YASKAWA

AC Servo Drives $$\begin{split} &\sum -V-FT \; Series \\ &USER'S \; MANUAL \\ &Model: \; \text{FT008} \\ &\text{Analog Voltage and Pulse Train Reference} \end{split}$$

SGDV-DDDDDDDDDFT008 SERVOPACK SGMMV/SGMJV/SGMAV/SGMPS/SGMGV/SGMSV/SGMCV/SGMCS /SGLGW/SGLFW/SGLTW/SGLC/SGT Servomotor





Outline

 $\Sigma\text{-}V\text{-}FT\text{-}series$ FT008 Functions

List of Monitor Displays and Parameters for the Σ -V-FT-series FT008

Copyright © 2013 YASKAWA ELECTRIC CORPORATION

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form, or by any means, mechanical, electronic, photocopying, recording, or otherwise, without the prior written permission of Yaskawa. No patent liability is assumed with respect to the use of the information contained herein. Moreover, because Yaskawa is constantly striving to improve its high-quality products, the information contained in this manual is subject to change without notice. Every precaution has been taken in the preparation of this manual. Nevertheless, Yaskawa assumes no responsibility for errors or omissions. Neither is any liability assumed for damages resulting from the use of the information contained in this publication.

About this Manual

This manual contains information that is required to design and adjust Σ -V-FT-series FT008 servo system. An FT008 servo system has improved features for building an absolute position detecting system with just about any controller.

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

When you use a Σ -V-FT-series FT008 servo system, read this manual together with the Σ -V Series User's Manual, Design and Maintenance.

Also read the documents that are listed in \blacksquare Manuals Related to the Σ -V Series as required by the application.

Reference Table

Information on different items is provided in different user's manuals. Read the correct user's manual as given in the following table.

Item		This Manual	Σ-V Series User's Manual Design and Maintenance, Analog Voltage and Pulse Train Reference		
			Rotational (Manual No.: SIEP S800000 45)	Linear (Manual No.: SIEP S800000 47)	
	Σ-V-FT-series FT008	1.1	-	-	
	Part Names	-	1.	2	
	SERVOPACK Ratings and Specifications	1.2	_		
Outline	SERVOPACK Internal Block Diagrams	-	1.	4	
	Examples of Servo System Configurations	-	1.	5	
	SERVOPACK Model Designation	1.3	-	-	
	Inspection and Maintenance	-	1.	7	
Panel Operato	or	_	Chapter 2		
Wiring and Co	onnection	_	Chapter 3		
Trial Operatio	n	_	Chapter 4		
	Absolute Encoder Setup	2.3	-	-	
	Absolute Data Reception Sequence	2.4	-	-	
	Absolute Data Request Signal (SEN or SEN2)	2.5	-	_	
Operation	PSO Serial Data	2.6	-		
	Encoder Ready (/E-RDY) Signal	2.7	_		
	Managing Positions at the Host Controller	2.8			
	Other types of operation	_	Chapter 5		
Adjustments		_	Chapter 6		
Utility Functions (Fn		-	Chapter 7		
Monitor Displays	Monitor Displays for the Σ -V-FT-series FT008	3.1	-	-	
(Un□□□)	Other Monitor Displays	_	Chap	oter 8	
Fully-closed L	oop Control	-	Chapter 9	-	

(cont'd) Σ -V Series User's Manual Design and Maintenance, Analog Voltage and Pulse Train Reference This Manual Item Rotational (Manual No.: Linear (Manual No.: SIEP S800000 45) SIEP \$800000 47) Troubleshooting Chapter 10 Chapter 9 _ Parameters for the 3.2 and 3.3 _ _ List of Σ-V-FT-series FT008 Parameters Other Parameters 11.2.2 10.2.2 _

Description of Technical Terms

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

Term	Meaning
Rotational Servomotor	Σ -V Series rotary servomotors (SGMMV, SGMJV, SGMAV, SGMPS, SGMGV, or SGMSV), and Σ -V Series direct drive servomotors (SGMCV or SGMCS)
Linear Servomotor	Σ -V Series SGLGW, SGLFW, SGLTW, SGLC linear servomotor or SGT linear slider
SERVOPACK	Σ -V-FT Series FT008 servo amplifier
Σ-V Standard SERVOPACK	Σ -V Series SERVOPACKs with analog voltage/pulse train reference
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	Power to motor ON
Servo OFF	Power to motor OFF
Base Block (BB)	Power supply to motor is turned OFF by shutting off the base current to the power transistor in the current amplifier.
Main Circuit Cable	Cables which connect to the main circuit terminals, including main circuit power supply cables, control power supply cables, servomotor main circuit cables, and others.

IMPORTANT Explanations

The following icon is displayed for explanations requiring special attention.



• 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

· Notation for Reverse Signals

The names of reverse signals (i.e., ones that are valid when low) are written with a forward slash (/) before the signal name.

 $\frac{\text{Notation Example}}{BK} = /BK$

• Notation for Parameters

The notation depends on whether the parameter requires a value setting (parameter for numeric settings) or requires the selection of a function (parameter for selecting functions).

• Parameters for Numeric Settings

	Control methods for which the parameter applies. Speed : Speed control Position : Position control Torque : Torque control Force : Force control				
	Vibration Detection	on Sensitivity	Speed	Position Torque	Classification
Pn311	Setting Range	Setting Unit	Factory Setting	When Enabled	
	50 to 500	1%	100	Immediately	Tuning
		Λ			\land
Indicates trange for t	the setting the parameter.	cates the mum setting unit he parameter.	ndicates the arameter setting efore shipment.	ndicates when a hange to the arameter will be ffective.	Indicates the parameter classification.
Parameters for Selecting Functions					
I	Parameter	Me	eaning	When Enabled	Classification
Pn002	n.□0□□ [Factory setting]	Uses the absolu absolute encode	te encoder as an er.	After restart	Setup
	n.0100	Uses the absolute encoder as an incremental encoder.			Cottap
Parameter number	The notation "In for selecting fu the setting value here means the	n.□□□□" indicat Inctions. Each □ Jue of that digit. Th at the third digit is	tes a parameter corresponds to the notation shown to 1.	This section explain selections for the fu	ns the unction.

Notation Example



(Display Example for Pn002)

]	Digit Notation		Setting Notation	
	<u>u u u</u>	J	Notation	Meaning	Notation	Meaning
T	ΤŢŢ	1st digit	Pn002.0	Indicates the value for the 1st digit of parameter Pn002.	Pn002.0 = x or n.□□□x	Indicates that the value for the 1st digit of parameter Pn002 is x.
		2nd digit	Pn002.1	Indicates the value for the 2nd digit of parameter Pn002.	Pn002.1 = x or n.□□x□	Indicates that the value for the 2nd digit of parameter Pn002 is x.
		 3rd digit 	Pn002.2	Indicates the value for the 3rd digit of parameter Pn002.	Pn002.2 = x or n.□x□□	Indicates that the value for the 3rd digit of parameter Pn002 is x.
		4th digit	Pn002.3	Indicates the value for the 4th digit of parameter Pn002.	Pn002.3 = x or n.x□□□	Indicates that the value for the 4th digit of parameter Pn002 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	System Design	Panels and Wiring	Trial Operation	Trial Operation and Servo Adjustment	Maintenance and Inspection
Σ-V Series Product Catalog (No.: KAEP S800000 42)	V	~	\checkmark				
Σ-V Series User's Manual Setup, Rotational Motor (No.: SIEP S800000 43)				~	V		
Σ-V Series User's Manual Setup Linear Motor (No.: SIEP S800000 44)				~	\checkmark		
Σ -V-FT Series User's Manual Model: FT008 Analog Voltage and Pulse Train Reference (This manual)			~			~	
Σ -V Series User's Manual Design and Maintenance Rotational Motor/ Analog Voltage and Pulse Train Reference (No.: SIEP S800000 45)			✓		✓	✓	~
Σ -V Series User's Manual Design and Maintenance, Linear Motor/Analog Voltage and Pulse Train Reference (No.: SIEP S800000 47)			✓		✓	✓	~
Σ-V Series User's Manual Operation of Digital Operator (No.: SIEP S800000 55)					~	~	~
Σ-V Series AC SERVOPACK SGDV Safety Precautions (No.: TOBP C710800 10)	¥			~			~
Σ Series Digital Operator Safety Precautions (No.: TOBP C730800 00)							~
AC SERVOMOTOR Safety Precautions (No.: 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 to indicate that grounding is compulsory as follows:



Safety Precautions

This section describes important precautions that must be followed during storage, transportation, installation, wiring, operation, maintenance, inspection, and disposal. Be sure to always observe these precautions thoroughly.

	•	Never touch the servomotor, any rotating servomotor parts, or the machine during operation.
		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 equipment.
	•	Install the SERVOPACK and servomotor before you wire them.
	•	Failure to observe this caution may result in electric shock. 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 lamp is ON.
		Residual voltage may cause electric shock.
	•	Follow the procedures and instructions provided in the manuals for the products being used in the trial operation.
	•	Failure to do so may result not only in faulty operation and damage to equipment, but also in personal injury. Do not remove the top front cover, cables, connectors, or optional items from the SERVOPACK while the power is ON.
		Failure to observe this warning may result in electric shock.
	•	Do not damage, pull, 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. Do not modify the product.
		Failure to observe this warning may result in injury, damage to the equipment, or fire.
	•	Provide appropriate braking devices 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.
	•	Do not come close to the machine immediately after resetting an instantaneous power interruption to avoid an unexpected restart. Take appropriate measures to ensure safety against an unexpected restart.
		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.
Y		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 or damage to the equipment.
Rotati	ona	al Servomotors
	•	The output range of the rotational serial data for the Σ -V-FT absolute position detecting system is different from that of earlier systems for 12-bit and 15-bit encoders. As a result, the infinite-length position gratem of the Σ Series must be changed for use with products in the Σ V ET Series
	•	The multiturn limit value need not be changed except for special applications.
		Changing it inappropriately or unintentionally can be dangerous.
	•	VOPACK to be sure that it is correct.
		If Fn013 is executed when an incorrect value is set in Pn205, 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.

(cont'd) 🗥 WARNING Linear Servomotors · If you have a pacemaker or any other electronic medical device, do not go near the magnetic way of the servomotor. Failure to observe this warning may result in the malfunction of the medical device. Be sure to use nonmagnetic tools when installing or working close to the servomotor. (Example: a beryllium-copper alloy hexagonal wrench set, made by NGK Insulators, Ltd.) 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 equipment. · Locations subject to direct sunlight · Locations subject to 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 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. **Rotational Servomotors** · Do not hold the product by the cables, motor shaft, or encoder while transporting it. Failure to observe this caution may result in injury or malfunction. Linear Servomotors · Be sure to store the magnetic way in the package that was used for delivery. · Do not hold the servomotor by the cables while transporting it. Failure to observe this caution may result in injury or malfunction.

Installation

 Never use the product in an environment subject to water, corrosive gases, flammable 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 or malfunction. 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.
 When unpacking and installing magnetic way, check that no metal fragments or magnetized objects near the magnetic because they may be affected by the magnetic attraction of the magnetic way. Failure to observe this caution may result in injury or damage to the magnetic way's magnets. Do not use the magnetic way near metal or other magnetized objects. Failure to observe this caution may result in injury. Do not place clocks, magnetic cards, floppy disks, or measuring instruments close to the magnetic force. Securely mount the servomotor onto the machine. If the servomotor is not mounted securely, it may loosen during operation. Do not carry the magnetic way by its magnet protection cover. Failure to observe this caution may result in injury by the cover's edge or the shape of the cover may become distorted.
Magnetic way
 When removing the dummy plate for reducing magnetic force used for the SGLFW magnetic way, pay attention to the magnetic attraction of the magnetic way. Do not place the removed plate close to the magnetic way. Failure to observe this caution may result in injury or damage to the magnetic way's magnets or the magnet protection cover. Install SERVOPACKs, servomotors, and regenerative resistors on nonflammable objects. Installation directly onto or near flammable objects may result in fire.

Wiring



Rotational Servomotors				
 Do not bundle or run the main circuit cables together with the I/O signal cables or the encoder cables in the same duct. Keep the main circuit cables separated from the I/O signal cables and the encoder cables with a gap of at least 30 cm. Placing these cables too close to each other may result in malfunction. Use shielded twisted-pair cables or screened unshielded twisted-pair cables for I/O signal cables and the encoder cables. The maximum wiring length is 3 m for I/O signal cables, 50 m for encoder cables or servomotor main circuit cables, and 10 m for control power supply cables for the SERVOPACK with a 400-V power supply (+24 V, 0 V). 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. Do not reverse the polarity of the battery when connecting it. Failure to observe this caution may damage the battery, the SERVOPACK or servomotor, or cause an explosion. 				
Linear Servomotors				
 Do not bundle or run the main circuit cables together with the I/O signal cables or the linear scale connection cables in the same duct. Keep the main circuit cables separated from the I/O signal cables and the linear scale connection cables with a gap of at least 30 cm. Placing these cables too close to each other may result in malfunction. Use shielded twisted-pair cables or screened unshielded twisted-pair cables for I/O signal cables and the linear scale connection cables. Make sure that the length of each cable is equal to or shorter than the maximum wiring length listed here. I/O signal cables: 3 m Connection cables for linear servomotor main circuit: 20 m Connection cables for linear scale: 15 m Connection cables for hall sensor: 15 m Control power supply cables for the SERVOPACK with a 400-V power supply (+24 V, 0 V):10 m 				

Operation

•	Do not stand within the machine's range of motion during operation.
	Failure to observe this caution may result in injury.
•	Always use the servomotor and SERVOPACK in one of the specified combinations.
	Failure to observe this caution may result in fire or malfunction.
•	Before operation, install a limit switch or stopper on the end of the slider to prevent unexpected movement.
	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 parameter 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 mal- function.
•	Do not turn the power ON and OFF more than necessary.
	 Do not use the SERVOPACK for applications that require the power to turn ON and OFF frequently. Such applications will cause elements in the SERVOPACK to deteriorate.
	• As a guideline, at least one nour should be allowed between the power being turned ON and OFF once actual operation has been started
•	When using the servomotor for a vertical axis, install safety devices to prevent workpieces from fall- ing 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.
•	Do not touch the SERVOPACK heat sinks, 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 equipment due to unstable operation.
•	If an alarm occurs, shut down the main circuit power supply.
	Failure to observe this caution may result in fire due to regenerative resistor overheating caused by regenera- tive transistor failure.
•	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 equipment, fire, or injury.
Rotationa	I Servomotors
•	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.
•	when carrying out JOG operation (Fn002), origin search (Fn003), or EasyFFT (Fn206), forcing movable machine parts to stop does not work for forward overtravel or reverse overtravel. Take necessary precautions.
	Failure to observe this caution may result in damage to the equipment.
•	When not using the turning-less function, set the correct moment of inertia ratio (Pn103).
	Setting an incorrect moment of inertia ratio may cause machine vibration.
•	Do not use the holding brake of the servomotor for braking.
	Failure to observe this caution may result in malfunction.
Linear Se	rvomotors
•	When carrying out JOG operation (Fn002), origin search (Fn003), or EasyFFT (Fn206), forcing movable machine parts to stop does not work for forward overtravel or reverse overtravel. Take necessary precautions. Failure to observe this caution may result in damage to the equipment
•	When not using the turning-less function, set the correct mass ratio (Pn103).
	Setting an incorrect mass ratio may cause machine vibration.

Maintenance and Inspection

- Do not disassemble the SERVOPACK and the servomotor. Failure to observe this caution may result in electric shock or injury.
- Do not attempt to 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 equipment.

Disposal Precautions

 Correctly discard the product as stipulated by regional, local, and municipal laws and regulations. Be sure to include these contents in all labelling and warning notifications on the final product as necessary.



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

Warranty Period

The warranty period for a product that was purchased (hereinafter called "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.

Warranty Scope

Yaskawa shall replace or repair a defective product free of charge if a defect attributable to Yaskawa occurs during the warranty period above. This warranty does not cover defects caused by the delivered product reaching the end of its service life and replacement of parts that require replacement or that have a limited service life.

This warranty does not cover failures that result from any of the following causes.

- 1. Improper handling, abuse, or use in unsuitable conditions or in environments not described in product catalogs or manuals, or in any separately agreed-upon specifications
- 2. Causes not attributable to the delivered product itself
- 3. Modifications or repairs not performed by Yaskawa
- 4. Abuse of 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 any programs (including parameter settings) or the results of program execution of the programs provided by the user or by a third party for use with programmable Yaskawa products.
- 3. The information described in product catalogs or manuals is provided for the purpose of the customer purchasing the appropriate product for the intended application. The use thereof does not guarantee that there are no infringements of intellectual property rights or other proprietary rights of Yaskawa or third parties, nor does it construe a license.
- 4. Yaskawa shall not be responsible for any damage arising from infringements of intellectual property rights or other proprietary rights of third parties as a result of using the information described in catalogs or manuals.

(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 system is designed to secure the required level of safety 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) Specifications Change

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. The next editions of the revised catalogs or manuals will be published with updated code numbers. Consult with your Yaskawa representative to confirm the actual specifications before purchasing a product.

Compliance with UL Standards, EU Directives, UK Regulations, Other Safety Standards and China Energy Efficiency Regulations

North American Safety Standards (UL)

Product	Model	North American Safety Standards (UL File No.)			
SERVOPACK	SGDV	UL508C (E147823)			
Rotary Servomotor	 SGMMV SGMJV SGMAV SGMPS SGMGV SGMSV 	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100			
Direct Drive Servomotor	SGMCV	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100			
Linear Servomotor	• SGLG ^{*1} • SGLF ^{*1} • SGLT ^{*1*2}	UL 1004-1 UL 1004-6 (E165827) CSA C22.2 No.100			

*1. Only products with derating specifications are in compliance with the UL Standards. Estimates are available for those products. Contact your Yaskawa representative for details.

*2. SGLTW-35ADDH and -50ADDH (high-force type) are not in compliance with the UL Standards.



(6

Product	Model	EU Directives	Harmonized Standards		
	SGDV	Machinery Directive 2006/42/EC	EN ISO 13849-1: 2015		
SERVOPACK		EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)		
		Low Voltage Directive 2014/35/EU	EN 61800-5-1		
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000		
		EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61800-3 (Category C2, Second environment)		
	• SGMGV • SGMSV	Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5		
Poton		RoHS Directive 2011/65/EU (EU)2015/863	EN 60034-5 EN IEC 63000 EN 55011 Group 1, Class A		
Servomotor	• SGMJV • SGMAV • SGMMV • SGMPS	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)		
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5		
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000		
	SGMCV SGMCS -□□B -□□C -□□D -□□E (Small- capacity, Coreless servomo- tors) *1	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)		
Direct Drive Servomotor		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5		
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000		
Linear	• SGLG ^{*2}	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)		
Servomotor	• SGLF ² • SGLT ^{*2}	Low Voltage Directive 2014/35/EU	EN 60034-1		
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000		

*1. For SGMCS, only models with "-E" at the end of model numbers are in compliance with the standards.

*2. Only Moving Coils of EU Directive-certified products (models with "-E" at the end of model numbers) are in compliance with the EU Directives. Estimates are available for those products. Contact your Yaskawa representative for details. For EU Directive-certified products for SGL□M (models with "-E" at the end of model numbers), the content of substances specified in 2011/65/EU as amended by (EU)2015/863 is below the standard value. However, these products are not marked since they are not subject to CE Marking requirements because they are not energized.

■ UK Conformity Assessed (UKCA)

UK CA

Product	Model	UK Regulations	Designated Standards
		Supply of Machinery (Safety) Regulations S.I. 2008/1597	EN ISO 13849-1: 2015
	SGDV	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
SERVOPACK		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 61800-5-1
		Restriction of the Use of Certain Hazardous Substances in Elec- trical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
		Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61800-3 (Category C2, Second environment)
	• SGMGV • SGMSV	Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
Deter		Restriction of the Use of Certain Hazardous Substances in Elec- trical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
Servomotor	• SGMJV • SGMAV • SGMMV • SGMPS	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
		Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
		Restriction of the Use of Certain Hazardous Substances in Elec- trical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
	 SGMCV SGMCS -□□B 	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
Direct Drive Servomotor	-□□C -□□D -□□E (Small-	Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1 EN 60034-5
	capacity, Coreless servomo- tors) *1	Restriction of the Use of Certain Hazardous Substances in Elec- trical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000

(conťd)

Product	Model	UK Regulations	Designated Standards
		Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 EN 61000-6-4 EN 61800-3 (Category C2, Second environment)
Linear Servomotor	 SGLG^{*2} SGLF^{*2} 	Electrical Equipment (Safety) Regulations S.I. 2016/1101	EN 60034-1
	• 3011	Restriction of the Use of Certain Hazardous Substances in Elec- trical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000

*1. For SGMCS, only models with "-E" at the end of model numbers are in compliance with the standards.

*2. Only Moving Coils of EU Directive-certified products (models with "-E" at the end of model numbers) are in compliance with the EU Directives. Estimates are available for those products. Contact your Yaskawa representative for details. For EU Directive-certified products for SGL□M (models with "-E" at the end of model numbers), the content of substances specified in S.I. 2012/3032 is below the standard value. However, these products are not marked since they are not subject to UKCA Marking requirements because they are not energized.

Note: We declared the UKCA marking based on the designated standards in the above table.

Safety Standards

Product	Model	Safety Standards	Standards
		Safety of Machinery	EN ISO 13849-1: 2015 EN 60204-1
SERVOPACK	SGDV	Functional Safety	EN 61508 series EN 61800-5-2
		Functional Safety EMC	EN 61326-3-1

· Safe Performance

Items	Standards	Performance Level
Safety Integrity Level	EN 61508	SIL2
Probability of Dangerous Failure per Hour	EN 61508	$PFH = 1.7 \times 10^{-9} [1/h]$ (0.17% of SIL2)
Performance Level	EN ISO 13849-1	PL d (Category 3)
Mean Time to Dangerous Failure of Each Channel	EN ISO 13849-1	MTTFd: High
Average Diagnostic Coverage	EN ISO 13849-1	DCavg: Low
Stop Category	EN 60204-1	Stop category 0
Safety Function	EN 61800-5-2	STO
Proof test Interval	EN 61508	10 years

■ China Energy Label for Permanent-Magnet Synchronous Motors

	していた	1R	
Product	Model	Application Range	Laws and Standards
Rotary Servomotor	SGMJV SGMAV SGMGV SGMSV SGMPS	Rated Voltage 1000 V max. Rated Output 0.55 kW to 90 kW Rated Motor Speed 500 to 3000 min ⁻¹	law CEL 038-2020 regulation GB 30253-2013

Note: The following products do not comply with the China Energy Label for permanent-magnet synchronous motors. • Models with holding brakes

Models with gears

Contents

About this Manual iii Safety Precautions. viii Warranty. xv Compliance with UL Standards, EU Directives, UK Regulations, viii Other Safety Standards and China Energy Efficiency Regulations xviii
Chapter 1 Outline1-1
1.1 Σ-V-FT-series FT008 1-2 1.2 SERVOPACK Ratings and Specifications 1-2 1.2.1 Ratings 1-2 1.2.2 Basic Specifications 1-4 1.2.3 Control Specifications 1-7 1.3 SERVOPACK Model Designation 1-8
Chapter 2 Σ-V-FT-series FT008 Functions2-1
2.1 Introductions to Functions 2-2 2.1.1 Differences from an Absolute Data Reception Sequence with a Standard 2-2 2.1.2 Parameter Set Values and Settings 2-3 2.2 Application Examples 2-4 2.2.1 When Using a Rotational Servomotor 2-4 2.2.2 When Using a Rotational Servomotor 2-4 2.2.2 When Using Fully-Closed Loop Control or When Using a Linear Servomotor 2-6 2.3 Setting the Specification for Absolute Encoder Setup (Initialization) (Fn008) (Fn008) 2-8 2.3.1 Description of Settings 2-8 2.3.1 Description of Settings 2-9 2.4 2.4 Setting the Specification for Absolute Data Reception Sequence 2-12 2.4.1 Description of Settings 2-12 2.4.2 Absolute Data Reception Sequence 2-13 2.5 Setting the Absolute Data Request Signal 2-16 2.5.1 Description of Settings 2-16 2.5.2 Connection to Host Controller 2-16 2.5.2 Connection to Host Controller 2-20 2.7 Encoder Ready (/E-RD
Chapter 3 List of Monitor Displays and Parameters for the Σ -V-FT-series FT0083-1
3.1 Additional Monitor Displays3-23.2 Special Parameters3-33.3 Precaution When Copying Parameters3-5
Index Index-1

Revision History

1

Outline

1.1 Σ -V-FT-series FT008	1-2
1.2 SERVOPACK Ratings and Specifications	1-2
1.2.1 Ratings 1.2.2 Basic Specifications 1.2.3 Control Specifications	. 1-2 . 1-4 . 1-7
1.3 SERVOPACK Model Designation	1-8

1

1-1

1.2.1 Ratings

1.1 Σ -V-FT-series FT008

An Σ -V-FT-series FT008 SERVOPACK has improved features for building an absolute position detecting system with just about any controller.

For details on functions, refer to Chapter 2 2-V-FT-series FT008 Functions.

1.2 SERVOPACK Ratings and Specifications

This section describes the ratings and specifications of SERVOPACKs.

1.2.1 Ratings

Ratings of SERVOPACKs are as shown below.

(1) SGDV with Single-phase, 100-V Rating for Rotational/Linear Servomotor

SGDV (Single-phase, 100 V)	R70	R90	2R1	2R8		
Continuous Output Current [Arms]	0.66	0.91	2.1	2.8		
Instantaneous Max. Output Current [Arms]	2.1 2.9 6.5 9.3					
Regenerative Resistor [*]	None or external					
Main Circuit Power Supply	Single-phase, 100 to 115 VAC ^{+10%} _{-15%} , 50/60 Hz					
Control Power Supply	Single-phase, 100 to 115 VAC ^{+10%} _{-15%} , 50/60 Hz					
Overvoltage Category	III					

* For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Rotational Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45/47).

(2) SGDV with Single-phase, 200-V Rating for Rotational Servomotor

SGDV (Single-phase, 200 V)	120 ^{*1}
Continuous Output Current [Arms]	11.6
Instantaneous Max. Output Current [Arms]	28
Regenerative Resistor ^{*2}	Built-in or external
Main Circuit Power Supply	Single-phase, 220 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz
Control Power Supply	Single-phase, 220 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz
Overvoltage Category	III

*1. The official model number is SGDV-120A01A008FT008.

*2. For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Rotational Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45).

(3) SGDV with Three-phase, 200-V Rating for Rotational Servomotor

SGDV (Three-phase, 200 V)	R70	R90	1R6	2R8	3R8	5R5	7R6	120	180	200	330	470	550	590	780
Continuous Output Current [Arms]	0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9	46.9	54.7	58.6	78.0
Instantaneous Max. Output Current [Arms]	2.1	2.9	5.8	9.3	11.0	16.9	17	28	42	56	84	110	130	140	170
Regenerative Resistor*	None	e or ex	ternal		Built-in or external External										
Main Circuit Power Supply	Thre	e-phas	se, 200) to 23	0 VA	C $^{+10\%}_{-15\%}$, 50/6	0 Hz							
Control Power Supply	Sing	Single-phase, 200 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz													
Overvoltage Category	III	II													

* For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Rotational Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45).

(4) SGDV with Three-phase, 200-V Rating for Linear Servomotor

SGDV (Three-phase, 200 V)	R70	R90	1R6	2R8	3R8	5R5	7R6	120	180	200	330	550
Continuous Output Current [Arms]	0.66	0.91	1.6	2.8	3.8	5.5	7.6	11.6	18.5	19.6	32.9	54.7
Instantaneous Max. Output Current [Arms]	2.1	2.9	5.8	9.3	11.0	16.9	17	28	42	56	84	130
Regenerative Resistor*	None	or exter	nal		Built-in or external							
Main Circuit Power Supply	Three-	-phase, i	200 to 2	230 VA	$C^{+10\%}_{-15\%}$,	50/60 H	Iz					
Control Power Supply	Single	Single-phase, 200 to 230 VAC ^{+10%} _{-15%} , 50/60 Hz										
Overvoltage Category	III											

* For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Linear Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 47).

(5) SGDV with Three-phase, 400-V Rating for Rotational Servomotor

SGDV (Three-phase, 400 V)	1R9	3R5	5R4	8R4	120	170	210	260	280	370		
Continuous Output Current [Arms]	1.9	3.5	5.4	8.4	11.9	16.5	20.8	25.7	28.1	37.2		
Instantaneous Max. Output Current [Arms]	5.5	8.5	14	20	28	42	55	65	70	85		
Regenerative Resistor*	Built-in	or extern	nal				Externa	1				
Main Circuit Power Supply	Three-p	hase, 38() to 480 V	/AC ^{+10%} 15%	, 50/60 H	Iz						
Control Power Supply	24 VDC ±15%											
Overvoltage Category	III	III										

* For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Rotational Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45).

(6) SGDV with Three-phase, 400-V Rating for Linear Servomotor

SGDV (Three-phase, 400 V)	1R9	3R5	5R4	8R4	120	170	260				
Continuous Output Current [Arms]	1.9	3.5	5.4	8.4	11.9	16.5	25.7				
Instantaneous Max. Output Current [Arms]	5.5	8.5	14	20	28	42	65				
Regenerative Resistor*	Built-in or e	external					External				
Main Circuit Power Supply	Three-phase	Three-phase, 380 to 480 VAC ^{+10%} 15%, 50/60 Hz									
Control Power Supply	24 VDC ±1	24 VDC ±15%									
Overvoltage Category	III										

* For details, refer to 3.6 Connecting Regenerative Resistors in the Σ-V Series User's Manual Design and Maintenance, Linear Motor/Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 47).

1.2.2 Basic Specifications

Basic specifications of SERVOPACKs are shown below.

Drive Method		Sine-wave current drive with PWM control of IGBT			
Rotational Servomotor Feedback Linear Servo- motor		Absolute encoder: 17 or 20 bits			
		I. C	Absolute linear scale		
		Linear Servo- motor	Signal resolution within absolute	n^{*1} = Linear scale pitch of absolute linear scale/Resolution linear scale	
	Surrounding Air Tem- perature		0°C to +55°C		
	Storage Temperature		-20°C to +85°C		
	Ambient Humidity		90% RH or less	With no fracting or condensation	
	Storage Hu	umidity	90% RH or less	with no neezing of condensation	
	Vibration R	esistance	4.9 m/s ²		
Operating	Shock Res	istance	19.6 m/s ²		
Conditions	Protection	Class	IP10	An environment that satisfies the following conditions. • Free of corrosive or flammable gases	
	Pollution Degree		2	Free of exposure to water, oil, or chemicalsFree 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		
Harmonized Standards		Refer to Compliance with UL Standards, EU Directives, UK Regulations, Other Safety Standards and China Energy Efficiency Regulations in the pref- ace for details.			
Mounting			Standard: Base-mounted Optional: Rack-mounted or duct-ventilated		
	Speed Control Range		1:5000 (The lower limit of the speed control range must be lower than the point at which the rated torque/force does not cause the servomotor to stop.)		
	Spood	Load Regulation	0% to 100% load: ±0.01% max. (at rated speed)		
Perfor-	Regu- lation ^{*2}	Voltage Regulation	Rated voltage ±10%: 0% (at rated speed)		
mance		Temperature Regulation	$25 \pm 25^{\circ}$ C: $\pm 0.1\%$ max. (at rated speed)		
	Torque/Force Control Precision (Repeatability)		±1%		
	Soft Start Time Setting		0 to 10 s (Can be s	set individually for acceleration and deceleration.)	

(cont'd)

Encoder Di		ivided Pulse	Phase A, B, C: line driver		
	Output		Encoder output pulse: any setting ratio ^{*3}		
I/O Signals		Fixed Input	SEN signal		
			Number of Channels	7 ch	
	Sequence Input	Input Signals which can be allocated	Functions	 Servo ON (/S-ON) Proportional control (/P-CON) Rotational servomotor: Forward run prohibited (P-OT), reverse run prohibited (N-OT) Linear servomotor: Forward run prohibited (P-OT), reverse run prohibited (N-OT) Alarm reset (/ALM-RST) Rotational servomotor: Forward external torque limit (/ P-CL), reverse external torque limit (/N-CL) Linear servomotor: Forward external force limit (/P-CL), reverse external force limit (/N-CL) Internal set speed selection (/SPD-D, /SPD-A, /SPD-B) Control selection (/C-SEL) Zero clamping (/ZCLAMP) Reference pulse inhibit (/INHIBIT) Linear servomotor only: Polarity detection (/P-DET) Gain selection (/G-SEL) Reference pulse input multiplication switching (/PSEL) Absolute data request (/SEN2) Signal allocations can be performed, and positive and negative logic can be changed. 	
		Fixed Output	Servo alarm (ALM), alarm code (ALO1, ALO2, ALO3) outputs		
	Sequence Output	Output Signals which can be allocated	Number of Channels	3 ch	
			Functions	 Positioning completion (/COIN) Speed coincidence detection (/V-CMP) Rotational servomotor: Rotation detection (/TGON) Linear servomotor: Movement detection (/TGON) Servo ready (/S-RDY) Encoder ready (/E-RDY) Rotational servomotor: Torque limit detection (/CLT) Linear servomotor: Force limit detection (/CLT) Linear servomotor: Force limit detection (/CLT) Speed limit detection (/VLT) Brake (/BK) Warning (/WARN) Near (/NEAR) Reference pulse input multiplication switching output (/PSELA) Signal allocations can be performed, and positive and negative logic can be changed. 	
		Interface	Digital operator (n nected with Sigma	nodel: JUSP-OP05A-1-E), personal computer (can be con-Win+)	
0	RS422A Commu- nications (CN3)	1:N Communica- tions	N = Up to 15 stations possible at RS422A		
Communi- cations Function		Axis Address Setting	Set by parameter		
	USB	Interface	Personal computer	(can be connected with SigmaWin+)	
	Commu- nications (CN7)	Communica- tions Standard	Complies with standard USB1.1. (12 Mbps)		
LED Display		CHARGE indicator			

1.2.2 Basic Specifications

(cont'd)

Panel Operator Func-	Display Unit	Five 7-segment LEDs			
tions	Switches	Four push switches			
Analog Monitor (CN5)		Number of points: 2 Output voltage: ± 10VDC (linearity effective range ± 8 V) Resolution: 16 bits Accuracy: ± 20 mV (Typ) Max. output current: ± 10 mA Settling time (± 1%): 1.2 ms (Typ)			
Dynamic Brake (DB)		Activated when a servo alarm or overtravelling occurs or when the power supply for the main circuit or servomotor is OFF.			
Regenerative Processin	g	Included ^{*4}			
Overtravel Prevention (OT)	Dynamic brake stop, deceleration to a stop, or free run to a stop at P-OT or N-OT			
Protective Function		Overcurrent, overvoltage, insufficient voltage, overload, regeneration error, and so on.			
Utility Function		Gain adjustment, alarm history, JOG operation, origin search, and so on.			
	Input	/HWBB1, /HWBB2: Baseblock signal for power module			
Safety Function	Output	EDM1: Monitoring status of internal safety circuit (fixed output)			
	Standards ^{*5}	EN ISO13849-1 PL d (Category 3), IEC61508 SIL2			

*1. The signal resolution depends on the absolute linear scale. For details, refer to 5.4.4 Electronic Gear in the Σ-V Series User's Manual Design and Maintenance, Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 47).

*2. Speed regulation by load regulation is defined as follows:

Speed regulation

= No-load motor speed - Total load motor speed Rated motor speed × 100%

*3. For details, refer to 5.3.7 Setting Encoder Output Pulse in the Σ-V Series User's Manual Design and Maintenance, Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45 or SIEP S800000 47).

*4. For details on regenerative resistors, refer to 1.2.1 Ratings.

*5. Perform risk assessment for the system and be sure that the safety requirements are fulfilled.

1.2.3 Control Specifications

The SERVOPACK specifications for speed, position, torque, and force control are given in the following table.

Control Method	Specifications			
Control Method				
	Soft Start Time	Setting		0 to 10 s (Can be set individually for acceleration and deceleration.)
	Input Signals	Reference Voltage		 Max. input voltage: ±12 V (Rotational servomotor: Forward motor rotation for pos- itive reference, Linear servomotor: Forward motor movement for positive reference) Factory setting: 6 VDC at rated speed Input gain setting can be varied.
Speed Control		Input Impeda	nce	Approx. 14 kΩ
-		Circuit Time (Constant	30 µs
		Rotation Dire ward Directio	ction or For- n Selection	With P control signal
	Internal Set Speed Control	Speed Selection		With forward/reverse external torque limit signals or for- ward/reverse external force limit signals (speed 1 to 3 selection). Servomotor stops or another control method is used when both are OFF.
	Feedforward Compensation			0% to 100%
	Positioning Co	mpleted Width	Setting	0 to 1073741824 reference units
	Input Signals	Reference Pulse	Туре	Select one of the following: Sign + pulse train, CW + CCW pulse trains, forward + reverse pulse trains, or two- phase pulse trains with 90° phase differential
			Form	For line driver, open collector
Position Control			Max. Input Pulse Fre- quency	Line driver Sign + pulse train, CW + CCW pulse trains, or forward + reverse pulse trains: 4 Mpps Two-phase pulse train with 90° phase differential: 1 Mpps Open Collector Sign + pulse train, CW + CCW pulse trains, or forward + reverse pulse trains: 200 kpps Two-phase pulse train with 90° phase differential: 200 kpps
			Reference Pulse Input Multiplication Switching	1 to 100 times
		Clear Signal		Position error clear For line driver, open collector
Torque Control/ Force Control	Input Signals	Reference Voltage		 Max. input voltage: ±12 V (forward torque output or forward force output for posi- tive reference) 3 VDC for rated torque or rated force (default setting). Input gain setting can be changed.
		Input Impedance		Approx. 14 kΩ
		Circuit Time Constant		16 μs

1.3 SERVOPACK Model Designation

This section shows SERVOPACK model designation.



*1. These amplifiers can be powered with single or three-phase.

- *2. Single-phase, 200-VAC SERVOPACKs are also available, but only for rotational servomotors (model: SGDV-120A01A008FT008).
- *3. These SERVOPACKs are manufactured only for rotational servomotors. SERVOPACKs for linear servomotors are not available.
- *4. SGDV-470A, -550A, -590A, -780A, -210D, -260D, -280D, and -370D are duct-ventilated types.
- *5. A resistor for the dynamic brake is not included. An external resistor for the dynamic brake can only be used with 400-V SERVOPACKs.

Σ -V-FT-series FT008 Functions

2.1 Introductions to Functions	2-2
 2.1.1 Differences from an Absolute Data Reception Sequence with a Standard Σ-V-series SERVOPACK 2.1.2 Parameter Set Values and Settings 	2-2 2-3
 2.2 Application Examples 2.2.1 When Using a Rotational Servomotor 2.2.2 When Using Fully-Closed Loop Control or When Using a Linear Servomotor 	2-4 2-4 2-6
 2.3 Setting the Specification for Absolute Encoder Setup (Initialization) (Fn008) 2.3.1 Description of Settings 2.3.2 Absolute Encoder Setup (Initialization) 	2-8 2-8 2-9
2.4 Setting the Specification for Absolute Data Reception Sequence 2.4.1 Description of Settings 2.4.2 Absolute Data Reception Sequence	2-12 2-12 2-13
2.5 Setting the Absolute Data Request Signal	2-16 2-16 2-16
2.6 PSO Serial Data 2.6.1 Data Specifications 2.6.2 Output Terminals	2-18 2-18 2-20
2.7 Encoder Ready (/E-RDY) Signal	2-21
2.8 Managing Positions at the Host Controller	2-22 2-22 2-24

2

2.1.1 Differences from an Absolute Data Reception Sequence with a Standard Σ -V-series SERVOPACK

2.1 Introductions to Functions

The Σ -V-FT-series FT008 SERVOPACK has an analog voltage/pulse train reference and can be used to easily build an absolute position detecting system with just about any controller without using Yaskawa's absolute data request signal (SEN) or absolute data reception sequence.

2.1.1 Differences from an Absolute Data Reception Sequence with a Standard Σ -V-series SERVOPACK

The following figure shows the differences from an absolute data reception sequence with a standard Σ -V-series SERVOPACK. The functions that were added to the Σ -V-FT-series FT008 are shown on the right side.



*1. If you use fully-closed loop control or use a Linear Servomotor, the serial data (upper 16 bits of the position data) is output.

*2. If you use fully-closed loop control or use a Linear Servomotor, signed 36-bit position data is output.

2.1.2 Parameter Set Values and Settings

The following table gives the set values of the Pn0D2.3 and Pn0D2.2 parameters and describes the meaning of the settings.

Pn0D2.3 Set Value	Rotational Serial Data Output ^{*1}	Initial Incremental Pulse Output	Absolute Data Request Signal	Pn0D2.2 Set Value ^{*2}	Reference Position	Remarks
	Ves	Yes	Required	n.□0□□	Encoder coordinate	Same as standard Σ -V products.
	105			n.□1□□	Machine coordinate	-
n.1000	No	Yes	Required	n.🗆0🗆	Encoder coordinate	Refer to 2.2.1 (1) Linear Motion System with a Short Stroke or
				n.0100	Machine coordinate	2.2.2 (1) Linear Motion System with a Short Stroke for an appli- cation example.
n.2000	No	No	Not required.	n.🗆0🗆 🗆	Encoder coordinate	Refer to 2.2.1 (2) Motion System with a Long Stroke or 2.2.2
				n.0100	Machine coordinate	<i>(2) Motion System with a Long Stroke</i> for an application example.

*1. If you use fully-closed loop control or use a Linear Servomotor, the serial data (upper 16 bits of the position data) is output.

*2. This parameter is enabled only for a rotational servomotor. If you use fully-closed loop control or use a Linear Servomotor, set Pn0D2 to n.□0□□. If you set Pn0D2 to n.□1□□, the setting will be disabled.

2.2.1 When Using a Rotational Servomotor

2.2 Application Examples

This section provides specific examples of the application methods and settings of Σ -V-FT-series FT008 functions.

2.2.1 When Using a Rotational Servomotor

(1) Linear Motion System with a Short Stroke

If you set the following parameters, the absolute data request signal is not required. The initial incremental pulses including the multiturn data are output, so the absolute position detecting system is built with only a pulse counter.

Parameter No.	Set Value	Description of Setting
Pn0D2	n.1□□□	The initial incremental pulses, including the multiturn data, are output. The rotational serial data is not output.
Pn515	n.□□□7	The SEN2 signal always indicates "valid."

The procedure is given below.

Step	Meaning
1	Turn ON the control power supply.
2	Clear the incremental pulse up/down counter to zero 100 ms after the servo alarm (ALM) output turns ON (closes).
3	The SERVOPACK will output the initial incremental pulses.
4	After outputting the initial incremental pulses, the SERVOPACK will turn ON (close) the encoder ready (/E-RDY) signal. This allows the host controller to enter normal incremental operating status.
5	The host controller enter normal incremental operating status.



(2) Motion System with a Long Stroke

If you set the following parameters, you can build an absolute position detecting system using the PSO serial data and the pulse counter.

Parameter No.	Set Value	Description of Setting
Pn0D2	n.2□□□	The absolute data reception sequence is not performed. Also, the absolute data request signal is not necessary.
Pn515	n.□□□8	The SEN2 signal always indicates "invalid."

The procedure is given below.

Step	Meaning
1	Turn ON the control power supply.
2	Place the host controller on standby to receive the PSO serial data and clear the incremental pulse up/down counter to zero 100 ms after the servo alarm (ALM) output turns ON (closes).
3	The SERVOPACK outputs the PSO serial data (multiturn data (5 digits) and absolute position within one revolu- tion (7 digits)).
4	Refer to the formula in 2.8 Managing Positions at the Host Controller and calculate the current value as required by your system.
5	The host controller enter normal incremental operating status.



2.2.2 When Using Fully-Closed Loop Control or When Using a Linear Servomotor(1) Linear Motion System with a Short Stroke

If you set the following parameters, the absolute data request signal is not required. The absolute position is output as the initial incremental pulses, so the absolute position detecting system is built with only a pulse counter.

Parameter No.	Set Value	Description of Setting
Pn0D2	n.1000	The absolute position is output as the initial incremental pulses.
Pn515	n.□□□7	The SEN2 signal always indicates "valid."

The procedure is given below.

Step	Meaning
1	Turn ON the control power supply.
2	Clear the incremental pulse up/down counter to zero 100 ms after the servo alarm (ALM) output turns ON (closes).
3	The SERVOPACK will output the initial incremental pulses.
4	After outputting the initial incremental pulses, the SERVOPACK will turn ON (close) the encoder ready (/E-RDY) signal. This allows the host controller to enter normal incremental operating status.
5	The host controller enter normal incremental operating status.



(2) Motion System with a Long Stroke

If you set the following parameters, you can build an absolute position detecting system using the PSO serial data and the pulse counter.

Parameter No.	Set Value	Description of Setting
Pn0D2	n.2□□□	The absolute data reception sequence is not performed. Also, the absolute data request signal is not necessary.
Pn515	n.□□□8	The SEN2 signal always indicates "invalid."

The procedure is given below.

Step	Meaning
1	Turn ON the control power supply.
2	Place the host controller on standby to receive the PSO serial data and clear the incremental pulse up/down counter to zero 100 ms after the servo alarm (ALM) output turns ON (closes).
3	The SERVOPACK outputs the PSO serial data (the upper 16 bits of the position data (5 digits) and the lower 20 bits of the position data (7 digits)).
4	Refer to the formula in 2.8 Managing Positions at the Host Controller and calculate the current value as required by your system.
5	The host controller enter normal incremental operating status.

A timing chart is given below.



2

2.3.1 Description of Settings

2.3 Setting the Specification for Absolute Encoder Setup (Initialization) (Fn008)



This utility function can be used only with a rotational servomotor. This utility function is disabled if you use fully-closed loop control or use a Linear Servomotor.

2.3.1 Description of Settings

You can use Pn0D2.2 to select to use the encoder coordinates or the machine coordinates as the reference position for the phase-C pulse output and PSO serial data after the absolute encoder is set up (initialized) (Fn008).

Pa	rameter	Meaning	Reference Position after Fn008 Execution	When Enabled	Classification
Pn0D2	n. \Box 0 \Box [factory Same as standard Σ-V products. setting]		Encoder coordinate system	A fter restart	Setup
111002	n.□1□□	Fn008 is executed first and then the posi- tion that resulted from setup is set as the origin of the machine coordinate system.	Machine coordinate system	Arter Testart	Setup

If Pn0D2 is set to $n.\Box 1 \Box \Box$, the absolute encoder is set up (initialized) (Fn008) first and then the offset between the origin of the machine coordinate system and the origin of the absolute encoder is stored in Pn2D4. You can adjust the value that is stored in Pn2D4 after the setup is completed.

	Absolute Encoder (Origin Offset			
Pn2D4	Setting Range	Unit	Factory Setting	When Enabled	Classification
	1,073,741,824 to 1,073,741,823	1 encoder pulse	0	After restart	Setup

The relationship between the machine coordinate system origin, the absolute encoder origin, and the encoder position are shown in the following figure.



2.3.2 Absolute Encoder Setup (Initialization)

(1) Precautions

🕂 DANGER

• When you set up the absolute encoder, the reference position of the machine will change. Adjust the reference position at the host controller to the correct the position after you perform the setup. If the machine is operated without aligning the position in the host controller, unintended operation may occur and may result in injuries or damage to the machine. Be careful when starting the machine to ensure that this does not occur.

(2) Execution Timing

It is necessary to set up (initialize) the absolute encoder in the following cases.

- When replacing the SERVOPACK or servomotor
- When an encoder backup alarm (A.810) occurs
- When an encoder checksum alarm (A.820) occurs
- When the multiturn limit (Pn205) is changed
- When the rotation direction selection (Pn000.0) is changed
- When the motor is disconnected from the machine

(3) Execution Conditions

Before you set up (initialize) the absolute encoder, confirm that the following conditions are met.

- The Write Prohibited Setting parameter (Fn010) must be set to permit writing.
- An incremental encoder must be used.
- The usage method of the absolute encoder (Pn002.2) must not be set to 1 (Use the absolute encoder as an incremental encoder).
- A test without a motor must not be in progress.
- The servo must be OFF.

(4) Operating Procedure with the Panel Operator

Step	Display after Operation	Keys	Operation
1	Confirm that all of the con	nditions given in 2.3.2 (3)	Execution Conditions have been met.
2	Fn000	MODE/SET	Press the MODE/SET Key to select the utility function.
3	Fn008		Press the UP or the DOWN Key to select Fn008.
4	PGCL I		Press the DATA/SHIFT Key for approximately one second. The display shown on the left appears.
5	PEELS	Mode/Set A V DATA/	Continue pressing the UP Key until "PGCL5" is displayed. Note: If the wrong key is pressed, "no-oP" will flash for about one second and it will return to the utility func- tion. Start the operation from the beginning.
6	(donE)	MODE/SET	Press the MODE/SET Key. The absolute encoder is initial- ized. When completed, "donE" flashes for approximately one second. Note: If Pn0D2 is set to n.□1□□, the warning A.941 (change of parameter requires restart) will occur. A warning status will exist, but continue to the next step in the procedure.

2.3.2 Absolute Encoder Setup (Initialization)

(conťd)

			()
Step	Display after Operation	Keys	Operation
7	PGELS	_	Then, "donE" changes to "PGCL5".
8	Fn008		Press the DATA/SHIFT Key for approximately one second. "Fn008" is displayed again.
9	To enable the settings, turn the power supply to the SERVOPACK OFF and ON again.		

(5) Operating Procedure with the Digital Operator

Step	Panel Display	Keys	Description		
1	Confirm that all of the conditions	given in 2.3.2 (3) Exe	ecution Conditions have been met.		
2	BB -FUNCTION- Fn006:AImHist CIr <u>Fn008</u> :Mturn CIr Fn009:Ref Adj Fn00A:Vel Adj		Press the \bigcirc Key to select the utility function. And press the \land or \lor Key to select the Fn008.		
3	BB Multiturn Clear PGCL <u>1</u>	DATA	Press the \square Key to view the execution display of Fn008.		
4	BB Multiturn Clear PGCL <u>5</u>		Keep pressing the A Key until "PGCL1" is changed to "PGCL5."		
5	BB Multiturn Clear PGCL <u>5</u>	DATA	Press the main Key to setup the absolute encoder. After completing the setup, "DONE" is flashed for approxi- mately one second and "BB" is displayed. Note: If Pn0D2 is set to n. 11 , the warning A.941 (change of parameter requires restart) will be dis- played instead of BB. A warning status will exist, but continue to the next step in the procedure.		
6	BB -FUNCTION- Fn006:AImHist CIr Fn008:Mturn CIr Fn009:Ref Adj Fn00A:Vel Adj	MODE/SET	Press the contract Key to return to the display of the proce- dure 1.		
7	To enable the settings, turn the power supply to the SERVOPACK OFF and ON again.				

(6) Operating Procedure with the SigmaWin+

Select *Setup - Set Absolute Encoder - Reset Absolute Encoder* from the toolbar of the main window of the SigmaWin+ Σ -V-EX/FT component. The following dialog box will be displayed.

Absolute encoder - Setup AXIS#41	×			
Perform absolute encoder setup under the following circumstances: 1. At first start-up of the machine 2. When an "encoder backup alarm" has been generated 3. After the Servopack power has been turned OFF and the encoder cable removed				
Absolute encoder setup can only be performed with the Restart power after setup processing is complete.				
Alarm name Normal				
Execute setting				

Proceed by following the instructions displayed in the dialog boxes.

2.4.1 Description of Settings

2.4 Setting the Specification for Absolute Data Reception Sequence

2.4.1 Description of Settings

The settings of Pn0D2.3 and setting combinations are described in the following table.

Pn0D2.3 Set Value	Rotational Serial Data ^{*1} Output	Initial Incremental Pulse ^{*2} Output	Absolute Data Request Signal ^{*3}	PSO Serial Data ^{*2} Output
n.0□□□ [factory setting]	Yes	Yes	Required	Updated every 40 ms.
n.1000	No	Yes	Required	Updated every 40 ms.
n.2000	No	No	Not required.	40 ms. However, the output data is not updated. After the control power is turned ON, the posi- tion data where the servo alarm output turned ON will be out- put every 40 ms.

*1. If you use fully-closed loop control or use a Linear Servomotor, the serial data (upper 16 bits of the position data) is output.

*2. If you use a rotational servomotor, the output reference position depends on the setting of Pn0D2.2. For details, refer to 2.3 Setting the Specification for Absolute Encoder Setup (Initialization) (Fn008).

*3. If the absolute data request signal is required, the set value of Pn515.0 and the connection to the host computer will depend on whether the SEN signal or the SEN2 signal is used. For details, refer to 2.5 Setting the Absolute Data Request Signal.

2.4.2 Absolute Data Reception Sequence

(1) Example for $Pn0D2 = n.0 \Box \Box \Box$

The timing chart is the same as for a standard Σ -V SERVOPACK, as shown below. After you receive the rotational serial data^{*1}, wait to receive the PSO serial data.



*1. If you use fully-closed loop control or use a Linear Servomotor, the serial data (upper 16 bits of the position data) is output.

*2. If you use fully-closed loop control or use a Linear Servomotor, signed 36-bit position data is output.

2.4.2 Absolute Data Reception Sequence

(2) Example for $Pn0D2 = n.1\Box\Box\Box$

Setting of the Encoder Output Pulses (Pn212)	Formula of the Initial Incremental Pulse Speed
16 to 16384	$\frac{680 \times Pn212}{16384} $ [kpps]
16386 to 32768	$\frac{680 \times Pn212}{32768} $ [kpps]
32772 to 65536	$\frac{680 \times Pn212}{65536} $ [kpps]
65544 to 131072	$\frac{680 \times Pn212}{131072} [kpps]$
131088 to 262144	$\frac{680 \times Pn212}{262144} $ [kpps]

A timing chart is given below.



* If you use fully-closed loop control or use a Linear Servomotor, signed 36-bit position data is output.

(3) Example for $Pn0D2 = n.2\Box\Box\Box$



- *1. The PSO serial output data is not updated. After the control power is turned ON, the position data where the servo alarm output turned ON will be output every 40 ms.
- *2. If you use fully-closed loop control or use a Linear Servomotor, signed 36-bit position data is output.

2.5.1 Description of Settings

2.5 Setting the Absolute Data Request Signal

2.5.1 Description of Settings

Set Pn515.0 according to the absolute data request signal that will be used.

- If the SEN signal will be used, set Pn515 to n. DDB [factory setting].
- If the SEN2 signal will be used, set Pn515 to n. $\Box\Box\Box$ to n. $\Box\Box\Box$, or n. $\Box\Box\Box$ to n. $\Box\Box\Box$ f (assign the signal to CN1-40 to CN1-46).

Supplemental Information

- Whether the absolute data request signal is used is determined by Pn0D2.3. For details, refer to 2.4 Setting the Specification for Absolute Data Reception Sequence.
- If you do not use the absolute data request signal, the setting of Pn515 is not relevant.
- If the SEN2 signal will be used, set Pn50A to n. DDD1 so that you can change the signal allocations.

2.5.2 Connection to Host Controller

The connections to the host controller are shown in the following figure.

(1) Using the SEN Signal

The connections are the same as for a standard Σ -V SERVOPACK, as shown below.



(2) Using the SEN2 Signal

Use the connections shown in the following figure if Pn515 is set to $n.\square\square\square0$ to $n.\square\square\square6$, or $n.\square\square\square9$ to $n.\square\square\squareF$.

If Pn515 is set to $n.\Box\Box\Box$ 7, the SEN2 signal will always indicate "valid," and therefore it is not necessary to connect the SEN2 signal.



* Use Pn515.0 to set the assigned pin number and valid timing.

2

2.6 PSO Serial Data

The Σ -V-FT-series FT008 outputs the PSO serial data from CN1-48 and CN1-49. PSO serial data gives the absolute position of the encoder or linear scale.

The contents of the PSO serial data depends on the servomotor that you use and on whether you use fullyclosed loop control, as described below.

- If you use a rotational servomotor, the PSO serial data gives the multiturn data and the absolute position within one revolution.
- If you use fully-closed loop control or use a Linear Servomotor, the PSO serial data gives the signed 36-bit position data (the upper 16 bits (5 digits) and the lower 20 bits (7 digits)).

2.6.1 Data Specifications

The following table gives the data specifications of the PSO serial data.

Data Transfer Method	Start-stop Synchronization (ASYNC)			
Baud rate	9600 bps			
Start bits	1 bit			
Stop bits	1 bit			
Parity	Even			
Character code	ASCII 7-bit code			
Data format	16 characters, as shown below. • When Using a Rotational Servomotor **" or "-" (Multitum count: 5 digits) • (Absolute position • (Absolute			

(conťd)

Data Transfer Method	St	tart-stop Synchror	nization (ASYNC)	
		Output timing	After the initial incremental pulses are out- put and while the absolute data request sig- nal is being input.	
		Output cycle	40 ms	
	Pn0D2 = n.0□□□ or n.1□□□	Output data contents	 When Using a Rotational Servomotor Normally, the multiturn data (5 digits) and absolute position within one revolution (7 digits) are output. When Using Fully-Closed Loop Control or When Using a Linear Servomotor Normally, the position data (the upper 16 bits (5 digits) and the lower 20 bits (7 dig- its)) is output. 	
Data output timing, output cycle, and		Output timing	After the servo alarm output turns ON (closed = no alarm)	
output data contents		Output cycle	40 ms	
	Pn0D2 = n.2□□□	Output data contents	 When Using a Rotational Servomotor The position data is not updated. After the control power is turned ON, the multiturn data (5 digits) and absolute position within one revolution (7 digits) when the servo alarm output turned ON are output each time. When Using Fully-Closed Loop Control or When Using a Linear Servomotor The position data is not updated. After the control power is turned ON, the position data (the upper 16 bits (5 digits) and the lower 20 bits (7 digits)) when the servo alarm output turned ON is output. 	
	Absolute data request signal			
Alarm output	PSO	Enlargement "A" "L" "I	[Data format] M" <u>"5"</u> "1" "." "CR" Upper 2 digits	

2

2.6.2 Output Terminals

2.6.2 Output Terminals

The PSO serial data is assigned to CN1-48 and CN1-49. CN1-48 and CN1-49 connect to a line driver output circuit, as shown in the following figure. Always use a line receiver circuit to receive the output at the host controller.



2.7 Encoder Ready (/E-RDY) Signal

When the absolute data reception sequence has been completed and the dividing output has entered the normal incremental operating status, the /E-RDY signal (encoder ready signal) is output. For details on the output timing, refer to 2.4.2 Absolute Data Reception Sequence.

The /E-RDY signal is output at the same time as the /S-RDY signal (servo ready output signal). The /S-RDY signal is not output while there is an active alarm.

No Alarm



* If you use fully-closed loop control or use a Linear Servomotor, signed 36-bit position data is output.

Active Alarm

Servo alarm output	OFF (open): Active alarm			
(CN1-31, -32)				
Encoder ready signal (/E-RDY) (Output pin number is set in Pn518.)	OFF (open): Not ready.		ON (closed): Ready.	
Servo ready output signal	OFF (open): Not ready.			
(/S-RDY)				
	(The /S-RDY signal will not turn ON while there is an			
	active alarm. Only the /E-RDY signal turns ON.)		

2.8.1 Pn0D2 = n.□0□□

2.8 Managing Positions at the Host Controller

If the motor position is managed by the host controller with the PSO serial data, the absolute data is found with the formulas given below.

2.8.1 Pn0D2 = n.□0□□

(1) When Using a Rotational Servomotor



The final absolute data, P_M, is found with the following formula.

Forward Rotation Mode (Pn000.0 = 0)	Reverse Rotation Mode (Pn000.0 = 1)
$\mathbf{P}_{\mathrm{E}} = (\mathbf{M} \times \mathbf{R}) + \mathbf{P}_{\mathrm{O}}$	$P_{E} = (-(M + 1) \times R) + (R - P_{O})$
$\mathbf{P}_{\mathbf{S}} = (\mathbf{M}_{\mathbf{S}} \times \mathbf{R}) + \mathbf{P}_{\mathbf{S}}'$	$\mathbf{P}_{\mathbf{S}} = (-\mathbf{M}_{\mathbf{S}} \times \mathbf{R}) + (\mathbf{R} - \mathbf{P}_{\mathbf{S}}')$
$P_M = P_E - P_S$	$\mathbf{P}_{\mathbf{M}} = \mathbf{P}_{\mathbf{E}} - \mathbf{P}_{\mathbf{S}}$

Signal	Meaning	Unit	
P _E	Current value read by encoder	Encoder pulses	
М	Multiturn count	Revolutions	
P _O	Position within one absolute encoder revolution	Encoder pulses	
P _S	Position read at the reference position (This position is recorded and managed at the host controller.)	Encoder pulses	
M _S	Multiturn count read at the reference position	Revolutions	
P _S '	Position within one absolute encoder revolution read at the reference position Encoder pulses		
P _M	Current value required for the user's system Encoder p		
R	Number of pulses per encoder revolution Encoder pulses		

(2) When Using Fully-Closed Loop Control or When Using a Linear Servomotor



The final absolute data, P_M , is found with the following formula.

 $P_{\rm E} = (M_{\rm O} \times R) + P_{\rm O}$ $P_{\rm S} = (M_{\rm S} \times R) + P_{\rm S}'$

 $P_M = P_E - P_S$

Note: The above formulas can also be used in reverse rotation mode (Pn000.0 = 1 or Pn002.3 = 3).

Signal	Meaning	Unit
P _E	Current value read by encoder	Encoder pulses
M _O	Absolute encoder position data (upper 16 bits) $(1 = 1,048,576 \text{ encoder pulses})$	-
P _O	Absolute encoder position data (lower 20 bits)	Encoder pulses
P _S	Position read at the reference position (This position is recorded and managed at the host controller.)	Encoder pulses
M _S	Absolute encoder position data (upper 16 bits) read at the reference position $(1 = 1,048,576 \text{ encoder pulses})$	_
Ps'	Absolute encoder position data (lower 20 bits) read at the reference position	Encoder pulses
P _M	Current value required for the user's system	Encoder pulses
R	1048576	Encoder pulses

2.8.2 Pn0D2 = n.□1□□

2.8.2 Pn0D2 = n.□1□□



This utility function can be used only with a rotational servomotor. This utility function is disabled if you use fully-closed loop control or use a Linear Servomotor.



The final absolute data, P_M, is found with the following formula.

Forward Rotation Mode (Pn000.0 = 0)	Reverse Rotation Mode (Pn000.0 = 1)
$P_{\rm M} = ({\rm M} \times {\rm R}) + P_{\rm O}$	$\mathbf{P}_{\mathbf{M}} = (-\mathbf{M} \times \mathbf{R}) + (\mathbf{R} - \mathbf{P}_{\mathbf{O}})$

Symbol	Meaning	Unit
М	Multiturn count	Revolutions
P _O	Position within one absolute encoder revolution in the machine coordinate system	Encoder pulses
P _M	Current value required for the user's system	Encoder pulses
R	Number of pulses per encoder revolution	Encoder pulses

List of Monitor Displays and Parameters for the $\Sigma\text{-}V\text{-}FT\text{-}series$ FT008

Here, the monitor displays and the parameters that are added to the Σ -V-FT-series FT008 are given.

All monitor displays and parameters that are not given here are the same as for the Σ -V Standard SERVOPACKs. For details, refer to the Σ -V Series User's Manual Design and Maintenance, Analog Voltage and Pulse Train Reference (manual no.: SIEP S800000 45 or SIEP S800000 47).

3.1	Additional Monitor Displays	3-2
3.2	Special Parameters	3-3
3.3	Precaution When Copying Parameters	3-5

3.1 Additional Monitor Displays

The following monitor displays were added to those for a standard Σ -V SERVOPACK.

Parameter No.	Description	Unit	Remarks	
Un040	Absolute Encoder Multiturn Data	Revolutions	Monitoring is possible only	
Un041	Absolute Encoder Position within One Revolution	Encoder pulses	is used.	
Un042	Absolute Encoder Position Data, Lower Bits	Encoder pulses	-	
Un043	Absolute Encoder Position Data, Upper Bits	Encoder pulses	-	
Un044	Absolute Encoder Position Data	Reference units	-	

3.2 Special Parameters

The following table lists the parameters that differentiate the FT008 from the Σ -V Series standard SERVO-PACKs.



* This parameter is enabled only for a rotational servomotor.

Input Signal Selection 6 Size Setting Range Setting Unit **Factory Setting** When Enabled Classification 2 0000 to FFFF 8888 After restart Setup 4th 3rd 2nd 1st **SEN2 Signal Mapping** 0 Active when CN1-40 input signal is ON (closed). 1 Active when CN1-41 input signal is ON (closed). 2 Active when CN1-42 input signal is ON (closed). 3 Active when CN1-43 input signal is ON (closed). 4 Active when CN1-44 input signal is ON (closed). 5 Active when CN1-45 input signal is ON (closed). 6 Active when CN1-46 input signal is ON (closed). 7 Always active (fixed). Pn515 8 Not active (fixed). 9 Active when CN1-40 input signal is OFF (open). A Active when CN1-41 input signal is OFF (open) В Active when CN1-42 input signal is OFF (open). С Active when CN1-43 input signal is OFF (open). D Active when CN1-44 input signal is OFF (open). E Active when CN1-45 input signal is OFF (open). F Active when CN1-46 input signal is OFF (open). Reference Pulse Input Multiplication Switching Input Signal (/PSEL) Mapping 0 to F Same as SEN2 Signal Mapping. Reserved (Do not change.) Reserved (Do not change.) **Output Signal Selection 7** Size Setting Range Setting Unit Factory Setting When Enabled Classification 2 0000 to 3333 0000 After restart Setup 4th 3rd 2nd 1st digit digit digit digit n. 🗆 🗆 🗖 Reserved (Do not change.) Encoder Ready Signal (/E-RDY) Mapping Pn518 0 Disabled (the above signal is not used.) Outputs the signal from CN1-25, -26 output terminal. 1 2 Outputs the signal from CN1-27, -28 output terminal. 3 Outputs the signal from CN1-29, -30 output terminal. Reserved (Do not change.) Reserved (Do not change.)

(cont'd)

3.3 Precaution When Copying Parameters

The digital operator can be used to copy parameters between two FT008 SERVOPACKs in the Σ -V-FT series.

If you copy parameters between a Σ -V-FT-series FT008 SERVOPACK and a different model of SERVO-PACK, alarms such as A.040 (Parameter Setting Error 1) will occur because different numbers of parameters are used.

3

Index

Symbols /E-RDY ----------2-21 Σ-V standard SERVOPACK -----iv Α absolute data reception sequence ----- 2-12 absolute data request signal ----- 2-16 absolute encoder origin -----2-8 absolute encoder origin offset -----2-8 absolute encoder setup (initialization) -----2-9 ambient humidity -----1-4 В base block (BB) ---------iv С CE ----- xviii Ε encoder ready signal -----2-21 EU Directives ----- xviii F FT008 ------ - ------1-2 н harmonized standards - - - - - ------1-4 L initial incremental pulse ----- 2-14 Μ machine coordinate system origin -----2-8 managing positions -----2-22 Ν notation for parameters - - - - v parameters for numeric settings ----- v parameters for selecting functions ----- v 0 -----2-8 offset -----Ρ pollution degree -----1-4 protection class -----1-4 PSO serial data -----2-18 data format ----- 2-18 data specification -----2-18 S SEN signal ----- 2-16 SEN2 signal ----- 2-17 SERVOPACK basic specifications -----1-4 control specifications -----1-7 model designation -----1-8 ratings -----1-2 shock resistance -----1-4 soft start time setting -----1-4 speed control range -----1-4 speed regulation -----1-4

storage humidity 1-4
storage temperature 1-4
surrounding air temperature 1-4
т
torque control tolerance 1-4
U
UKCAxix
ULxvii
V
vibration resistance 1-4

Revision History

The revision dates and numbers of the revised manuals are given on the bottom of the back cover.

MANUAL NO. SIEP S800001 19B <1>-1 WEB revision number Revision number Date of publication

Date of Publication	Rev. No.	WEB Rev. No.	Section	Revised Content
April 2024	<6>	0	All chapters	Addition: SGMCV
			Preface	Partly revised
			Back cover	Revision: Address
March 2023	<5>	0	Preface	Partly revised
			Back cover	Revision: Address
March 2022	<4>	0	Preface	Revision: EU Directives
			Back cover	Revision: Address
January 2020	<3>	0	Preface	Revision: ■ Disposal precautions
			Back cover	Revision: Address
January 2018	<2>	0	All chapters	Partly revised
			Back cover	Revision: Address
March 2017	<1>	1	Front cover	Revision: Format
			2.5.1	Revision: Settings for the absolute data request signal
			Back cover	Revision: Address and format
June 2014		0	-	Based on Japanese user's manual, SIJP S800001 19B<1>-0, available on the Web from March 2014.
			All sections	Addition: Information on using fully-closed loop control or using a Linear Servomotor.
			Back cover	Revision: Address
December 2013	-	-	_	First edition

AC Servo Drives Σ -V-FT Series **USER'S MANUAL** Model: FT008 Analog Voltage and Pulse Train Reference

IRUMA BUSINESS CENTER (SOLUTION CENTER) 480, Kamifujisawa, Iruma, Saitama, 358-8555, Japan Phone: +81-4-2962-5151 Fax: +81-4-2962-6138 www.vaskawa.co.ip

YASKAWA AMERICA, INC.

2121, Norman Drive South, Waukegan, IL 60085, U.S.A. Phone: +1-800-YASKAWA (927-5292) or +1-847-887-7000 Fax: +1-847-887-7310 www.yaskawa.com

YASKAWA ELÉTRICO DO BRASIL LTDA. 777, Avenida Piraporinha, Diadema, São Paulo, 09950-000, Brasil Phone: +55-11-3585-1100 Fax: +55-11-3585-1187 www.yaskawa.com.br

YASKAWA EUROPE GmbH

Philipp-Reis-Str. 6, 65795 Hattersheim am Main, Germany Phone: +49-6196-569-300 Fax: +49-6196-569-398 www.yaskawa.eu.com E-mail: info@yaskawa.eu.com

YASKAWA ELECTRIC KOREA CORPORATION

6F, 112, LS-ro, Dongan-gu, Anyang-si, Gyeonggi-do, Korea Phone: +82-31-8015-4224 Fax: +82-31-8015-5034 www.yaskawa.co.kr

YASKAWA ASIA PACIFIC PTE. LTD.

30A, Kallang Place, #06-01, 339213, Singapore Phone: +65-6282-3003 Fax: +65-6289-3003 www.yaskawa.com.sg

YASKAWA ELECTRIC (THAILAND) CO., LTD. 59, 1F-5F, Flourish Building, Soi Ratchadapisek 18, Ratchadapisek Road, Huaykwang, Bangkok, 10310, Thailand Phone: +66-2-017-0099 Fax: +66-2-017-0799 www.yaskawa.co.th

YASKAWA ELECTRIC (CHINA) CO., LTD.

22F, Link Square 1, No.222, Hubin Road, Shanghai, 200021, China Phone: +86-21-5385-2200 Fax: +86-21-5385-3299 www.vaskawa.com.cn

YASKAWA ELECTRIC (CHINA) CO., LTD. BEIJING OFFICE

Room 1011, Tower W3 Oriental Plaza, No.1, East Chang An Avenue, Dong Cheng District, Beijing, 100738, China Phone: +86-10-8518-4086 Fax: +86-10-8518-4082

YASKAWA ELECTRIC TAIWAN CORPORATION 12F, No. 207, Section 3, Beishin Road, Shindian District, New Taipei City 23143, Taiwan Phone: +886-2-8913-1333 Fax: +886-2-8913-1513 or +886-2-8913-1519 www.yaskawa.com.tw



YASKAWA ELECTRIC CORPORATION

In the event that the end user of this product is to be the military and said product is to be employed in any weapons systems or the manufacture thereof, the export will fall under the relevant regulations as stipulated in the Foreign Exchange and Foreign Trade Regulations. Therefore, be sure to follow all procedures and submit all relevant documentation according to any and all rules, regulations and laws that may apply. Specifications are subject to change without notice for ongoing product modifications and improvements.

© 2013 YASKAWA ELECTRIC CORPORATION

MANUAL NO. SIEP S800001 19G <6>-0 Published in Japan April 2024 23-4-19 Original instructions