SERVOPACKs for the command option attachable type.

■ European Standards

	Model	Low Voltage Directive	EMC Directive		Safety Standards
			EMI	EMS	
SERVOPACK	• SGDV	EN50178 EN61800-5-1	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	EN954-1 IEC61508-1 to 4
Servomotor	• SGMJV • SGMAV • SGMEV • SGMGV • SGMSV	IEC60034-1 IEC60034-5 IEC60034-8 IEC60034-9	EN55011/A2 group 1 class A EN61800-3	EN61800-3 EN61000-6-2	–

Note 1. Because SERVOPACKs and servomotors are built into machines, certification is required after installation in the final product.

2. Applicable when the Feedback Option Module is attached to SERVOPACKs for the command option attachable type.

CONTENTS

Chapter 1 Checking Products 1-1
1.1 Checking Products on Delivery 1-2
1.2 Nameplate and Model Designation 1-2
1.3 Nameplate Location 1-4

Chapter 2 Specifications 2-1
2.1 Overview 2-2
2.2 Specifications of the Universal Feedback Option Module 2-2
2.2.1 General Specifications 2-2

Chapter 3 Hardware Installation 3-1
3.1 Mounting the Universal Feedback module 3-2

Chapter 4 Applicable Scope 4-1
4.1 SERVOPACK for Rotary and Linear Motors 4-2
4.2 SERVOPACK with Semi-closed Loop Control 4-3
4.3 SERVOPACK with Fully-closed Loop Control 4-4

Chapter 5 Encoder Interfaces 5-1
5.1 A quad B Pulse interface 5-2
5.1.1 Overview 5-2
5.1.2 Technical Data 5-2
5.1.3 Connection 5-2

Chapter 6 Hall Sensor Signals Interface 6-1
6.1 Overview 6-2
6.1.1 Technical Data 6-2

Chapter 7 Set-up Procedure for Fully-closed Loop Control 7-1
7.1 Safety Precautions 7-2
7.2 Set-up Procedure 7-2
7.2.1 Feedback Option Module Set-up for Fully-closed Loop Control 7-3
7.2.2 Sigma-5 SERVOPACK Set-up for Fully-Closed Loop Control 7-8
7.3 SERVOPACK for Fully-closed Loop Control 7-9
7.3.1 Rotation/Movement Direction 7-9
7.3.2 External Encoder Resolution to Motor Feedback 7-10
7.3.3 Encoder Pulse Output (PAO, PBO, and PCO) 7-10

Chapter 8 Set-up Procedure for Semi-closed Loop Control 8-1
8.1 Safety Precautions. 8-2
8.2 Setup Procedure 8-2
8.2.1 Feedback Option Module Set-up 8-3
8.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor 8-9
8.2.3 Sigma-5 SERVOPACK Set-up with Linear Motor. 8-10

Chapter 9 Motor and Scale Parameter File. 9-1
9.1 Motor and Scale Parameter File Requirements for SERVOPACKs for Rotary Motors 9-2
9.1.1 Motor Parameters 9-2
9.1.2 Scale Parameters. 9-3
9.2 Motor and Scale Parameter File Requirements for SERVOPACKs for Linear Motors 9-4
9.2.1 Motor Parameters 9-4
9.2.2 Scale Parameters. 9-5

Chapter 10 SERVOPACK Semi-closed Loop Control for Rotary Motors .10-1
10.1 Magnetic Pole 10-2
10.2 Motor Rotation Direction 10-3
10.3 Pole Detection Functionality 10-4
10.4 SERVOPACK for Rotary Motors 10-6
10.4.1 Encoder Pulse Output 10-6

Chapter 11 SERVOPACK Semi-closed Loop Control for Linear Motors . . 11-1
11.1 Magnetic Pole 11-2
11.2 Motor Rotation Direction 11-3
11.3 Pole Detection Functionality. 11-4
11.4 SERVOPACK for Linear Motors. 11-6
11.4.1 Encoder Pulse Output 11-6

Chapter 12 Error Lists 12-1
12.1 Errors related to Feedback Option Module Identification. 12-2
12.2 Errors in Fully-closed Loop Control 12-3
12.3 Errors in Semi-closed Loop Control with Rotary Motors 12-4
12.4 Errors in Semi-closed Loop Control with Linear Motors 12-6
12.5 Errors with Pole Sensor Signals Interface 12-8
12.6 Errors during Pole Detection Functionality. 12-9
12.6.1 Troubleshooting for Pole Detection Alarms with Rotary Motors. 12-11
12.6.2 Troubleshooting for Pole Detection Alarms with Linear Motors 12-12

1

Checking Products

This chapter describes how to check products upon delivery.

1.1 Checking Products on Delivery 1-2
1.2 Nameplate and Model Designation 1-2
1.3 Nameplate Location 1-4

1.1 Checking Products on Delivery

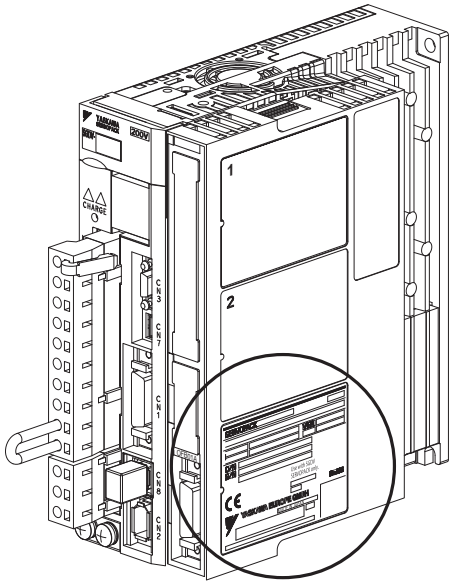
(1) When the Universal Feedback Module is Not Connected to the SERVOPACK

1. Mount the Universal Feedback Module to the SERVOPACK as described in the enclosed *Σ-V Series Universal Feedback Module Installation Guide* (YEU TOEP C720829 03).
   For the location of the nameplate, refer to *Option case unit type code*.
2. Check the nameplate to confirm that the product is the one that was ordered.
   For the nameplate, refer to *Nameplate and Model Designation*.

(2) When the Universal Feedback Module is Connected to the SERVOPACK

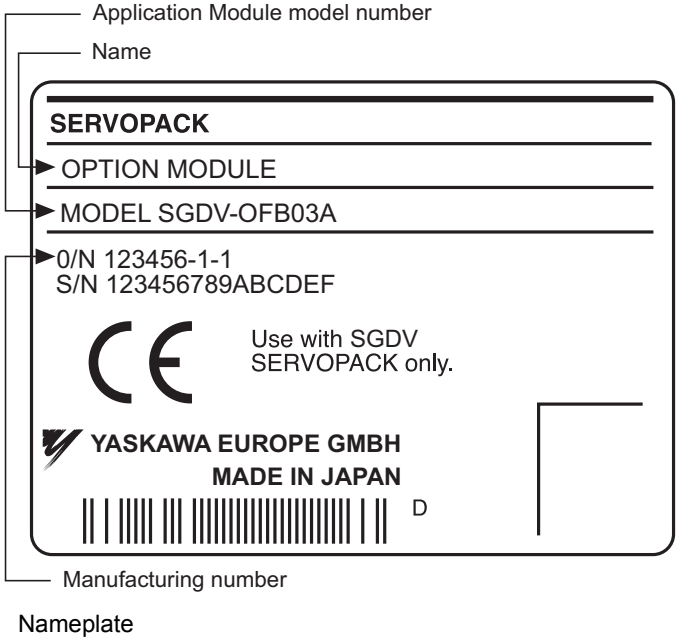
Check the nameplate to confirm that the Module that is mounted is the Universal Feedback Module.

The nameplate is located in the following position.



1.2 Nameplate and Model Designation

■ Nameplate Example



Nameplate

■ Model Designation

SGDV – OF B03 A

Series	
SGDV	Σ-V Series

1st + 2nd digits: Module Type	
Code	Module
OF	Feedback type option module

3rd + 4th + 5th digits: Interface Specifications	
Code	Interface
B03	Pulse A quad B Encoders

6th digit: Design Revision Order

■ Option case unit type code

SGDV – OZ A01 A

Series	
SGDV	Σ-V Series

1st + 2nd digits: Module Type	
Code	Module
OZ	Option case

3rd + 4th + 5th digits: Case Specifications	
Code	Option case specification
A01	General purpose

6th digit: Design Revision Order

■ Applicable SERVOPACK model

SGDV – *** * ** A

Series	
SGDV	Σ-V Series

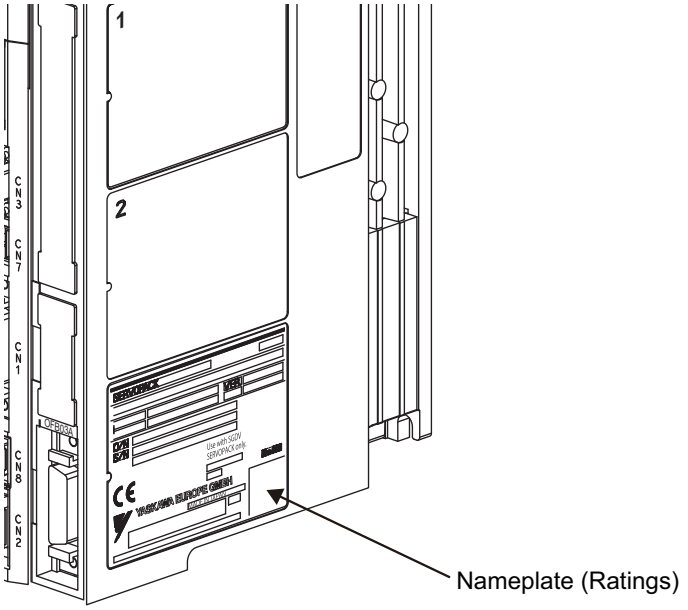
Current
Refer to SERVPACK Specification

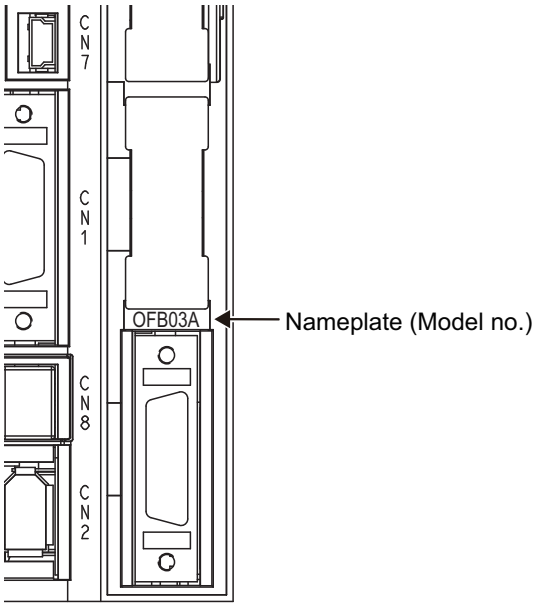
Voltage specification
Refer to SERVPACK Specification

Interface Specification
**: All types

6th digit: Design Revision Order

1.3 Nameplate Location





2

Specifications

This chapter gives an overview and describes the specifications of the Universal Feedback Option Module.

2.1 Overview 2-2
2.2 Specifications of the Universal Feedback Option Module 2-2
2.2.1 General Specifications 2-2

2.1 Overview

The Σ-V series Universal Feedback Option Module SGDV-OFB03A supports encoders with A quad B. The feedback option module consists of option card and option case unit. It can be installed to all the types of Sigma-5 SERVOPACKs.

2.2 Specifications of the Universal Feedback Option Module

2.2.1 General Specifications

This table lists the general specifications of the Universal Feedback Option Module.

Applicable SERVOPACK		All Σ-V Series SGDV-□□□□□□□□ SERVOPACKs
Applicable SERVOPACK Firmware Version		Version 0029 or later
Placement		Attached to the SGDV-SERVOPACK
Power Specification	Power Supply Method	Supplied from the control power supply of the SGDV SERVOPACK.
Operating Conditions	Surrounding Air/Storage Temperature	0 °C to +55 °C/ -20 °C to +85 °C
	Ambient/Storage Humidity	90% RH or less (with no condensation)
	Vibration/Shock Resistance	4.9 m/s^2 / 19.8 m/s^2
	Protection Class/ Pollution Degree	Protection class: IP10, Pollution degree: 2 An environment that satisfies the following conditions. • Free of corrosive or explosive gases • Free of exposure to water, oil or chemicals • Free of dust, salts or iron dust
	Altitude	1000 m or less
	Others	Free of static electricity, strong electromagnetic fields, magnetic fields or exposure to radioactivity
Supported motors		Permanent magnet, Synchronous AC rotary or linear motor
Max. output frequency range		Must be lower than 500 [rev/sec]. Note: UL application: 400 [rev/sec] (200 V), 300 [rev/sec] (400 V). If UL is needed, the combination should be applied to UL on customer side.
Supported scales for motor driving usage		A quad B
Supported scales for fully-closed usage		A quad B
Motor pole information for motor driving	Without hall sensor signals	Sigma-5 detecting function is available. In other cases, the function should be carried out each boot-up.
	With hall sensor signals	The data is used (any functions needed for the information).
Unsupported option modules		INDEXER option module: SGDV-OCA03A MP2600iec option module: SGDV-OCC02A Advanced safety option module: SGDV-OSA01A Fully-closed option module: SGDV-OFA01A

3

Hardware Installation

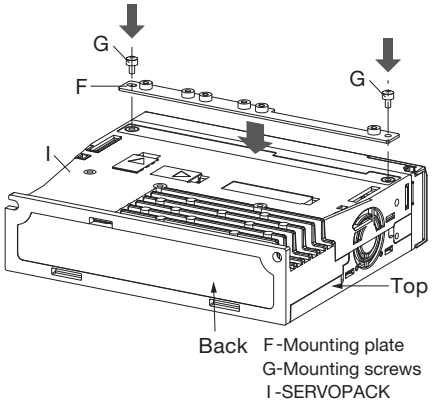
This chapter describes the hardware installation of the Universal Feedback Option Module.

3.1 Mounting the Universal Feedback module 3-2

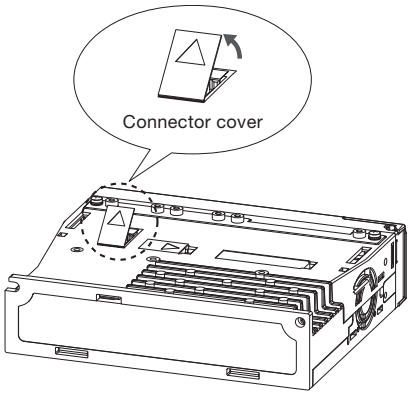
3.1 Mounting the Universal Feedback module

The Universal Feedback module will be mounted on the right side of the Sigma-V servopack.
To mount the network module to the SERVOPACK follow the instructions below.

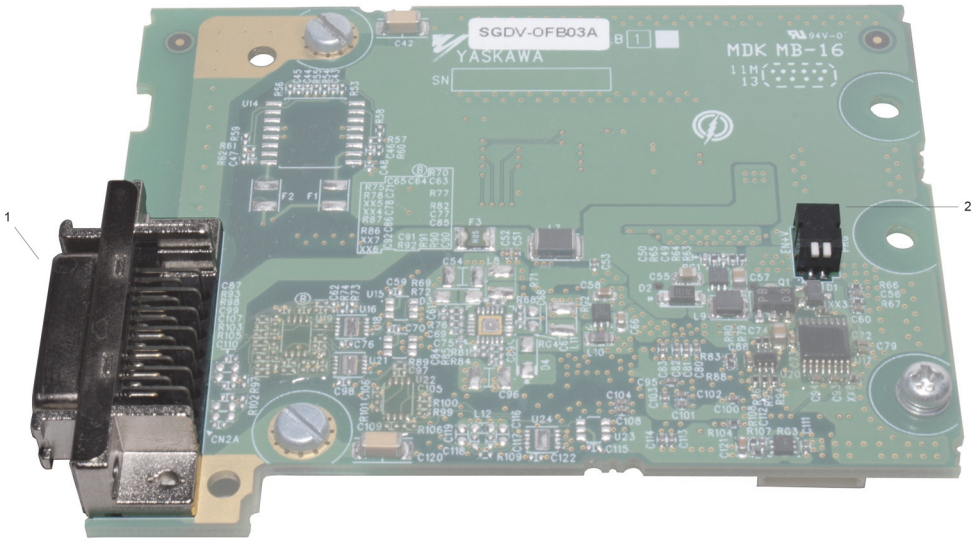
1. Fit the mounting plate (F) into the recess on the SERVOPACK, and fix the plate with the mounting screws (G). (Tightening torque: 0.14 Nm).



2. Remove the connector cover from the SERVOPACK.



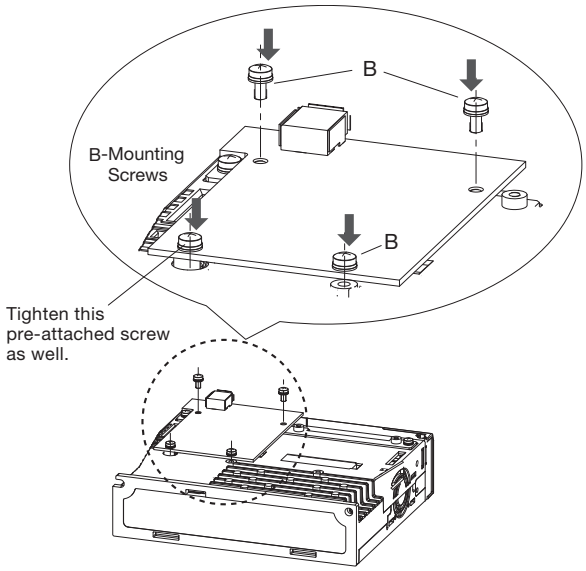
3. Check DIP switch setting of S1.



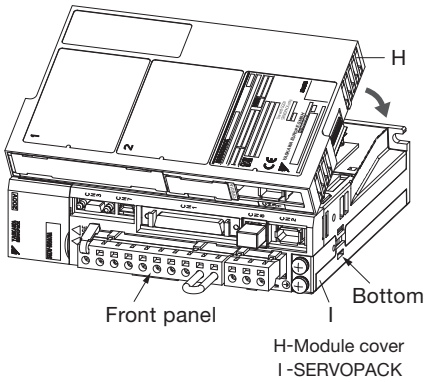
Caption: 1 = Position of Sub-D connector - 2 = Position of DIP switch S1

For A quad B encoders both switches of S1 have to be off (white colored parts in the upper position).

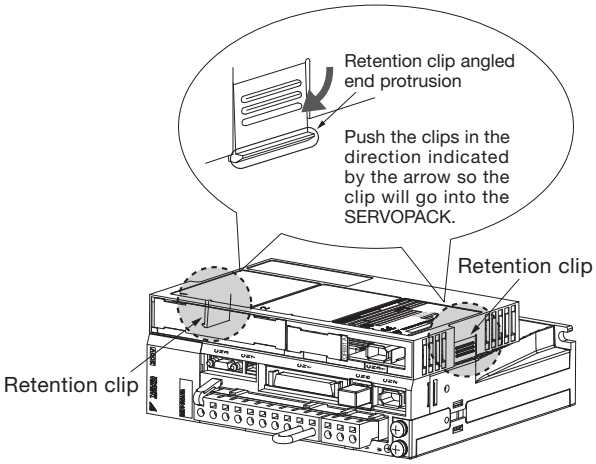
4. Fix the board on the SERVOPACK with three screws. (Tightening torque: 0.14 Nm)



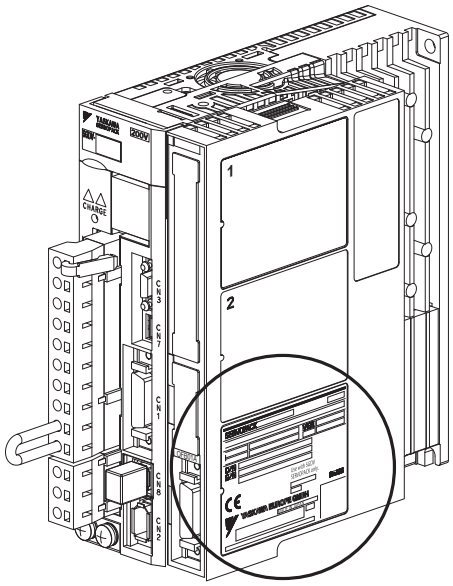
5. Align the front end of the module cover (H) with the front panel of the SERVOPACK as shown in the illustration, and place the module cover so that you can view the installed board from the opening (where the front cover is removed) on the module cover.



6. Fix the module cover to the SERVOPACK by pushing in the retention clips on the left and right side of the module cover, while directing their angled end protrusions to enter the SERVOPACK.



7. Now snap on the cover for the network module to the servo amplifier, the completed unit will look like the following picture.



4

Applicable Scope

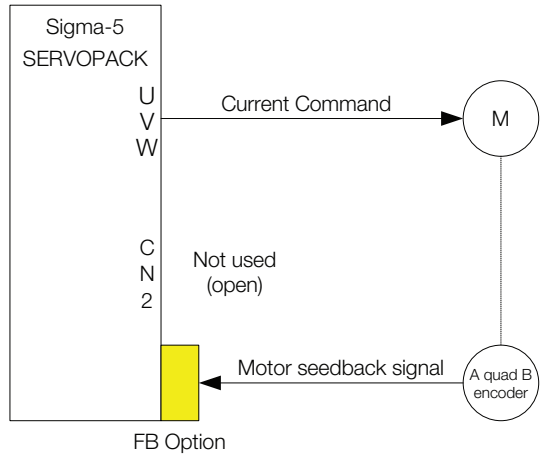
This chapter describes the application fields of the Universal Feedback Option Module.

4.1 SERVOPACK for Rotary and Linear Motors 4-2
4.2 SERVOPACK with Semi-closed Loop Control 4-3
4.3 SERVOPACK with Fully-closed Loop Control 4-4

4.1 SERVOPACK for Rotary and Linear Motors

Motor	Scale Interface	Available solutions	Remarks
YASKAWA	YASKAWA Serial	without any feedback boards	-
	A quad B pulse	with SGDV-OFB03A	-
3rd Party	A quad B pulse	with SGDV-OFB03A	Motor parameter file needs to be prepared by YASKAWA

Feature	SERVOPACK for Rotary and Linear Motors
	This system is for driving the Sigma-1 servo motors or third party servo motors.
Parameter Setting	Pn002.3=0, Pn00B.3=1

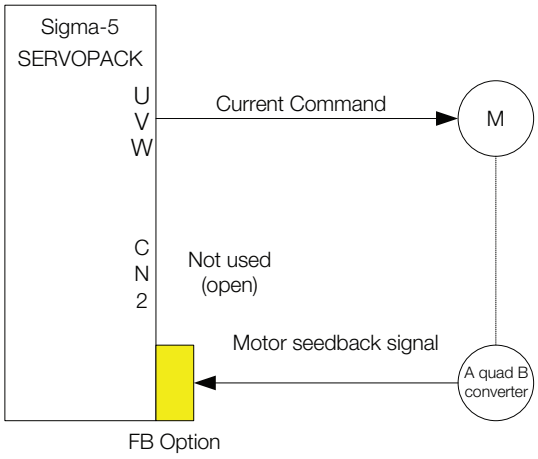


Description	
M	Third party servo motor
Sensor	Motor feedback sensor
UVW	Current command for motor drive
CN2	Sigma-5 encoder connector
FB OPTION	SGDV-OFB03A

4.2 SERVOPACK with Semi-closed Loop Control

Motor	Scale Interface	Available solutions	Remarks
YASKAWA	Sine and Cosine	with JZDP-□□□-000-E	-
	A quad B pulse	with SGDV-OFB03A	-
3rd Party	A quad B pulse	with SGDV-OFB03A	Motor parameter file needs to be prepared by YASKAWA

Feature	SERVOPACK with Semi-closed Loop Control
	This system is for driving YASKAWA linear motors or third party linear motors.
Parameter Setting	Pn002.3=0, Pn00B.3=1

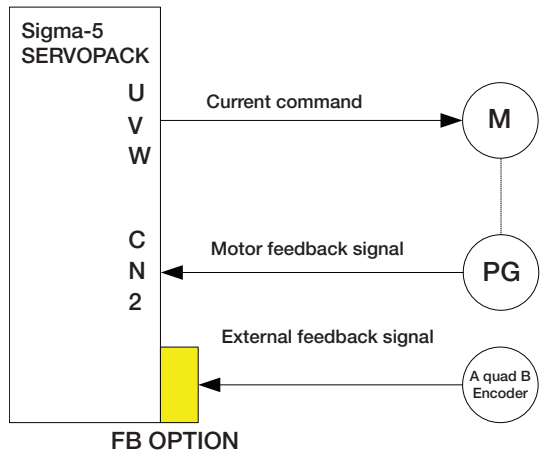


Description	
M	• YASKAWA linear motor • Third party linear motor
Sensor	Motor feedback sensor
UVW	Current command for motor drive
CN2	Sigma-5 encoder connector
FB OPTION	SGDV-OFB03A

4.3 SERVOPACK with Fully-closed Loop Control

Motor	Scale Interface	Available solutions	Remarks
YASKAWA	YASKAWA Serial	with SGDV-OFA01A	-
	Sine and Cosine	with SGDV-OFA01A and with JZDP-□□□-000-E	-
	A quad B pulse	with SGDV-OFB03A	Retrofit to Sigma-2

Feature	SERVOPACK with Fully-closed Loop Control
	This system is for driving the Sigma-5 servo motors with external encoder for fully-closed loop control.
Parameter Setting	Pn002.3=1/3, Pn00B.3=0



Description	
M	Sigma-5 servo motor
PG	Motor encoder
Sensor	External feedback sensor
UVW	Current command for motor drive
CN2	Sigma-5 encoder connector
FB OPTION	SGDV-OFB03A

5

Encoder Interfaces

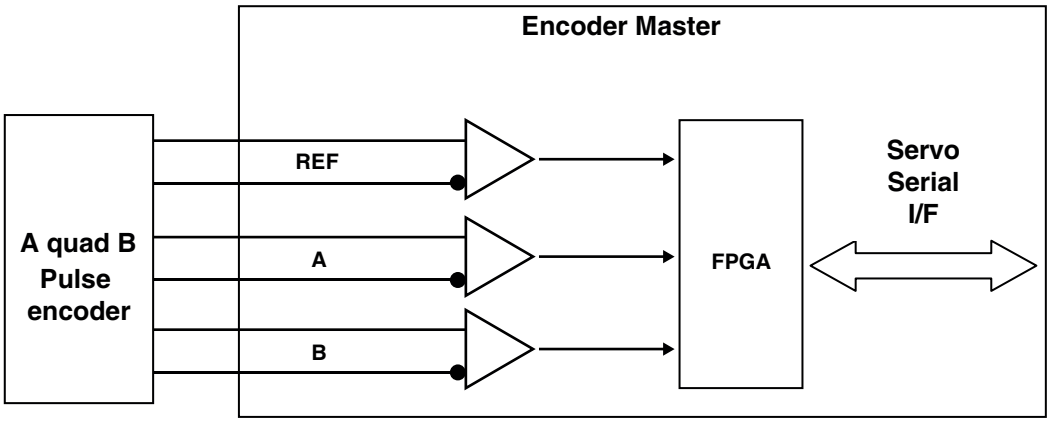
This chapter describes the encoder interfaces of the Universal Feedback Option Module.

5.1 A quad B Pulse interface 5-2
5.1.1 Overview 5-2
5.1.2 Technical Data. 5-2
5.1.3 Connection 5-2

5.1 A quad B Pulse interface

5.1.1 Overview

A quad B pulse signals is counted by each edges in the master. The interface block diagram is shown below.



5.1.2 Technical Data.

Items		Description
Encoder Supply	Output voltage	Typically 5 V
Incremental Encoder Input	Signal form	Square wave pulse
	Evaluation	4x
	Max. input frequency	1 MHz
	Max. counter frequency	4 MHz
	Max. reference frequency	1 MHz
	Distance between edges	0.2 µsec or more
	Differential voltage	0.2 V or more

5.1.3 Connection

No	Signal	Pin Function	Dir.		No	Signal	Pin Function	Dir.
1		N.C. *2	OUT		14	-	N.C. *2	I/O
2		N.C. *2	OUT		15	-	N.C. *2	I/O
3	V	Hall Signal V + *1	IN		16	W	Hall Signal W + *1	IN
4	U	Hall Signal U + *1	IN		17	PG_0V	Ground	-
5	/C(Z)	Pulse /C(Z)	-		18	-	N.C. *2	-
6	C(Z)	Pulse C(Z)	-		19	-	N.C. *2	-
7	-	N.C. *2	-		20	-	N.C. *2	-
8	PG+5V	Power	OUT		21	-	N.C. *2	-
9	PG+5V	Power	OUT		22	-	N.C. *2	-
10	PG+5V	Power	OUT		23	A	Pulse A	-
11	PG_0V	Ground	-		24	/A	Pulse /A	-
12	PG_0V	Ground	-		25	B	Pulse B	-
13	PG_0V	Ground	-		26	/B	Pulse /B	-

*1 Without hall sensor, do not connect to any signals. With hall sensor, please refer to section 6-1, too.

*2 Pins denoted as N.C. do not connect to any signals.

6

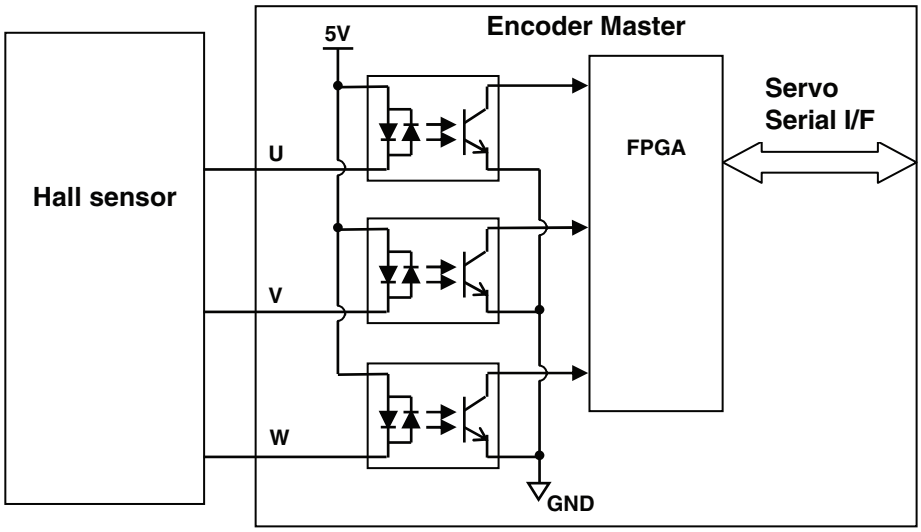
Hall Sensor Signals Interface

This chapter describes the hall sensor signals interface of the Universal Feedback Option Module.

6.1 Overview 6-2
6.1.1 Technical Data 6-2

6.1 Overview

Hall sensor signals provided by some sensor devices are used as easier recognition for motor pole position. With hall sensor signals, the detecting function implemented on Sigma-5 is not required. Used sensor devices must output each U/V/W hall sensor signals. The Interface block diagram is shown below.



6.1.1 Technical Data

Items		Description
Hall sensor interface		
	Isolation	Yes
	Signal form	Square wave pulse
	Signal transfer	C-MOS signals
	Code	Absolute

7

Set-up Procedure for Fully-closed Loop Control

This chapter describes the set-up procedure for fully-closed loop control of the Universal Feedback Option Module.

7.1 Safety Precautions 7-2

7.2 Set-up Procedure 7-2

7.2.1 Feedback Option Module Set-up for Fully-closed Loop Control 7-3

7.2.2 Sigma-5 SERVOPACK Set-up for Fully-Closed Loop Control 7-8

7.3 SERVOPACK for Fully-closed Loop Control 7-9

7.3.1 Rotation/Movement Direction 7-9

7.3.2 External Encoder Resolution to Motor Feedback 7-10

7.3.3 Encoder Pulse Output (PAO, PBO, and PCO) 7-10

7.1 Safety Precautions

These set-ups shall be done in accordance with described procedures.
And, they shall be done when the system configurations and components are changed.

Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.

7.2 Set-up Procedure

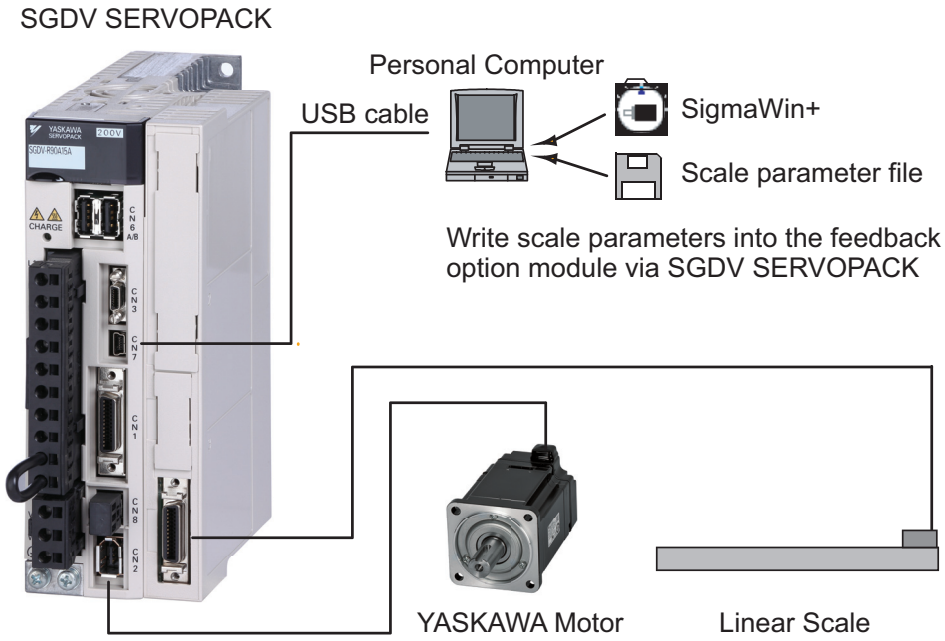
Follow the procedures and instructions provided in this manual and the following user's manuals for trial operation:

- Sigma-5 series User's Manual Setup Rotational Motor (SIEP S800000 43),
- Sigma-5 series User's Manual Setup Linear Motor (SIEP S800000 44),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor Analog Voltage and Pulse Train Reference (SIEP S800000 45),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor MECHATROLINK-II Communications Reference (SIEP S800000 46),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor Analog Voltage and Pulse Train Reference (SIEP S800000 47),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor MECHATROLINK-II Communications Reference (SIEP S800000 48),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor MECHATROLINK-III Communications Reference (SIEP S800000 64),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor MECHATROLINK-III Communications Reference (SIEP S800000 65),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor Command Option Attachable Type (SIEP S800000 60)
- Sigma-5 series User's Manual Design and Maintenance Linear Motor Command Option Attachable Type (SIEP S800000 66)

No.	Items	Description	Remarks
1	Connections	Make sure that the cables are correctly connected.	Refer to the manuals above
2	Power supply	Turn ON the control power supply.	
3	Sigma-5 SERVOPACK Set-up	Set Sigma-5 parameters correctly in accordance with the usage.	Refer to the manuals above and 7.2.2 Sigma-5 SERVOPACK Set-up for Fully-Closed Loop Control 7-8
4	Feedback Option Module Set-up	Write the scale parameters into the module.	Refer to 7.2.1 Feedback Option Module Set-up for Fully-closed Loop Control 7-3
5	Power supply again	Turn OFF the control power supply, and then turn ON the control and the main power supply.	

7.2.1 Feedback Option Module Set-up for Fully-closed Loop Control

The scale parameters must be written into the module via the SERVOPACK using the SigmaWin+ software engineering tool.



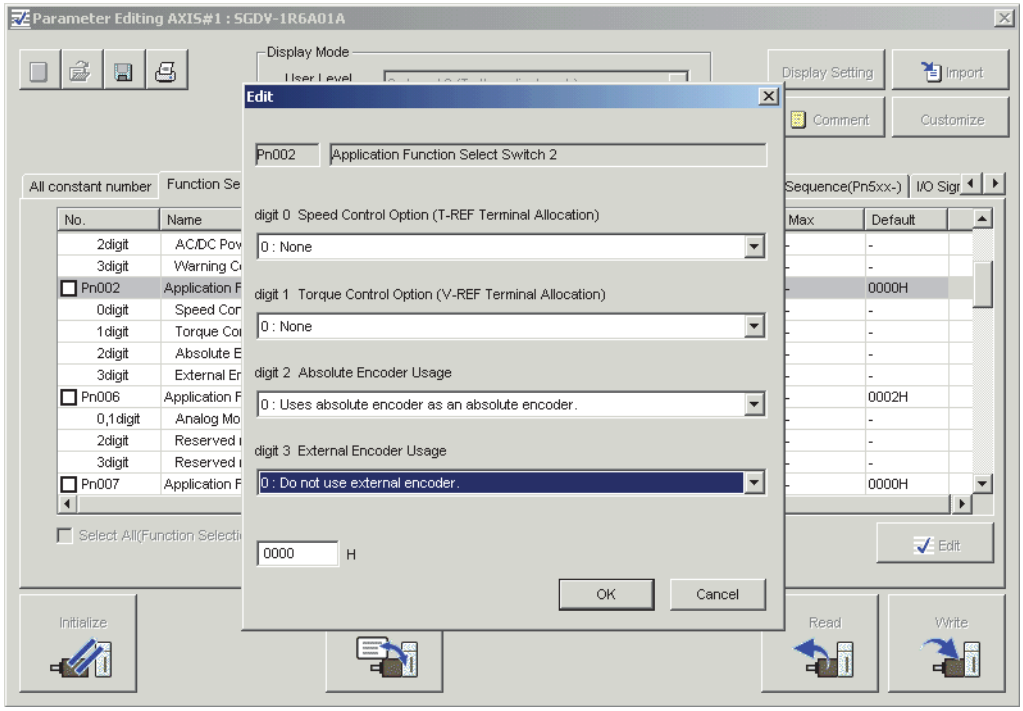
Note: This feature is available in SigmaWin+ Version 5.6.1 and later.

(1) Set-up Procedure for Encoder File

1. Install a motor, scale and SERVOPACK.
2. In SigmaWin+ select “Parameters > Parameter edit”.
   Set parameter Pn002.3 = 1 or 3.
3. Start “Setup > Motor parameter scale write” in SigmaWin+.
4. Write the parameters of the motor parameter file to the scale.

Note: Refer to SigmaWin+ Operation Manual for information on how to write parameters using SigmaWin+.

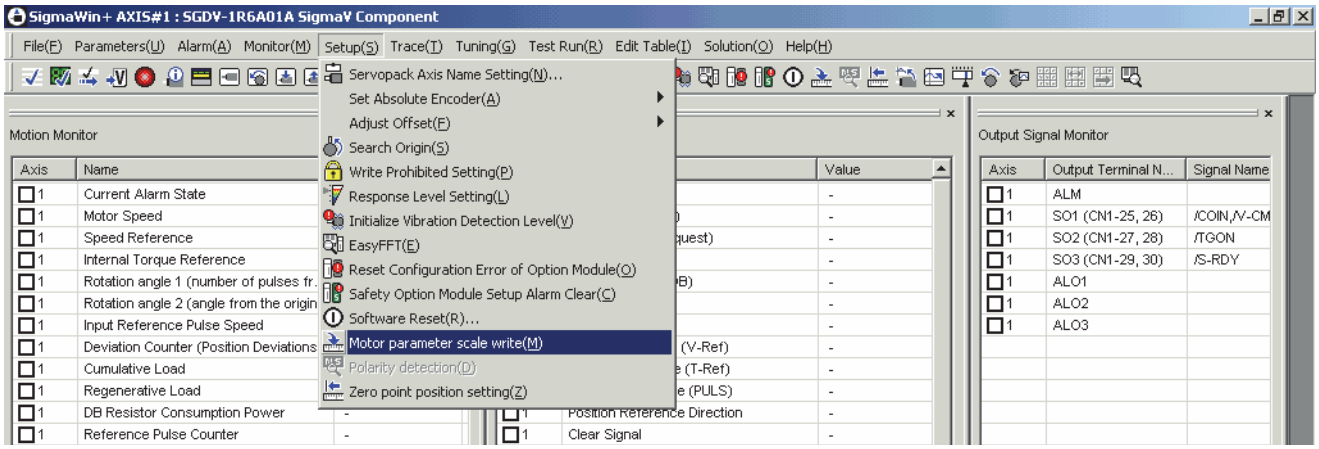
For *Fully-closed Loop* operation, the parameters have to be set as follows:



Pn002.3 = 1 or 3
Pn00B.3 = 0

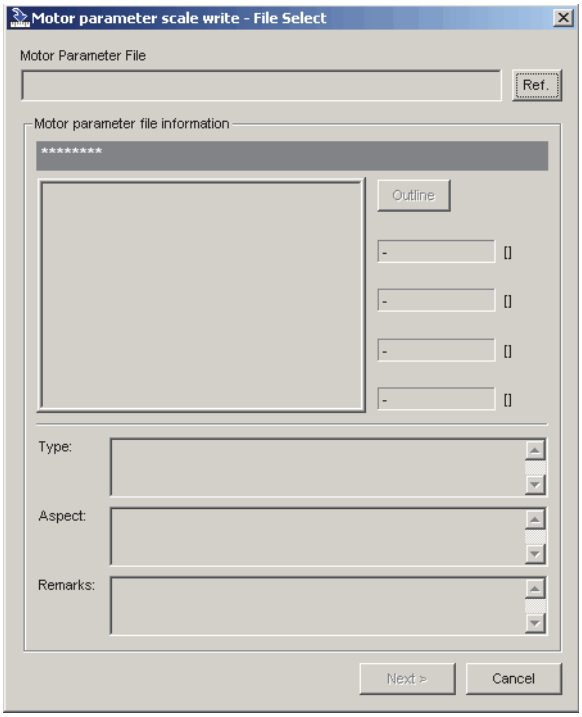
(2) Write Parameters using SigmaWin+

1. In SigmaWin+ select “Setup > Motor parameter scale write”.

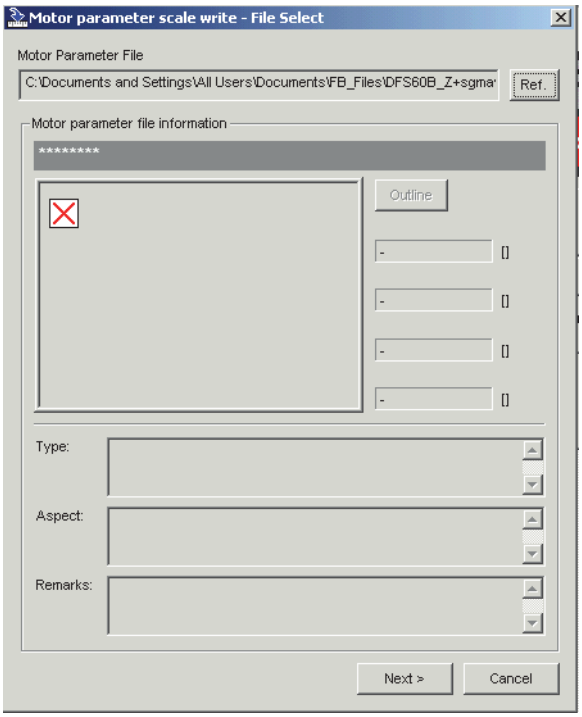


2. If you are sure the settings suit the connected motor, confirm the warning with “OK”. Clicking “Cancel” to return to the main window without writing motor parameters to the scale.
After clicking “OK”, the SERVOPACK starts reading the parameter information from the scale.

3. Click “Ref.” to open the motor parameter file.



4. Select the parameter file provided by YASKAWA and click “Open”. The scale parameter file information is displayed.



5. Make sure that the scale parameter file information of the installed encoder is displayed.

6. Click “Next” to prepare writing the scale parameters.

7. If all scale parameter file information is correct, click “Write” to start writing the scale parameters.
If the scale parameter file information is not correct, click “Back” to select another scale parameter file or click “Cancel” to return to the main window without writing scale parameters to the scale.

8. Confirm the message with “Yes” to start the writing process.
Click “No” to cancel writing.

9. If the scale parameters were transferred successfully, click “Complete”.
If a data transmission error occurred, a message is displayed asking to select the next step.
Click “OK” to execute the selected step.

10. Confirm the message box with “OK”.
Turn power OFF and ON again to validate the written data.

(3) Precautions

If the scale parameters have not been written in the module, A.CA0 (Encoder Parameter Error) will occur when the power in turned ON. Monitor the scale data using the monitoring function to see if the scale parameters are saved in the module. If they are not saved, write the scale parameters and then turn the power OFF and then ON again to monitor the scale data.

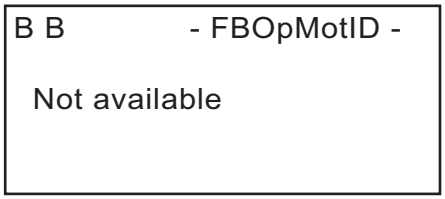
If the proper scale parameters have not been written, the following alarms will occur when the power is turned ON:

A.8A0 (External Encoder Error), A.8A1 (External Encoder Error of Module),
A.8A2 (External Encoder Error of Sensor), A.8A3 (Extern Encoder Error of Position)

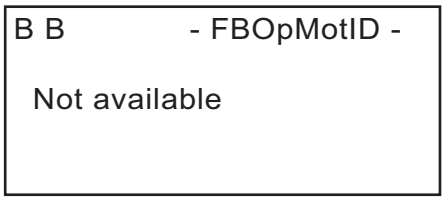
(4) How to Monitor the Scale Data Using the Digital Operator

Step	Display Example	Description
1	B B - FUNCTION - Fn01E:SvMotOp ID Fn01F:FBOpMot ID Fn020:S-Orig Set Fn030:Soft Reset	Press the MODESET Key to open the Utility Function Mode main menu. and select Fn01F using ∧ or ∨ key.
3	Encoder Type/Resolution Encoder Type B B - FBOpMotID - Encoder UTTAH-U11DB Serial No. 11 bit - INC	Press the DATA key, and the encoder ID will be shown. Use the < and > Keys to scroll left and right through the information.
5	B B - FUNCTION - Fn01E:SvMotOp ID Fn01F:FBOpMot ID Fn020:S-Orig Set Fn030:Soft Reset	Press the MODESET Key. The display returns to the Utility Functions Mode main menu.

Note: If a feedback option card is not connected, the following message will appear.



Even if a feedback option card is connected, the following message will appear if the option card contains no motor data or encoder data.



- When using SigmaWin+
  Start SigmaWin+. Click *Monitor* in the main menu and then click *Product Information*.

Note: The linear scale pitch can be checked by using the monitor mode parameters Un084 (Linear Scale Pitch) and Un085 (Linear Scale Pitch Index).

- Example
  When Un084 = 800, and Un085 = 6
  Linear scale pitch = Un084 × 10^{Un085} [pm] = 800 × 10^{6} [pm] = 800 [μm]

7.2.2 Sigma-5 SERVOPACK Set-up for Fully-Closed Loop Control

According to applications, these parameters should be set for the correct operation of Sigma-5 with the option modules. The detailed usage for each parameter is shown in section 7.2.2 Sigma-5 SERVOPACK Set-up for Fully-Closed Loop Control 7-8.

Parameter		Function		Default Value	Required value	Cat.	When enabled
No.	Dig.						
Pn000		Basic Function Select Switch 0		-	-	-	-
	0	Direction Selection		0	*1	O	After restart
		0	Forward command for forward direction				
		1	Forward command for reverse direction				
Pn002		Application Function Select Switch 2		-	-	-	-
	2	Absolute Encoder Usage		0	*1	O	After restart
		0	Uses absolute encoder as an absolute encoder				
		1	Uses absolute encoder as an incremental encoder				
	3	External Encoder Usage		0	1 or 3	M	After restart
		0	Do not use external encoder				
		1	Uses external encoder in forward rotation/ movement direction				
		2	Reserved (Do not change.)				
		3	Uses external encoder in reversed rotation/ movement direction				
		4	Reserved (Do not change.)				
Pn00B		Application Function Select Switch B		-	-	-	-
	3	Feedback Option Module Usage		0	0	M	After restart
		0	Uses for external encoder feedback				
		1	Uses for motor encoder feedback				
Pn081		Application Function Select Switch 81		-	-	-	-
	1	Encoder Pulse Output Usage		0	*1	O	After restart
		0	Enables the pulse output function (Pn281)				
		1	Disables the pulse output function				
Pn20A		Number of External Encoder Period		32768	*1	M	After restart
Pn281		Encoder Output pulses [Pulse edge/Period]		20	*1	O	After restart

*1 these settings are dependent on the applications

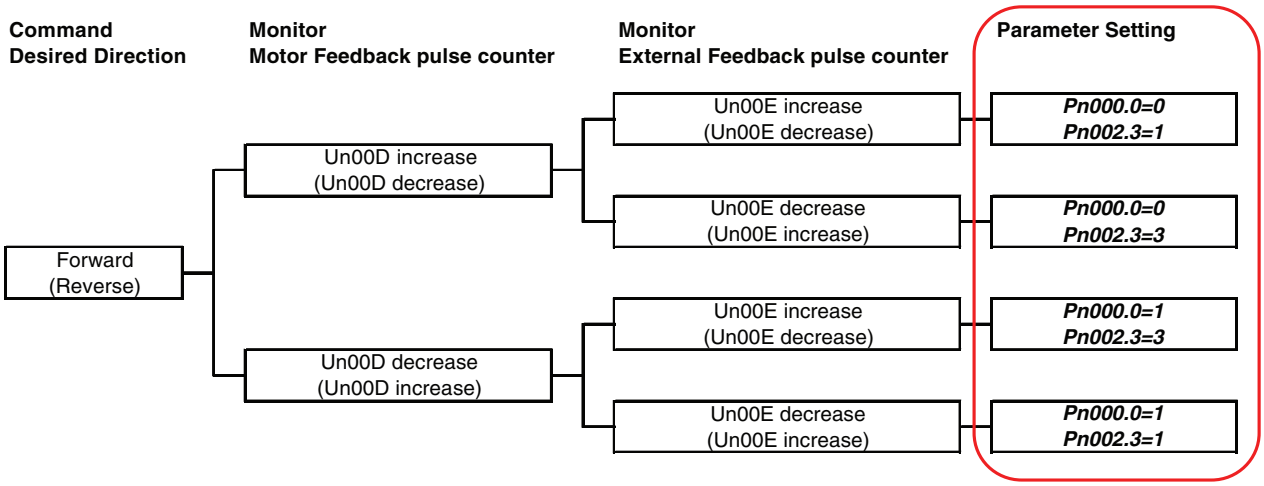
7.3 SERVOPACK for Fully-closed Loop Control

7.3.1 Rotation/Movement Direction

The relationship between motor feedback direction and external feedback direction is dependent on the mounted conditions. So, the parameters below are used for the coordination.

Parameter No.	Parameter Dig.	Function		Default Value	When enabled
Pn000		Basic Function Select Switch 0		-	-
	0	Direction Selection		0	After restart
		0	Forward command for forward direction		
		1	Forward command for reverse direction		
Pn002		Application Function Select Switch 2		-	-
	3	External Encoder Usage		0	After restart
		0	Do not use external encoder		
		1	Uses external encoder in forward rotation direction		
		2	Reserved (Do not change.)		
		3	Uses external encoder in reversed rotation direction		
		4	Reserved (Do not change.)		

Parameter Setting



Note) Please set surely Pn000.0 and Pn002.3 by the situation above. Otherwise, the motor-load position error overflow alarm (A.D10) occurs.

7.3.2 External Encoder Resolution to Motor Feedback

The relationship between motor feedback position and external feedback position is dependent on the mounted encoder specifications. So, the parameter below is used for the coordination. This parameter indicates the number of external encoder period per motor rotation.

Parameter	Function	Default Value	When enabled
Pn20A	Number of External Encoder Period	32768	After restart

Note)

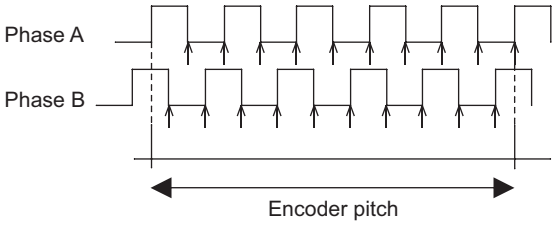
1. If there is a fraction, it is necessary to round off the decimal point.
2. If the number of external encoder period per motor rotation is not an integer, there is some error in the speed loop. However, this is not relevant for the position loop. Therefore it does not interfere with the position accuracy.

7.3.3 Encoder Pulse Output (PAO, PBO, and PCO)

Set the position resolution to Pn281. Set the number of phase A and phase B edges.

(1) Setting Example

Specifications
External encoder pitch: 20 μm
Ball screw lead: 30 mm
Speed: 1600 mm/s



"↑" shows the edge position. In this example, the set value is 20 therefore the number of ↑ is 20.

Note: The upper limit of the encoder signal output frequency (multiplied by 4) is 6.4 Mpps. Do not set a value that would cause the output to exceed 6.4 Mpps. If the output exceeds the upper limit, the overspeed of encoder output pulse rate alarm (A.511) will be output.
Example: The frequency is as follows if the set value is 20 and the speed is 1600 mm/s:

$$\frac{1600\ \text{mm/s}}{0.001\ \text{mm}} = 1600000 = 1.6\ \text{Mpps}$$

Because 1.6 Mpps is less than 6.4 Mpps, this value can be used.

These parameters are used for position counting by upper controller. Sigma-5 SERVOPACK outputs the pulse according to the settings.
If the application does not use this encoder pulse output (e.g. network application), the functionality can be disabled by the parameter Pn081.1=1.
Important: C-pulse synchronizes to the edge of A/B-pulse.

Parameter		Function		Default Value	When enabled
No.	Dig.				
Pn081		Application Function Select Switch 81		-	-
	1	Encoder Pulse Output Usage		0	After restart
		0	Enables the pulse output function (Pn281)		
		1	Disables the pulse output function		
Pn281		Encoder Output pulses [Pulse edge/Period]		20	After restart

8

Set-up Procedure for Semi-closed Loop Control

This chapter describes the setup procedure for semi-closed loop control of the Universal Feedback Option Module.

8.1 Safety Precautions 8-2

8.2 Setup Procedure 8-2

8.2.1 Feedback Option Module Set-up 8-3

8.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor 8-9

8.2.3 Sigma-5 SERVOPACK Set-up with Linear Motor 8-10

8.1 Safety Precautions

These set-ups shall be done in accordance with described procedures.
And, they shall be done when the system configurations and components are changed.

Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury.

8.2 Setup Procedure

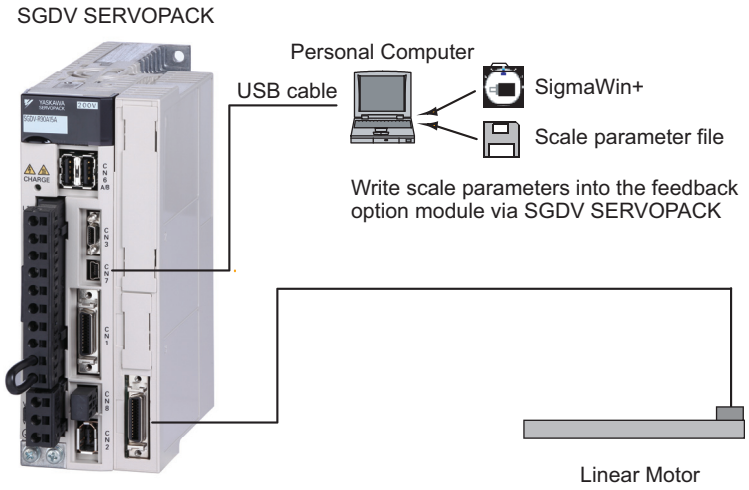
Follow the procedures and instructions provided in this manual and the following user's manuals for trial operation:

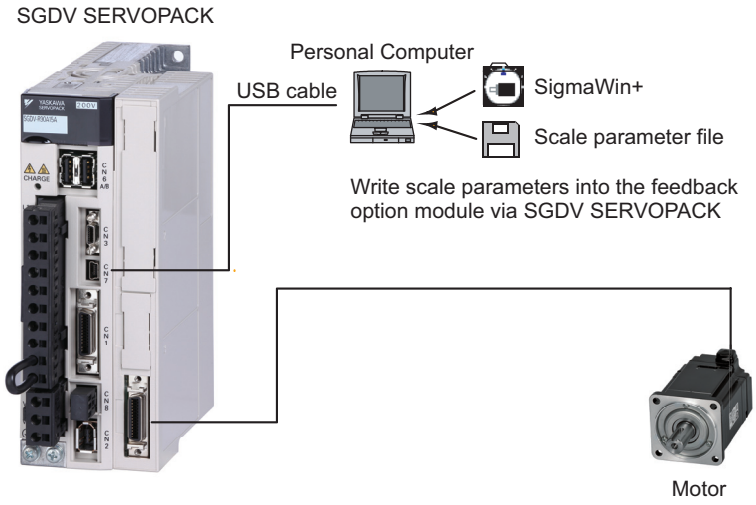
- Sigma-5 series User's Manual Setup Rotational Motor (SIEP S800000 43),
- Sigma-5 series User's Manual Setup Linear Motor (SIEP S800000 44),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor Analog Voltage and Pulse Train Reference (SIEP S800000 45),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor MECHATROLINK-II Communications Reference (SIEP S800000 46),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor Analog Voltage and Pulse Train Reference (SIEP S800000 47),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor MECHATROLINK-II Communications Reference (SIEP S800000 48),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor MECHATROLINK-III Communications Reference (SIEP S800000 64),
- Sigma-5 series User's Manual Design and Maintenance Linear Motor MECHATROLINK-III Communications Reference (SIEP S800000 65),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor Command Option Attachable Type (SIEP S800000 60)
- Sigma-5 series User's Manual Design and Maintenance Linear Motor Command Option Attachable Type (SIEP S800000 66)

No.	Items	Description	Remarks
1	Connections	Make sure that the cables are correctly connected.	Refer to the manuals above
2	Power supply	Turn ON the control power supply.	
3	Sigma-5 SERVOPACK Set-up	Set Sigma-5 parameters correctly in accordance with the usage.	Refer to the manuals above and 8.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor 8-9 and 8.2.3 Sigma-5 SERVOPACK Set-up with Linear Motor 8-10
4	Feedback Option Module Set-up	Write the scale parameters into the module.	Refer to 8.2.1 Feedback Option Module Set-up 8-3
5	Power Supply again	Turn OFF the control power supply, and then turn ON the control and the main power supply.	
6	Motor Pole Detection Execution	Execute pole detection function.	Refer to the manuals above
7	Power Supply again (only absolute encoder scale)	Turn OFF the control power supply, and then turn ON the control and the main power supply.	

8.2.1 Feedback Option Module Set-up

The scale parameters must be written into the module via the SERVOPACK using the SigmaWin+ software engineering tool.





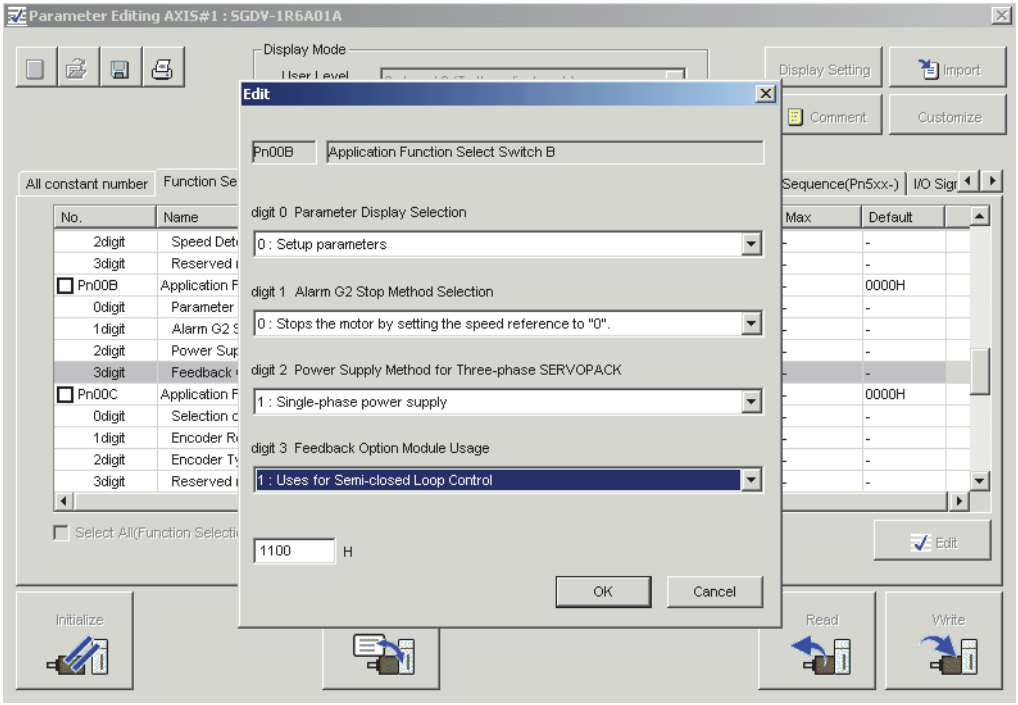
Note: This feature is available in SigmaWin+ Version 5.6.1 and later.

(1) Set-up Procedure

1. Install a motor, scale and SERVOPACK.
2. Request the motor parameter file of the installed motor from YASKAWA Europe GmbH.
3. In SigmaWin+ select “Parameters > Parameter edit”.
   Set parameter Pn00B.3 = 1.
4. Start “Setup > Motor parameter scale write” in SigmaWin+.
5. Write the parameters of the motor parameter file to the scale.

Note: Refer to SigmaWin+ Operation Manual for information on how to write parameters using SigmaWin+.

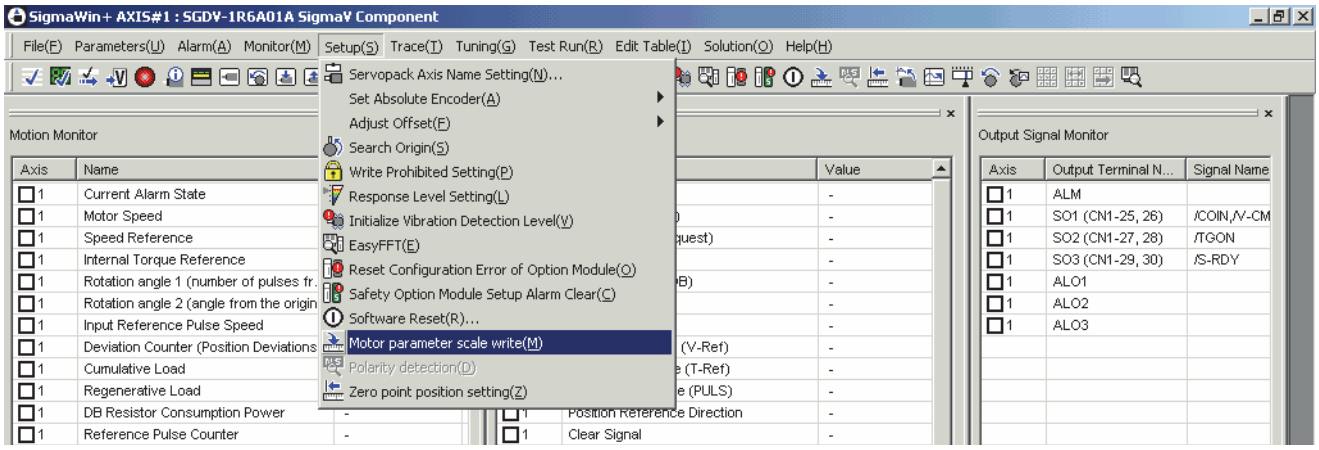
For *Semi-closed Loop* operation, the parameters have to be set as follows:



Pn002.3 = 1
Pn00B.3 = 1

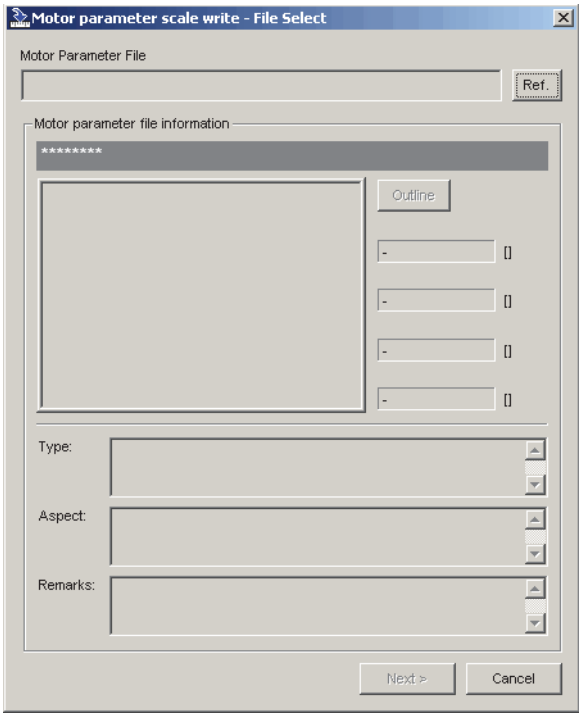
(2) Write Parameters using SigmaWin+

1. In SigmaWin+ select “Setup > Motor parameter scale write”.

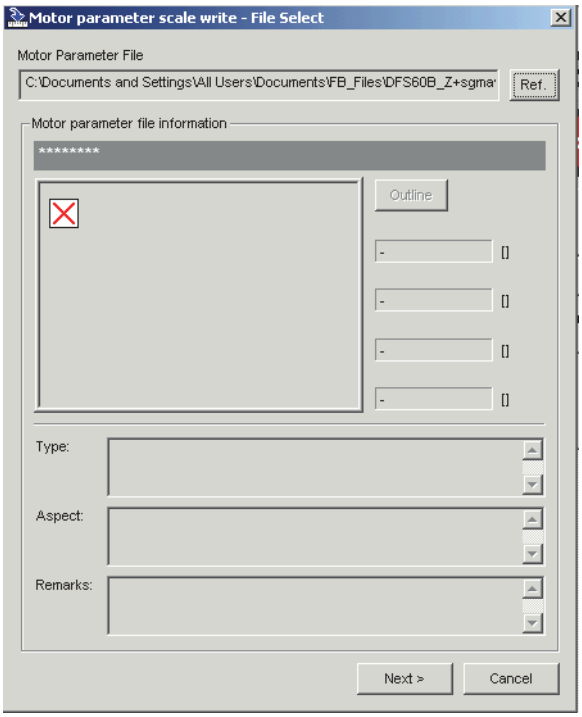


2. If you are sure the settings suit the connected motor, confirm the warning with “OK”. Clicking “Cancel” to return to the main window without writing motor parameters to the scale.
After clicking “OK”, the SERVOPACK starts reading the parameter information from the scale.

3. Click “Ref.” to open the motor parameter file.



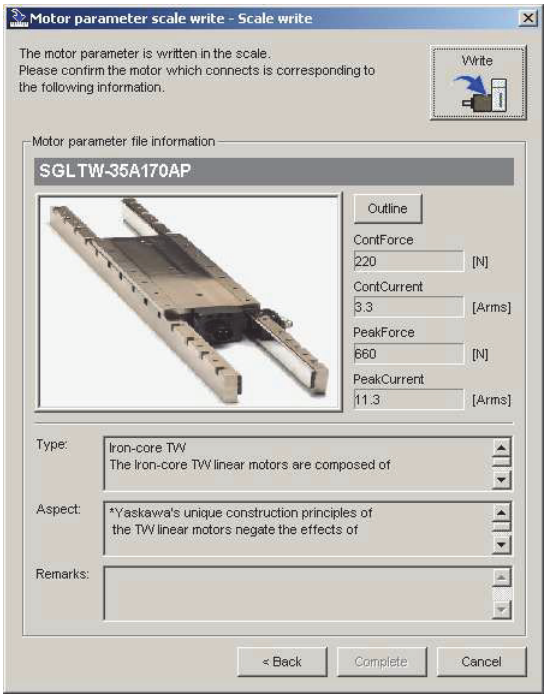
4. Select the parameter file provided by YASKAWA and click “Open”. The motor parameter file information is displayed.



5. Make sure that the motor parameter file information of the installed motor is displayed.

6. Click “Next” to prepare writing the motor parameters.

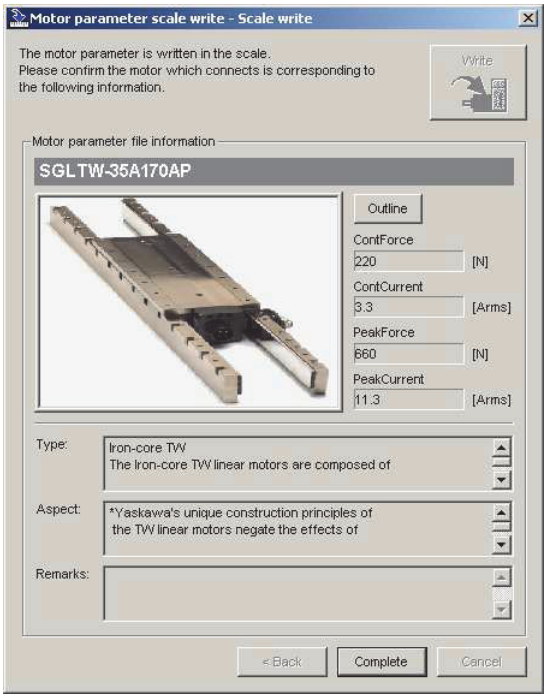
7. If all motor parameter file information is correct, click “Write” to start writing the motor parameters.



If the motor parameter file information is not correct, click “Back” to select another motor parameter file or click “Cancel” to return to the main window without writing motor parameters to the scale.

8. Confirm the message with “Yes” to start the writing process.
Click “No” to cancel writing.

9. If the motor parameters were transferred successfully, click “Complete”.



If a data transmission error occurred, a message is displayed asking to select the next step. Click “OK” to execute the selected step.

10. Confirm the message box with “OK”.
Turn power OFF and ON again to validate the written data.

(3) Precautions

If the scale parameters have not been written in the module, A.CA0 (Encoder Parameter Error) will occur when the power in turned ON. Monitor the scale data using the monitoring function to see if the scale parameters are saved in the module. If they are not saved, write the scale parameters and then turn the power OFF and then ON again to monitor the scale data.

If the proper scale parameters have not been written, the following alarms will occur when the power is turned ON:

A.8A0 (External Encoder Error), A.8A1 (External Encoder Error of Module),
A.8A2 (External Encoder Error of Sensor), A.8A3 (Extern Encoder Error of Position)

(4) How to Monitor the Scale Data Using the Digital Operator

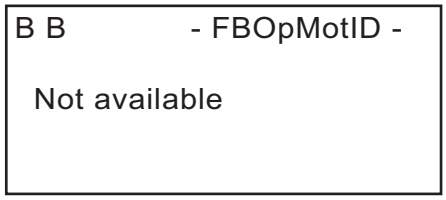
Step	Display Example	Description
1	B B - FUNCTION - Fn01E:SvMotOp ID Fn01F:FBOpMot ID Fn020:S-Orig Set Fn030:Soft Reset	Press the MODESET Key to open the Utility Function Mode main menu. and select Fn01F using ∧ or ∨ key.
3	Encoder Type/Resolution Encoder Type B B - FBOpMotID - Encoder UTTAH-U11DB Serial No. 11 bit - INC	Press the DATA key, and the encoder ID will be shown. Use the < and > Keys to scroll left and right through the information.
5	B B - FUNCTION - Fn01E:SvMotOp ID Fn01F:FBOpMot ID Fn020:S-Orig Set Fn030:Soft Reset	Press the MODESET Key. The display returns to the Utility Functions Mode main menu.

Note: If a feedback option card is not connected, the following message will appear.

B B - FBOpMotID -

Not available

Even if a feedback option card is connected, the following message will appear if the option card contains no motor data or encoder data.



• When using SigmaWin+
Start SigmaWin+. Click *Monitor* in the main menu and then click *Product Information*.

Note: The linear scale pitch can be checked by using the monitor mode parameters Un084 (Linear Scale Pitch) and Un085 (Linear Scale Pitch Index).

• Example
When Un084 = 800, and Un085 = 6
Linear scale pitch = Un084 × 10^{Un085} [pm] = 800 × 10^{6} [pm] = 800 [μm]

8.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor

According to applications, these parameters should be set for the correct operation of Sigma-5 with the option modules.

Parameter No.	Parameter Dig.	Function		Default Value	Required value	Cat.	When enabled
Pn000		Basic Function Select Switch 0		-	-	-	-
	0	Direction Selection		0	*1	O	After restart
		0	Forward command for forward direction				
		1	Forward command for reverse direction				
Pn002		Application Function Select Switch 2		-	-	-	-
	2	Absolute Encoder Usage		0	*1	O	After restart
		0	Uses absolute encoder as an absolute encoder				
		1	Uses absolute encoder as an incremental encoder				
	3	External Encoder Usage		0	0	M	After restart
		0	Do not use external encoder				
		1	Uses external encoder in forward rotation direction				
		2	Reserved (Do not change.)				
		3	Uses external encoder in reversed rotation direction				
		4	Reserved (Do not change.)				
Pn00B		Application Function Select Switch B		-	-	-	-
	3	Feedback Option Module Usage		0	*1	M	After restart
		0	Used for external encoder feedback				
		1	Used for motor encoder feedback				
Pn080		Application Function Select Switch B		-	-	-	-
	0	Hall Sensor Selection		0	*1	O	After restart
		0	Enables hall sensor				
		1	Disables hall sensor				
	1	Motor Phase Selection		0	*1	O	After restart
		0	Sets positive position feedback as phase sequence of U, V, W				
		1	Sets negative position feedback as phase sequence of U, V, W				
Pn081		Application Function Select Switch 81		-	-	-	-
	1	Encoder Pulse Output Usage		0	*1	O	After restart
		0	Enables the pulse output function (Pn281)				
		1	Disables the pulse output function				
	2	Coordination Setting between Origin and U-phase position		0	*2	O	After restart
		0	Both positions are same				
		1	The positions are different				
	3	Hall Sensor Signal Inversion		0	*1	O	After restart
		0	Does not inverse the signals (Pos-Logic)				
		1	Inverses the signals (Neg-Logic)				
Pn212		Encoder Output pulses [Pulse/Rev]		2048	*1	O	After restart
Pn481		Polarity Detection Speed Loop Gain [0.1 Hz]		40.0	*1	O	Immediately

Parameter		Function		Default Value	Required value	Cat.	When enabled
No.	Dig.						
Pn482		Polarity Detection Speed Loop Integral Time [0.01 msec]		30.00	*1	O	Immediately
Pn486		Polarity Detection Command Accel/Decel Time [msec]		25	*1	O	Immediately
Pn487		Polarity Detection Constant Speed Time [msec]		0	*1	O	Immediately
Pn488		Polarity Detection Command Waiting Time [msec]		100	*1	O	Immediately
Pn490		Polarity Detection Load Level [%]		100	*1	O	Immediately
Pn493		Polarity Detection Command Speed [min^{-1}]		50	*1	O	Immediately
Pn494		Polarity Detection Range [0.001 rev]		0.250	*1	O	Immediately
Pn495		Polarity Detection Confirmation Torque Command [%]		100	*1	O	Immediately
Pn498		Polarity Detection Allowable Error Range [deg.]		10	*1	O	Immediately
Pn587		Polarity Detection for Absolute Scale Selection		-	-	-	Immediately
	0	0	Does not detect polarity	0	*1	O	Immediately
		1	Detects polarity				

*1 these settings are dependent on the applications

*2 in case of Pn080.0=1 (Disables hall sensor), the setting is not required

*3 this is only required when using Sigma-1 motors

8.2.3 Sigma-5 SERVOPACK Set-up with Linear Motor

According to applications, these parameters should be set for the correct operation of Sigma-5 with the option modules.

Parameter		Function		Default Value	Required value	Cat.	When enabled
No.	Dig.						
Pn000		Basic Function Select Switch 0		-	-	-	-
	0	Direction Selection		0	*1	O	After restart
		0	Forward command for forward direction				
		1	Forward command for reverse direction				
Pn002		Application Function Select Switch 2		-	-	-	-
	2	Absolute Encoder Usage		0	*1	O	After restart
		0	Uses absolute encoder as an absolute encoder				
		1	Uses absolute encoder as an incremental encoder				
Pn00B		Application Function Select Switch B		-	-	-	-
	3	Feedback Option Module Usage		0	*1	M	After restart
		0	Uses CN2 for external encoder feedback				
		1	Uses FB option for motor encoder feedback				

Parameter		Function		Default Value	Required value	Cat.	When enabled
No.	Dig.						
Pn080		Application Function Select Switch B		-	-	-	-
	0	Hall Sensor Selection		0	*1	O	After restart
		0	Enables hall sensor				
		1	Disables hall sensor				
	1	Motor Phase Selection		0	*1	O	After restart
		0	Sets positive position feedback as phase sequence of U, V, W				
		1	Sets negative position feedback as phase sequence of U, V, W				
Pn081		Application Function Select Switch 81		-	-	-	-
	1	Encoder Pulse Output Usage		0	*1	O	After restart
		0	Enables the pulse output function (Pn281)				
		1	Disables the pulse output function				
	3	Hall Sensor Signal Inversion		0	*1	O	After restart
		0	Does not inverse the signals (Pos-Logic)				
		1	Inverses the signals (Neg-Logic)				
Pn281		Encoder Output pulses [Pulse edge/Period]		20	*1	O	After restart
Pn481		Polarity Detection Speed Loop Gain [0.1 Hz]		40.0	*1	O	Immediately
Pn482		Polarity Detection Speed Loop Integral Time [0.01 msec]		30.00	*1	O	Immediately
Pn485		Polarity Detection Command Speed [mm/sec]		20	*1	O	Immediately
Pn486		Polarity Detection Command Accel/Decel Time [msec]		25	*1	O	Immediately
Pn487		Polarity Detection Constant Speed Time [msec]		0	*1	O	Immediately
Pn488		Polarity Detection Command Waiting Time [msec]		100	*1	O	Immediately
Pn48E		Polarity Detection Range [mm]		10	*1	O	Immediately
Pn490		Polarity Detection Load Level [%]		100	*1	O	Immediately
Pn495		Polarity Detection Confirmation Torque Command [%]		100	*1	O	Immediately
Pn498		Polarity Detection Allowable Error Range [deg.]		10	*1	O	Immediately
Pn587		Polarity Detection for Absolute Scale Selection		-	-	-	Immediately
	0	0	Does not detect polarity	0	*1	O	Immediately
		1	Detects polarity				

*1 these settings are dependent on the applications

9

Motor and Scale Parameter File

This chapter describes the motor and scale parameter file for rotary and linear motors of the Universal Feedback Option Module.

9.1 Motor and Scale Parameter File Requirements for SERVOPACKs for Rotary Motors 9-2
9.1.1 Motor Parameters 9-2
9.1.2 Scale Parameters 9-3
9.2 Motor and Scale Parameter File Requirements for SERVOPACKs for Linear Motors 9-4
9.2.1 Motor Parameters 9-4
9.2.2 Scale Parameters 9-5

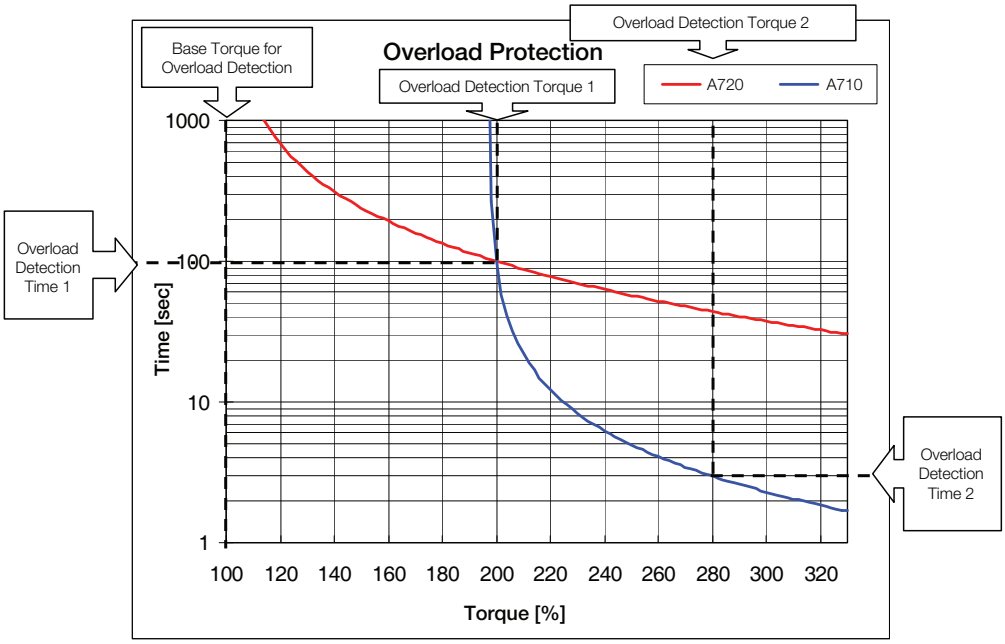
9.1 Motor and Scale Parameter File Requirements for SERVOPACKs for Rotary Motors

If a 3rd party motor shall be operated, then a motor parameter file has to be created by Yaskawa. To create this file, provide Yaskawa with the following information: motor data and a sample motor for checking the overload characteristics. Send these information to the YASKAWA Europe Headquarter, please find the address on the last cover page.

9.1.1 Motor Parameters

	Description	Unit	Category*	Remarks
Characteristics	Motor voltage	V	M	
	Rated capacity	W	M	
	Rated torque	Nm	M	
	Maximum torque	Nm	M	
	Rated current	A_{rms}	M	
	Maximum current	A_{rms}	M	
	Rated speed	min^{-1}	M	
	Maximum speed	min^{-1}	M	
	Moment of inertia	kgm^2	M	
	Winding resistance (per phase)	Ω	M	
	Winding inductance (per phase)	mH	M	
	Electromotive force (per phase)	V_{rms}/min^{-1}	M	
	Motor pole number	-	M	
	Resonance frequency	Hz	O	Cancel resonance frequency by motor itself
Overload protection	Base torque for overload detection	%	M	
	Overload detection torque 1	%	M	
	Overload detection time 1	sec	M	
	Overload detection torque 2	%	O	
	Overload detection time 2	sec	O	
Over-speed protection	Over-speed detection level	%	O	

* M: Mandatory, O: Optional



9.1.2 Scale Parameters

	Description	Unit	Category*	Remarks
Characteristics	Periods in 1-turn (per revolution)	Periods	M	

* M: Mandatory, O: Optional

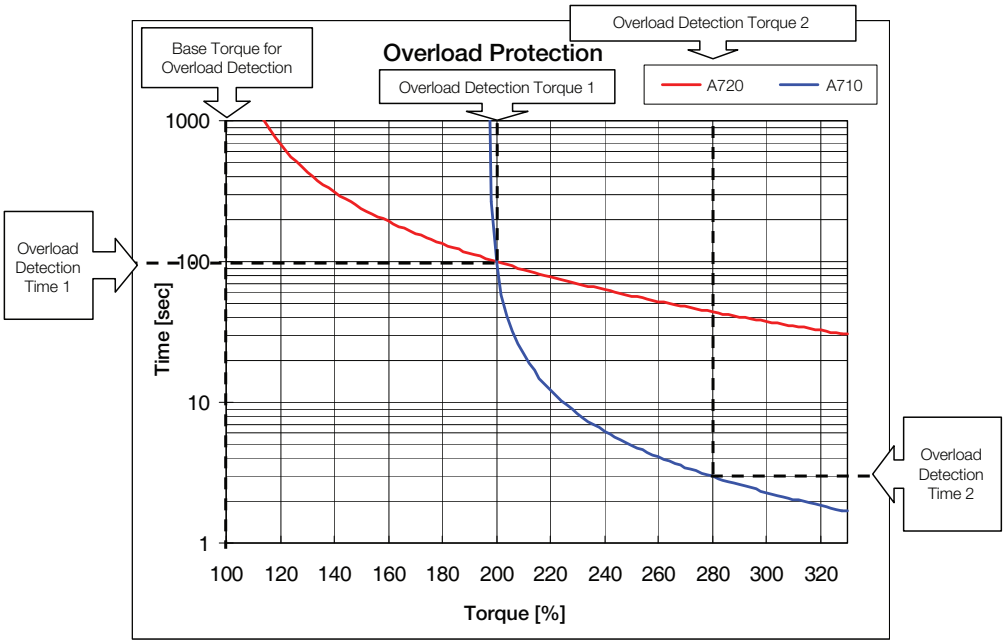
9.2 Motor and Scale Parameter File Requirements for SERVOPACKs for Linear Motors

If a 3rd party motor shall be operated, then a motor parameter file has to be created by Yaskawa. To create this file, provide Yaskawa with the following information: motor data and a sample motor for checking the overload characteristics. Send these information to the YASKAWA Europe Headquarter, please find the address on the last cover page.

9.2.1 Motor Parameters

	Description	Unit	Category*	Remarks
Characteristics	Motor voltage	V	M	
	Rated capacity	W	M	
	Rated force	N	M	
	Maximum force	N	M	
	Rated current	A_{rms}	M	
	Maximum current	A_{rms}	M	
	Rated velocity	m/s	M	
	Maximum velocity	m/s	M	
	Mass	kg	M	
	Winding resistance (per phase)	Ω	M	
	Winding inductance (per phase)	mH	M	
	Electromotive force (per phase)	V_{rms}/(m/s)	M	
	Pole pitch (per 180 degree)	mm^{-1}	M	
	Resonance frequency	Hz	O	Cancel resonance frequency by motor itself
	Hall sensor offset	deg	O	The offset between hall sensor data and motor phase
Overload protection	Base torque for overload detection	%	M	
	Overload detection torque 1	%	M	
	Overload detection time 1	sec	M	
	Overload detection torque 2	%	O	
	Overload detection time 2	sec	O	
Over-speed protection	Over-speed detection level	%	O	

* M: Mandatory, O: Optional



9.2.2 Scale Parameters

	Description	Unit	Category*	Remarks
Characteristics	Scale type (incremental)	-	M	
	Scale pitch/Period length	nm	M	

* M: Mandatory, O: Optional

10

SERVOPACK with Semi-closed Loop Control for Rotary Motors

This chapter describes the rotary drives common in semi-closed loop.

10.1 Magnetic Pole 10-2

10.2 Motor Rotation Direction 10-3

10.3 Pole Detection Functionality 10-4

10.4 SERVOPACK for Rotary Motors 10-6

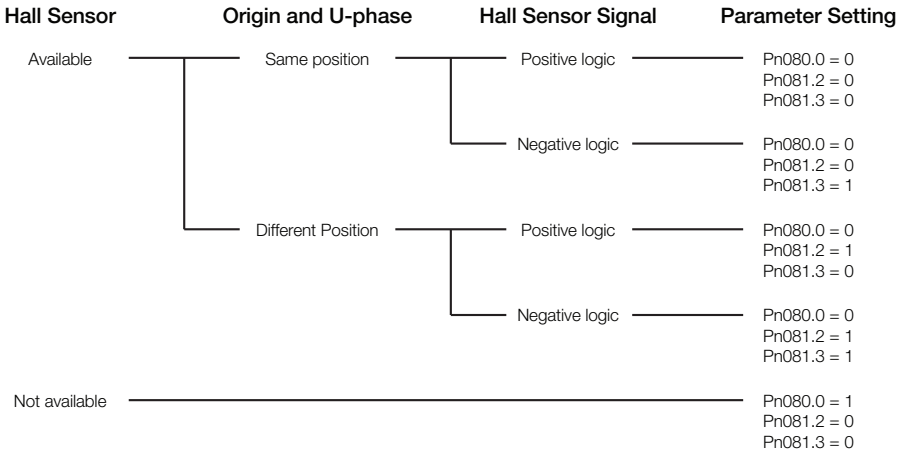
10.4.1 Encoder Pulse Output 10-6

10.1 Magnetic Pole

For driving third party motors and some Sigma-1 motors, the magnetic pole should be coordinated. The parameters in the following table are used for that.

Parameter		Function		Default Value	When enabled
No.	Dig.				
Pn080		Application Function Select Switch 80		-	-
	0	Hall Sensor Selection		0	After restart
		0	Enables hall sensor		
		1	Disables hall sensor		
Pn081		Application Function Select Switch 81		-	-
	2	Coordination Setting between Origin and U-phase position		0	After restart
		0	Both positions are same		
		1	The positions are different		
	3	Hall Sensor Signal Inversion		0	After restart
		0	Does not inverse the signals (Pos-Logic)		
		1	Inverses the signals (Neg-Logic)		

■ Parameter Setting



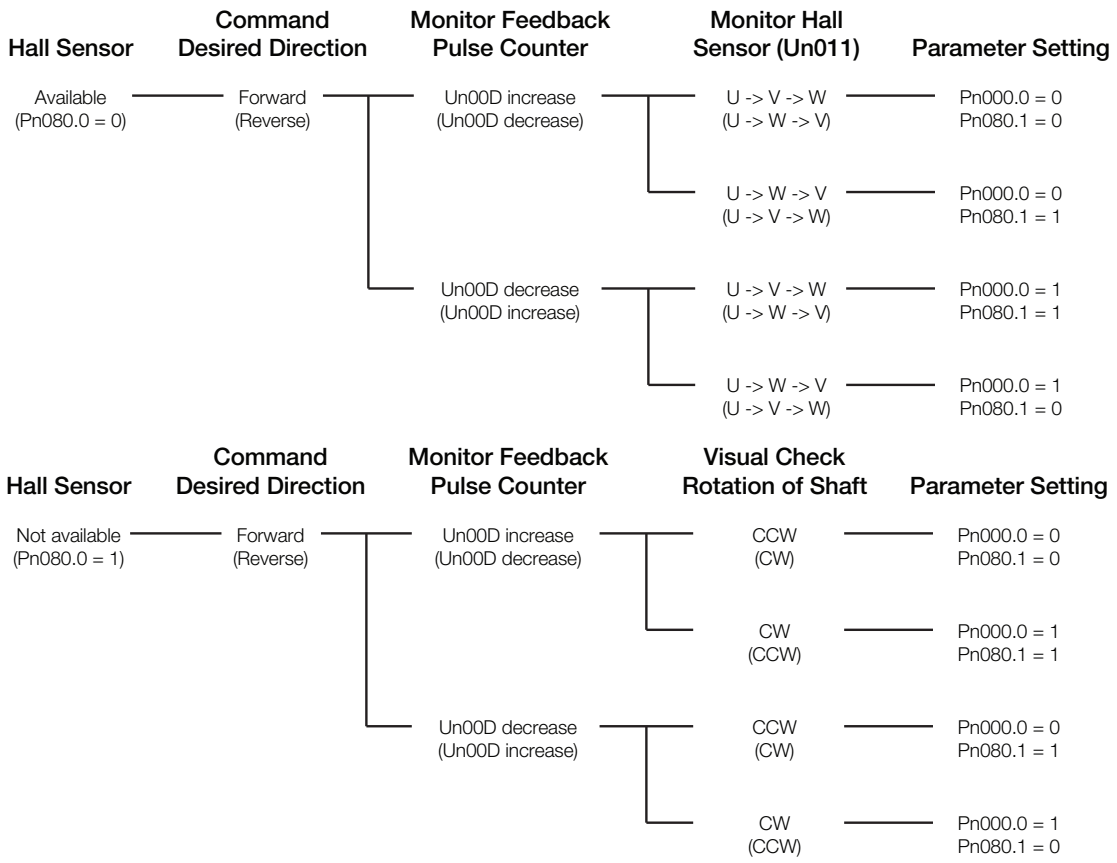
Note 1. If the relation between origin and U phase position is not sure, please set Pn081.2 to 1. Otherwise motor malfunction may occur.
2. In case the hall sensor is not available refer to chapter 10-4.

10.2 Motor Rotation Direction

The relationship between feedback position and motor magnetic pole position is dependent on the mounted conditions. So, the parameters below are used for the coordination.

Parameter No.	Parameter Dig.	Function		Default Value	When enabled
Pn000		Application Function Select Switch 0		-	-
	0	Direction Selection		0	After restart
		0	Forward command for counterclockwise rotation		
		1	Forward command for clockwise rotation		
Pn080		Application Function Select Switch 80		-	-
	1	Motor Phase Selection		0	After restart
		0	Sets positive position feedback as phase sequence of U, V, W		
		1	Sets negative position feedback as phase sequence of U, V, W		

■ Parameter Setting



Note: Please make sure Pn080.1 is set according the above diagram. Otherwise motor malfunction may occur.

10.3 Pole Detection Functionality

When using a rotary motor without hall sensor (except Sigma-1 motors), the pole detection should be executed. Make sure the following conditions are satisfied when executing the function.

1. There is no danger when the rotary motor moves approximately 1/4 turn. In case the function fails, the rotary motor may move approximately 1.5 turns.
2. The encoder resolution is 2000 pulses per revolution or more.
3. Minimum unequal external torque to the rotary motor (5% of the rated torque maximum is recommended).
4. The moment of inertia ratio is within 50 times.
5. On a horizontal axis.

Note 1. The rotary motor is turned ON during the function. Take measures to avoid electric shock.
2. The rotary motor will make large movements during detection. Take the machine's range of motion into consideration and do not stand near any moving parts.
3. The function depends on many factors such as inertia ratio and friction. If any error occurs because of one of these factors the function may fail.

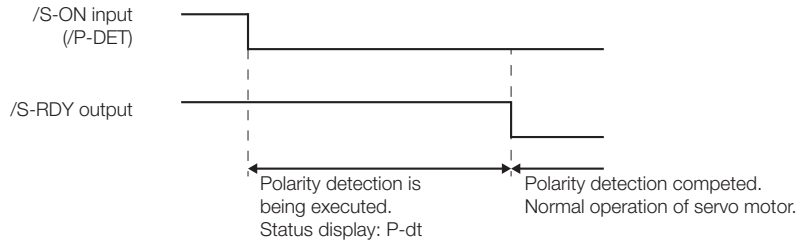
(1) Requirements that Enable the Function

The function is enabled by the following settings:

1. The parameter Pole Sensor Selection Pn080.0 is set to disable pole sensor Pn080.0 = 1.
2. The main power is supplied.
3. No alarms occur.
4. Hard wire base block is not active.
5. The parameter Writing Prohibited Setting Fn010 is not set to prohibit writing.
6. The SEN signal is turned ON in case of an absolute encoder.

(2) Execution of the Function with Analog Voltage and Pulse Train Model

■ Input Signal Through CN1 connector



■ Factory-set Input Signal Allocations (Pn50A.0 = 0)

If the factory settings are used to allocate the input signals (Pn50A.0 = 0), the function will start when the Servo On signal (/S-ON) is ON, and the Servo Ready signal (/S-RDY) will be ON after the function has been completed.

Type	Name	Connector Pin No.	Setting	Description
Input	/S-ON	CN1-40	ON	Motor power is ON. The function is executed only once then the motor will be ready for operation (/S-RDY signal is ON).
			OFF	Motor power is OFF.

■ Changing Input Signal Allocations (Pn50A.0 = 1)

The function signal (/P-DET) must be allocated under the following conditions:

- When designing a sequence for the host controller in which the Servo Ready signal is monitored and then the Servo ON signal is output.
- When using different timing for the execution of the function and sending the Servo ION signal.

After the function has been completed the motor power will turn OFF and the Servo Ready signal will turn ON. Then the function cannot be executed even if the /P-DET signal is turned ON and OFF. Then the control power is restored, the function must be executed again.

Type	Name	Connector Pin No.	Setting	Description
Input	/S-ON	CN1-40 [Factory setting]	ON	Motor power is ON. Motor will be ready for operation (/S-RDY signal is ON).
			OFF	Motor power is OFF.
	/P-DET	Must be allocated	ON	The function is executed only once then the signal turns ON for the first time.
			OFF	-

■ Utility Function: Pole Detection (Fn080)

This utility function is executed using Panel operator, Digital operator and SigmaWin+.

(3) Execution of the Function with MECHATROLINK and Network Option Model

■ Servo ON Command

Type	Name	Description
Servo ON	Incremental Encoder	The function is executed only once when the command is sent. Then, motor will be ready for operation.
	Absolute Encoder	In the Pn587.0 = 1 setting, the function is executed only once when the command is sent. Then, motor will be ready for operation.
Servo OFF	Motor power is OFF.	

■ Utility Function: Pole Detection (Fn080)

This utility function is executed using Panel operator, Digital operator and SigmaWin+.

(4) Related Parameters

Parameter No.	Parameter Dig.	Function		Default Value	When enabled
Pn481		Polarity Detection Speed Loop Gain [0.1 Hz]		40.0	Immediately
Pn482		Polarity Detection Speed Loop Integral Time [0.01 msec]		30.00	Immediately
Pn486		Polarity Detection Command Accel/Decel Time [msec]		25	Immediately
Pn487		Polarity Detection Constant Speed Time [msec]		0	Immediately
Pn488		Polarity Detection Command Waiting Time [msec]		100	Immediately
Pn490		Polarity Detection Load Level [%]		100	Immediately
Pn493		Polarity Detection Command Speed [min^{-1}]		50	Immediately
Pn494		Polarity Detection Range [0.001 rev]		0.250	Immediately
Pn495		Polarity Detection Confirmation Torque Command [%]		100	Immediately
Pn498		Polarity Detection Allowable Error Range [deg.]		10	Immediately
Pn587		Polarity Detection for Absolute Scale Selection		-	-
	0	0	Does not detect polarity	0	Immediately
		1	Detects polarity		

10.4 SERVOPACK for Rotary Motors

10.4.1 Encoder Pulse Output

These parameters are used for position counting by upper controller. Sigma-5 SERVOPACK outputs the pulse according to the settings. If the application does not use this encoder pulse output (e.g. network application), the functionality can be disabled by the parameter Pn081.1 = 1

Note: This specification is applied to the usage with the encoder feedback. In case that the pulse resolution is not 2^n, C-pulse (origin pulse) does not synchronize to A-pulse. C-pulse synchronizes to the edge of A/B-pulse.

Parameter		Function		Default Value	When enabled
No.	Dig.				
Pn081		Application Function Select Switch 81		-	-
	1	Encoder Pulse Output Usage		0	After restart
		0	Enables the pulse output function (Pn212)		
		1	Disables the pulse output function		
Pn212		Encoder Output pulses [Pulse/Rev]		2048	After restart

11

SERVOPACK with Semi-closed Loop Control for Linear Motors

This chapter describes the linear drives common in semi-closed loop.

11.1 Magnetic Pole 11-2

11.2 Motor Rotation Direction 11-3

11.3 Pole Detection Functionality 11-4

11.4 SERVOPACK for Linear Motors 11-6

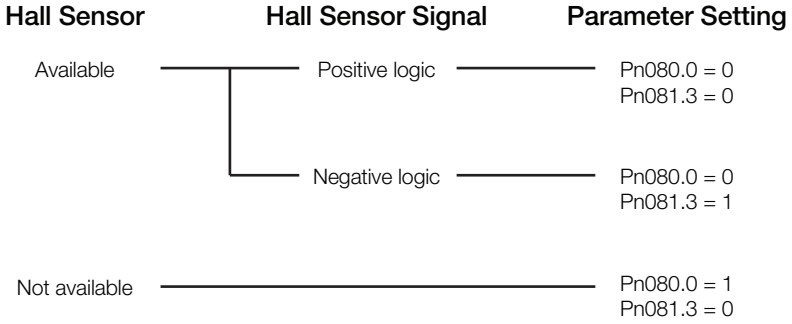
11.4.1 Encoder Pulse Output 11-6

11.1 Magnetic Pole

For driving linear motors, the magnetic pole should be coordinated. The parameters in the following table are used for that.

Parameter		Function		Default Value	When enabled
No.	Dig.				
Pn080		Application Function Select Switch 80		-	-
	0	Hall Sensor Selection		0	After restart
		0	Enables hall sensor		
		1	Disables hall sensor		
Pn081		Application Function Select Switch 81		-	-
	3	Hall Sensor Signal Inversion		0	After restart
		0	Does not inverse the signals (Pos-Logic)		
		1	Inverses the signals (Neg-Logic)		

■ Parameter Setting



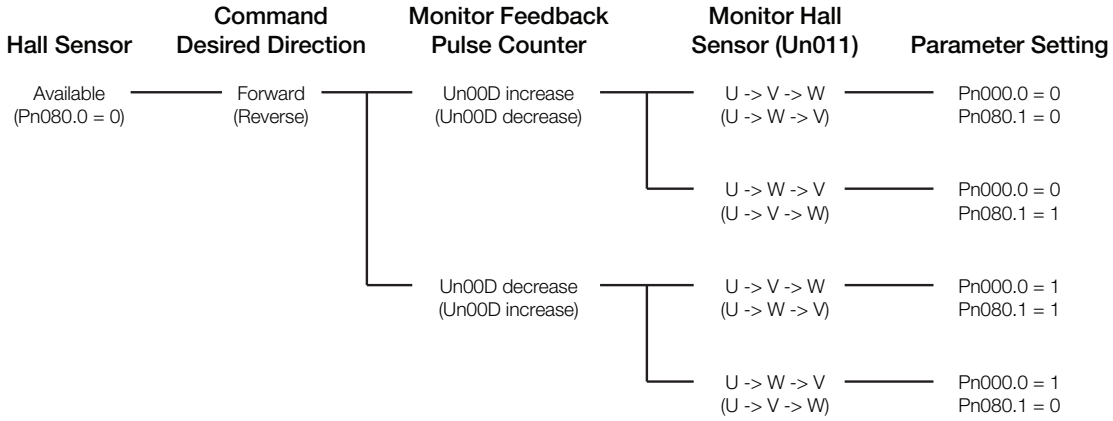
Note: In case the hall sensor is not available refer to chapter 11-4.

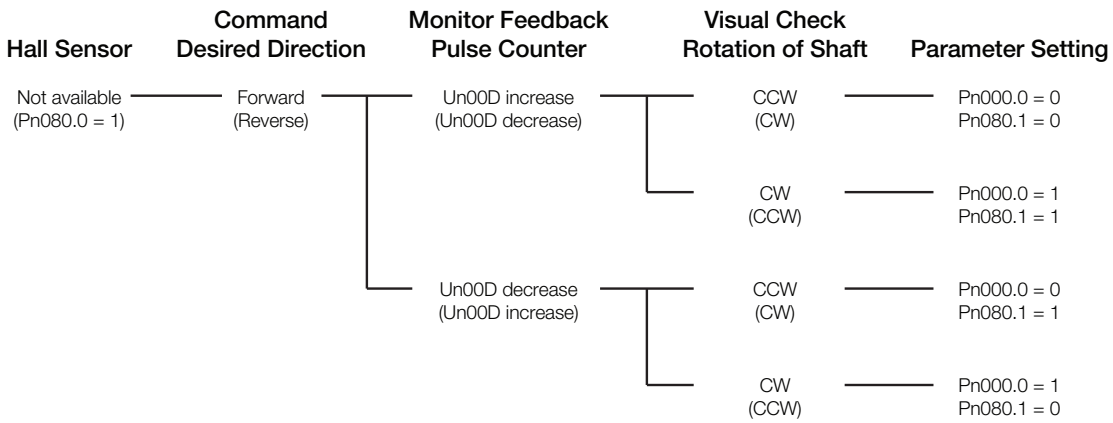
11.2 Motor Rotation Direction

The relationship between feedback position and motor magnetic pole position is dependent on the mounted conditions. So, the parameters below are used for the coordination.

Parameter No.	Parameter Dig.	Function		Default Value	When enabled
Pn000		Application Function Select Switch 0		-	-
	0	Direction Selection		0	After restart
		0	Forward command for forward direction		
		1	Forward command for reverse direction		
Pn080		Application Function Select Switch 80		-	-
	1	Motor Phase Selection		0	After restart
		0	Sets phase A lead as phase sequence of U, V, W		
		1	Sets phase B lead as phase sequence of U, V, W		

■ Parameter Settings





Note: Please make sure Pn080.1 is set according the above diagram. Otherwise motor malfunction may occur.

11.3 Pole Detection Functionality

When using a linear motor without pole sensor, the pole detection should be executed. Make sure the following conditions are satisfied when executing the function.

1. There is no danger when the linear motor moves approximately 10 mm. In case the function fails, the linear motor may move approximately 50 mm.
2. The encoder period is within 100 µm. (Within 40 µm is recommended when using an incremental encoder.)
3. Minimum unequal external force on the linear motor (5% of the rated force maximum is recommended).
4. The mass ratio is within 50 times.
5. On a horizontal axis.
6. Friction on the guide is a few percentages of the rated force (air slide not used).

Note 1. The linear motor is turned ON during the function. Take measures to avoid electric shock.
2. The linear motor will make large movements during detection. Take the machine's range of motion into consideration and do not stand near any moving parts.
3. The function depends on many factors such as cable tension, mass ratio and friction. If any error occurs because of one of these factors the function may fail.

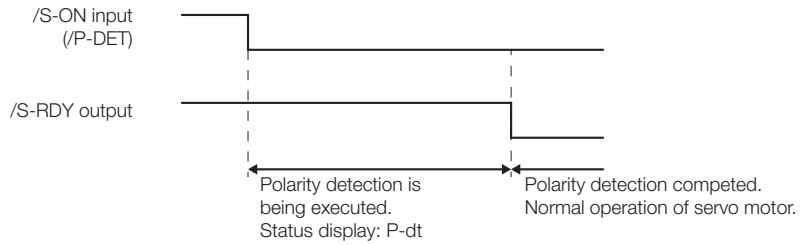
(1) Requirements that Enable the Function

The function is enabled by the following settings:

1. The parameter Pole Sensor Selection Pn080.0 is set to disable pole sensor Pn080.0 = 1.
2. The main power is supplied.
3. No alarms occur.
4. Hard wire base block is not active.
5. The parameter Writing Prohibited Setting Fn010 is not set to prohibit writing.
6. The SEN signal is turned ON in case of an absolute encoder.

(2) Execution of the Function with Analog Voltage and Pulse Train Model

■ Input Signal Through CN1 connector



■ Factory-set Input Signal Allocations

If the factory settings are used to allocate the input signals (Pn50A.0 = 0), the function will start when the Servo On signal (/S-ON) is ON, and the Servo Ready signal (/S-RDY) will be ON after the function has been completed.

Type	Name	Connector Pin No.	Setting	Description
Input	/S-ON	CN1-40	ON	Motor power is ON. The function is executed only once then the motor will be ready for operation (/S-RDY signal is ON).
			OFF	Motor power is OFF.

■ Changing Input Signal Allocations

The function signal (/P-DET) must be allocated under the following conditions:

- When designing a sequence for the host controller in which the Servo Ready signal is monitored and then the Servo ON signal is output.

• When using different timing for the execution of the function and sending the Servo ION signal.

After the function has been completed the motor power will turn OFF and the Servo Ready signal will turn ON. Then the function cannot be executed even if the /P-DET signal is turned ON and OFF. Then the control power is restored, the function must be executed again.

Type	Name	Connector Pin No.	Setting	Description
Input	/S-ON	CN1-40 [Factory setting]	ON	Motor power is ON. Motor will be ready for operation (/S-RDY signal is ON).
			OFF	Motor power is OFF.
	/P-DET	Must be allocated	ON	The function is executed only once then the signal turns ON for the first time.
			OFF	-

■ Utility Function: Pole Detection

This utility function is executed using Panel operator, Digital operator and SigmaWin+.

(3) Execution of the Function with MECHATROLINK and Network Option Model

■ Servo ON Command

Type	Name	Description
Servo ON	Incremental Encoder	The function is executed only once when the command is sent. Then, motor will be ready for operation.
	Absolute Encoder	In the Pn587.0 = 1 setting, the function is executed only once when the command is sent. Then, motor will be ready for operation.
Servo OFF	Motor power is OFF.	

■ Utility Function: Pole Detection

This utility function is executed using Panel operator, Digital operator and SigmaWin+.

(4) Related Parameters

Parameter No.	Dig.	Function		Default Value	When enabled
Pn481		Polarity Detection Speed Loop Gain [0.1 Hz]		40.0	Immediately
Pn482		Polarity Detection Speed Loop Integral Time [0.01 msec]		30.00	Immediately
Pn485		Polarity Detection Command Speed [mm/sec]		20	Immediately
Pn486		Polarity Detection Command Accel/Decel Time [msec]		25	Immediately
Pn487		Polarity Detection Constant Speed Time [msec]		0	Immediately
Pn488		Polarity Detection Command Waiting Time [msec]		100	Immediately
Pn48E		Polarity Detection Range [mm]		10	Immediately
Pn490		Polarity Detection Load Level [%]		100	Immediately
Pn493		Polarity Detection Command Speed [min^{-1}]		50	Immediately
Pn495		Polarity Detection Confirmation Torque Command [%]		100	Immediately
Pn498		Polarity Detection Allowable Error Range [deg.]		10	Immediately
Pn587		Polarity Detection for Absolute Scale Selection		-	-
	0	0	Does not detect polarity	0	Immediately
		1	Detects polarity		

11.4 SERVOPACK for Linear Motors

11.4.1 Encoder Pulse Output

These parameters are used for position counting by upper controller. Sigma-5 SERVOPACK outputs the pulse according to the settings. If the application does not use this encoder pulse output (e.g. network application), the functionality can be disabled by the parameter Pn081.1 = 1

Note: C-pulse synchronizes to the edge of A/B-pulse.

Parameter		Function		Default Value	When enabled
No.	Dig.				
Pn081		Application Function Select Switch 81		-	-
	1	Encoder Pulse Output Usage		0	After restart
		0	Enables the pulse output function (Pn281)		
		1	Disables the pulse output function		
Pn212		Encoder Output pulses [Pulse edge/Period]		20	After restart

12

Error Lists

This chapter describes the error lists of the Universal Feedback Option Module.
In the combination with this option module, Sigma-5 SERVOPACK can detect the alarms shown as below. For error handling, refer to Sigma-5 SERVOPACK user's manual.

12.1 Errors related to Feedback Option Module Identification 12-2
12.2 Errors in Fully-closed Loop Control 12-3
12.3 Errors in Semi-closed Loop Control with Rotary Motors 12-4
12.4 Errors in Semi-closed Loop Control with Linear Motors 12-6
12.5 Errors with Pole Sensor Signals Interface 12-8
12.6 Errors during Pole Detection Functionality 12-9

12.1 Errors related to Feedback Option Module Identification

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.044: Semi-closed/Fully-closed Loop Control Parameter Setting Error	The connected option module and the setting value of Pn00B.3 and/or Pn002.3 do not match.	Check the settings of PN00B.3 and/or Pn002.3	The setting of option module must be compatible with the settings of Pn00B.3 and/or Pn002.3.
A.051: Unsupported Device Alarm	1) An unsupported device was connected. 2) The unsupported combination: a) SERVOPACK (rotary motor) with feedback option module for linear motor b) SERVOPACK (linear motor) with feedback option module for rotary motor 3) The fully closed loop functionality is not enabled. Please configure Pn002.3.	Check the product specifications	Configure Pn00B.3. Select the correct combination of units
A.E72: Feedback Option Module Detection Failure	The connection between the SERVOPACK and the feedback option module is faulty.	Check the connection between the SERVOPACK and the feedback option module.	Correctly connect the feedback option module.
	The feedback option module was disconnected.	-	Execute Fn014 (Resetting configuration error of option module) with the digital operator or SigmaWin+ and turn the power supply OFF and then ON again.
	A feedback option module fault occurred.	-	Replace the feedback option module.
	A SERVOPACK fault occurred.	-	Replace the SERVOPACK.
A.E75: Unsupported Feedback Option Module	An unsupported feedback option module was connected.	Refer to the catalog of the connected feedback option module or the manual of the SERVOPACK	Connect a compatible feedback option module.
	An inapplicable Sigma-5 firmware version was used.	-	Replace the SERVOPACK.

12.2 Errors in Fully-closed Loop Control

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.041: Encoder Output Pulse Setting Error	The encoder output pulse (Pn212) is out of the setting range and does not satisfy the setting condition.	Check the parameter Pn212.	Set Pn212 to a correct value.
A.042: Parameter Combination Error	The speed of program JOG operation (Fn004) is lower than the setting range after having changed the setting of Pn533 “Program JOG Movement Speed.”	Check that the detection conditions is satisfied.	Increase the setting for Pn533 “Program JOG Movement Speed.”
A.511: Overspeed of Encoder Output Pulse Rate	The pulse output speed upper limit of the set encoder output pulse (Pn212) is exceeded.	Check the encoder output pulse output setting	Decrease the setting of the encoder output pulse (Pn212).
A.8A0: External Encoder Error	An external encoder fault occurred.	-	Replace the external encoder.
A.8A1: External Encoder Error of Module	A serial converter unit fault occurred.	-	Replace the serial converter unit.
A.8A2 External Encoder Error of Sensor	An external encoder fault occurred.	-	Replace the external encoder.
A.8A3 External Encoder Error of Position	An absolute external encoder fault occurred	-	The absolute external encoder may be faulty. Refer to the encoder manufacture’s instruction manual for corrective actions.
A.8A5 External Encoder Overspeed	The overspeed from the external encoder occurred.	-	Replace the external encoder.
A.8A6 External Encoder Overheated	The overheat from the external encoder occurred.	-	Replace the external encoder.
A.CF1: External Encoder Communications Error	Wiring of cable between serial converter unit and SERVOPACK is incorrect or contact is faulty.	Check the external encoder wiring.	Correct the cable wiring.
	The specified cable is not used or the cable is too long.	Confirm the external encoder wiring specifications.	Use the specified cable with max. 20 m length.
A.CF2: External Encoder Communications Timer Error	Noise interferes with the cable between serial converter unit and SERVOPACK.	-	Correct the wiring around serial converter unit, e.g., separating input/output signal line from main circuit cable or grounding.
A.D10: Motor-load Position Error Overflow	Motor rotation direction and external encoder installation direction are opposite.	Check the servomotor rotation direction and the external encoder installation direction.	Install the external encoder in the opposite direction, or reverse the setting of the external encoder usage method (Pn002.3).
	Mounting of the load (e.g., stage) and external encoder joint installation are incorrect.	Check the external encoder mechanical connection	Check the mechanical joints.

12.3 Errors in Semi-closed Loop Control with Rotary Motors

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.041: Encoder Output Pulse Setting Error	The encoder output pulse (Pn212) is out of the setting range and does not satisfy the setting condition.	Check the parameter Pn212.	Set Pn212 to a correct value.
A.511: Overspeed of Encoder Output Pulse Rate	The pulse output speed upper limit of the set encoder output pulse (Pn212) is exceeded.	Check the encoder output pulse output setting	Decrease the setting of the encoder output pulse (Pn212).
A.810: Encoder Backup Error	All the power supplies for the absolute encoder have failed and position data was cleared.	Check the encoder connector battery or the connector contact status.	Replace the battery or take similar measures to supply power to the encoder, and set up the encoder (Fn008).
A.820: Encoder Checksum Error	An encoder fault occurred.	-	Set up the encoder again using Fn008. If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.830: Absolute Encoder Battery Error	The battery voltage is lower than the specified value after the control power supply is turned ON.	Measure the battery voltage.	Replace the battery.
A.840: Encoder Data Error	An encoder fault occurred	Turn the power supply OFF and then ON again.	If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	Malfunction of encoder because of noise interference, etc.	-	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the grounding and other wiring.
	Note: If the scale file is configured for Hall sensor connectivity, a Hall sensor must be connected. Disabling Hall sensor connectivity (Pn080.0 = 1) and trying to work without the sensor will cause error A.840.		
A.850: Encoder Over-speed	The encoder was operating at high speed when the power was turned ON.	Check the speed monitor (Un000) to confirm the servomotor speed when the power is turned ON	Reduce the servomotor speed to a value less than 200 min^{-1}, and turn ON the control power supply.
A.860: Encoder Over-heated	The internal temperature of encoder is too high.	Measure the ambient operating temperature around the servomotor.	The ambient operating temperature of the servomotor must be 40 °C or less.
A.C80: Absolute Encoder Clear Error and Multi-turn Limit Setting Error	The multi-turn for the absolute encoder was not properly cleared or set.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the servomotor may be faulty. Replace the servomotor
	The absolute encoder reset was not completed or not supported.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C90: Encoder Communications Error	Communications between the Sigma-5 and the Feedback option module is not possible.	Check the encoder connector contact status. Check the encoder cable.	Re-insert the encoder connector and confirm that the encoder is correctly wired. Use the encoder cable with the specified rating.

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C91: Encoder Communications Position Data Error	The noise interference occurred on the input/output signal line because the encoder cable is bent and the sheath is damaged. The encoder cable is bundled with a high-current line or near a high-current line.	Check the encoder cable, the connector and the encoder cable layout.	Confirm that there is no problem with the encoder cable layout. Confirm that there is no surge voltage on the encoder cable.
A.C92: Encoder Communications Timer Error	Noise interference occurred on the input/output signal line from the encoder.	Check the operating environment.	Take countermeasures against noise.
	Excessive vibration and shocks were applied to the encoder.	Check the operating environment.	Reduce the machine vibration or correctly install the servomotor.
A.CA0: Encoder Parameter Error	An encoder fault occurred.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the servomotor may be faulty. Replace the servomotor
A.CB0: Encoder Echo-back Error	The encoder wiring and contact are incorrect.	Check the encoder wiring.	Correct the encoder wiring.
	Noise interference occurred due to incorrect encoder cable specifications.	Check the encoder wiring.	Use tinned annealed copper twisted pair or shielded twisted-pair cable with a core of at least 0.12 mm².
	Noise interference occurred because the wiring distance for the encoder cable is too long.	Check the encoder wiring.	The wiring distance must be 20 m max.
A.CC0: Multi-turn Limit Disagreement	When using a direct-drive (DD) servomotor, the multi-turn limit value (Pn205) is different from that of the encoder.	Check the value of the Pn205.	Correct the setting of Pn205 (0 to 65535).
A.D30: Position Data Overflow	The multi-turn position data exceeded +/-32767.	-	Correct the setting (-32767 to +32767)

12.4 Errors in Semi-closed Loop Control with Linear Motors

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.041: Encoder Output Pulse Setting Error	The linear scale output pulse (Pn212) is out of the setting range and does not satisfy the setting condition.	Check the parameter Pn212.	Set Pn212 to a correct value.
A.511: Overspeed of Encoder Output Pulse Rate	The pulse output speed upper limit of the set linear scale output pulse (Pn212) is exceeded.	Check the linear scale output pulse output setting	Decrease the setting of the linear scale output pulse (Pn212).
A.550: Maximum Speed Setting Error	The Pn385 setting is greater than the maximum speed.	-	Decrease the setting for Pn385.
A.820: Encoder Checksum Error	An linear scale fault occurred.	-	Set up the linear scale again using Fn008. If the alarm still occurs, the linear servomotor may be faulty. Replace the linear servomotor.
	A SERVOPACK fault occurred.	-	The SERVOPACK may be faulty. Replace the SERVOPACK.
A.830: Absolute Encoder Battery Error	The battery voltage is lower than the specified value after the control power supply is turned ON.	Measure the battery voltage.	Replace the battery.
A.840: Encoder Data Error	A linear scale fault occurred	Turn the power supply OFF and then ON again.	If the alarm still occurs, the linear scale may be faulty. Replace the servomotor.
	Malfunction of linear scale because of noise interference, etc.	-	Correct the wiring around the linear scale by separating the cable for linear scale from the main circuit cable or by checking the grounding and other wiring.
	Note: If the scale file is configured for Hall sensor connectivity, a Hall sensor must be connected. Disabling Hall sensor connectivity (Pn080.0 = 1) and trying to work without the sensor will cause error A.840.		
A.850: Encoder Over-speed	The linear scale was operating at high speed when the power was turned ON.	Check the motor speed (Un000) to confirm the motor speed when the power is turned ON.	Reduce the motor speed to a value below the speed specified by the linear scale manufacturer, and turn ON the control power supply.
A.860: Encoder Over-heated	The internal temperature of linear servomotor is too high.	Measure the ambient operating temperature around the linear servomotor.	The ambient operating temperature of the linear servomotor must be 40 °C or less.
A.890: Encoder Scale Error	A linear scale fault occurred.	-	The linear scale may be faulty. Replace the linear scale.
A:891: Encoder Module Error	A linear scale fault occurred.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the linear servomotor may be faulty. Replace the linear servomotor.

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C80: Absolute Encoder Clear Error and Multi-turn Limit Setting Error	A linear scale fault occurred.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the linear servomotor may be faulty. Replace the linear servomotor.
	A SERVOPACK fault occurred.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C90: Encoder Communications Error	Contact fault of cable connector for linear scale or incorrect wiring.	Check the status of cable connector contact for linear scale.	Re-insert the cable connectors for linear scale and confirm that the linear scale is correctly wired.
	Disconnection or short-circuit of the cable for linear scale. Or, incorrect cable impedance.	Check the linear scale connection cables.	Use the linear scale connection cables with the specified rating.
	• Corrosion caused by improper temperature, humidity, or gas. • Short-circuit caused by intrusion of water drops or cutting oil. • Connector contact fault caused by vibration.	Check the operating environment.	Improve the operating environmental conditions, and replace the cable. If the alarm still occurs, replace the SERVOPACK.
	Malfunction caused by noise interference.	-	Correct the wiring around the linear scale to avoid noise interference (Separate the linear scale connection cables from the linear servomotor main circuit cable, improve grounding, etc.)
	A SERVOPACK fault occurred.	-	Connect the linear servomotor to another SERVOPACK, and turn ON the control power. If no alarm occurs, the SERVOPACK may be faulty. Replace the SERVOPACK.
A.C91: Encoder Communications Position Data Error	The noise interference occurred on the input/output signal line because the linear scale connection cable is bent and the sheath is damaged.	Check the cables and connectors for linear scale.	Confirm that there is no problem with the layout of the linear scale connection cable.
	The encoder cable is bundled with a high-current line or near a high-current line.	Check the layout of the linear scale connection cable.	Confirm that there is no surge voltage on the linear scale connection cable.
A.C92: Encoder Communications Timer Error	Noise interference occurred on the input/output signal line from the linear scale.	-	Take countermeasures against noise.
	Excessive vibration and shocks were applied to the linear scale.	Check the operating environment.	Reduce the machine vibration or correctly install the linear servomotor.
A.CA0: Encoder Parameter Error	An linear scale fault occurred.	Turn the power supply OFF and then ON again.	If the alarm still occurs, the linear servomotor may be faulty. Replace the linear servomotor.

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.CB0: Encoder Echo-back Error	The linear scale wiring and contact are incorrect.	Check the encoder wiring.	Correct the linear scale wiring.
	Noise interference occurred due to incorrect linear scale cable specifications.	-	Use tinned annealed copper twisted pair or shielded twisted-pair cable with a core of at least 0.12 mm².
	Noise interference occurred because the wiring distance for the linear scale cable is too long.	-	The wiring distance must be 20 m max.
A.D30: Position Data Overflow	The multi-turn position data exceeded +/-32767.	-	Correct the setting (-32767 to +32767)

12.5 Errors with Pole Sensor Signals Interface

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.840: Encoder Data Error	An encoder fault occurred	Turn the power supply OFF and then ON again.	If the alarm still occurs, the servomotor may be faulty. Replace the servomotor.
	Malfunction of encoder because of noise interference, etc.	-	Correct the wiring around the encoder by separating the encoder cable from the servomotor main circuit cable or by checking the grounding and other wiring.
	Note: If the scale file is configured for Hall sensor connectivity, a Hall sensor must be connected. Disabling Hall sensor connectivity (Pn080.0 = 1) and trying to work without the sensor will cause error A.840.		
A.C20: Phase Detection Error	The linear scale signal is weak.	Check the voltage of the linear scale signal.	Fine-adjust the installation status of the linear scale head, or replace the linear scale.
	The count-up direction of the linear scale does not match the forward direction of the motor moving coil.	Check the setting of Pn080.1 (Motor Phase Selection). Check the installation directions for the linear scale and motor moving coil.	Change the setting of Pn080.1 (Motor Phase Selection). Correctly reinstall the linear scale and motor moving coil.
	The hall sensor signal is affected by noise.	-	Correct the FG wiring and take measures against noise for the hall sensor wiring.
A.C21: Pole Sensor Error	A pole sensor fault occurred.	-	Replace the pole sensor.

12.6 Errors during Pole Detection Functionality

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C22: Pole Information Disagreement	The SERVOPACK phase data does not match that of the linear scale.	-	Execute polarity detection (Fn080).
A.C50: Pole Detection Error	Parameter settings are incorrect.	Check the linear scale specifications and feedback signal status.	The settings of the linear scale pitch (Pn282) and motor phase selection (Pn080.1) may not match the actual product requirements. Set these parameters to the correct values
	Noise interference occurred on the scale signal.	Check the wiring to see if: • Each FG of the serial converter unit and linear servomotor is connected to the FG of the SERVOPACK. • The FG of the SERVOPACK is connected to the FG of the power supply. • The linear scale connection cables are securely shielded. Check to see if the detection reference is repeatedly output in one direction.	Take measures to avoid noise interference by correctly connecting FG lines, shielding the linear scale connection cables, etc.
	An external force was applied to the motor moving coil.	-	The polarity cannot be properly detected if the detection reference is 0 (zero), but the speed feedback is not 0 (zero) because of an external force, such as cable tension, applied to the motor moving coil. Take measures to reduce the external force so that the speed feedback becomes 0 for a 0 detection reference. If external force cannot be reduced, increase the polarity detection speed loop gain (Pn481).
	The linear scale resolution is too low.	Check the linear scale pitch to see if it is within 100 μm.	If the linear scale pitch is 100 μm or longer, the SERVOPACK cannot detect the correct speed feedback. Use a scale pitch with higher accuracy (a pitch within 40 μm recommended.) Or, increase the value of the polarity detection reference speed (Pn485). However, note that increasing the value of Pn485 will widen the linear servomotor movement range required for polarity detection.

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C51: Overtravel Detection at Pole Detection	An overtravel signal was detected during polarity detection.	Check the position after overtravel.	Perform the wiring for an overtravel signal. Execute polarity detection at a position where an overtravel signal is not detected.
A.C52: Pole Detection Uncompleted	The servo has been turned ON under the following circumstances. • An absolute linear scale is being used. • The polarity detection selection for the absolute linear scale was set to not execute. (Pn587.0 = 0) • Polarity was not yet detected	-	When using an absolute linear scale, set the parameter Pn587.0 to 1 to execute polarity detection.
A.C53: Out of Range for Pole Detection	The movement distance exceeded the set value of Pn48E in the middle of detection.	-	Increase the value of the polarity detection range (Pn48E). Or, increase the polarity detection speed loop gain (Pn481).
A.C54: Pole Detection Error 2	External force was applied to the linear servomotor.	-	Increase the value of the polarity detection confirmation force reference (Pn495). Increase the value of the polarity detection allowable error range (Pn498). (Note that increasing the allowable error range will also increase the motor temperature.)

12.6.1 Troubleshooting for Pole Detection Alarms with Rotary Motors

Alarm code	Cause	Countermeasure
Detection Error A.C50	Parameter settings are incorrect.	The settings of the resolution and motor phase selection (Pn080.1) may not be appropriate. Check the encoder specifications and feedback signal conditions.
	Noise is present in the scale signal.	When the command during the detection is repeatedly output several times in the same direction, noise may occur in the scale signal, resulting in malfunction. Check the connection to earth ground and the encoder cable.
	The motor is being subjected to an external torque.	The external torque prevents the SERVOPACK from executing the function. • Reduce the external torque. • If not possible, increase the value of speed loop gain (Pn481).
	The resolution is rough.	The SERVOPACK cannot detect correct speed feedback. • Use the recommended resolution. • Alternatively, increase the value of command speed (Pn493). However, the movement range will increase.
Overtravel detection A.C51	The OT signal was detected.	This alarm occurs when the OT signal is detected during the function. Before executing the function, place the motor to the position where the OT signal is not detected.
Detection uncompleted A.C52	Before the detection completes, Servo ON signal was input.	Analog Pulse Model • Input the /P-DET signal.
		MECHATROLINK and Network Option Model • When using an absolute encoder, set Pn587.0 = 1 in order to execute the function.
Out of range A.C53	The movement range during the detection exceeds.	If the range (Pn494) has not been changed from default value, the motor might have been moved for some reason. Check for the cause and take proper measure.
Detection Error2 A.C54	An external torque was applied.	• Increase the value of confirmation torque command (Pn495). • Increase the value of allowable error range (Pn498). Note: Increasing the error range will also increase the motor temperature.

12.6.2 Troubleshooting for Pole Detection Alarms with Linear Motors

Alarm code	Cause	Countermeasure
Detection Error A.C50	Parameter settings are incorrect.	The settings of the resolution and motor phase selection (Pn080.1) may not be appropriate. Check the encoder specifications and feedback signal conditions.
	Noise is present in the scale signal.	When the command during the detection is repeatedly output several times in the same direction, noise may occur in the scale signal, resulting in malfunction. Check the connection to earth ground and the encoder cable.
	The motor is being subjected to an external force.	The external force prevents the SERVOPACK from executing the function. • Reduce the external force. • If not possible, increase the value of speed loop gain (Pn481).
	The resolution is rough.	The SERVOPACK cannot detect correct speed feedback. • Use the recommended resolution. • Alternatively, increase the value of command speed (Pn493). However, the movement range will increase.
Overtravel detection A.C51	The OT signal was detected.	This alarm occurs when the OT signal is detected during the function. Before executing the function, place the motor to the position where the OT signal is not detected.
Detection uncompleted A.C52	Before the detection completes, Servo ON signal was input.	Analog Pulse Model • Input the /P-DET signal.
		MECHATROLINK and Network Option Model • When using an absolute encoder, set Pn587.0 = 1 in order to execute the function.
Out of range A.C53	The movement range during the detection exceeds.	If the range (Pn48E) has not been changed from default value, the motor might have been moved for some reason. Check for the cause and take proper measure.
Detection Error2 A.C54	An external torque was applied.	• Increase the value of confirmation torque command (Pn495). • Increase the value of allowable error range (Pn498). Note: Increasing the error range will also increase the motor temperature.

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Σ-V Series

USER'S MANUAL

Universal Feedback Module Type 3

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