YASKAWA

AC Servo Drives

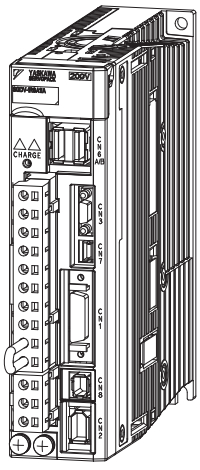
Σ-V-FT Series

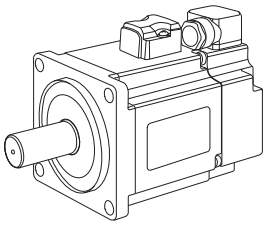
USER'S MANUAL

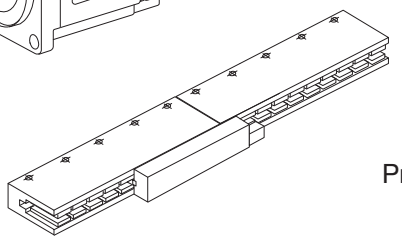
Model: FT003

MECHATROLINK-II Communications Reference

SGDV-□□□□1□□□□□FT003 SERVOPACK
SGMMV/SGMJV/SGMAV/SGMPS/SGMGV/SGMSV/SGMCV/SGMCS/
SGLGW/SGLFW/SGLTW/SGLC/SGT Servomotor







MANUAL NO. SIEP S800001 09H

About this Manual

This manual contains information that is required to design, test, adjust, and maintain a Σ-V-FT-series FT003 servo system. The FT003 servo system supports pressure feedback control.

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

When you use a Σ-V-FT-series FT003 servo system, read this manual together with the Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-II Communications Reference.

Also read the documents that are listed on the next page 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, MECHATROLINK-II Communications Reference	
			For Rotation Motors (Manual No.: SIEP S800000 46)	For Linear Motors (Manual No.: SIEP S800000 48)
Outline	Σ-V-FT-series FT003	1.1	–	
	Part Names	–	1.2	
	SERVOPACK Ratings and Specifications	1.2	–	
	SERVOPACK Internal Block Diagrams	–	1.4	
	Examples of Servo System Configurations	–	1.5	
	SERVOPACK Model Designation	1.3	–	
	Inspection and Maintenance	–	1.7	
Panel Display and Operation of Digital Operator		–	Chapter 2	
Wiring and Connections	Input Signal Connections for Pressure Feedback Control	2.3	–	
	Other Wiring and Connections	–	Chapter 3	
Operation		–	Chapter 4	
Pressure Feedback Control		Chapter 2	–	
Adjustments	Adjusting Pressure Feedback Control	Chapter 2	–	
	Other Adjustments	–	Chapter 5	
Utility Functions (Fn□□□)	Automatic Offset of Pressure Feedback Detection Input Signal (Fn009)	2.7.2 (3)	–	
	Other Utility Functions	–	Chapter 6	
Monitor Displays (Un□□□)	Monitoring Pressure Feedback Control	Chapter 3	–	
	Other Monitor Functions	–	Chapter 7	
Fully-closed Loop Control		–	Chapter 8	–

(cont'd)

Item		This Manual	Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-II Communications Reference	
			For Rotation Motors (Manual No.: SIEP S800000 46)	For Linear Motors (Manual No.: SIEP S800000 48)
Trouble-shooting	Troubleshooting Unique to the Σ-V-FT-series FT003	Chapter 4	–	
	Other Troubleshooting	–	Chapter 9	Chapter 8
List of Utility Functions		–	10.1.1	9.1.1
List of Parameters	Σ-V-FT-series FT003 parameters	Chapter 5	–	–
	Other Parameters	–	10.1.2	9.1.2
List of Monitor Displays		–	10.2	9.2
Parameter Recording Table		–	10.3	9.3

■ Description of Technical Terms

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

Term	Meaning
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, SGLCW linear servomotor or SGT linear slider
SERVOPACK	Σ-V-FT Series FT003 servo amplifier
Σ-V Standard SERVOPACK	Σ-V Series SERVOPACKs for use with rotational or linear motors with MECHATROLINK-II communications 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.
Pressure Feedback Control	Control with a fully-closed circuit for torque/force references

■ Specific Technical Terms

Different technical terms are used for rotational motors and linear motors, and the terms for rotational motors are used in this manual.

Rotational Motors	Linear Motors
rotation	movement
moment of inertia	mass
forward rotation, reverse rotation	forward direction, reverse direction

■ 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.

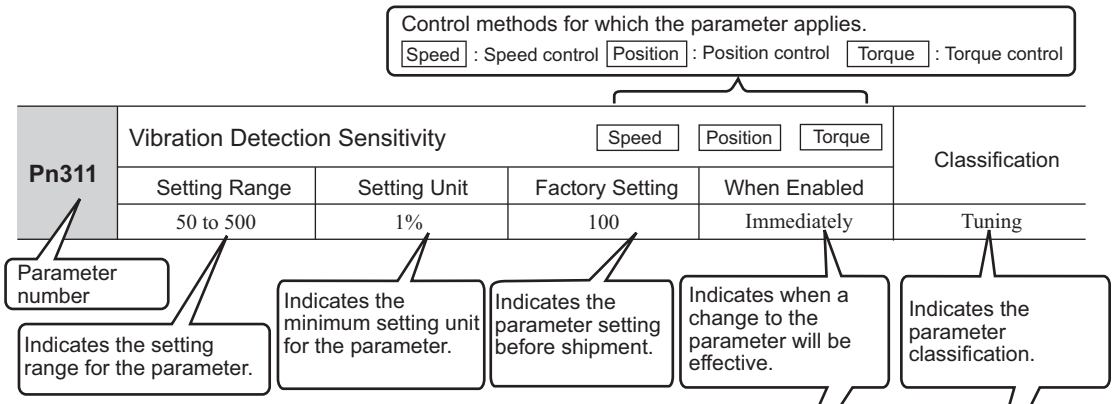
  Notation Example

  $\overline{BK}$ = /BK

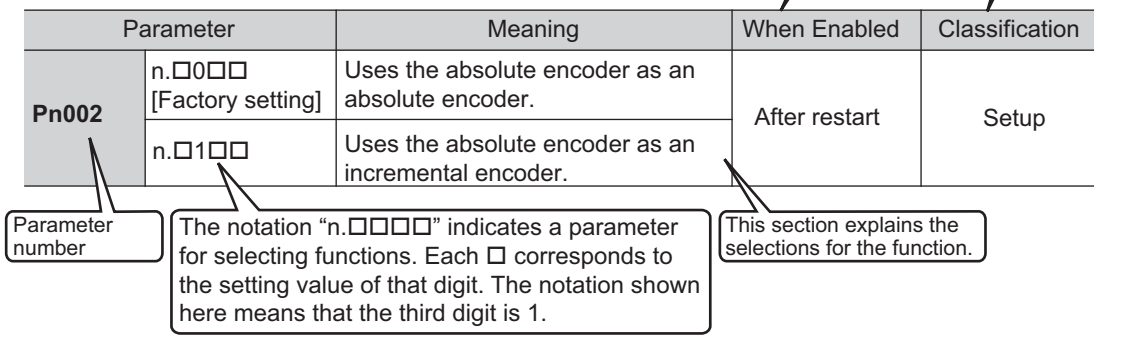
- Notation for Parameters

  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

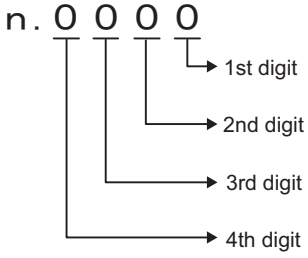


  - Parameters for Selecting Functions



  Notation Example

Digital Operator Display (Display Example for Pn002)



Digit Notation		Setting Notation	
Notation	Meaning	Notation	Meaning
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.
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.
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.
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.

■ Related Manuals

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 User's Manual Setup Rotational Motor (No.: SIEP S800000 43)				✓	✓		
Σ-V Series User's Manual Setup Linear Motor (No.: SIEP S800000 44)				✓	✓		
Σ-V Series Product Catalog (No.: KAEP S800000 42)	✓	✓	✓				
Σ-V-FT Series User's Manual Model: FT003/ MECHATROLINK-II Communications Reference (this manual)			✓		✓	✓	✓
Σ-V Series User's Manual Design and Maintenance Rotational Motor/ MECHATROLINK-II Communications Reference (No.: SIEP S800000 46)			✓		✓	✓	✓
Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-II Communications Reference (No.: SIEP S800000 48)			✓		✓	✓	✓
Σ-V Series User's Manual MECHATROLINK-II Standard Servo Profile Commands (No.: SIEP S800000 54)			✓		✓	✓	
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)				✓			✓

■ Trademarks

MECHATROLINK is a trademark of the MECHATROLINK Members Association.

■ Safety Information

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

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

⚠ WARNING

- 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.
  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.

Rotational 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 positioning system of the Σ Series must be changed for use with products in the Σ-V-FT Series.
- The multiturn limit value need not be changed except for special applications.
  Changing it inappropriately or unintentionally can be dangerous.
- If the Multiturn 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 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.

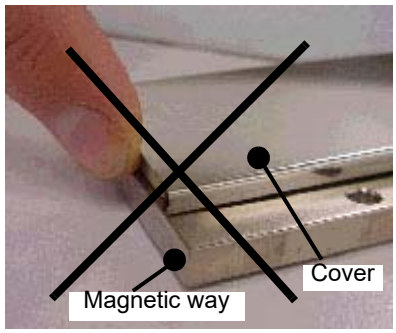
■ Installation

⚠ CAUTION

- 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.

Linear Servomotors

- 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 way.
  Failure to observe this caution may result in malfunction or damage to these items by 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.



- 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

⚠ CAUTION

- Be sure to wire correctly and securely.
  Failure to observe this caution may result in motor overrun, injury, or malfunction.
- Securely tighten the cable connector screws and securing mechanism.
  If the connector screws and securing mechanism are not secure, they may loosen during operation.
- Use cables with a radius, heat resistance, and flexibility suitable for the system.
- If the SERVOPACK malfunctions, turn OFF the main circuit's power supply of the SERVOPACK.
  The continuous flow of a large current may cause fire.
- Use a noise filter to minimize the effects of electromagnetic damage.
  Failure to observe this caution may result in electromagnetic damage to electronic devices used near the SERVOPACK.
- 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 terminals.
  Failure to observe this caution may result in fire.
- Do not touch the power supply terminals while the CHARGE lamp 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 to do wiring or inspections.
- Be sure to observe the following precautions when wiring the SERVOPACK main circuit terminal blocks.
  - Do not turn the SERVOPACK power ON until all wiring, including the main circuit terminal blocks, has been completed.
  - Remove detachable main circuit terminals from the SERVOPACK prior to wiring.
  - Insert only one 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-circuits) adjacent wires.
- Do not connect a power supply that exceeds the power supply specifications.
  Failure to observe this warning may result in damage to the SERVOPACK.
- When connecting an External Regenerative Resistor to the SGDV-3R8A, -5R5A, -7R6A, -120A, -180A, -200A, -330A, -1R9D, -3R5D, -5R4D, -8R4D, -120D, or -170D, first remove the lead wire between the B2 and B3 terminals on the SERVOPACK, and then connect the External Regenerative Resistor.
  There is a risk of SERVOPACK failure.
- Always use the specified power supply voltage.
  An incorrect voltage may result in fire or malfunction.
- Make sure that the polarity is correct.
  Incorrect polarity may cause ruptures or damage.
- 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 equipment.
- Install external breakers or other safety devices against short-circuiting in external wiring.
  Failure to observe this caution may result in fire.
- Take appropriate and sufficient countermeasures for each form of potential interference when installing systems in the following locations.
  - Locations subject to static electricity or other forms of noise
  - Locations subject to strong electromagnetic fields and magnetic fields
  - Locations subject to possible exposure to radioactivity
  - Locations close to power supplies

  Failure to observe this caution may result in damage to the equipment.
- Wiring or inspection must be performed by a technical expert.
- Use a 24-VDC power supply with double insulation or reinforced insulation.

⚠ CAUTION

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 serial converter unit: 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

⚠ CAUTION

- 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 malfunction.
- 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 hour 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 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.
- 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 regenerative 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.

Rotational 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 Servomotors

- 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

⚠ CAUTION

- 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

⚠ CAUTION

- 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-35A□□□H and -50A□□□H (high-force type) are not in compliance with the UL Standards.

■ EU Directives

CE

Product	Model	EU Directives	Harmonized Standards
SERVOPACK	SGDV	Machinery Directive 2006/42/EC	EN ISO 13849-1: 2015
		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
Rotary Servomotor	• SGMGV • SGMSV	EMC Directive 2014/30/EU	EN 55011 Group 1, Class A EN 61000-6-2 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
	• 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
Direct Drive Servomotor	• SGMCV • SGMCS -□□B -□□C -□□D -□□E (Small-capacity, Coreless servomotors) *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)
		Low Voltage Directive 2014/35/EU	EN 60034-1 EN 60034-5
		RoHS Directive 2011/65/EU (EU)2015/863	EN IEC 63000
Linear Servomotor	• SGLG*2 • SGLF*2 • SGLT*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)
		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)

Product	Model	UK Regulations	Designated Standards
SERVOPACK	SGDV	Supply of Machinery (Safety) Regulations S.I. 2008/1597	EN ISO 13849-1: 2015
		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 61800-5-1
		Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
Rotary Servomotor	• SGMGV • SGMSV	Electromagnetic Compatibility Regulations S.I. 2016/1091	EN 55011 Group 1, Class A EN 61000-6-2 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 Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
	• 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 Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000
Direct Drive Servomotor	• SGMCV • SGMCS -□□B -□□C -□□D -□□E (Small-capacity, Coreless servomotors) *1	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 Electrical and Electronic Equipment Regulations S.I. 2012/3032	EN IEC 63000

(cont'd)

Product	Model	UK Regulations	Designated Standards
Linear Servomotor	• SGLG*2 • SGLF*2 • SGLT*2	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
		Restriction of the Use of Certain Hazardous Substances in Electrical 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
SERVOPACK	SGDV	Safety of Machinery	EN ISO 13849-1: 2015 EN 60204-1
		Functional Safety	EN 61508 series EN 61800-5-2
		Functional Safety EMC	EN 61326-3-1

• Safety Performance

Items	Standards	Performance Level
Safety Integrity Level	EN 61508	SIL2
Probability of Dangerous Failure per Hour	EN 61508	PFH = 1.7×10^{-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

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

1

Outline

1.1 Σ-V-FT-series FT003

A Σ-V-FT-series FT003 SERVOPACK supports pressure feedback control.

For details on the pressure feedback control, refer to *Chapter 2 Pressure Feedback Control*.

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: Rotational/Linear Motors

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 *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46/48).

(2) SGDV with Single-phase, 200-V Rating: Rotational Motors

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-120A11A008FT003.
*2. For details, refer to *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46).

(3) SGDV with Three-phase, 200-V Rating: Rotational Motors

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 or external				Built-in or external							External			
Main Circuit Power Supply	Three-phase, 200 to 230 VAC $^{+10\%}_{-15\%}$, 50/60 Hz														
Control Power Supply	Single-phase, 200 to 230 VAC $^{+10\%}_{-15\%}$, 50/60 Hz														
Overvoltage Category	III														

* For details, refer to *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46).

(4) SGDV with Three-phase, 200-V Rating: Linear Motors

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 external				Built-in or external							External
Main Circuit Power Supply	Three-phase, 200 to 230 VAC $^{+10\%}_{-15\%}$, 50/60 Hz											
Control Power Supply	Single-phase, 200 to 230 VAC $^{+10\%}_{-15\%}$, 50/60 Hz											
Overvoltage Category	III											

* For details, refer to *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance Linear Motor/MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 48).

(5) SGDV with Three-phase, 400-V Rating: Rotational Motors

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 external						External			
Main Circuit Power Supply	Three-phase, 380 to 480 VAC $^{+10\%}_{-15\%}$, 50/60 Hz									
Control Power Supply	24 VDC ±15%									
Overvoltage Category	III									

* For details, refer to *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance Rotational Motor/MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46).

(6) SGDV with Three-phase, 400-V Rating: Linear Motors

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 external						External
Main Circuit Power Supply	Three-phase, 380 to 480 VAC $^{+10\%}_{-15\%}$, 50/60 Hz						
Control Power Supply	24 VDC ±15%						
Overvoltage Category	III						

* For details, refer to *3.7 Connecting Regenerative Resistors* in the *Σ-V Series User's Manual Design and Maintenance Linear Motor/MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 48).

1.2.2 Basic Specifications

Basic specifications of SERVOPACKs are shown below.

Drive Method			Sine-wave current drive with PWM control of IGBT	
Feedback			Rotational Motor	Encoder: 13 bit (incremental), 17 and 20 bit (incremental/absolute)
			Linear Motor	Linear scale: The signal resolution depends on the linear scale that is used.*1 (incremental/absolute)
			Pressure Feedback	Recommended pressure sensor amplifier specifications: Output voltage: ±12 V Response frequency: 500 Hz min.
Operating Conditions	Surrounding Air Temperature		0°C to +55°C	
	Storage Temperature		-20°C to +85°C	
	Ambient Humidity		90% RH or less	With no freezing or condensation
	Storage Humidity		90% RH or less	
	Vibration Resistance		4.9 m/s^2	
	Shock Resistance		19.6 m/s^2	
	Protection Class		IP10	An environment that satisfies the following conditions. • Free of corrosive or flammable gases • Free of exposure to water, oil, or chemicals • Free of dust, salts, or iron dust
	Pollution Degree		2	
	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 preface for details.	
Mounting			Standard: Base-mounted Optional: Rack-mounted or duct-ventilated	
Performance	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.)	
	Speed Regulation*2	Load Regulation	0% to 100% load: ±0.01% max. (at rated speed)	
		Voltage Regulation	Rated voltage ±10%: 0% (at rated speed)	
		Temperature Regulation	25 ± 25 °C: ±0.1% max. (at rated speed)	
	Torque/Force Control Tolerance (Repeatability)		±1%	
	Soft Start Time Setting		0 to 10 s (Can be set individually for acceleration and deceleration.)	

(cont'd)

I/O Signals	Encoder Output Pulse		Phase A, B, C: line driver Encoder output pulse: any setting ratio*3	
	Sequence Input	Input Signals which can be allocated	Number of Channels	7 ch
			Functions	• Homing deceleration switch (/DEC) • External latch (/EXT 1 to 3) • Forward run prohibited (P-OT), reverse run prohibited (N-OT) • Forward external torque/force limit (/P-CL), reverse external torque/force limit (/N-CL) • Polarity detection (/P-DET) only for linear motor Signal allocations can be performed, and positive and negative logic can be changed.
	Sequence Output	Fixed Output	Servo alarm (ALM) output	
		Output Signals which can be allocated	Number of Channels	3 ch
			Functions	• Positioning completion (/COIN) • Speed coincidence detection (/V-CMP) • Rotation detection (/TGON) • Servo ready (/S-RDY) • Torque/force limit detection (/CLT) • Speed limit detection (/VLT) • Brake (/BK) • Warning (/WARN) • Near (/NEAR) Signal allocations can be performed, and positive and negative logic can be changed.
Communications Function	RS422A Communications (CN3)	Interface	Digital operator (model: JUSP-OP05A-1-E), personal computer (can be connected with SigmaWin+)	
		1:N Communications	N = Up to 15 stations possible at RS422A	
		Axis Address Setting	Set by parameter	
	USB Communications (CN7)	Interface	Personal computer (can be connected with SigmaWin+)	
		Communications Standard	Complies with standard USB1.1. (12 Mbps)	
LED Display			Panel display (seven-segment), CHARGE, POWER, and COM indicators	
MECHATROLINK-II Communications Setting Switches			Rotary Switch (SW1)	Position: 16 positions
			DIP Switch (SW2)	Number of pins: Four pins*4
Analog Monitor (CN5)			Number of points: 2 Output voltage: ± 10 VDC (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 Processing			Included*5	
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.	

(cont'd)

Safety Function	Input	/HWBB1, /HWBB2: Baseblock signal for power module
	Output	EDM1: Monitoring status of internal safety circuit (fixed output)
	Standards*6	EN ISO13849-1 PL d (Category 3), IEC61508 SIL2
Option Module		Fully-closed module only for rotational motor

∗1. For details, refer to *4.4.3 Electronic Gear* in the *Σ-V Series User's Manual Design and Maintenance Linear Motor/ MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 48).
∗2. Speed regulation by load regulation is defined as follows:

$$\text{Speed regulation} = \frac{\text{No-load motor speed} - \text{Total load motor speed}}{\text{Rated motor speed}} \times 100\%$$

∗3. Refer to *4.4.5 Setting Encoder Output Pulse* in the *Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46/48).
∗4. Refer to *4.1 MECHATROLINK-II Communications Settings* in the *Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46/48).
∗5. Refer to *1.2.1 Ratings* for details on regenerative resistors.
∗6. Perform risk assessment for the system and be sure that the safety requirements are fulfilled.

1.2.3 MECHATROLINK-II Function Specifications

The following table shows the specifications of MECHATROLINK-II.

Function		Specifications
MECHATROLINK-II Communication	Communication Protocol	MECHATROLINK-II
	Station Address	41H to 5FH (Max. number of stations: 30) Use the rotary switch SW1 and the DIP switch SW2 to set the station address.
	Baud Rate	10 Mpbs, 4 Mpbs Use the DIP switch SW2 to select the number of words.
	Transmission Cycle	250 μs, 0.5 ms to 4.0 ms (increments of 0.5 ms)
	Number of Transmission Bytes	17 bytes per station or 32 bytes per station Use the DIP switch SW2 to select the number of words.
Reference Method	Control Method	Position, speed, or torque/force control with MECHATROLINK-II communication
	Reference Input	MECHATROLINK-I, MECHATROLINK-II commands (sequence, motion, data setting/reference, monitoring, or adjustment)

1.3 SERVOPACK Model Designation

This section shows SERVOPACK model designation.

1st + 2nd + 3rd digits	4th digit	5th + 6th digits	7th digit	8th + 9th + 10th digits	11th + 12th + 13th + 14th + 15th digits
SGDV – 2R8	A	11	A	000	FT003

Series	
SGDV	Σ-V Series
	Σ-V-FT Series

7th digit: Design Revision Order	
A	Other than below
B	• SGDV-R70A□□ • SGDV-R90A□□ • SGDV-1R6A□□ • SGDV-2R8A□□

11th + 12th + 13th + 14th + 15th digits: Function Specification	
Code	Specification
FT003	Pressure feedback control

1st + 2nd + 3rd digits: Current		
Voltage	Code	Max. Allowable Motor Capacity (kW)
100 V	R70	0.05
	R90	0.1
	2R1	0.2
	2R8	0.4
200 V	R70*1	0.05
	R90*1	0.1
	1R6*1	0.2
	2R8*1	0.4
	3R8	0.5
	5R5*1	0.75
	7R6	1
	120*2	1.5
	180	2
	200	3
	330	5
	470*3, *4	6
	550*4	7.5
	590*3, *4	11
	780*3, *4	15
400 V	1R9	0.5
	3R5	1
	5R4	1.5
	8R4	2
	120	3
	170	5
	210*3, *4	6
	260*4	7.5
	280*3, *4	11
	370*3, *4	15

4th digit: Voltage	
Code	Voltage
F	100 V
A	200 V
D	400 V

5th + 6th digits: Interface Specifications	
Code	Interface
11	MECHATROLINK-II communications reference, rotational servomotor
15	MECHATROLINK-II communications reference, linear servomotor
21	MECHATROLINK-III communications reference, rotational servomotor
25	MECHATROLINK-III communications reference, linear servomotor

8th + 9th + 10th digits: Hardware Specifications	
Code	Specifications
000	Base-mounted (standard)
001	Rack-mounted*4
002	Varnished
003	Rack-mounted*4 and Varnished
008	Single-phase, 200-V Power Supply*3 (SGDV-120A11A008FT003)
020	Dynamic brake (DB)*5

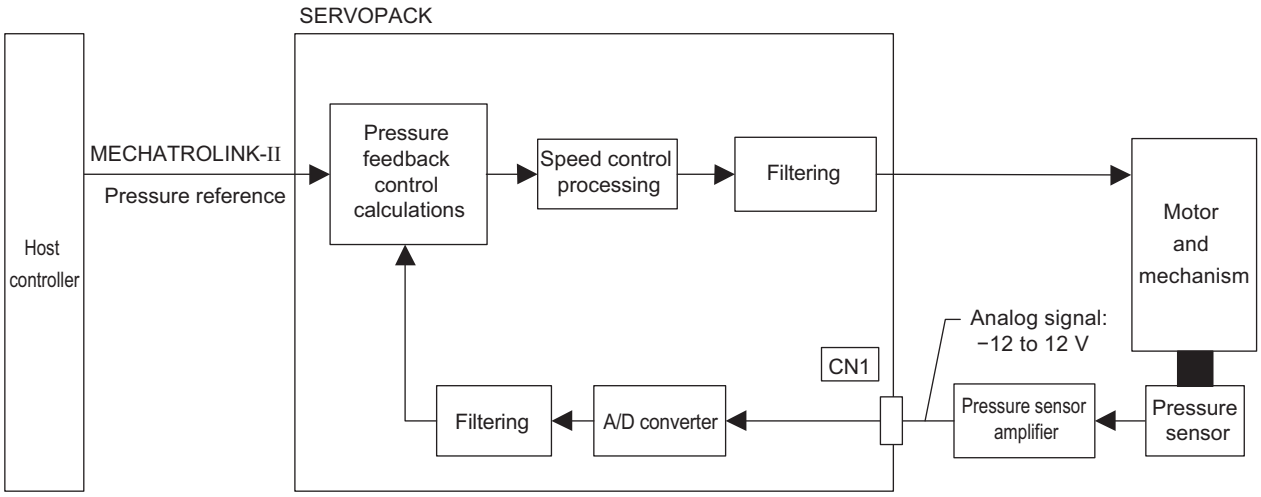
∗1. These amplifiers can be powered with single or three-phase.
∗2. Single-phase, 200-VAC SERVOPACKs for rotational motors are also available (model number: SGDV-120A□1A008FT003).
∗3. Only SERVOPACKs for rotational motors are available.
∗4. SGDV-470A, -550A, -590A, -780A, -210D, -260D, -280D, and -370D 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.

2

Pressure Feedback Control

2.1 Overview

You can perform pressure feedback control by inputting a feedback signal from a pressure sensor to the MECHATROLINK-II pressure reference (for a torque/force control command). An analog signal is input from a pressure sensor in the controlled system through a pressure sensor amplifier and directly into the CN1 connector on the SERVOPACK. You can perform high-speed, high-precision pressure feedback control.



2.2 Application Restrictions

2.2.1 Functional Restrictions

You cannot use the tuning-less function with this SERVOPACK.
For details on these functions, refer to the *Σ-V Series User's Manual Design and Maintenance, MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46/48).

2.2.2 SigmaWin+ Engineering Tool

Use the SigmaWin+ Σ-V-EX/FT component.

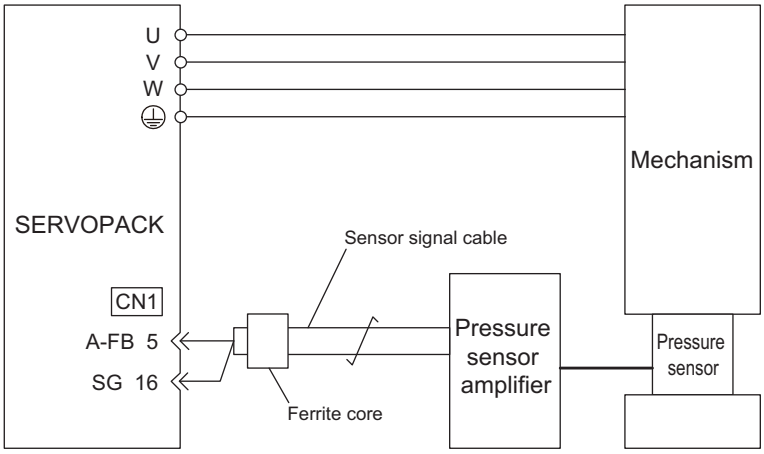
2.3 Input Signal Connection

Connect the input signal from the pressure sensor amplifier to pin 5 (A-FB) and pin 16 (SG) on the CN1 I/O connector.

Type	Signal Name	Pin No.	Name	Remarks
Input	A-FB	5	Pressure feedback detection input	Connect this input to the pressure sensor amplifier.
	SG	16	Signal ground	

The input specifications are as follows:

- Maximum input voltage: ±12 V
- Input voltage resolution: 10 bits plus a sign bit
- Input impedance: 30 kΩ



2.3.1 Cable Connection

Connect the pressure sensor amplifier and the CN1 connector on the SERVOPACK with a sensor signal cable. To prevent inductive noise, take following measures against noise.

- Use twisted-pair cable.
- Use the shortest possible distance.
- Install ferrite cores.

2.3.2 Recommended Pressure Sensor Amplifier Specifications

- Output voltage: ±12 V
- Response frequency: 500 Hz min.

2.4 Pressure Feedback Operation Patterns

IMPORTANT

- If you execute a torque/force command (TRQCTRL: 3D hex) while pressure feedback control is enabled (i.e., while Pn440.0 is set to 1), pressure feedback control is performed.
- Change the control method under the following conditions to suppress shock when the control method changes.

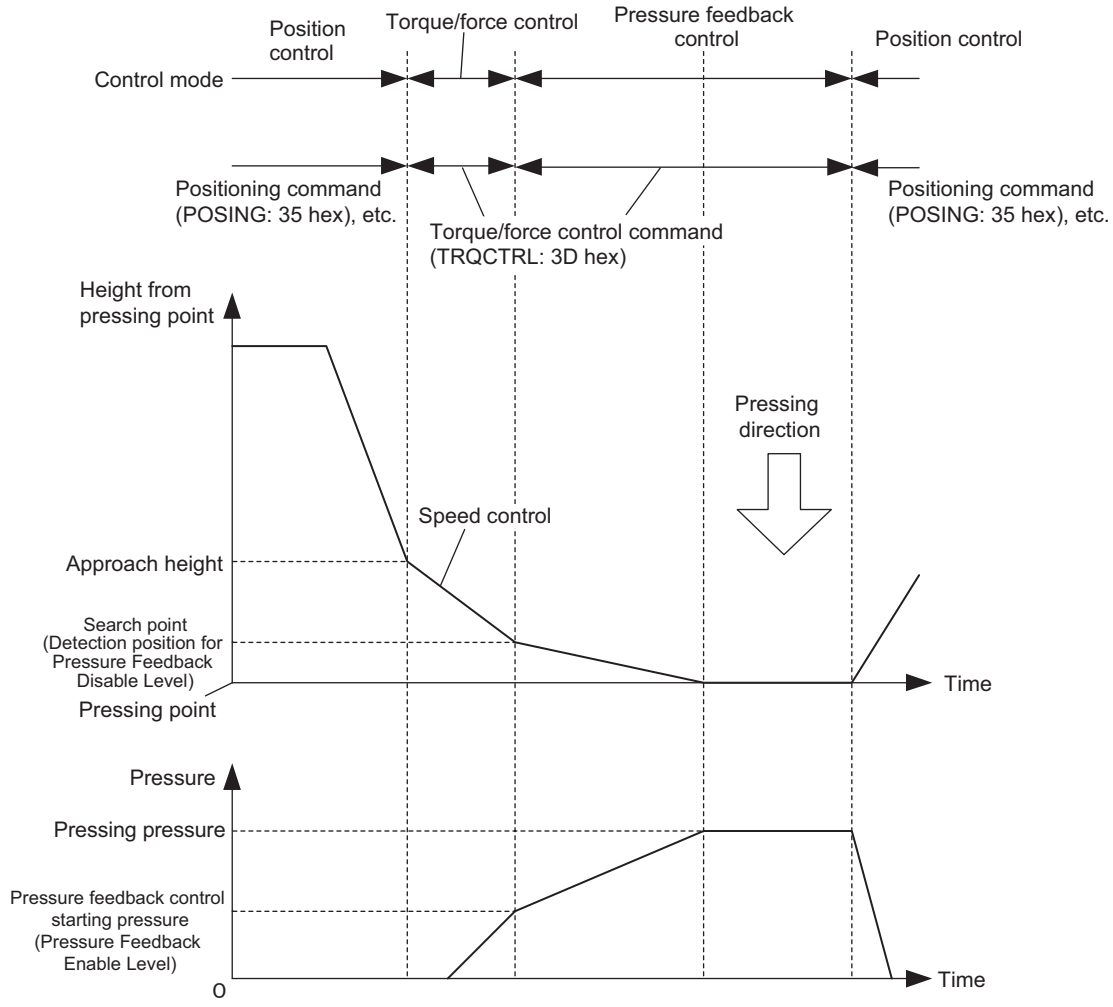
<Changing Torque/Force Control or Pressure Feedback Control to Position Control or Speed Control>

Stop the motor.

<Changing Position Control or Speed Control to Torque/Force Control>

Adjust the setting for the Speed Limit During Torque Control parameter (Pn407) or Speed Limit During Force Control parameter (Pn480) to maintain a constant speed.

An example of pressure feedback control operation is given below. In this example, the control method is changed from torque/force control to pressure feedback control.



2.5 Changing from Torque Control to Pressure Feedback Control

There are two modes that you can use to change from torque control to pressure feedback control, mode 1 and mode 2. Set Pn458.0 (Pressure Feedback Control Mode Selection) to select the mode.

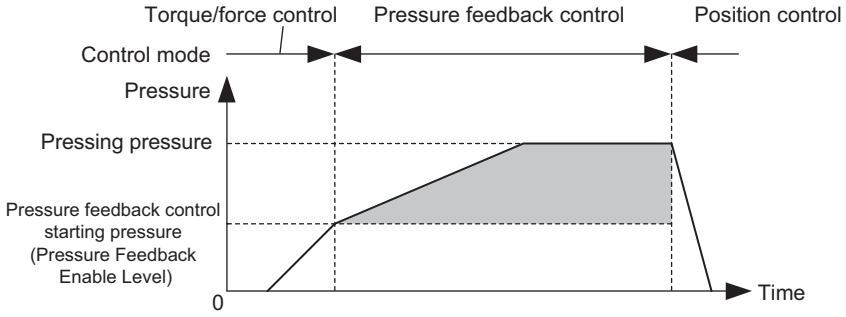
Parameter		Meaning	When Enabled	Classification
Pn458	n.□□□0 [factory setting]	Performs pressure feedback control in mode 1.	Immediately	Setup
	n.□□□1	Performs pressure feedback control in mode 2.		

Operation is possible only in mode 1 for SERVOPACKs with software version 0023_12F1 or lower. For SERVOPACKs with software version 0023_12F2 or higher, you can select mode 1 or mode 2 in Pn458.0. You can confirm the software version in Fn012 (Software Version Display).
For the checking procedure for Fn012, refer to the *Σ-V Series User's Manual Design and Maintenance MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46).

2.5.1 Mode 1

If you set mode 1, torque control is changed to pressure feedback control according to the set value of Pn44C (Pressure Feedback Enable Level).

Pn44C	Pressure Feedback Enable Level [Torque]				Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	0.01%	1000	Immediately	Setup

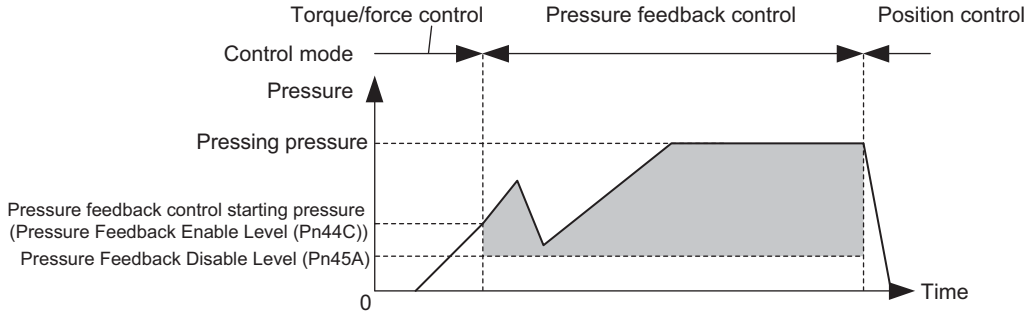


Note: Pressure feedback control is enabled in the gray area in the above figure.

2.5.2 Mode 2

If you set mode 2, torque control is changed to pressure feedback control according to the set values of Pn44C (Pressure Feedback Enable Level) and Pn45A (Pressure Feedback Disable Level).

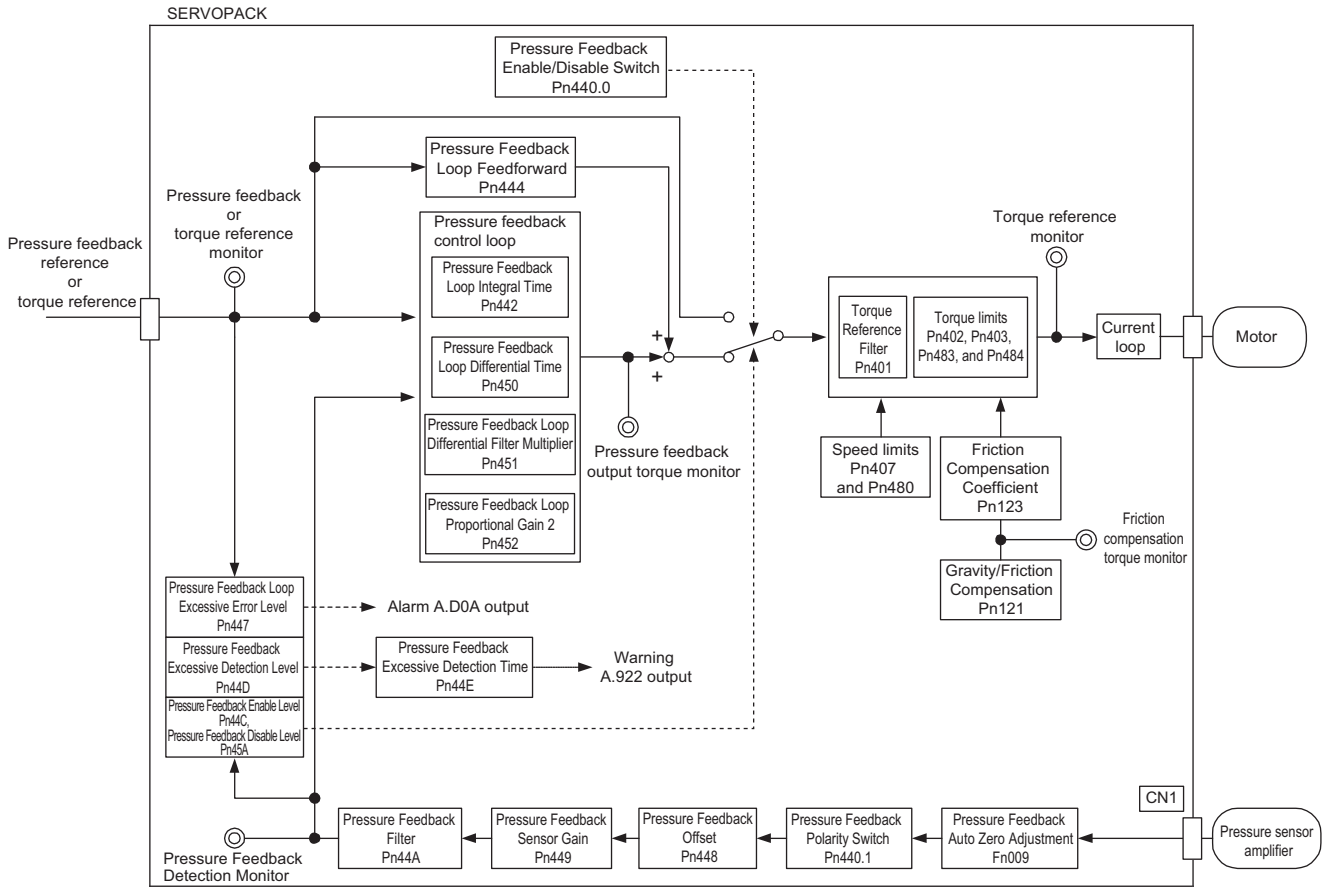
Pn44C	Pressure Feedback Enable Level			Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	0.01%	1000	Immediately	Setup
Pn45A	Pressure Feedback Disable Level			Torque	Classification
	Setting Range	Setting Unit	Factory Setting	When Enabled	
	0 to 10000	0.01%	1000	Immediately	Setup



Note 1. Pressure feedback control is enabled in the gray area in the above figure.
2. If pressure chattering occurs, you can select pressure feedback control mode 2 to enable stably changing to pressure feedback control.

2.6 Control Block Diagram

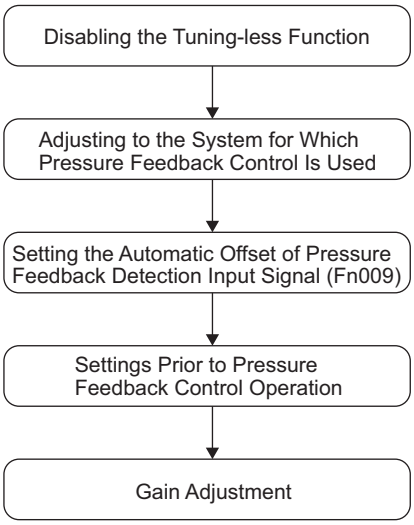
A block diagram for pressure feedback control is given below.



2.7 Setup Procedures

2.7.1 Flowchart

The setting procedures for pressure feedback control are given in the following flowchart.



Reference: *2.7.2 (1) Disabling the Tuning-less Function*

Reference: *2.7.2 (2) Adjusting to the System for Which Pressure Feedback Control Is Used*

Reference: *2.7.2 (3) Setting the Automatic Offset of Pressure Feedback Detection Input Signal (Fn009)*

Reference: *2.7.2 (4) Settings Prior to Pressure Feedback Control Operation*

Reference: *2.7.3 Gain Adjustment*

2.7.2 Parameter Settings

This section gives the parameter setting procedures.

(1) Disabling the Tuning-less Function

Disable the tuning-less function by setting Pn170.0 to 0.

(2) Adjusting to the System for Which Pressure Feedback Control Is Used

Set the Pressure Feedback Sensor Gain parameter (Pn449) according to the output of the sensor amplifier.

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn449	2	Pressure Feedback Sensor Gain	0 to 10000	0.01 V/rated torque or 0.01 V/rated force	0	Immediately	Setup
	A coefficient to convert the value from the pressure sensor amplifier to units of torque/force						

<Setting Example>

- If using a SGMGV-20A servomotor
  Motor rated torque: 11.5 N·m
- Ball screw lead: 20 mm
- Sensor amplifier outputs an analog signal of 0 to 10 V when a pressure of 0 to 980 N is input.

Pressure at the rated torque is about 3612.8 N (11.5 N·m × 2 × π × 1000 mm/20 mm).
Therefore, the sensor amplifier output at the rated torque is 36.86 V (10 V × 3612.8 N/980 N).
Accordingly, set Pn449 to 3686 (36.86 V) [0.01 V/rated torque or rated force].

If the pressure feedback detection input is negative, set the Pressure Feedback Polarity Switch parameter to 1 to invert the polarity (Pn440.1 = 1).

Parameter		Meaning	When Enabled	Classification
Pn440	n.□□0□ [factory setting]	Do not invert the polarity.	After restart	Setup
	n.□□1□	Inverts the polarity.		

If using an axis which is affected by gravity such as a vertical axis, set the Gravity Compensation Switch for Torque/Force Control parameter to 1 to compensate for gravity and unbalanced pressure (Pn440.3 = 1).

Parameter		Meaning	When Enabled	Classification
Pn440	n.0□□□	Do not automatically compensate for gravity and unbalanced pressure for torque/force control.	Immediately	Setup
	n.1□□□ [factory setting]	Automatically compensates for gravity and unbalanced pressure for torque/force control.		

If using a horizontal axis, set the Gravity Compensation Switch for Torque/Force Control parameter to 0 since you do not have to compensate for gravity and unbalanced pressure (Pn440.3 = 0).

IMPORTANT

For gravity compensation, input the pressure sensor output to the SERVOPACK and monitor the pressure feedback detection value. If you do not connect a pressure sensor and disable pressure feedback control (Pn440 = n.□□□0), always disable gravity compensation (Pn440 = n.0□□□) for torque/force control.

(3) Setting the Automatic Offset of Pressure Feedback Detection Input Signal (Fn009)

■ Confirmations before Execution

Confirm the following before you automatically adjust the offset for the pressure feedback detection input signal.

- The Write Prohibited Setting parameter (Fn010) must be set to permit writing.
- The servo must be OFF.

■ Operating Procedure

Use the following procedure.

Step	Display after Operation	Keys	Operation
1	BB –PRM/MON– Un000 = 00000 Un002 = 00000 Un003 = 0000000000 Un00D = 0000000000	–	Turn OFF the servo. Input a reference voltage of 0 V.
2	BB –FUNCTION– Fn008:Mturn Clr Fn009:Ref Adj Fn00A:Vel Adj Fn00B:Trq Adj	MODE/SET ∧ ∨	Press the MODE/SET Key to view the main menu for the utility functions. Use the ∧ or ∨ Key to move through the list and select Fn009.
3	BB Ref Adjust Start : [DATA] Return: [SET]	DATA	Press the DATA Key. The execution display for Fn009 (Automatic Offset of Pressure Feedback Detection Input Signal) will be displayed.
4	BB Ref Adjust Start : [DATA] Return: [SET]	DATA MODE/SET	Press the DATA. The offset for the pressure feedback detection input signal will be automatically adjusted. "DONE" flashes on the status display for approximately 1 second during processing. When processing is completed, the display will change to "BB." Note: To cancel the automatic offset for the pressure feedback detection input signal, press the MODE/SET to return to the main menu for the utility functions.

(4) Settings Prior to Pressure Feedback Control Operation

1. Set the Pressure Feedback Select Switch parameter (Pn440.0) to 1.

Parameter		Meaning	When Enabled	Classification
Pn440	n.□□□1	Enables pressure feedback control	Immediately	Setup

Note: You can normally use the default settings for the following parameters.

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn448	2	Pressure Feedback Offset	-10000 to 10000	0.01%	0	Immediately	Setup
	You can use this parameter to change the offset of the pressure feedback signal after you use the Automatic Offset of Pressure Feedback Detection Input Signal parameter (Fn009) to adjust the offset. The parameter is set as a percentage of the rated torque/force.						
Pn44A	2	Pressure Feedback Filter	0 to 65535	0.01 ms	0	Immediately	Setup
Pn44E	2	Pressure Feedback Excessive Detection Time	0 to 5000	0.1 ms	0	Immediately	Setup
	The total time that the pressure is detected in the feedback as being excessive is measured. If this time is greater than the value set for this parameter, a Pressure Feedback Overflow Warning (A.922) is issued.						

2. Set the Pressure Feedback Enable Level parameter (Pn44C) and the Pressure Feedback Excessive Detection Level parameter (Pn44D) to suitable values for the system.

<Supplemental Information>

Pressure feedback control is enabled for the value of Pn44C or higher and less than the value of Pn44D.

Pressure Feedback Value	Pressure Feedback Control	Pressure Feedback Overflow Warning (A.922)*	Remarks
Less than the value of Pn44C	Disabled	None	If the pressure feedback value is less than or equal to the set value of the Pressure Feedback Disable Level parameter, pressure feedback control is not performed because it is not yet time to start pressing. Normal torque/force control is performed. The parameter is set as a percentage of the rated torque/force. Note: This setting should be set to a value as small as possible to determine as early as possible whether or not pressing should be enabled.
Pn44C or higher and less than Pn44D	Enabled	None	–
Pn44D or higher	Disabled	Warning	If the pressure feedback value is greater than or equal to the set value of the Pressure Feedback Excessive Detection Level parameter, an error is detected and a Pressure Feedback Overflow Warning (A.922) is issued if that condition continues for the time that is set for the Pressure Feedback Excessive Detection Time parameter (Pn44E). The parameter is set as a percentage of the rated torque/force. Note: If you set Pn44D to 800, an error is not detected and a warning does not occur.

* Even if a Pressure Feedback Overflow Warning (A.922) occurs, pressure feedback control is enabled again when the pressure feedback value drops to below the set value of Pn44D. To reset the warning, execute the ALM_CLR command.

3. Set the Speed Limit During Torque Control parameter (Pn407) or Speed Limit During Force Control parameter (Pn480).

> **IMPORTANT**
> To provide greater safety during setup, the default settings are intentionally low. Check the motor speed using the monitor function and set a suitable value.

Parameter No.	Motor	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn407	Rotational motor	2	Speed Limit During Torque Control	0 to 10000	1 min^{-1}	100	Immediately	Setup
Pn480	Linear motor	2	Speed Limit During Force Control	0 to 10000	1 mm/s	100	Immediately	Setup

(5) Gain Adjustment

The gain is adjusted while performing pressure feedback control operation. For details, refer to *2.7.3 Gain Adjustment*.

2.7.3 Gain Adjustment

(1) Gain Adjustment Parameters

The following parameters are adjusted while performing pressure feedback control operation. Refer to *(2) Gain Adjustment Flowchart* for the procedure.

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn442	2	Pressure Feedback Loop Integral Time	0 to 51200	0.01 ms	2000	Immediately	Setup
Pn444	2	Pressure Feedback Loop Feedforward	0 to 1000	1%	100	Immediately	Setup
Pn450	2	Pressure Feedback Loop Differential Time	0 to 51200	0.1 ms	0	Immediately	Setup
	Differential compensation is disabled if this parameter is set to 0 ms.						
Pn451	2	Pressure Feedback Loop Differential Filter Multiplier	0 to 10000	1%	100	Immediately	Setup
	This parameter sets the low-pass filter that comes before the differential compensator in the pressure feedback loop. Set the value as a percentage of the differential time.						
Pn452	2	Pressure Feedback Loop Proportional Gain 2	0 to 10000	1%	100	Immediately	Setup
	Adjust the setting for the proportional gain of the pressure feedback loop.						

In the following case, adjust the parameter in the following table.

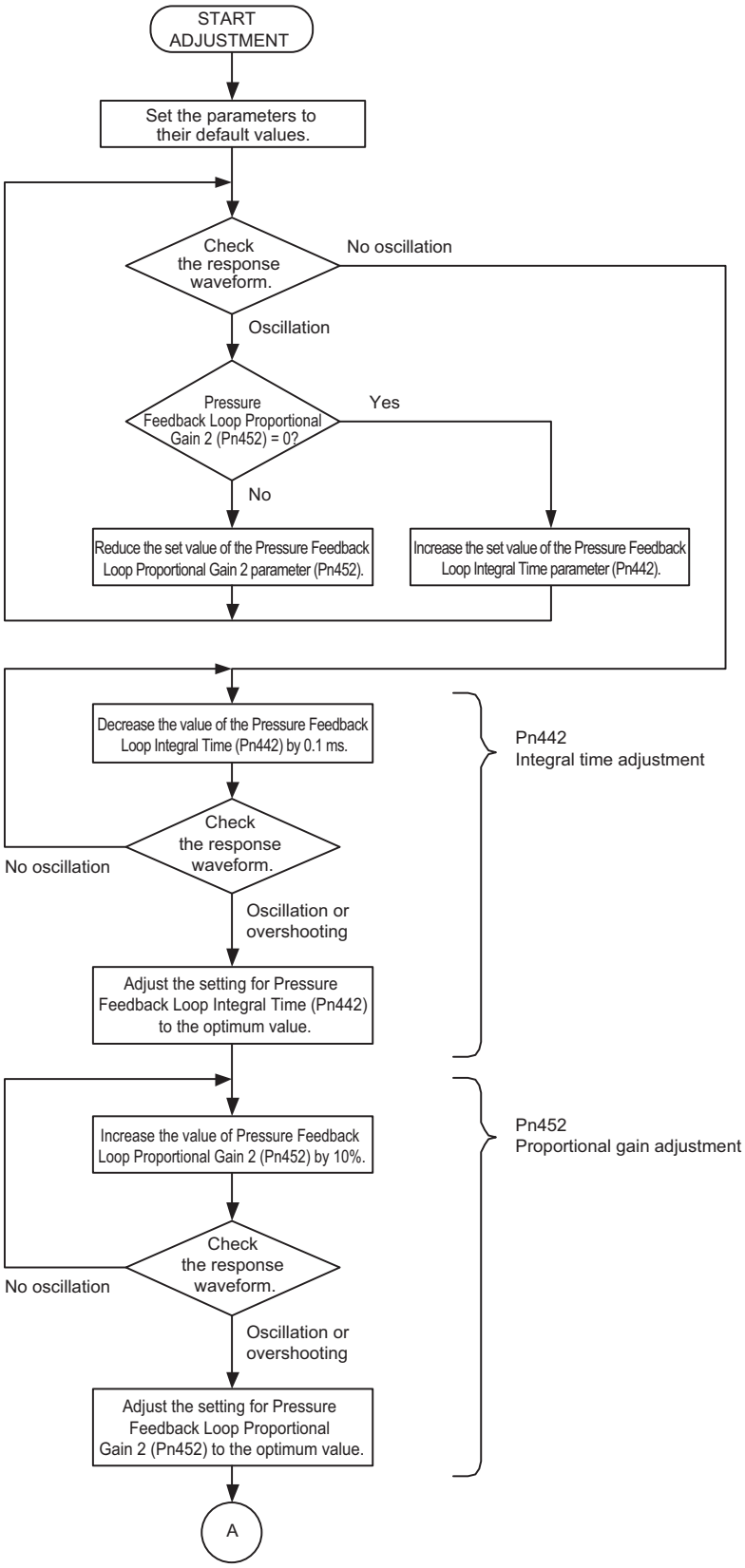
<If a Pressure Feedback Loop Error Overflow Alarm Occurs and the Cause Is Not Clear>

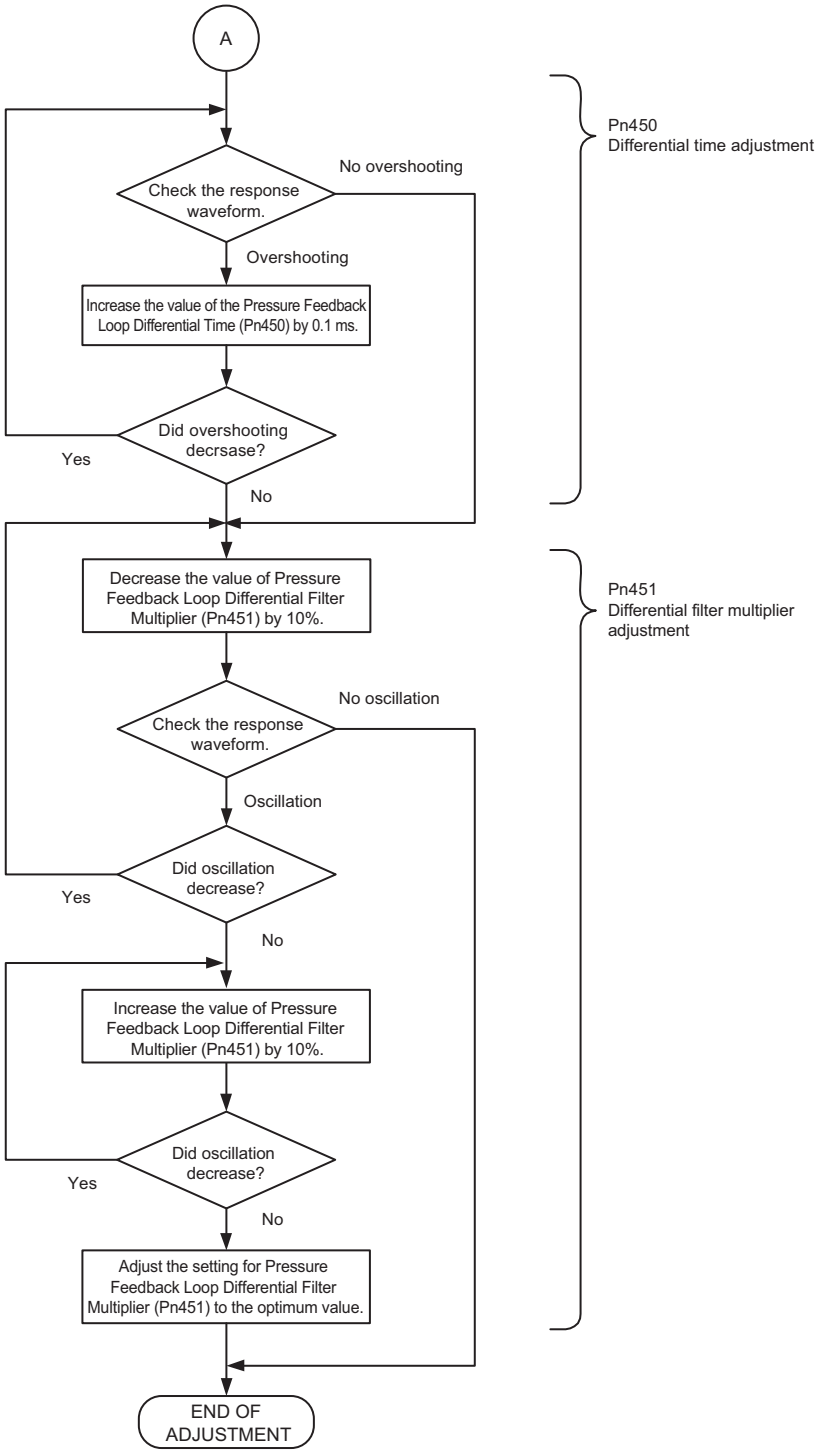
Increase the value of the Pressure Feedback Loop Excessive Error Level parameter (Pn447).

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn447	2	Pressure Feedback Loop Excessive Error Level	0 to 800	1%	100	Immediately	Setup
	If the differences between the pressure reference and the pressure feedback detection value is greater than or equal to the set value of this parameter, a Pressure Feedback Loop Error Overflow Alarm (A.D0A) is issued. Set this parameter after you adjust the pressure feedback gain. The parameter is set as a percentage of the rated torque/force. Note: If you set Pn447 to 800, an error is not detected and an alarm does not occur.						

(2) Gain Adjustment Flowchart

A gain adjustment flowchart is given below.




A
Check the response waveform.
No overshooting
Overshooting
Increase the value of the Pressure Feedback Loop Differential Time (Pn450) by 0.1 ms.
Did overshooting decrsase?
Yes
No
Pn450
Differential time adjustment
Decrease the value of Pressure Feedback Loop Differential Filter Multiplier (Pn451) by 10%.
Check the response waveform.
No oscillation
Oscillation
Did oscillation decrease?
Yes
No
Increase the value of Pressure Feedback Loop Differential Filter Multiplier (Pn451) by 10%.
Did oscillation decrease?
Yes
No
Adjust the setting for Pressure Feedback Loop Differential Filter Multiplier (Pn451) to the optimum value.
Pn451
Differential filter multiplier adjustment
END OF ADJUSTMENT

3

Monitoring

You can monitor any of the following signals with the optional monitors through MECHATROLINK-II communications or with the analog monitors.

■ Analog Monitors

Pn006 or Pn007	Signal Name	Output Unit
30H	Pressure Feedback Torque/Force Reference Monitor	1 V/100% (rated torque/force)
31H	Pressure Feedback Detection Monitor	1 V/100% (rated torque/force)
32H	Pressure Feedback Output Torque/Force Monitor	1 V/100% (rated torque/force)
33H	Pressure Feedback Loop Error Monitor	1 V/100% (rated torque/force)

■ Optional Monitors with MECHATROLINK-II Communications

Pn824 or Pn825	Signal Name	Unit
0050H	Pressure Feedback Detection Monitor	10,000/100% (rated torque/force)
0052H	Control Change Monitor	0: Position/speed control, 1: Torque/force control, 3: Pressure feedback control

■ Monitoring with a SigmaWin+ Waveform Trace

Signal Name	Unit
Pressure Feedback Torque/Force Reference Monitor	%
Pressure Feedback Detection Monitor	%
Pressure Feedback Output Torque/Force Monitor	%
Pressure Feedback Loop Error Monitor	%

■ Monitoring with a SigmaWin+ I/O Trace

Signal Name	Selected Data Name	Description
Control Changed Bit 0	/A-FB0	Position/speed control: High, Torque/force control: Low, Pressure feedback control: Low
Control Changed Bit 1	/A-FB1	Position/speed control: High, Torque/force control: High, Pressure feedback control: Low

4

Troubleshooting Unique to the Σ-V-FT-series FT003

4.1 Alarm Displays

The following sections describe troubleshooting in response to alarm displays.

The alarm names, alarm meanings, servomotor stopping methods, and alarm reset capabilities that are unique to the Σ-V-FT-series FT003 are listed in *4.1.1 Alarms Unique to the Σ-V-FT-series FT003*.

The causes of alarms and troubleshooting methods are provided in *4.1.2 Troubleshooting of Alarms*.

4.1.1 Alarms Unique to the Σ-V-FT-series FT003

This section describes the alarms that are unique to the Σ-V-FT-series FT003.

■ Servomotor Stopping Method

Gr.1: The servomotor is stopped according to the setting in Pn001.0 if an alarm occurs. Pn001.0 is factory-set to stop the servomotor by applying the DB.

■ Alarm Reset

Available:Removing the cause of alarm and then executing the alarm reset can clear the alarm.
N/A:Executing the alarm reset cannot clear the alarm.

Alarm Number	Alarm Name	Meaning	Servo-motor Stopping Method	Alarm Reset
A.D0A	Pressure Feedback Loop Error Overflow	The difference between the pressure feedback reference and pressure feedback detection value exceeded the value set for the Pressure Feedback Loop Excessive Error Level parameter (Pn447).	Gr.1	Available

4.1.2 Troubleshooting of Alarms

If an error occurs in servo drives, an alarm display such as A.□□□ and CPF□□ will appear on the panel display.

Refer to the following table to identify the cause of an alarm and the action to be taken.
Contact your Yaskawa representative if the problem cannot be solved by the described corrective action.

Alarm Number: Alarm Name (Alarm Description)	Cause	Investigative Actions	Corrective Actions
A.D0A: Pressure Feedback Loop Error Overflow	The difference between the pressure feedback reference and pressure feedback detection value exceeded the value set for the Pressure Feedback Loop Excessive Error Level parameter (Pn447).	Check the Pressure Feedback Detection Monitor or the Pressure Feedback Loop Error Monitor.	Change the value of the Pressure Feedback Loop Excessive Error Level parameter (Pn447).
			Adjust the Pressure Feedback Loop Integral Time parameter (Pn442) and the other parameters that adjust pressure feedback control.

4.2 Warning Displays

The following sections describe troubleshooting in response to warning displays.

The warning names and warning meanings that are unique to the Σ-V-FT-series FT003 are listed in *4.2.1 Warnings Unique to the Σ-V-FT-series FT003*.

The causes of warnings and troubleshooting methods are provided in *4.2.2 Troubleshooting of Warnings*.

4.2.1 Warnings Unique to the Σ-V-FT-series FT003

This section describes the warnings that are unique to the Σ-V-FT-series FT003.

Warning Number	Warning Name	Meaning
A.922	Pressure Feedback Overflow	The pressure feedback detection level exceeded the value set for the Pressure Feedback Excessive Detection Level parameter (Pn44D) for longer than the time set for the Pressure Feedback Excessive Detection Time parameter (Pn44E).

4.2.2 Troubleshooting of Warnings

Refer to the following table to identity the cause of a warning and the action to be taken. Contact your Yaskawa representative if the problem cannot be solved by the described corrective action.

Warning Number: Warning Name (Warning Description)	Cause	Investigative Actions	Corrective Actions
A.922: Pressure Feedback Overflow	The pressure feedback detection level exceeded the value set for the Pressure Feedback Excessive Detection Level parameter (Pn44D) for longer than the time set for the Pressure Feedback Excessive Detection Time parameter (Pn44E).	Check the output from the pressure sensor amplifier.	Adjust the pressure sensor amplifier.
		Check the setting of the Pressure Feedback Sensor Gain parameter (Pn449).	Change the setting of the Pressure Feedback Sensor Gain parameter (Pn449).

5

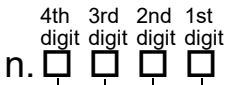
Parameters Specifically Related to the Σ-V-FT-series FT003

Here, the parameters that are added to the Σ-V-FT-series FT003 and the parameters that have different default settings than those of the Σ-V standard SERVOPACKs are given.
All parameters that are not given here are the same as for the Σ-V standard SERVOPACKs. For details, refer to *Σ-V Series User's Manual Design and Maintenance MECHATROLINK-II Communications Reference* (manual no.: SIEP S800000 46/48).

5.1 Special Parameters

The following table lists the parameters that differentiate the FT003 from the Σ-V Series standard SERVOPACKs.

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn440*	2	Pressure Feedback Select Switch	0000 to 1111	–	1000	–	Setup



1st digit: Pressure Feedback Enable/Disable Switch (When Enabled: Immediately)

0	Disables pressure feedback control and enables normal torque/force control.
1	Enables pressure feedback control.

2nd digit: Pressure Feedback Polarity Switch (When Enabled: After restart)

This setting is used to invert the pressure feedback value when the pressure feedback detection input value is negative.

0	Does not invert the polarity.
1	Inverts the polarity.

3rd digit: Reserved (Do not change.)

4th digit: Gravity Compensation Switch for Torque/Force Control (When Enabled: Immediately)

Automatically compensates for gravity and unbalanced pressure for torque/force control.

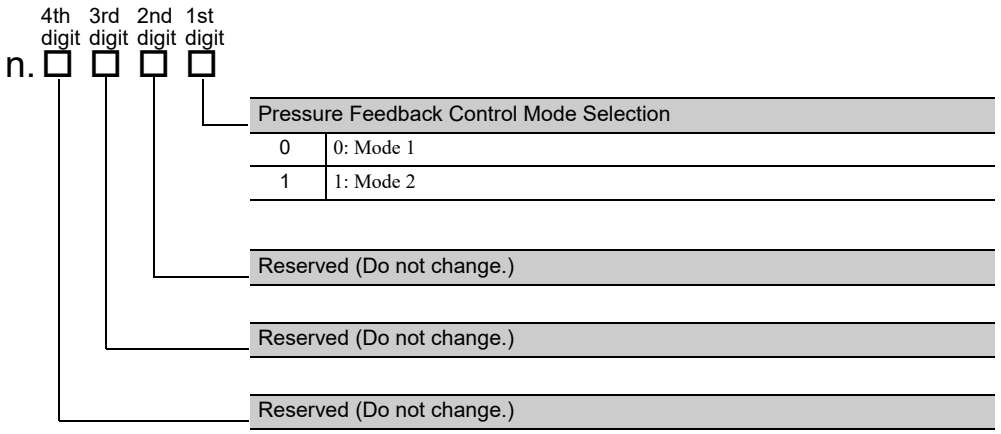
0	Do not automatically compensate for gravity and unbalanced pressure for torque/force control.
1	Automatically compensates for gravity and unbalanced pressure for torque/force control.

Pn442	2	Pressure Feedback Loop Integral Time	0 to 51200	0.01 ms	2000	Immediately	Setup
Pn444	2	Pressure Feedback Loop Feedforward	0 to 1000	1%	100	Immediately	Setup
Pn447	2	Pressure Feedback Loop Excessive Error Level	0 to 800	1%	100	Immediately	Setup
Pn448	2	Pressure Feedback Offset	-10000 to 10000	0.01%	0	Immediately	Setup
Pn449	2	Pressure Feedback Sensor Gain	0 to 10000	0.01 V/rated torque or 0.01 V/rated force	0	Immediately	Setup
Pn44A	2	Pressure Feedback Filter	0 to 65535	0.01 ms	0	Immediately	Setup
Pn44C	2	Pressure Feedback Enable Level	0 to 10000	0.01%	1000	Immediately	Setup
Pn44D	2	Pressure Feedback Excessive Detection Level	0 to 800	1%	300	Immediately	Setup
Pn44E	2	Pressure Feedback Excessive Detection Time	0 to 5000	0.1 ms	0	Immediately	Setup
Pn450	2	Pressure Feedback Loop Differential Time	0 to 51200	0.1 ms	0	Immediately	Setup
Pn451	2	Pressure Feedback Loop Differential Filter Multiplier	0 to 10000	1%	100	Immediately	Setup

(cont'd)

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn452	2	Pressure Feedback Loop Proportional Gain 2	0 to 10000	1%	100	Immediately	Setup
Pn458	2	Pressure Feedback Select Switch 2	0000 to 0001	–	0000	Immediately	Setup
Pn459	2	Gravity Compensation Standard Level for Torque/ Force Control	0 to 10000	0.01%	500	Immediately	Setup
Pn45A	2	Pressure Feedback Disable Level	0 to 10000	0.01%	1000	Immediately	Setup

Pn458



* For gravity compensation, input the pressure sensor output to the SERVOPACK and monitor the pressure feedback detection value. If you do not connect a pressure sensor and disable pressure feedback control (Pn440 = n.□□□0), always disable gravity compensation (Pn440 = n.0□□□) for torque/force control.

5.2 Changed Parameters

The default settings of the parameters that have changed in comparison with the Σ-V standard SERVOPACKs are listed in the following table.

Parameter No.	Size	Name	Setting Range	Setting Unit	Factory Setting	When Enabled	Classification
Pn170	2	Tuning-less Function Related Switch	0000 to 2411	–	1400	–	Setup

n.□□□□ (4th digit, 3rd digit, 2nd digit, 1st digit)

Tuning-less Function Selection		When Enabled
0	Disables tuning-less function. (default)	After restart
1	Enables tuning-less function.	

Control Method during Speed Control		When Enabled
0	Uses as speed control.	After restart
1	Uses as speed control and uses the host controller for position control.	

Rigidity Level		When Enabled
0 to 4	Sets rigidity level.	Immediately

Load Level		When Enabled
0 to 2	Sets load level.	Immediately

Pn407	2	Speed Limit During Torque Control	0 to 10000	min^{-1}	100	Immediately	Setup
Pn480	2	Speed Limit During Force Control	0 to 10000	mm/s	100	Immediately	Setup

5.3 Precaution When Copying Parameters

The digital operator can be used to copy parameters between two FT003 SERVOPACKs in the Σ-V-FT series.

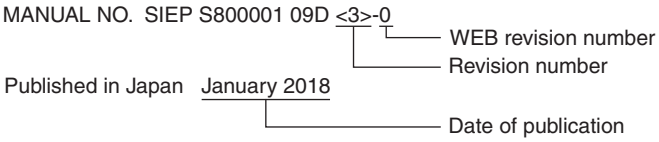
If you copy parameters between a Σ-V-FT-series FT003 SERVOPACK and a different model of SERVOPACK, alarms such as A.040 (Parameter Setting Error 1) will occur because different numbers of parameters are used.

Index

Symbols

Revision History

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



Date of Publication	Rev. No.	WEB Rev. No.	Section	Revised Content
April 2024	<7>	0	All chapters	Addition: SGMCV
			Preface	Partly revised
			Back cover	Revision: Address
March 2023	<6>	0	Preface	Partly revised
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			2.7.2, 5.1	Addition: Notes for gravity compensation
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			2.6.2 (4)	Addition: Description of *IMPORTANT*
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Σ-V-FT Series

USER'S MANUAL

Model: FT003

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