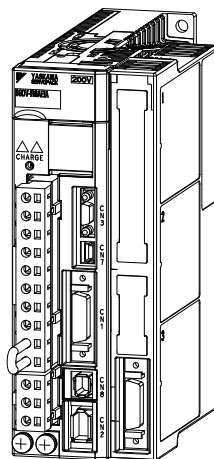


AC Servo Drives Σ -V Series USER'S MANUAL Universal Feedback Module

Model: SGD-V-OFB04A

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



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

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 4 of the module supports Resolvers (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
SERVOPACK	Σ -V Series SGD V 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
Semi-closed loop control	Main motor encoder

■ 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

Pn000 = n . 0 0 0 0

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 SGD V 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.



Indicates precautions that, if not heeded, could possibly result in loss of life or serious injury.



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.



Indicates prohibited actions that must not be performed. For example, this symbol would be used to indicate that fire is prohibited as follows:



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.
- 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.
- 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 suppliesFailure to observe this caution may result in damage to the product.
- 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

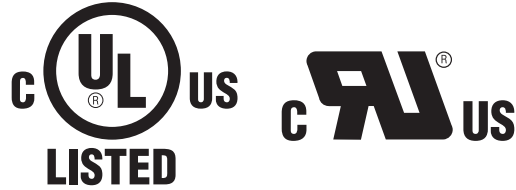
1. It is the customer’s responsibility to confirm conformity with any standards, codes, or regulations that apply if the Yaskawa product is used in combination with any other products.
2. The customer must confirm that the Yaskawa product is suitable for the systems, machines, and equipment used by the 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.

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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
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1.1 Checking Products on Delivery

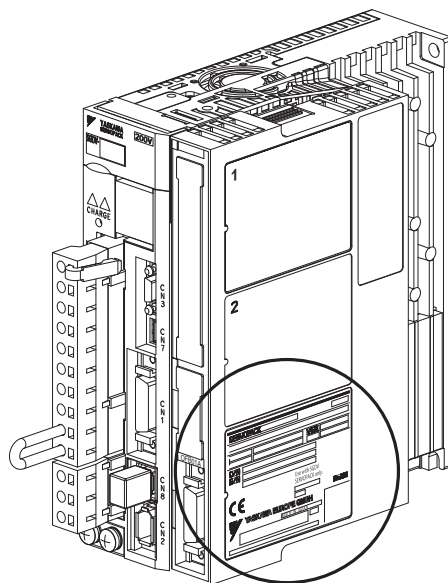
(1) When the Universal Feedback Module is Not Connected to the SERVOPACK

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 *1.2 Nameplate and Model Designation*.

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

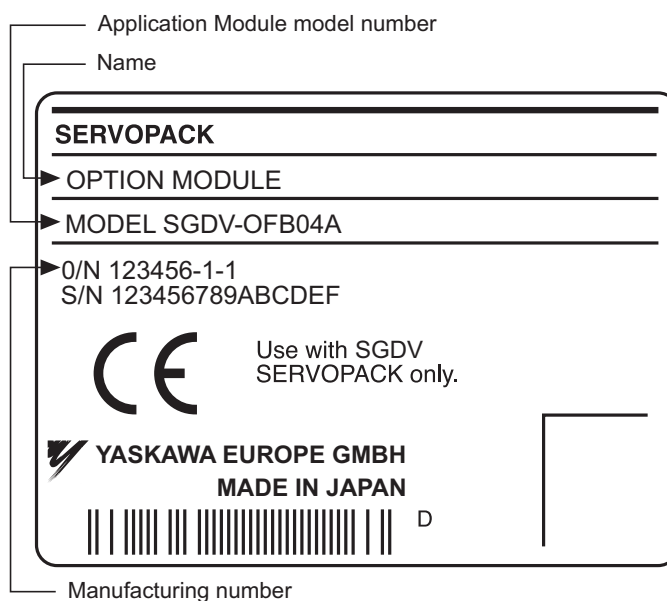
Check the nameplate to confirm that the Module that is mounted is the Universal Feedback Module.

The nameplate is located in the following position.

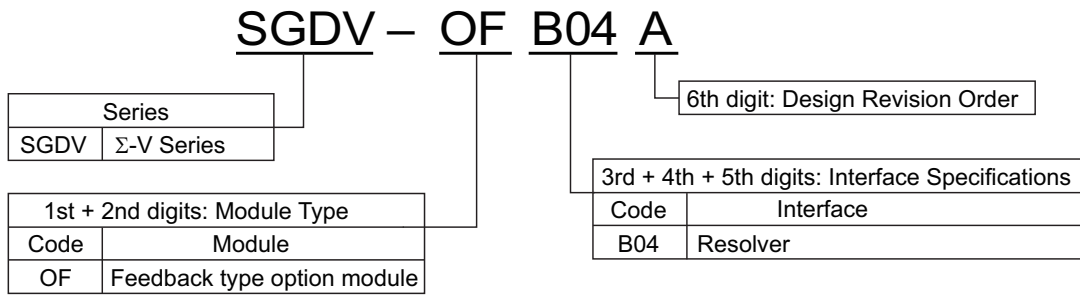


1.2 Nameplate and Model Designation

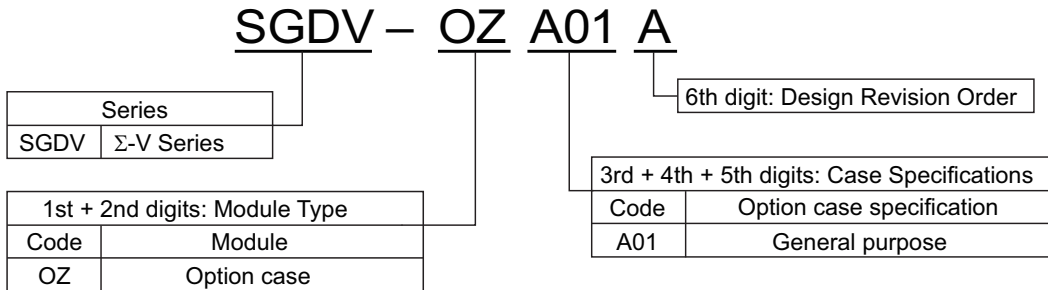
■ Nameplate Example



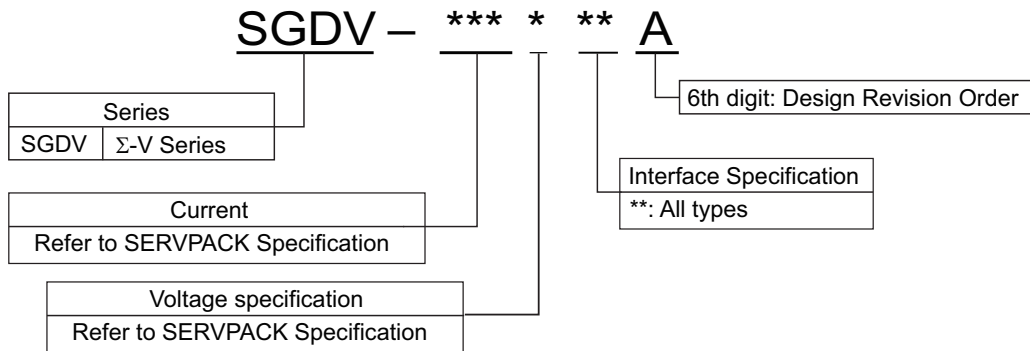
■ Model Designation



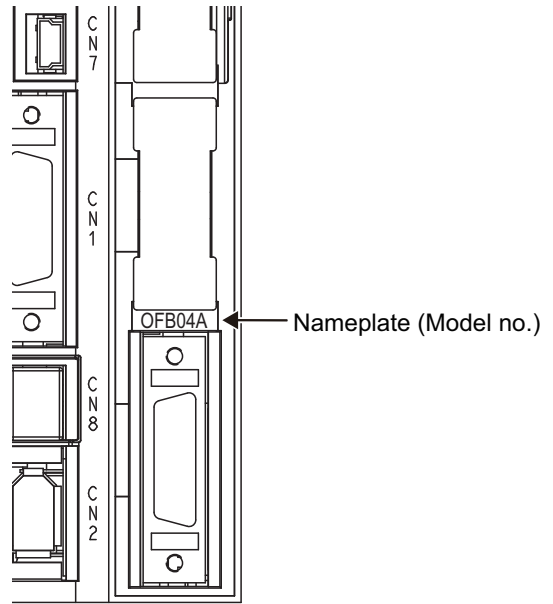
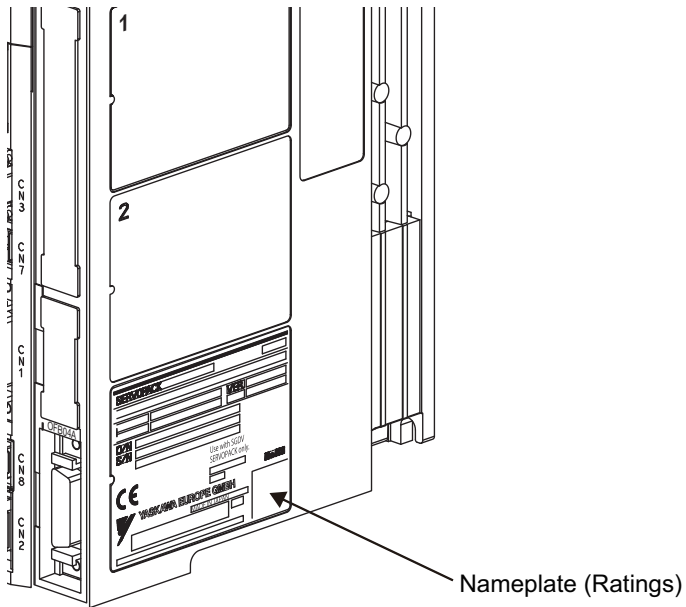
■ Option case unit type code



■ Applicable SERVOPACK model



1.3 Nameplate Location



Specifications

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

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2.1 Overview

The Σ -V series Universal Feedback Option Module SGDV-OFB04A supports resolvers.
 This encoder type is suitable for speed control and torque control.
 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. <ul style="list-style-type: none"> • 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 motor
Max. output frequency range		Must be lower than 240 [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		Resolver
Motor pole information for motor driving	Incremental usage	Sigma-5 detecting function is available. The function should be carried out at each boot-up.
	Absolute usage	The data is used (any functions needed for the information). The pole detection function should be carried out only once after the card or the motor has been replaced.
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 Universal Feedback option module (type 1): SGDV-OFB01A

Hardware Installation

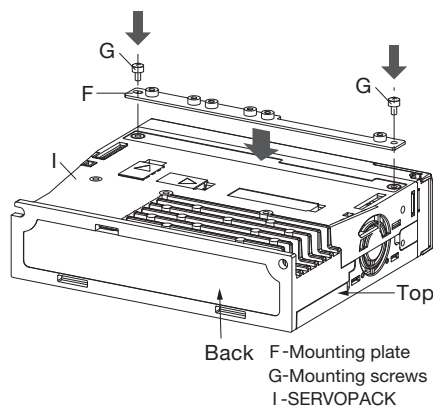
This chapter describes the hardware installation of the Universal Feedback Option Module.

3.1 Mounting the Universal Feedback module 3-2

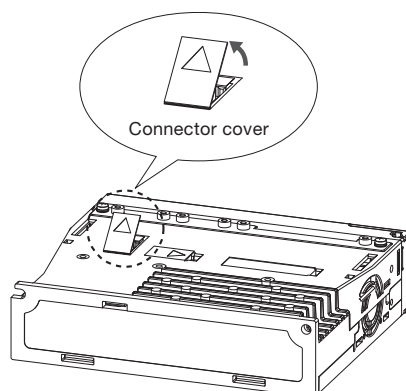
3.1 Mounting the Universal Feedback module

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.

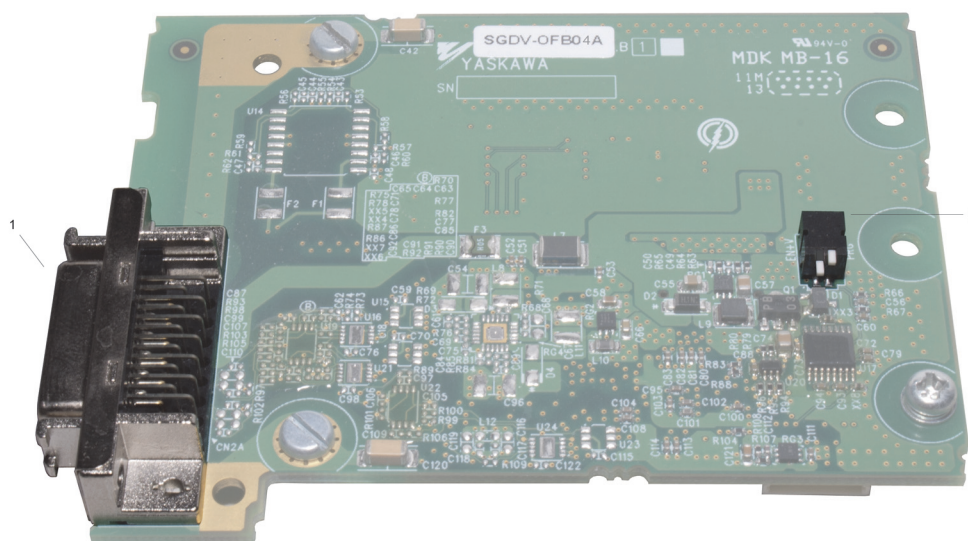
1. Fit the mounting plate (F) into the recess on the SERVOPACK, and fix the plate with the mounting screws (G). (Tightening torque: 0.14 Nm).



2. Remove the connector cover from the SERVOPACK.



3. Check DIP switch setting of S1.

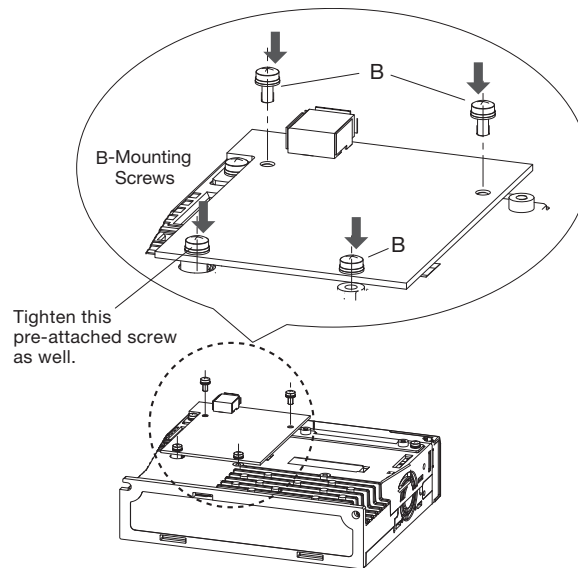


Caption: 1 = Position of Sub-D connector - 2 = Position of DIP switch S1

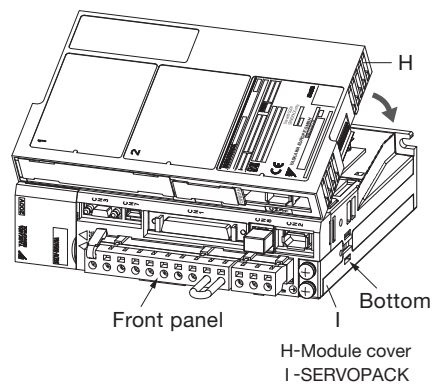
For resolver the switch S1 has to be on, the switch S2 has to be off.



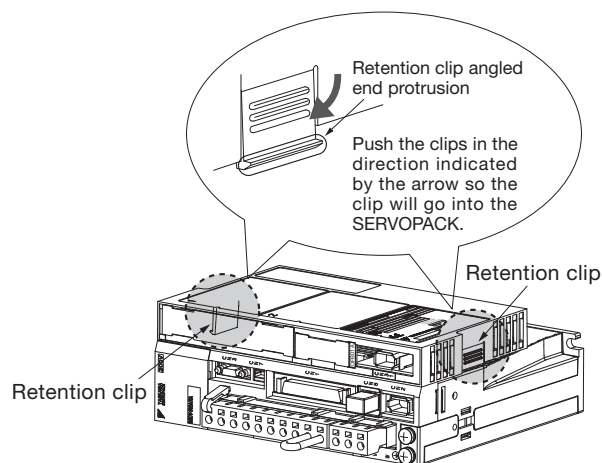
4. Fix the board on the SERVOPACK with four screws. (Tightening torque: 0.14 Nm)



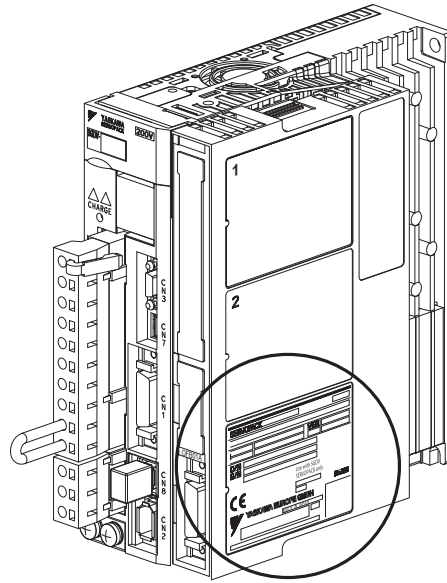
5. Align the front end of the module cover (H) with the front panel of the SERVOPACK as shown in the illustration, and place the module cover so that you can view the installed board from the opening (where the front cover is removed) on the module cover.



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.



Applicable Scope

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

4.1 SERVOPACK for Rotary Motors4-2

4.1 SERVOPACK for Rotary Motors

Motor	Scale Interface	Available solutions	Features
3 rd Party	Resolver	with SGDV-OFB04A	-

Encoder Interfaces

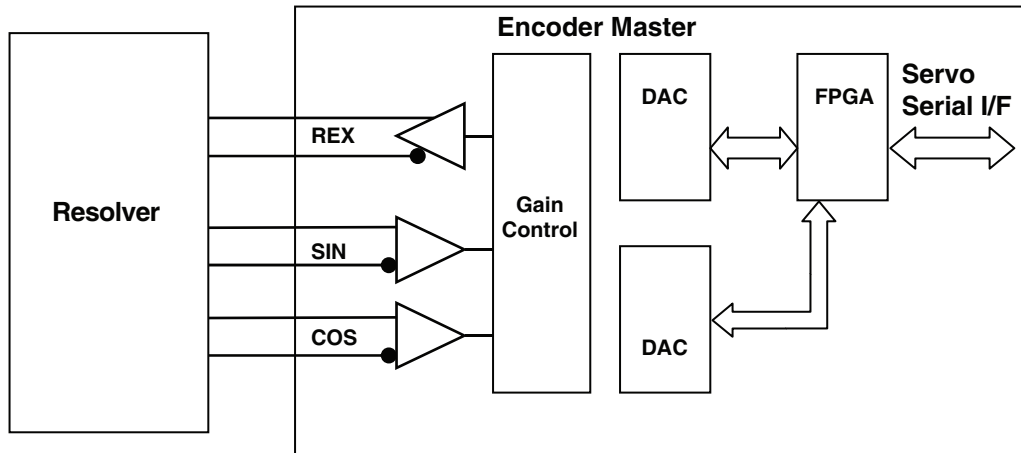
This chapter describes the encoder interfaces of the Universal Feedback Option Module.

5.1 Resolver interface	5-2
5.1.1 Overview	5-2
5.1.2 Technical Data	5-2
5.1.3 Connection	5-3

5.1 Resolver interface

5.1.1 Overview

The Interface provides with the absolute position within one revolution. Interpolated in the master, Sin/Cos signals give higher encoder resolution. The Interface block diagram is shown below.



5.1.2 Technical Data.

Items	Description
Resolver Type	BRX (Amplitude Modulation Model)
Number of Poles	2
Transformation Ratio	0.5
Excitation Frequency	0.4 to 10 kHz
Max. Input Voltage	20 Vp-p
Resolution	14 bit (16384)
Max. Rotation Speed	240 rps
Sine-Cosine Input	
Signal Transfer	Differential Signals, symmetric
Input Impedance (per pin)	About 12 kΩ - 13 kΩ
Reference Output	
Signal Transfer	Differential Signals, referenced to PG_0V
Max. Differential Voltage	20 Vp-p
Max. Output Current	200 mA
Frequency	0.4 to 10 kHz

5.1.3 Connection

No	Signal	Pin Function	Dir.
1	REX	Resolver Excitation +	OUT
2	/REX	Resolver Excitation -	OUT
3	-	N.C. *1	
4	-	N.C. *1	
5	-	N.C. *1	
6	-	N.C. *1	
7	-	N.C. *1	
8	-	N.C. *1	
9	-	N.C. *1	
10	-	N.C. *1	
11	PG_0V	Ground	
12	PG_0V	Ground	
13	PG_0V	Ground	

No	Signal	Pin Function	Dir.
14	-	N.C. *1	
15	-	N.C. *1	
16	-	N.C. *1	
17	PG_0V	Ground	
18	SIN	Sin Signal +	IN
19	/SIN	Sin Signal -	IN
20	COS	Cos Signal +	IN
21	/COS	Cos Signal -	IN
22	-	N.C. *1	
23	-	N.C. *1	
24	-	N.C. *1	
25	-	N.C. *1	
26	-	N.C. *1	

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

Set-up Procedure for Semi-closed Loop Control

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

6.1 Safety Precautions	6-2
6.2 Set-up Procedure	6-2
6.2.1 Feedback Option Module Set-up	6-3
6.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor	6-9

6.1 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.

6.2 Set-up Procedure

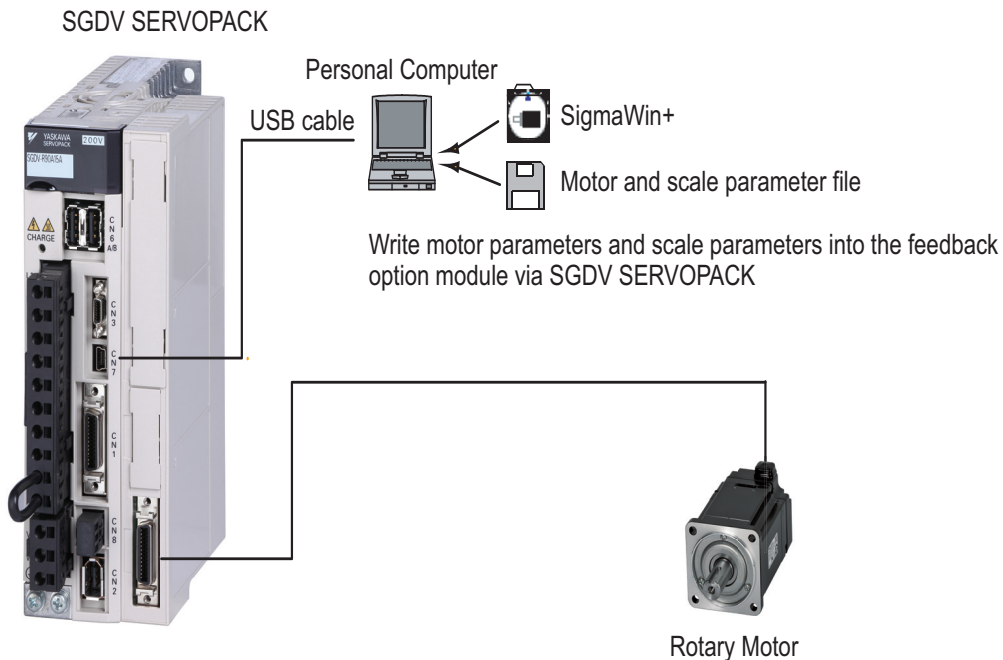
Follow the procedures and instructions provided in this manual and the following user's manuals for trial operation:

- Sigma-5 series User's Manual Setup Rotational Motor (SIEP S800000 43),
- Sigma-5 series User's Manual 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 Rotational Motor MECHATROLINK-III Communications Reference (SIEP S800000 64),
- Sigma-5 series User's Manual Design and Maintenance Rotational Motor Command Option Attachable Type (SIEP S800000 60)

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 6.2.2 Sigma-5 SERVOPACK Set-up with Rotary Motor 6-9
4	Feedback Option Module Set-up	Write the motor and scale parameters into the module.	Refer to 6.2.1 Feedback Option Module Set-up 6-3
5	Power Supply again	Turn OFF the control power supply, and then turn ON the control and the main power supply.	
6	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.	

6.2.1 Feedback Option Module Set-up

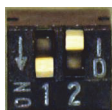
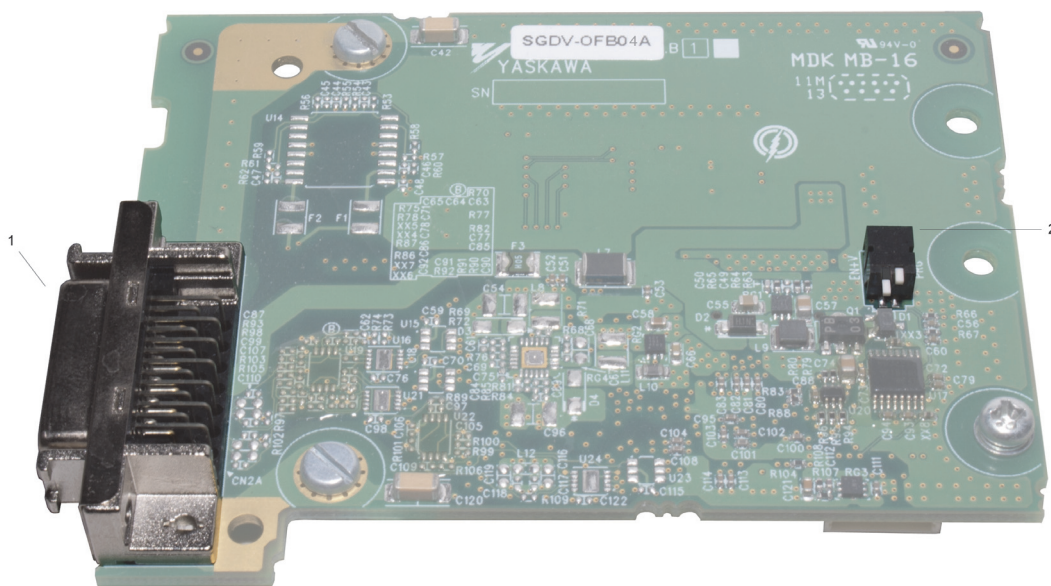
The motor and scale parameters must be written into the module via the SERVOPACK using the SigmaWin+ software engineering tool.



Note: This feature is available in SigmaWin+ Version 5.61 and later.

(1) Set-up Procedure

Check DIP switch setting of S1.



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

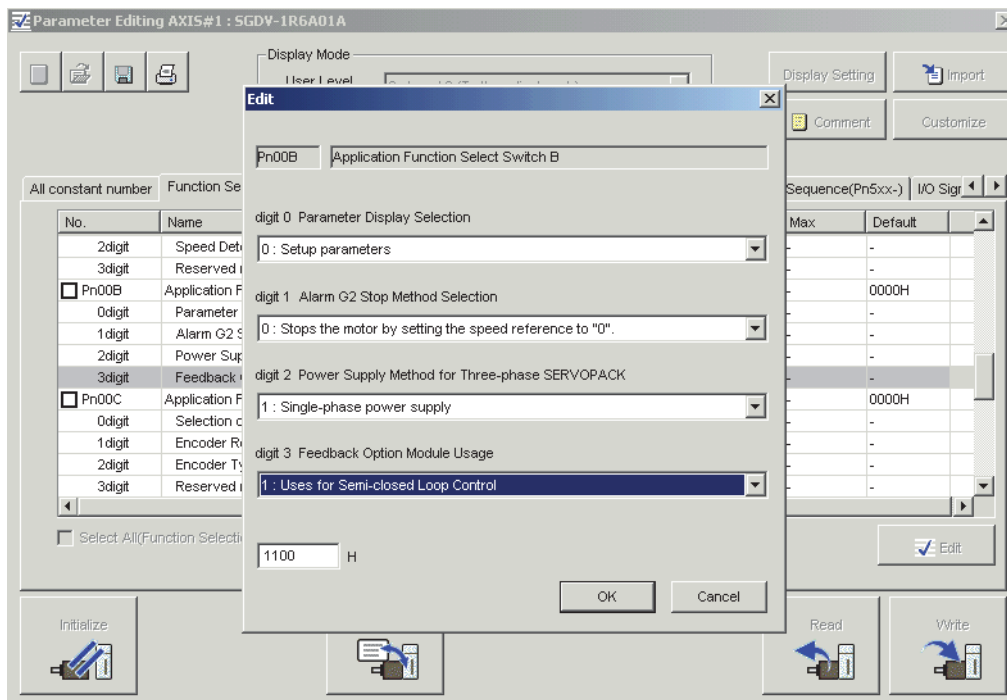
For resolver the switch S1 has to be on, the switch S2 has to be off.

(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+.

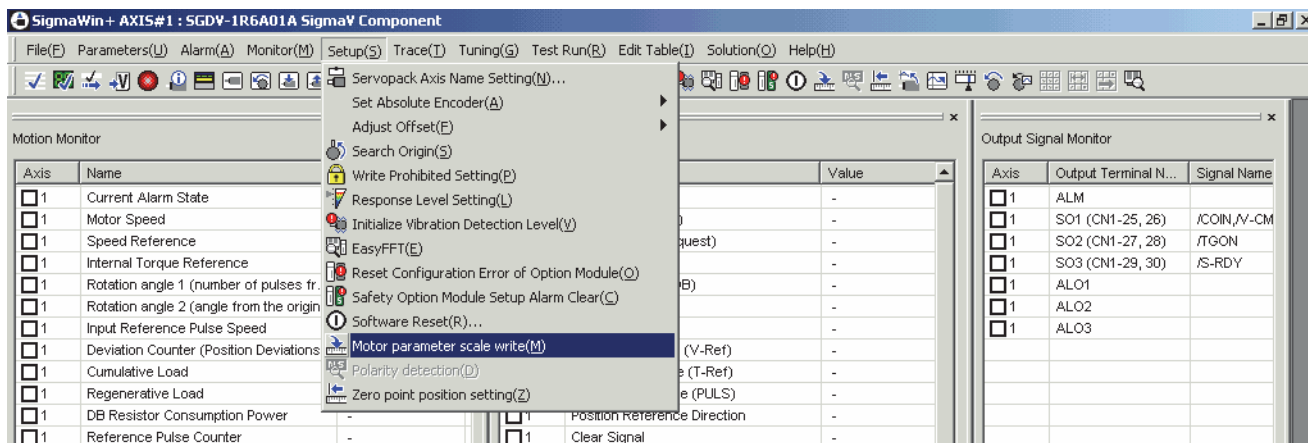
For *Semi-closed Loop* operation, the parameters have to be set as follows:



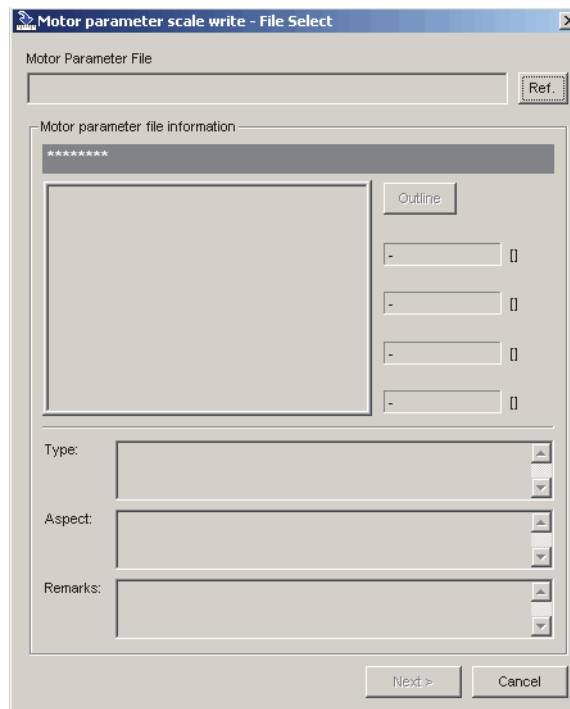
Pn00B.3 = 1

(2) Write Parameters using SigmaWin+

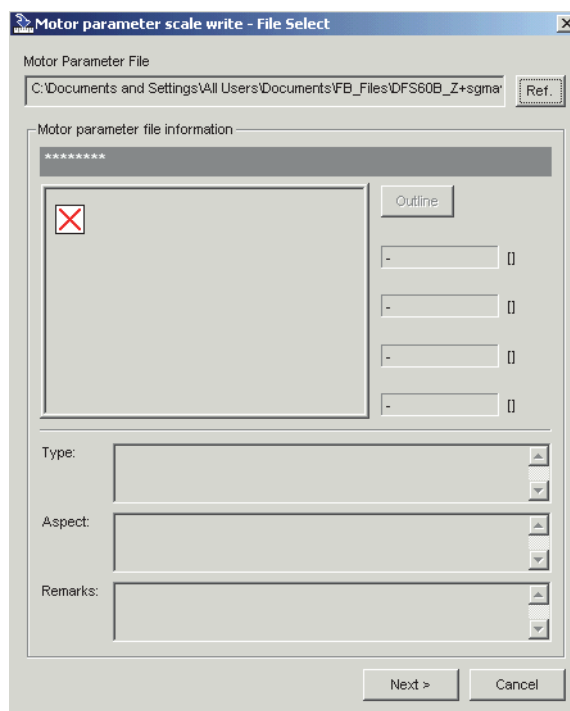
1. In SigmaWin+ select “Setup > Motor parameter scale write”.



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.

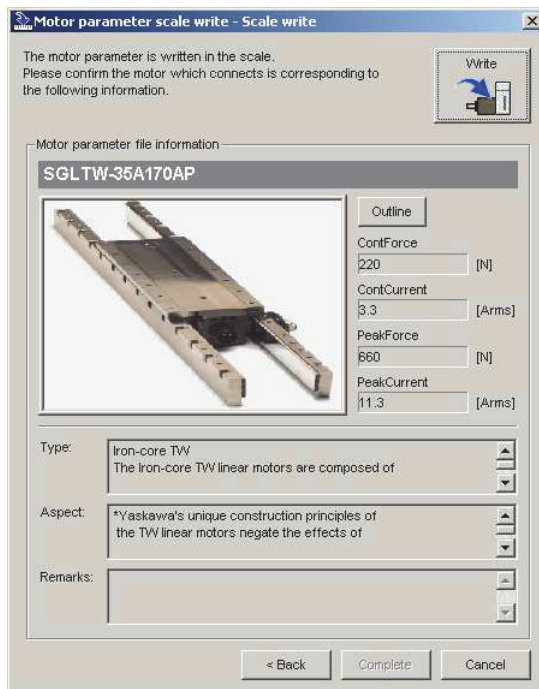


4. Select the parameter file provided by YASKAWA and click “Open”. The motor parameter file information is displayed.



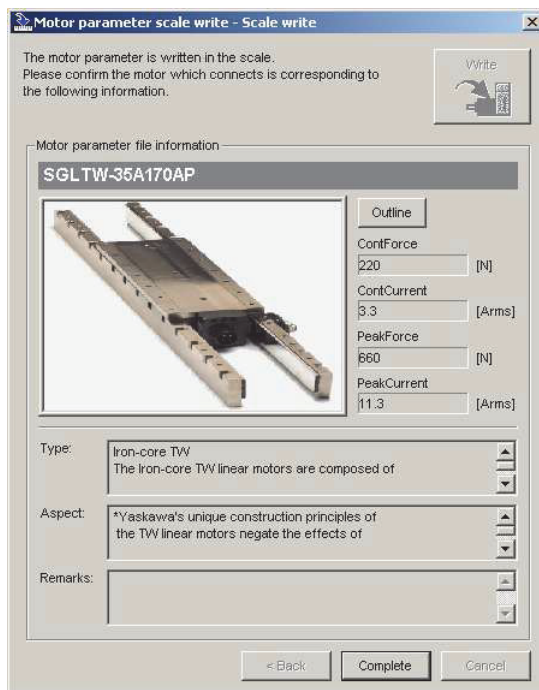
5. Make sure that the motor parameter file information of the installed motor is displayed.
6. Click “Next” to prepare writing the motor parameters.

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 is 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:

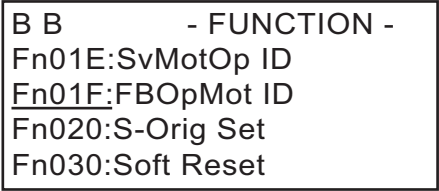



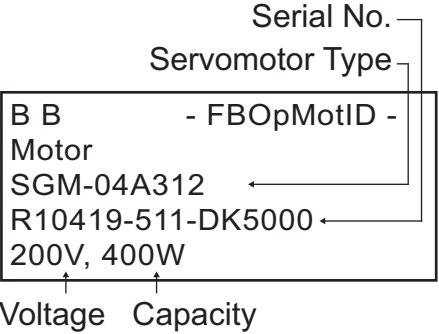







A.820 (Encoder Checksum Error), A.840 (Encoder Data Error), A.C21 (Hall Sensor Error)

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


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

A.550 (Maximum Speed Setting Error), A.041 (Encoder Output Pulse Setting Error),
A.040 (Parameter Setting Error 1), A.050 (Combination Error),
A.710 (Overload: High Load), A.720 (Overload: Low Load),
A.C90 (Encoder Communication Error)

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

Step	Display Example	Description
1		Press the  Key to open the Utility Function Mode main menu. Select Fn01F using the  or  Key.
2		Press the  Key. The screen will change to the Fn01F main window. The Motor ID will be shown first. Use the  and  Keys to scroll left and right through the information.
3		Press the  Key, and the encoder ID will be shown. Use the  and  Keys to scroll left and right through the information.

6.2.1 Feedback Option Module Set-up

Step	Display Example	Description
4	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <p>B B - FUNCTION - Fn01E:SvMotOp ID Fn01F:FBOpMot ID Fn020:S-Orig Set Fn030:Soft Reset</p> </div>	<p>Press the  Key. The display returns to the Utility Function Mode main menu.</p>

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.

B B - FBOpMotID -

 Not available

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

6.2.2 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. The detailed usage for each parameter is shown in section.

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	Used for external encoder feedback				
		1	Used for motor encoder feedback				
Pn080		Application Function Select Switch 80	-	-	-	-	
	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 (Pn212)				
		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 invert the signals (Pos-Logic)				
		1	Inverts the signals (Neg-Logic)				

Parameter		Function	Default Value	Required value	Cat.	When enabled	
No.	Dig.						
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	
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	-	-	-	-	
	0	Polarity Detection for Absolute Scale Selection	0	*1	O	Immediately	
		0					Does not detect polarity
		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

Note: The parameter Pn002.3 must be equal to "0" whenever the resolver card is being mounted to the SERVOPACK.

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.

7.1 Motor and Scale Parameter File Requirements for SERVOPACKS for Rotary Motors	7-2
7.1.1 Motor Parameters	7-2
7.1.2 Scale Parameters	7-3

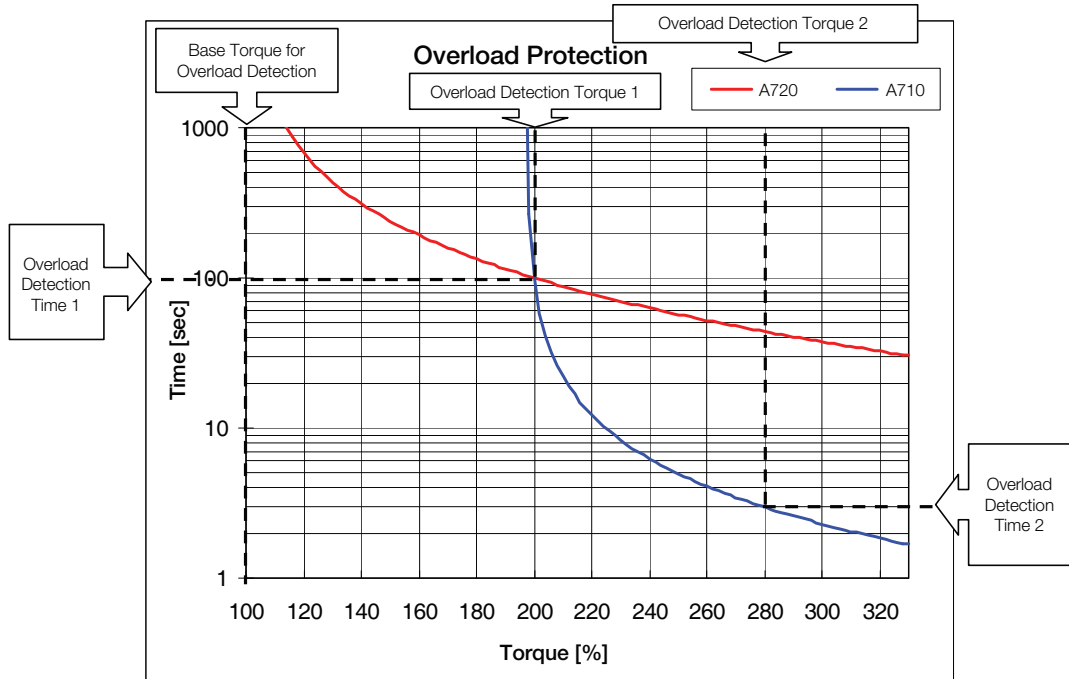
7.1 Motor and Scale Parameter File Requirements for SERVOPACKS for Rotary Motors

For all 3rd party motors, the 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 over-load characteristics. Send these information to the YASKAWA Europe Headquarter, please find the address on the last cover page.

7.1.1 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



7.1.2 Scale Parameters

	Description	Unit	Category*	Remarks
Characteristics	Scale type (absolute or incremental)	-	M	
	Numbers of poles	-	M	
	Excitation frequency	Hz	M	
	Input voltage	V	M	
	Transformation ratio	-	M	

* M: Mandatory, O: Optional

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.

8.1 Errors related to Feedback Option Module Identification	8-2
8.2 Errors in Semi-closed Loop Control with Rotary Motors	8-2
8.3 Errors with Pole Sensor Signals Interface	8-3
8.4 Errors during Pole Detection Functionality	8-4

8.1 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.

8.2 Errors in Semi-closed Loop Control with Rotary Motors

Alarm code	Alarm name	Reasons
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.
A.08A	Encoder Resolution Setting Uncompleted	The encoder resolution (Pn2D0) is not set.
A.511	Overspeed of Encoder Output Pulse Rate	The pulse output speed upper limit of the set encoder output pulse (Pn212) is exceeded.
A.810	Encoder Backup Error	All the power supplies for the absolute encoder have failed and position data was cleared.
A.820	Encoder Checksum Error	The checksum result of encoder memory is incorrect.
A.830	Absolute Encoder Battery Error	The battery voltage is lower than the specified value after the control power supply is turned ON.
A.840	Encoder Data Error	Data in the encoder is incorrect.

Alarm code	Alarm name	Reasons
A.850	Encoder Over-speed	The encoder was operating at high speed when the power was turned ON.
A.860	Encoder Over-heated	The internal temperature of encoder is too high.
A.C80	Absolute Encoder Clear Error Multi-turn Limit Setting Error	The multi-turn for the absolute encoder was not properly cleared or set. The absolute encoder reset was not completed or not supported.
A.C90	Encoder Communications Error	Communications between the Sigma-5 and the Feedback option module is not possible.
A.C91	Encoder Communications Position Data Error	All encoder position data calculation error occurred.
A.C92	Encoder Communications Timer Error	An error occurs in the communications timer between the Sigma-5 and the Feedback option module.
A.CA0	Encoder Parameter Error	Feedback option module parameters are faulty. Feedback option module does not have proper motor and/or scale parameters.
A.CB0	Encoder Echo-back Error	Contents of communications with feedback option module are incorrect.
A.CC0	Multi-turn Limit Disagreement	Different multi-turn limits have been set in the Sigma-5 and the Feedback option module. Multi-turn limits parameter inside Sigma-5 was changed from default setting.
A.D30	Position Data Overflow	The multi-turn position data exceeded +/-32767.

8.3 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.
A.C20: Phase Detection Error	The result of pole detection function was faulty.	-	Perform the pole detection function again.

8.4 Errors during Pole Detection Functionality

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C22: Pole Information Dis-agreement	The SERVOPACK phase data is not available.	-	Execute polarity detection (Fn080).
A.C50: Pole Detection Error	Parameter settings are incorrect.	Check the resolver specifications and feedback signal status.	The motor phase selection (Pn080.1) may not match the actual product requirements. Change this parameter to the correct value.
	Noise interference occurred on the scale signal.	Check the wiring to see if: <ul style="list-style-type: none"> • Each FG of the servomotor is connected to the FG of the SERVOPACK. • The FG of the SERVOPACK is connected to the FG of the power supply. • The resolver 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 resolver connection cables, etc.
	An external torque was applied to the motor shaft.	-	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 torque applied to the motor shaft. Take measures to reduce the external torque so that the speed feedback becomes 0 for a 0 detection reference. If external torque cannot be reduced, increase the polarity detection speed loop gain (Pn481).
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. <ul style="list-style-type: none"> • The polarity detection selection for the resolver was set to not execute. (Pn587.0 = 0) • Polarity was not yet detected 	-	Analogue drives: <ul style="list-style-type: none"> • Input at /P-DET signal When using a resolver, 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).

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.C54: Pole Detection Error 2	External force was applied to the 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.)

8.4.1 Troubleshooting for Rotary Pole Detection Alarms

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. <ul style="list-style-type: none"> 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. <ul style="list-style-type: none"> 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 <ul style="list-style-type: none"> Input the /P-DET signal.
		MECHATROLINK and Network Option Model <ul style="list-style-type: none"> 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.	<ul style="list-style-type: none"> 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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The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

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USER'S MANUAL
Universal Feedback Module Type 4

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