CKD

Electric Actuator
FFLD Series

INSTRUCTION MANUAL

SM-A25107/4-A

- Read this Instruction Manual before using the product.
- Read the safety notes carefully.
- Keep this Instruction Manual in a safe and convenient place for future reference.

PREFACE

Thank you for purchasing CKD's **"FFLD Series" electric actuator.**
This Instruction Manual contains basic matters such as installation and usage instructions in order to ensure optimal performance of the product. Please read this Instruction Manual thoroughly and use the product properly.
Keep this Instruction Manual in a safe place and be careful not to lose it.

Product specifications and appearances presented in this Instruction Manual are subject to change without notice.

- The product is intended for users who have basic knowledge of materials, wiring, electricity, and mechanisms. CKD shall not be responsible for accidents caused by persons who selected or used the product without knowledge or sufficient training.
- Since there are a wide variety of customer applications, it is impossible for CKD to be aware of all of them. Depending on the application and usage, the product may not be able to exercise its full performance due to fluid, piping, and other conditions, or an accident may occur. It is the responsibility of the customer to check the product specifications and decide how the product shall be used in accordance with the application and usage.

SAFETY INFORMATION

When designing and manufacturing any device incorporating the product, the manufacturer has an obligation to ensure that the device is safe. To that end, make sure that the safety of the machine mechanism of the device and the electric system that controls such mechanism is ensured.

In order to use our products safely, it is important to select, use, handle, and maintain the products properly.
Observe the warnings and precautions described in this Instruction Manual to ensure device safety.

Although various safety measures have been adopted in the product, customer's improper handling may lead to an accident. To avoid this:

Thoroughly read and understand this Instruction Manual before using the product.

To explicitly indicate the severity and likelihood of a potential harm or damage, precautions are classified into three categories: "DANGER", "WARNING", and "CAUTION".

⚠ DANGER	Indicates an imminent hazard. Improper handling will cause death or serious injury to people.
⚠ WARNING	Indicates a potential hazard. Improper handling may cause death or serious injury to people.
⚠ CAUTION	Indicates a potential hazard. Improper handling may cause injury to people or damage to property.

Precautions classified as "CAUTION" may still lead to serious results depending on the situation.
All precautions are equally important and must be observed.

Other general precautions and tips on using the product are indicated by the following icon.

✎	Indicates general precautions and tips on using the product.

Precautions on Product Use

⚠ DANGER

Do not use the product for the following applications:

- Medical equipment pertaining to sustainment and management of human life and body
- Mechanism and mechanical device for transferring and transporting people
- Critical parts for securing safety in a mechanical device

⚠ WARNING

Use the product within the specifications.

Precautions on Product Disposal

⚠ CAUTION

When disposing of the product, comply with laws pertaining to disposal and cleaning of wastes and have an industrial waste disposal company dispose of the product.

CONTENTS

1. PRODUCT OVERVIEW

1.1 System Overview

1.1.1 System structure

Components in the system structure that are available from CKD are listed below.

	Component	Product name/Model no.
This product	Actuator/Controller	FFLD Series
Sold separately	24 VDC power supply	EA-PWR-KHNA240F-24
	Noise filter	AX-NSF-NF2015A-OD
	Y-branch connector	EA-YJOINT-1
Provided for free	PC setting software (provided for free)	S-Tools

To use this product as a product conforming to the European standards, refer to "6 PRODUCT COMPLIANCE" and follow the instructions.

1.2   Instruction Manuals Related to This Product

For the Instruction Manuals for controllers and setting tools related to this product, refer to the following.

Part name	No.
PC Setting Software for Electric Actuators - S-Tools	SM-A11147

1.3   Names of Parts

1.3.1   FFLD-08,30,04H,12H,30H

■ External appearance

Manual operation cover   USB cover

Threaded hole for earthing   Actuator

Finger

Lead cable

Controller (built into the actuator)

■ Connection

Manual operation shaft

CN2: USB connector   CN1: Interface connector

Symbol	Part name	Description

CN1	Interface connector	Connector for connecting to upper level equipment
		    Refer to "2.4.1 Connecting to upper level equipment" for wiring.
		    Cable: Commercially available M12 connector cable (5-conductor)

CN2	USB connector	Connector for connecting to the setting tool (PC setting software) Cable: Commercially available USB cable (mini-B)

1.3.2 FFLD-50,50H

■ External appearance

USB cover

Manual operation cover

Actuator

Finger

Lead cable

Threaded hole
for earthing

Controller (built into the actuator)

■ Connection

Manual operation shaft

CN2: USB connector

CN1: Interface connector

Symbol	Part name	Description
CN1	Interface connector	Connector for connecting to upper level equipment Refer to "2.4.1 Connecting to upper level equipment" for wiring. Cable: Commercially available M12 connector cable (5-conductor)
CN2	USB connector	Connector for connecting to the setting tool (PC setting software) Cable: Commercially available USB cable (mini-B)

1.4   Model Number Indication

1.4.1 FFLD Series

FFLD - **08** **50** N C N 30- **LK** S **R00**
Ⓐ Ⓑ Ⓒ Ⓓ

Ⓐ Gripping power
| 08 | 80 N |

Ⓒ Interface specification
| LK | IO-Link |

Ⓑ Stroke
| 50 | 100 mm (50 mm per finger) |

Ⓓ Relay cable
| R00 | Movable cable |

FFLD - **30** **70** N C N 30- **LK** S **R00**
Ⓐ Ⓑ Ⓒ Ⓓ

Ⓐ Gripping power
| 30 | 300 N |

Ⓒ Interface specification
| LK | IO-Link |

Ⓑ Stroke
| 70 | 140 mm (70 mm per finger) |

Ⓓ Relay cable
| R00 | Movable cable |

FFLD - **50** **80** N C N 30- **LK** S **R00**
Ⓐ Ⓑ Ⓒ Ⓓ

Ⓐ Gripping power
| 50 | 500N |

Ⓒ Interface specification
| LK | IO-Link |

Ⓑ Stroke
| 80 | 160mm (80 mm per finger) |

Ⓓ Relay cable
| R00 | Movable cable |

1.4.2　FFLD-H Series

FFLD - 04 H 50 N C N 30- LK S R00

Ⓐ　　　Ⓑ　　　　　　　　Ⓒ　　Ⓓ

Ⓐ Gripping force

04	40N

Ⓒ Interface specification

LK	IO-Link

Ⓑ Stroke

50	100 mm (single side 50 mm)

Ⓓ Relay cable

R00	Movable cable

FFLD - 12 H 70 N C N 30- LK S R 00

Ⓐ　　　Ⓑ　　　　　　　　Ⓒ　　Ⓓ

Ⓐ Gripping force

12	120N

Ⓒ Interface specification

LK	IO-Link

Ⓑ Stroke

70	140 mm (single side 70 mm)

Ⓓ Relay cable

R00	Movable cable

FFLD - 30 H 70 N C N 30- LK S R 00

Ⓐ　　　Ⓑ　　　　　　　　Ⓒ　　Ⓓ

Ⓐ Gripping force

30	300 N

Ⓒ Interface specification

LK	IO-Link

Ⓑ Stroke

70	140 mm (single side 70 mm)

Ⓓ Relay cable

R00	Movable cable

FFLD - 50 H 80 N C N 30- LK S R00

Ⓐ　　　Ⓑ　　　　　　　　Ⓒ　　Ⓓ

Ⓐ Gripping force

50	500 N

Ⓒ Interface specification

LK	IO-Link

Ⓑ Stroke

80	160 mm (single side 80 mm)

Ⓓ Relay cable

R00	Movable cable

1.5   Specifications

1.5.1   Actuator specifications

Item	Model		FFLD-08	FFLD-30	FFLD-50
Motor size			□20	□25L	□25L
Motor type			Stepping motor		
Encoder type			Incremental encoder		
Drive system			Rack and pinion, worm gear		
Controller			Embedded		
Stroke		(mm)	100 (50 per finger)	140 (70 per finger)	160 (80 per finger)
Gripping power (each finger)	Note 1	(N)	80	300	500
Opening/closing speed (each finger)		(mm/s)	1 to 10		
Acceleration/deceleration		(G)	0.01 to 0.05		
Gripping speed (each finger)		(mm/s)	1 to 5		
Repeatability		(mm)	±0.02		
Positioning repeatability (each finger)	Note 2	(mm)	±0.05		
Lost motion (each finger)		(mm)	0.4 or less		
Static allowable moment	MR	(N·m)	15	45	64
	MP	(N·m)	15	45	64
	MY	(N·m)	15	45	55
Power supply voltage	Control		24 VDC ± 10%		
	Motor		24 VDC ± 10%		
Current consumption	Control	(A)	0.2 or less		
	Motor	(A)	1.1 or less	2.8 or less	2.8 or less
Motor section max. instantaneous current		(A)	1.5	4.0	4.0
Power capacity			Max. 100 W		
Insulation resistance			10 MΩ, 500 VDC		
Withstand voltage			500 VAC for 1 minute (no abnormality)		
Working ambient temperature			0 to 40°C (no freezing)		
Working ambient humidity			35% to 80% RH (no condensation)		
Storage ambient temperature			−10 to 50°C (no freezing)		
Storage ambient humidity			35% to 80% RH (no condensation)		
Atmosphere			No corrosive gas, explosive gas, and dust		
Degree of protection			IP20		
Weight		(kg)	1.2	1.7	2.5

Note 1:   Gripping is performed by a pressing operation.
Note 2:   This is the variation in the stop position when positioning is repeatedly performed at the same point.

> • Repeatability refers to the displacement of the finger stop position when clamping and unclamping are repeated under the same conditions (gripper is fixed, same attachments are used, etc.).
> • The workpiece position can become displaced due to the impact of opening and closing the fingers and lead to the deterioration of repeatability. Wear and lack of rigidity of the attachments may also lead to the deterioration of repeatability.

Item		Model	FFLD-04H	FFLD-12H,FFLD-30H	FFLD-50H
Motor size			□20	□25L	□25L
Motor type			Stepping motor		
Encoder type			Incremental encoder		
Drive system			Rack and pinion, worm gear		
Controller			Embedded		
Stroke		(mm)	100 (50 per finger)	140 (70 per finger)	160 (80 per finger)
Gripping power (each finger)	Note 1	(N)	80	120,300	500
Opening/closing speed (each finger)		(mm/s)	1 to 10		
Acceleration/deceleration		(G)	0.01 to 0.05		
Gripping speed (each finger)		(mm/s)	1 to 5		
Repeatability		(mm)	±0.02		
Positioning repeatability (each finger)	Note 2	(mm)	±0.05		
Lost motion (each finger)		(mm)	0.4 or less		
Static allowable moment	MR	(N·m)	15	45	64
	MP	(N·m)	15	45	64
	MY	(N·m)	15	45	55
Power supply voltage	Control		24 VDC ± 10%		
	Motor		24 VDC ± 10%		
Current consumption	Control	(A)	0.2 or less		
	Motor	(A)	1.1 or less	2.8 or less	2.8 or less
Motor section max. instantaneous current		(A)	1.5	4.0	4.0
Power capacity			Max. 100 W		
Insulation resistance			10 MΩ, 500 VDC		
Withstand voltage			500 VAC for 1 minute (no abnormality)		
Working ambient temperature			0 to 40°C (no freezing)		
Working ambient humidity			35% to 80% RH (no condensation)		
Storage ambient temperature			−10 to 50°C (no freezing)		
Storage ambient humidity			35% to 80% RH (no condensation)		
Atmosphere			No corrosive gas, explosive gas, and dust		
Degree of protection			IP20		
Weight		(kg)	1.2	1.7	2.7

Note 1: Gripping is performed by a pressing operation.
Note 2: This is the variation in the stop position when positioning is repeatedly performed at the same point.

- Repeatability refers to the displacement of the finger stop position when clamping and unclamping are repeated under the same conditions (gripper is fixed, same attachments are used, etc.).
- The workpiece position can become displaced due to the impact of opening and closing the fingers and lead to the deterioration of repeatability. Wear and lack of rigidity of the attachments may also lead to the deterioration of repeatability.

1.5.2 Communication specifications

Item		Description
Communication protocol (version)		IO-Link (V1.1)
Baud rate		COM2 (38.4 kbps)
Port		Class A
Process data PD (in) data length	Note 1	5 bytes
Process data PD (out) data length	Note 1	15 bytes
Minimum cycle time		10 ms
Data storage		2 kbytes
SIO mode support		None
Vendor ID	Note 2	855 (Decimal) / 0x357 (Hexadecimal)

Note 1: When setting the data with the IO-Link master (PLC), if the data table cannot be set with the data length shown here, the data table is generally mapped to be larger than this data length.
Note 2: Indicates CKD Corporation.

The device ID varys depending on the software version.

Software version	Device ID Note1
Ver.1.00.03	4198401 (Decimal) / 0x401001 (Hexadecimal)
Ver.1.01.00 or later	4198406 (Decimal) / 0x401006 (Hexadecimal)

Note 1: Indicates this product.

2. INSTALLATION

⚠ DANGER

Do not use the product in a place where dangerous substances such as ignitable, inflammable, or explosive materials are present.
> Ignition, inflammation, or explosion may occur.

Prevent water and oil from splashing onto the product.
> A fire, electric leakage, or failure may occur. Even oil drops and oil mists are prohibited.

Make sure to hold and secure the product (including the workpiece) while installing the product.
> An injury may occur if the product falls down, falls off, or operates abnormally.

Use a DC stabilized power supply (24 VDC ± 10%) with sufficient capacity as a power supply for the controller and the input/output circuit.
> If the product is directly connected to an AC power supply, a fire, burst or damage may occur.

Do not work with wet hands.
> An electric shock may occur.

When connecting a personal computer, prevent frame ground (FG) of the computer.
> If a plus terminal of the product is grounded, connecting the product to a PC and peripheral equipment with a USB cable may cause short-circuit in the DC power supply.

Install overcurrent protective equipment (such as a breaker for wiring and a circuit protector) on the primary side of the power supply when wiring in accordance with "JIS B 9960-1:2019 （IEC 60204-1:2016） Safety of machinery - Electrical equipment of machines - Part 1: General requirements".

⚠ WARNING

Do not install the product to a combustible material.
   If the product is installed directly to or near a combustible material, a fire may result.

If the system is such that the machine stops in the event of a system failure such as an emergency stop or a power failure, design and implement a safety circuit or a safety device to prevent damages to the devices and injuries to people.

Install a safety fence to prevent entry into the actuator movable range.

Perform class D grounding (ground resistance: 100 Ω or less) for the product.
   An electric leakage may occur and cause an electric shock or malfunction.

When wiring the product, refer to this Instruction Manual or any other relevant instruction manuals to make sure that the connectors are firmly connected and the wires are properly insulated.
   Make sure that the wires do not contact other circuits and there is no ground fault and insulation failure between terminals. Otherwise, an overcurrent may flow into the product and cause damage. This may result in an abnormal operation or fire.

Insulate unused wires.
   A malfunction, failure, or electric shock may occur.

Do not damage or pinch the cables, apply unnecessary stress to the cables, or place heavy objects on the cables.
   A conduction failure or electric shock may occur.

Do not connect the communication connector of the product to other devices.
   A malfunction or damage may occur.

Make sure to install the emergency stop button in a location where operation is easy.
   Adopt a structure and wiring system that inhibit any automatic resetting of emergency stop button, and that prevent a person from accidentally resetting the emergency stop button.
   When an emergency stop is executed, it may take several seconds until the machine has actually stopped, depending on the traveling speed and carrying load.

Install the product indoors and in a dry place.
   In a place where water can splash onto the product or where humidity is high (80% or more and with condensation), an electric leakage or fire accident may occur.

Do not use or store the product in an environment where there is strong electromagnetic waves, ultraviolet rays, or radiation.
   A malfunction or failure may occur.

Consider the possibility of power source failure.
   Implement measures so as to prevent injuries to people and damages to devices even if a failure occurs with the power source.

Consider the possibility of motor failure.

Consider the operating state when restarting the product after an emergency stop or an irregular stop.

When there is a need for resetting the actuator to the starting position, design a safe control unit.

Because precision instruments are integrated, do not lay the product sideways or subject the product to vibration or impact during its transportation.
   Component damage may occur.

Take into consideration the decrease in gripping power due to a power failure when integrating safety into design.
   The gripping power may decrease due to a power failure and the workpiece may come off. Design and implement a safety device that prevent injuries to people and damages to mechanical devices.

⚠ CAUTION

Install the wiring so that no induction noise is applied.
- Avoid using the product in a place where a large current or strong magnetic field occurs.
- Do not pipe or wire the product in the same wiring (with multi-conductor cables) as the power lines for other large motors.
- Do not pipe or wire the product in the same wiring as the power supplies and wires for inverters used in robots. Frame ground the power supply and insert a filter into the output section.

Do not use the product in an environment where a strong magnetic field occurs.
A malfunction may occur.

Separate the power for the output section of the product from the power for inductive loads (such as a solenoid valve and a relay) that generate surge currents.
If the power is shared, a surge current will flow into the output section and cause damage.
If the power cannot be separated, connect the surge absorption elements in parallel directly to all the inductive loads.

Do not perform a withstand voltage test or an insulation resistance test in a device with the product installed.
A capacitor is connected between the circuit of the control board in the product and the metal body to prevent damages from static electricity. Therefore, performing the tests above will damage the product. If these tests are required for the device, remove the product beforehand.

Remove all the FG (frame ground) connections of the product before performing electric welding on the device to which the product is installed.
If electric welding is performed without removing the FG connections, the product may become damaged due to a welding current or excessive high voltage and surge voltage from welding.

Select a power that has sufficient capacity for the number of products installed.
If the capacity is not sufficient, a malfunction may occur.

Secure the lead cable so that it will not move easily. Do not bend the cable beyond a bending radius of 25 mm.

When installing an external stopper or a holding mechanism (such as a brake), place it at a position where it does not affect the detection of the home position.
The home position detection is carried out at power-on. If the detection is interfered by an external stopper or a holding mechanism, an unintended position may be recognized as the home position.

Do not use the product in a place exposed to ultraviolet rays or in an atmosphere where corrosive gas and salt are present.
A performance degradation, abnormal operation, or strength deterioration due to rust formation may occur.

Do not install the product in a place subjected to strong vibrations or shocks.
If the product is subjected to strong vibrations or shocks, a malfunction may occur.

Do not use the product in a place where condensation occurs due to a sudden change in the ambient temperature.

The customer is responsible for checking the compatibility of the product with the customer's system, machinery, and device.

Connect only cables designed for the product.
A failure of the product or unexpected accident may occur.

⚠ CAUTION

Do not carry or install the product by holding its cable or the movable section.
An injury or cable disconnection may occur.

Secure sufficient space for maintenance and inspection.
Maintenance and inspection cannot be performed if sufficient space is not provided and this may cause equipment stoppage, failure, or injury.

When holding the product, hold its bottom surface.

When transporting or installing the product, ensure the safety of the workers by securely supporting the product using a lift or supporting gear and by assigning more than one worker.

Install the product in a way that it is not subjected to twisting or bending force.

Before adjusting the gain, firmly secure the actuator body to a rigid device and mount the jigs.

When using positioning holes, make sure to use pins having the size that does not require press-fitting.
If press-fitting sized pins are used, the press-fitting load may cause the guide section to become damaged or distortion may reduce accuracy. The recommended tolerance of the pin is JIS tolerance of 6 μm or less.

When removing the workpiece while the power is not supplied, open/close the finger by operating the manual operation shaft or remove the attachment.
A damage or operation fault may occur.

Do not apply any excess force to the manual operation shaft.
A damage or operation fault may occur.

Prevent any excess load from being applied to the fingers and attachment while attaching/removing or transferring the workpiece.
Scratches or dents may occur to the linear guide rolling surface of the finger, leading to an operation fault.

Do not put dents and scratches interfering with the flatness or perpendicularity of the body mounting surface and of the finger.

Except for the body securing screws and attachment securing screws, do not disassemble or retighten.
An operation fault may occur.

Select a model with sufficient gripping power with respect to the weight of the workpiece.

Select a model with sufficient opening/closing width with respect to the size of the workpiece.
The gripping position may become inconsistent due to the opening/closing width and workpiece variations. For the opening from gripping action, increase the stroke with an amount of backlash.

2.1   Environment

- Check the environment temperature and atmosphere before using and storing the product.
- Use the product at an ambient temperature between 0°C and 40°C. Ventilate if heat can become trapped.
- Use the product at an ambient humidity between 35% and 80%. Do not use the product in a place where condensation occurs.
- Install the product where it is not subjected to direct sunlight and away from a heating element. Also, avoid dust, corrosive gas, explosive gas, inflammable gas, and combustible material. Chemical resistance has not been considered for the product.
- Install the actuator on a smooth and flat surface.
- In order to avoid operation fault and damage, do not install the actuator on a surface with dents.
- The controller is set using a setting software (S-Tools). Leave a space of 70 mm or more in front of the USB cover so that the connector of the connection cable to the PC can be connected and disconnected.

2.2   Unpacking

✎	• When carrying or handling the product, use extreme care not to apply impact to the product (for example, do not drop the product). • Do not carry heavy products alone. • Place the product horizontally when not in use. • Do not stand on the package. • In order to prevent deforming the package, do not place heavy objects and objects of which their load concentrates. • When taking the actuator out of the package, hold the actuator body. • Do not apply unnecessary force to any part of the actuator.

- Check that the model number ordered and the model number indicated on the product are the same.
- Check the exterior of the product for any damage.

2.3 Mounting

2.3.1 Body

✏️ • Do not apply an excessive shock or moment to the slider.
A malfunction or damage may occur.
• The flatness of the workpiece mounting surface should be 0.02 mm or less. Do not apply twisting or bending force to the product.
An operation fault or damage may occur.

• The body can be mounted from two directions. Select the direction appropriate for the application.
• For the screw-in depth and tightening torque of the bolt for mounting the body, refer to the table below.

Model	Ⓐ Mounting to body			Ⓑ Mounting to body	
	Bolt	Tightening torque (N·m)	Max. screw-in depth L(mm)	Bolt	Tightening torque (N·m)
FFLD-08 FFLD-30	M5x0.8	3.2	10	M4x0.7	2.1
FFLD-50	M6x1.0	4.0	12	M5x0.8	3.2
FFLD-04H FFLD-12H FFLD-30H	M5x0.8	3.2	10	M4x0.7	2.1
FFLD-50H	M6x1.0	4.0	12	M5x0.8	3.2

■ Allowable load

For details, refer to the "Selection guide" page in the catalog.

2.3.2 Fingers

✎ When tightening the bolts to mount the attachment to the finger, support the finger using a tool such as a spanner so to prevent the finger from distorting and having an effect on the actuator body.
Damage may occur.

- When mounting the attachment to the finger, observe the values below for the tightening torque.

Model	Bolt	Tightening torque (N·m)	Max. screw-in depth L (mm)
FFLD-08	M5 x 0.8	0.9	10
FFLD-30	M6 x 1.0	1.3	10
FFLD-50	M6x1.0	2.2	10
FFLD-04H	M5 x 0.8	0.9	10
FFLD-12H	M6 x 1.0	1.3	10
FFLD-30H	M6x1.0	1.3	10
FFLD-50H	M6x1.0	2.2	10

- Applying an excessive lateral load or a high-impact load to the fingers can cause backlash or damage. Do not apply any external force to the fingers that exceed the allowable load listed in the catalog.

2.4   Wiring

⚠ WARNING

Turn off the power before wiring.
   An electric shock may occur by touching the electrical wiring connection (bare live part).
Do not touch live parts with bare hands.
   An electric shock may occur.
Thoroughly read and understand this Instruction Manual before working on electrical wiring.

⚠ CAUTION

Check the working voltage and polarity before wiring and energizing.
Take measures against lightning surges on the device side.
   The product has no resistance to lightning surges.
   Use AC voltage models in an installation category II environment.
Connect the wiring securely so that it does not come loose or come off.
   A malfunction may occur.
Provide sufficient bending radius for the network cable. Do not bend it forcibly.
Separate the network cable from power lines and high-voltage lines.

2.4.1   Connecting to upper level equipment

■ Communication specifications
Refer to "1.5.2 Communication specifications" for communication specifications.

■ Connection method

<IO-Link master, power supply>
Wire the master and the power supply according to the connection diagram below

Connection diagram

<Network cable>
Follow the steps below to connect the network cable to CN1.

1 After confirming safety, stop network communication and turn off all peripheral equipment.

2 Refer to the following figure to wire the IO-Link compliant network cable (M12 connector, 5-conductor) to the network connector included.

M12 connector (male)

Pin	Cable cloler ※1	Signal	Function
1	Brown	L+	Communication and control power supply (+)
2	White	P24	Motor power supply (+)
3	Blue	L−	Communication and control power supply (−)
4	Brack	C/Q	IO-Link communication
5	Gray	N24	Motor power supply (−)

*1 Compliance with the IO-Link standard

✏ • This product does not support class B IO-Link port. Communication and control power supplies (L+, L−) and motor power supplies (P24, N24) are not isolated. They have a common ground (GND) via an internal circuit board.
• Although this product can be operated connected to an IO-Link master of port class B, communication and control power supplies and motor power supplies are not isolated. If a problem occurs in the motor power supply system inside the FFLD, it may affect other devices connected to the IO-Link master.

<Y-branch connector>

Follow the steps below to use a Y-branch connector (sold separately) for wiring to CN1.

1   After confirming safety, stop network communication and turn off all peripheral equipment.

2   Wire the Y-branch connector to CN1.

3   Refer to the following figure to wire the IO-Link compliant network cable (M12 connector, 4-conductor) to Y-branch connector.

Port A(Control)
M12 4-pin (male)

Port B(Power)
M12 4-pin (male)

Port A			
Pin	**Cable Coler *1**	**Signal**	**Function**
1	Brown	L+	Communication and control power supply (+)
2	White	Unused	Unused
3	Blue	L−	Communication and control power supply (−)
4	Black	C/Q	IO-Link communication

Port B			
Pin	**Cable Coler *1**	**Signal**	**Function**
1	Brown	P24	Motor power supply (+)
2	White	Unused	Unused
3	Blue	N24	Motor power supply (−)
4	Black	Unused	Unused

*1 Compliance with the IO-Link standard

2.4.2 Connecting to S-Tools

> ⚠ **CAUTION**
>
> **During normal operation, remove the USB cable from the controller before use.**
>   The actuator may malfunction.

■ Communication specifications

Item	Specification
Interface	USB 2.0
Baud rate	Full speed (12 Mbps)

■ Connection method(FFLD-08,30,04H,12H,30H)

<Connecting>
Follow the steps below to connect the PC.

1   Remove the USB cover.

2   Connect a USB cable (mini-B) to CN2 and PC's USB port.

<Disconnecting>
Follow the steps below to disconnect the USB cable.

1   Close the software (S-Tools).

2   Disconnect the USB cable from CN2.

3   Attach the USB cover.

> ✎ The controller has two modes when S-Tools is connected.
>   PLC mode: Control from upper level equipment is valid, and
>   control from S-Tools is invalid (with a few exceptions)
>   TOOL mode: Control from S-Tools is valid, and
>   control from upper level equipment is invalid (with a few exceptions)
>   If the USB cable is disconnected in the TOOL mode, the controller cannot be controlled from
>   upper level equipment (such as the PLC). Make sure that the controller is in the PLC mode
>   before removing the USB cable.

■ Connection method(FFLD-50,50H)

<Connecting>
Follow the steps below to connect the PC.

1 Remove the bolts and attach it to screw hole.
Pull on the bolts and remove the USB cover.

2 Connect a USB cable (mini-B) to CN2 and PC's USB port.

<Disconnecting>
Follow the steps below to disconnect the USB cable.

1 Close the software (S-Tools).

2 Disconnect the USB cable from CN2.

3 Attach the USB cover and the bolts.

> ✎ The controller has two modes when S-Tools is connected.
> PLC mode: Control from upper level equipment is valid, and
>   control from S-Tools is invalid (with a few exceptions)
> TOOL mode: Control from S-Tools is valid, and
>   control from upper level equipment is invalid (with a few exceptions)
> If the USB cable is disconnected in the TOOL mode, the controller cannot be controlled from upper level equipment (such as the PLC). Make sure that the controller is in the PLC mode before removing the USB cable.

Model	Bolt	Tightening torque (N·m)
FFLD-50 FFLD-50H	M3x0.5	0.3

screw hole
M3 depth 6

USB connector(mini-B)

USB cover

bolt
M3

3. USAGE

3.1 Safety Instructions

⚠ DANGER

Do not enter the operating area of the device when the product is in an operational state.
The product may operate unexpectedly and an injury may occur.

Do not work with wet hands.
An electric shock may occur.

When connecting a personal computer, prevent frame ground (FG) of the computer.
If a plus terminal of the product is grounded, connecting the product to a PC and peripheral equipment with a USB cable may cause short-circuit in the DC power supply.

⚠ WARNING

Before supplying electricity to the product, check that the operation area of the device is safe.
If electricity is supplied without checking safety, an electric shock or injury may occur.

Do not touch the product body during or immediately after operation.
A burn injury may occur.

Do not stand or put an object on the product.
A fall accident, injury due to the product falling down or off, or malfunction and runaway due to the product becoming damaged may occur.

Take measures to prevent damage to the human body and the device in case of power failures.
An unexpected accident may occur.

Before controlling the actuator from a position where it cannot be seen, check that it is safe for the actuator to operate.

Do not give commands that are smaller than the positioning repeatability.
The positioning control may not be performed properly.

When a power failure occurs, turn off the power to the controller.
The product can suddenly start moving when the power is restored and it can lead to an accident.

Before moving the movable section of the product manually, make sure that the servo is turned off.
When the servo is turned off, an unexpected event (such as the movable section falling off) may occur. Before turning off the servo, make sure that the safety measures are implemented to eliminate danger and operate with utmost care to ensure safety

Do not apply a load that exceeds the allowable load specified in the "Selection guide" page in the catalog to the product.

⚠ CAUTION

Do not move the movable section of the product with external force and do not use the product in an application that requires the movable section to decelerate suddenly.
A malfunction or damage may occur due to regenerative currents.

Other than in home position return and pressing operations, do not subject the fingers to impact (such as allowing the fingers to hit against the stroke end or the attachments to collide with each other).
The feed screw may become damaged due to impact and an operation fault may occur.

Do not subject the product to external force when returning to the home position.
The home position may not be recognized correctly.

Do not put dents and scratches on the movable section.
An operation fault may occur.

Do not subject the movable section to impact.

Leave a margin for the transfer load since the product life changes depending on the transfer load and the environment.

If vibrations are generated, change the set speed and use the product at a speed that does not generate vibrations.
Depending on the conditions of use, vibrations may be generated during an operation even when the product is used within the operation speed range.

Set the required gripping power so that is has sufficient margin.
The gripping power and the pressing rate given in "1.5 Specifications" are provided as a reference. Variation in the motor torque may cause errors even when the setting values are the same.

Do not turn off the servo while gravity or force of inertia is applied.
The movable section may continue to move or fall off if the servo is turned off. Turn off the servo in an equilibrium state where no gravity and force of inertia are applied or after safety is ensured.

Do not give a stop command when the product is accelerating or decelerating.
It may lead to a change in speed (acceleration) and cause a risk.

Do not insert a (human) finger or an object into the opening of the product.
An injury or product damage may occur.

Do not turn the power on and off frequently.
Elements in the controller may become damaged.

Do not use a load that does not fall within the specified range.
If the load falls outside the range, an excessive uneven load applied to the guide section may cause rattling in the guide section, deteriorate accuracy, and adversely affect service life.

When operating the product without supplying power, make sure to use the manual operation shaft.
A self-locking mechanism using gears prevents fingers from moving even when external force is applied. Attempting to move them forcibly may damage the product.

When performing positioning operation, take the backlash amount into consideration.
Because the finger position becomes displaced due to a backlash when positioning operation is performed, the position needs to be set with the backlash amount taken into consideration.

When gripping by performing pressing operation, set the target position so that there is a margin with respect to the desired stopping position (also consider the backlash amount).

When gripping the workpiece, make sure to perform the action with pressing operation.
During positioning operation and within the positioning range, do not bump the fingers or the attachments into the workpiece. The feed screw may become jammed, and an operation fault may occur.

Set the operating torque for releasing the gripping larger than the pressing operation torque.
If the releasing torque is small, galling may occur and releasing may become impossible.

3.2 IODD file

In order for the IO-Link device to participate in the network, an IODD (IO Device Description) file describing the communication specifications of the device must be installed in the PLC development tool of the master unit. Refer to the instruction manual provided by the master unit manufacturer for how to install the IODD file. Use the latest IODD file to configure an appropriate network.

The IODD file is available on our company's website (https://www.ckd.co.jp/).
Other files are downloaded at the same time as the IODD file. Copy them to the folder designated by the PLC development tool used.

File	File name
IODD file	CKD-FFLD-yyyymmdd-IODDvvv.xml "yyyymmdd" is the date. "vvv" is the version.
Device icon	CKD-FFLD-icon.png
Device symbol	CKD-FFLD-pic.png
Vendor logo	CKD-logo.png
Connector symbol	CKD-con-pic.png

The IODD file differs depending on the software version. Refer to the following table.

Software version	Folder name
Ver.1.00.03	Ver.1.00.03
Ver.1.01.00 or later	Ver.1.01.00

> ✏ Depending on the master unit, the controller may be added to the network without installing the IODD file.

3.3 Setting the IO-Link Device

In order to connect this product to the relevant port setting of the IO-Link master as an IO-Link device, it is necessary to set the device ID, process data, process data length, etc. using the PLC development tool.

> ✏ In most cases, input/output process data are mapped using the setting table. If there is no corresponding setting table, the data table is generally mapped to be larger than the data length.

3.4   Communication Format

Process data and service data are transmitted and received between the PLC and the controller.

3.4.1 Process data

The controller is operated from the PLC by operating the items described later with process data. In addition, the present position can be monitored.

Process data are cyclically exchanged between the IO-Link master and the IO-Link device. The data length and structure are set using the connection settings of the PLC development tool and the relays and data memory are assigned.
(Refer to the manuals for the PLC and IO-Link master for details.)

Process data input can be referenced with the contacts, the compare command, or the Move command. The process data output is updated when data is set with the coils, the bit SET, or the Move command. The actuator operations such as servo ON, home position return, point number selection, and start travel can be controlled only with process data.

■ **Data access example of process data**

■ Process data input (FFLD ⇒ IO-Link master)

Byte order	Item	Format	Unit
0	Status monitor	UInteger8	
1	Point number monitor	UInteger8	
2, 3	Present position monitor	Integer16	0.01 mm
4	Selection monitor	UInteger8	% mm/s

\<Byte 0: Status monitor\>

Bit	Item	Setting	Description
7	Operation preparation complete	0: Incomplete 1: Complete	This item is ON ("1") when the travel command from upper level equipment can be accepted and OFF ("0") when it cannot be accepted.
6	Warning	0: Triggered 1: Not triggered	This item is OFF ("0") when a warning is triggered and ON ("1") when it is not triggered.
5	Alarm	0: Triggered 1: Not triggered	This item is OFF ("0") when an alarm is triggered and ON ("1") when it is not triggered.
4	Servo ON state	0: OFF state 1: ON state	This item is ON ("1") when the servo is on and OFF ("0") when it is off.
3	Home position return complete	0: Incomplete 1: Complete	This item is ON ("1") when the actuator has completed home position return and OFF ("0") when it is incomplete.
2	Travel complete	0: Incomplete 1: Complete	This item is ON ("1") when the actuator has completed traveling. It is OFF ("0") before the actuator starts traveling for the first time after power-on and while it is traveling.
1	Traveling	0: Stopped 1: Traveling	This item is ON ("1") while the actuator is traveling and OFF ("0") when it has stopped.
0	Point zone	0: Inside zone 1: Outside zone	While and after traveling with the settings made to point number n, this item is ON ("1") when the present position is inside the range set with "Point zone (+)/(−)" for point number n (n = 0 to 63) and OFF ("0") when it is outside the range.

Item	Byte 0 input for setting to ON ("1")	
	Decimal	Hexadecimal
Operation preparation complete	128	0x80
Warning	64	0x40
Alarm	32	0x20
Servo ON state	16	0x10
Home position return complete	8	0x08
Travel complete	4	0x04
Traveling	2	0x02
Point zone	1	0x01

* The input for setting to OFF ("0") is 0 (0x00).

- At startup, make sure that communication with PLC is established before referring to the data for alarm and warning signals.
- There is a particular point in time when Travel complete and Traveling both switches to ON ("1") at the same time.

\<Byte 1: Point number monitor\>

Bit	Item	Setting	Description
7	Direct value travel status	0: Point travel 1: Direct value travel	This item is ON ("1") when the actuator has started direct value travel and OFF ("0") when the actuator has started point travel.
6	-	-	-
5	Point number confirmation bit 5	0 to 63	When set to direct value travel, this item is "0". When set to point travel, the point number (0 to 63) to which the actuator has completed traveling is output.
4	Point number confirmation bit 4		
3	Point number confirmation bit 3		
2	Point number confirmation bit 2		
1	Point number confirmation bit 1		
0	Point number confirmation bit 0		

Item	Input of byte 1 for setting to ON ("1")	
	Decimal	Hexadecimal
Direct value travel status	128	0x80

\<Bytes 2, 3: Present position monitor\>

The present position when the home position is 0.00 mm can be monitored. Depending on the home position return direction and the home position offset, the same position may have different values. (Refer to"3.6.3 Home position return operation" for details.)
*Byte 2 indicates the high-order bit, Byte 3 indicates the low-order bit.

> ✏ Depending on the PLC development tool, the value (unit) may be displayed as a number with a decimal part.
> Example) Present position (mm) −99.99 to 99.99

\<Byte 4: Selection monitor\>

The current or speed can be monitored according to the "Monitor selection" of the process data output.

■ Process data output (IO-Link master ⇒ FFLD)

Byte order	Item	Format	Unit
0	Control 1	UInteger8	
1	Point number selection	UInteger8	
2, 3	Position (direct value travel)	Integer16	0.01 mm
4	Speed (direct value travel)	UInteger8	mm/s
5	Pressing rate (direct value travel)	UInteger8	%
6, 7	Pressing distance (direct value travel)	Integer16	0.01 mm
8	Pressing speed (direct value travel)	UInteger8	mm/s
9	Mode selection (direct value travel)	UInteger8	
10, 11	Point zone (+) (direct value travel)	Integer16	0.01 mm
12, 13	Point zone (−) (direct value travel)	Integer16	0.01 mm
14	Control 2	UInteger8	

<Byte 0: Control 1>

Bit	Item	Setting	Description
7	-	-	-
6	Stop	0: Stop 1: Release	When this item is ON ("1"), the actuator can travel. When it is OFF ("0"), the actuator cannot travel. When it is set to OFF while the actuator is traveling, the actuator decelerates to a stop and the travel command is cancelled. (Even if it is set back to ON, the actuator will not resume traveling.)
5	Alarm reset	1: Reset	When this item is switched from OFF ("0") to ON ("1"), Alarm reset is executed.
4	Servo ON	0: Servo OFF 1: Servo ON	When this item is OFF ("0"), the actuator is switched to servo OFF state. When it is ON ("1"), the actuator is switched to servo ON state.
3	Home position return start	1: Home position return start	When this item is switched from OFF ("0") to ON ("1"), the actuator will start home position return.
2	Travel start	1: Start	When this item is switched from OFF ("0") to ON ("1"), the actuator will start traveling.
1	Direct value travel selection	0: Point travel 1: Direct value travel	When this item is set to OFF ("0"), the actuator will travel to the point number selected with "Point number selection bit". When this item is set to ON ("1"), the actuator will travel according to the items set for direct value travel in process data output. When "Travel start" is switched from OFF to ON, the actuator will start traveling.
0	-	-	-

Item	Output of byte 0 when set to ON ("1")	
	Decimal	Hexadecimal
Stop	64	0x40
Alarm reset	32	0x20
Servo ON	16	0x10
Home position return start	8	0x08
Travel start	4	0x04
Direct value travel selection	2	0x02

*   The output when set to OFF ("0") is 0 (0x00).

> • At startup, make sure that communication with PLC is established before referring to the data for alarm and warning signals. If the bits are set to ON ("1") without establishing communication with PLC, they will not be transmitted to the controller.
> • Stop is negative logic. To allow operation, set the bit to ON ("1") (release).

<Byte 1: Point number selection>

Bit	Item	Setting	Description
7	-	-	-
6	-	-	-
5	Point number selection bit 5	0 to 63	When set to direct value travel, this bit is not referenced. When set to point travel, the point number can be set.
4	Point number selection bit 4		
3	Point number selection bit 3		
2	Point number selection bit 2		
1	Point number selection bit 1		
0	Point number selection bit 0		

<Bytes 2, 3: Position (direct value travel)>
The target position for direct value travel is set. Refer to "3.7 Point Data" for details.
*Byte 2 indicates the high-order bit, Byte 3 indicates the low-order bit.

<Byte 4: Speed (direct value travel)>
The speed for direct value travel is set. Refer to "3.7 Point Data" for details.

<Byte 5: Pressing rate (direct value travel)>
The pressing rate for direct value travel is set. Refer to "3.7 Point Data" for details.

<Bytes 6, 7: Pressing distance (direct value travel)>
The pressing distance for direct value travel is set. Refer to "3.7 Point Data" for details.
*Byte 6 indicates the high-order bit, Byte 7 indicates the low-order bit.

<Byte 8: Pressing speed (direct value travel)>
The pressing speed for direct value travel is set. Refer to "3.7 Point Data" for details.

<Byte 9: Mode selection (direct value travel)>

Bit	Item	Setting
7	Position specification method	0: Absolute 1: Incremental
6	Operation method	0: Positioning operation 1: Pressing operation 1 2: Pressing operation 2
5		
4	-	-
3	-	-
2	Stop method	0: Common 1: Control 2: Fixed excitation 3: Automatic servo OFF 1 4: Automatic servo OFF 2 5: Automatic servo OFF 3
1		
0		

Item	Setting and output of byte 9		
	Setting	Decimal	Hexadecimal
Position specification method	Absolute	0	0x00
	Incremental	128	0x80
Operation method	Positioning operation	0	0x00
	Pressing operation 1	32	0x20
	Pressing operation 2	64	0x40
Stop method	Common	0	0x00
	Control	1	0x01
	Fixed excitation	2	0x02
	Automatic servo OFF 1	3	0x03
	Automatic servo OFF 2	4	0x04
	Automatic servo OFF 3	5	0x05

*   Refer to "3.7 Point Data" for details of each item.

<Bytes 10, 11: Point zone (+) (direct value travel)>
The point zone (+) for direct value travel is set. Refer to "3.7 Point Data" for details.
*Byte 10 indicates the high-order bit, Byte 11 indicates the low-order bit.

<Bytes 12, 13: Point zone (−) (direct value travel)>
The point zone (−) for direct value travel is set. Refer to "3.7 Point Data" for details.
*Byte 12 indicates the high-order bit, Byte 13 indicates the low-order bit.

\<Byte 14: Control 2>

Bit	Item	Setting	Description
7	INCH selection	0: JOG 1: INCH	INCH is selected when this item is ON ("1") and the actuator will start inching with "JOG/INCH (+)/(−) travel start". JOG is selected when this item is OFF ("0") and the actuator will start jogging with "JOG/INCH (+)/(−) travel start".
6	JOG/INCH (+) travel start	0: Stop (JOG) 1: Travel start	When INCH is selected, switching this item from OFF ("0") to ON ("1") will cause the actuator to start inching in + direction. When JOG is selected, the actuator will start jogging in + direction while this item is ON ("1"). + direction means the direction in which the fingers close.
5	JOG/INCH (−) travel start	0: Stop (JOG) 1: Travel start	When INCH is selected, switching this item from OFF ("0") to ON ("1") will cause the actuator to start inching in − direction. When JOG is selected, the actuator will start jogging in − direction while this item is ON ("1"). − direction means the direction in which the fingers open.
4	-	-	-
3	-	-	-
2	Monitor selection Note 1	0: Current 1: Speed 2: Alarm (high-order) 3: Alarm (low-order)	The item that can be read with the "Selection monitor" of PD (in) changes according to this setting.
1			
0			

Note 1: The "Alarm (high-order)" and "Alarm (low-order)" settings are available from software Ver.1.01.00 or later.

Item	Output of byte 14 when set to ON ("1")	
	Decimal	Hexadecimal
INCH selection	128	0x80
JOG/INCH (+) travel start	64	0x40
JOG/INCH (−) travel start	32	0x20

*   The output when set to OFF ("0") is 0 (0x00).

Item	Setting and output of byte 14		
	Setting	Decimal	Hexadecimal
Monitor selection Note1	Current	0	0x00
	Speed	1	0x01
	Alarm (high-order)	2	0x02
	Alarm (low-order)	3	0x03

Note 1: The "Alarm (high-order)" and "Alarm (low-order)" settings are available from software Ver.1.01.00 or later.

> ✎ • After switching the Monitor selection setting, there will be some time lag before the data is actually switched. If data is referenced immediately after switching the setting, an unintended data may be displayed.
> • If the alarm (high-order) is "96 (0x60)" and the alarm (low-order) is "2 (0x02)", the alarm code is 0x6002.

■ Timing charts

The minimum communication cycle time of this product is 10 ms. Response output may be delayed depending on the cycle time.

<From power-on to home position return>

> **⚠ CAUTION**
>
> **Make sure that the fingers are not in contact with the mechanical end or the workpiece before the first servo ON after power-on.**
> The actuator may malfunction.

1 Turn on the servo.

2 Set Stop to ON. (Order of steps 1 and 2 can be reversed.)

3 Confirm that Operation preparation completion is ON and perform home position return.

Horizontal axis: Time

	Signal	
Power supply	Control	ON / OFF
	Motor	ON / OFF
Process data output	Stop (negative logic)	ON / OFF
	Servo ON	ON / OFF
	Home position return start	ON / OFF
Process data input	Operation preparation complete	ON / OFF
	Alarm (negative logic)	ON / OFF
	Servo ON state	ON / OFF
	Home position return complete	ON / OFF
	Traveling	ON / OFF

Timing markers (left to right):
- Power ON
- Servo ON
- Operation preparation complete
- Home position return start
- Home position return complete

Note 1 (between Servo ON and Operation preparation complete)

Note 1: For the first servo ON after power-on, it takes several seconds for Servo ON state to switch to ON depending on the stroke position.

<Positioning operation: Point number selection>

1 Set the point number to which the actuator should travel to Point number selection.

2 Set Travel start to ON.
When the actuator completes traveling, Travel complete switches to ON and the point number is output to Point number confirmation.

Note 1: Leave an interval of at least 20 ms between setting Point number selection and switching Travel start to ON.
Note 2: Travel complete for previously completed travel remains ON until the instruction after setting the next Travel start to ON is accepted; do not confuse the previously completed travel with the next one.
Also, there is a particular point in time when Travel complete and Traveling both switches to ON at the same time.
Note 3: Since Stop is negative logic, the actuator starts traveling (Travel start switches to ON) while the bit for Stop is ON. If Stop is used to stop the actuator, Travel complete will not switch to ON.
*   ① shows the state in which point 3 is set to Point number selection and ② shows the state in which point 7 is set to Point number selection.

✎ If the positioning operation is executed while the service data is being rewritten, the operation intended by the data rewriting may not occur.

<Positioning operation: direct value travel selection>

1   Set the point data for direct value travel in process data output.

2   Set Direct value travel selection to ON. (Order of steps 1 and 2 can be reversed.)

3   Set Travel start to ON.
       When the actuator completes traveling, Travel complete switches to ON. (Point number confirmation switches to "0").

Note 1: After setting the point data, leave an interval of at least 20 ms before switching Travel start to ON.
Note 2: Travel complete for previously completed travel remains ON until the instruction after setting the next Travel start to ON is accepted; do not confuse the previously completed travel with the next one.
          Also, there is a particular point in time when Travel complete and Traveling both switches to ON at the same time.
*   ① shows the state in which data for traveling to position 1 is set and ② shows the state in which data for traveling to position 2 is set.

✎   If the positioning operation is executed while the service data is being rewritten, the operation intended by the data rewriting may not occur.

<Jog/Inch operation>

Jog operation

1 Set JOG/INCH speed in service data as desired.

2 Set INCH selection to OFF.

3 To operate the actuator in the direction in which the fingers close, set JOG/INCH (+) travel start to ON. To operate the actuator in the direction in which the fingers close, set JOG/INCH (−) travel start to ON.

Inch operation

1 Set JOG/INCH speed and INCH distance in service data as desired.

2 Set INCH selection to ON.

3 To operate the actuator in the direction in which the fingers close, set JOG/INCH (+) travel start to ON. To operate the actuator in the direction in which the fingers close, set JOG/INCH (−) travel start to ON.

Horizontal axis: Time

- Since JOG/INCH travel start uses edge detection, the operation that switches to ON first has priority.
- Even when home position return is not completed, jog operation is performed but inching operation is not performed.

<Alarm>

When an alarm is triggered, the servo is turned off and Operation preparation complete switches to OFF. When the alarm is cleared with Alarm reset, the servo is turned back on and Operation preparation complete also switches back to its original state.
Some alarms cannot be reset. Refer to "5.2 Alarm Code" for details on the alarms.

Horizontal axis: Time

Process data output	Alarm reset	ON / OFF
Process data input	Operation preparation complete	ON / OFF
	Alarm (negative logic)	ON / OFF
	Servo ON state	ON / OFF

Alarm triggered   Alarm cleared

✎ The alarm code can be checked in the service data. Refer to "5.2 Alarm Code" for alarm codes and their descriptions.

3.4.2 Service data

With service data (on-request data, message communication), the point data and parameters are set, and the alarm history is read. The controller is operated from the PLC by transmitting and receiving service data. Also, process data can be read as service data.

Process data input   Index: 0x0028
Process data output   Index: 0x0029

To read data: Specify the Index and Subindex of the data to be read and then execute the read command.

To write data: Specify the Index and Subindex of the the data to be written, set the data length and the value to be written, and then execute the write command.

Service data uses FBs (function blocks) provided by the PLC manufacturer for reading and writing. There are FBs that specify the node number (station alias). (Refer to the manuals for the PLC and IO-Link master for details.)

Following are access examples.

■ Access example 1: Using the IO-Link access function

Port: Setting information regarding the port to be read
Obj: Index and Subindex information to be read
ReadData: Storage area for the read data
DataSize: Storage area for the read data size

■ Access example 2: Using the CoE object write (read) function

■ **Access example 3: Transmitting a message to the controller from the IO-Link master**

The following object format provides only the information necessary for explaining the data writing and reading examples described later. Since the format differs depending on the object used, refer to the manual for the IO-Link master for details on the object.

Object format

Object name	Index	Subindex	Command
Control	0x4000 +0x00n0	0x01	0 = None, 2 = Write, 3 = Read
Status		0x02	2 = Successful, 4 = Error
Index		0x03	Index of the data to be operated is set.
Subindex		0x04	Subindex of the data to be operated is set.
Data length		0x05	Size of the data to be written is set when writing.
Data		0x06	Data to be written is set when writing. Read data is stored when reading.

*   n indicates the port number of the IO-Link master.

<Example of writing to the specified service data address>
Execute FBs (1) through (5) below to use Index = 0x4000 for the object (IO-Link master port number = 0) when writing 20 to Home position return speed (Index = 0x310).
    (1) Write 0x310 (Index of the data to be written) to Subindex = 0x03.
    (2) Write 0 (Subindex of the data to be written) to Subindex = 0x04.
    (3) Write 2 (Data length of the data to be written) to Subindex = 0x05.
    (4) Write 20 (Data to be written) to Subindex = 0x06.
    (5) Write "2" to Subindex = 0x01 and execute writing to relevant data.

<Example of reading to the specified service data address>
Execute FBs (1) through (5) below to use Index = 0x4000 for the object (IO-Link master port number = 0) when reading the content of Soft limit (+) (Index = 0x302).
    (1) Write 0x302 (Index of the data to be read) to Subindex = 0x03.
    (2) Write 0 (Subindex of the data to be read) to Subindex = 0x04.
    (3) Write "3" to Subindex = 0x01 and execute reading of relevant data.
    (4) Monitor until Subindex = 0x02 is "2" (successful). (Read function is used from here on.)
    (5) Acquire data with Subindex = 0x06.

- If the entire data composed of multiple elements (data with multiple Subindex data) is accessed with Subindex = 0, some items (such as the point data "Position specification method") will have bit configuration. Refer to "3.4 Communication Format" for details.
- If the data of the item that is stored with the DS function is rewritten, data download in the DS function will be executed at the next power-on, and the data may return to its pre-update state. For details on the DS function, refer to "3.5 Data Storage (DS) Function". For the items that are stored with the DS function, refer to "Items that can be uploaded/downloaded" in "3.5.2 Download/Upload".
- Set multi-byte data so that the most significant value comes first.
(Example: 2-byte data)

First byte	Second byte
Most significant	Least significant

Take note of the data types used in ladders. Depending on the manufacturer, data may not be accessed correctly even if the data types with corresponding size (for example, 4-byte data to data types such as DWORD or UINT and 2-byte data to data types such as WORD or USINT) are specified for the input/output parameters of the FB. In that case, access data using a bite array of the same size (a bite array of 4 bytes in the case of the above example).
- When writing data, there are FBs where a bite array of 232 bytes must be specified with a data length of 232 bytes.

■ Data formats

In each table, "R" stands for Read and "R/W" stands for Read/Write.

(1) Identification

Index (Hex)	Sub index	Item		Value (Dec)		Access	Data length	Format
0x0010	0	Vendor Name		CKD Corporation		R	64 bytes	String
0x0011	0	Vender Text		https://www.ckd.co.jp/		R	64 bytes	String
0x0012	0	Product Name		FFLD-LK		R	64 bytes	String
0x0013	0	Product ID		FFLD-LK_GRIPPER		R	64 bytes	String
0x0014	0	Product Text		Electric Controller		R	64 bytes	String
0x0015	0	Serial-Number		***		R	16 bytes	String
0x0016	0	Hardware Revision		***		R	64 bytes	String
0x0017	0	Firmware Revision		***		R	64 bytes	String
0x0018	0	Application Specific Tag		Factory setting: "Developed by v33fan/V_STACK"		R/W	32 bytes	String
0x0000	0	Direct Parameters 1		Direct parameters Note 1		R	16 bytes	Record
	1	Reserved		Reserved		R	1 byte	UInteger8
	2	Master Cycle Time		Master cycle duration		R	1 byte	UInteger8
	3	Min Cycle Time		Minimum cycle duration		R	1 byte	UInteger8
	4	M-Sequence Capability		Sequence capabilities		R	1 byte	UInteger8
	5	IO-Link VersionID		IO-Link version ID		R	1 byte	UInteger8
	6	Process Data Input Length		Process data PD (in) length		R	1 byte	UInteger8
	7	Process Data Output Length		Process data PD (out) length		R	1 byte	UInteger8
	8	Vendor ID 1		0x03		R	1 byte	UInteger8
	9	Vendor ID 2		0x57		R	1 byte	UInteger8
	10	Device ID 1		0x40		R	1 byte	UInteger8
	11	Device ID 2		0x10		R	1 byte	UInteger8
	12	Device ID 3	Ver.1.00.03	0x01		R	1 byte	UInteger8
			Ver.1.01.00 or later	0x06				
	13	Reserved		Reserved		R	1 byte	UInteger8
	14	Reserved		Reserved		R	1 byte	UInteger8
	15	Reserved		Reserved		R	1 byte	UInteger8
	16	Standard Command		Reserved		R/W	1 byte	UInteger8

Note 1: The value format of each set item conforms to the IO-Link standard.

(2) Parameters and commands
Common specifications

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS Note 1
0x0002	0	System Command	Refer to the table "System Command".	W	1 byte	UInteger8	-
0x000C	0	Device Access Locks	0x0000： Unlocked 0x0001： Parameter locked 0x0002： Data Storage locked	R/W	2 bytes	Record	●
0x0020	0	Error Count	Error count (Cleared at power-on) Note 2	R	2 bytes	UInteger16	-
0x0024	0	Device Status	0: Operating properly 1: Reserved 2: Reserved 3: Process data temporarily invalid 4: Process data invalid due to malfunction	R	1 byte	UInteger8	-
0x0025	0	Detailed Device Status	Refer to the table "EventQualifier". Event code high order Event code low order 3-byte configuration x maximum of 8	R	24 bytes	Array[8] of 3Octet String	-
0x0030	0	Offset Time	0 (reserved)	R/W	1 byte	Record	-

Note 1: "●" indicates that the item is included in data storage.
Note 2: If an error of level 2 or higher occurs when the process data input alarm signal falls, then it is +1 to the count (it is only +1 even if multiple errors occur simultaneously).

System command

Value (Hex)	Command	Definition
0x82	Restore Factory Settings	Restores parameters to the original delivery status. Note 1

Note 1: User data other than Identification is initialized (to the original delivery status). To initialize point data and all user data, use data initialization (Index = 0x505, Subindex = 0).

EventQualifier

Bit	Item	Setting
7	MODE	1: Event single shot 2: Event disappears 3: Event appears
6		
5	TYPE	1: Notification 2: Warning 3: Error
4		
3	SOURCE	0: Device
2	INSTANCE	0: Unknown 4: Application
1		
0		

Individual specifications 1 (Vendor)

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS
0x0042	0	Data Storage mode	1: Forced upload Note 1	R/W	1 byte	UInteger8	-
0x0044	0	Data initialization executing	1: Data initialization executing Note 2	R	1 byte	UInteger8	-

Note 1: This requests a forced data storage upload. After the request is accepted, the written value is cleared. For this request to be executed, the Data Storage function of the master unit must be enabled.
Note 2: When data initialization (Index = 0x0505) is executed, the completion of the process is confirmed from this information. If this item is referenced after the process is completed in a short time, "1 (Data initialization executing)" cannot be confirmed at all.

Individual specifications 2

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS Note 1
0x1000	0	Point data number specification	0 to 63	R/W	2 bytes	UInteger16	-
0x1001	0	Point data		R/W	14 bytes	Record	●
	1	Position (0.01 mm)	− stroke to + stroke	R/W	2 bytes	Integer16	-
	2	Speed (mm/s)	0 to 10 (When set to 0, value of common parameter is applied)	R/W	1 byte	UInteger8	-
	3	Pressing rate (%)	0, 30 to 100 (When set to 0, value of common parameter is applied)	R/W	1 byte	UInteger8	-
	4	Pressing distance (0.01 mm)	− stroke to + stroke (When set to 0, value of common parameter is applied)	R/W	2 bytes	Integer16	-
	5	Pressing speed (mm/s)	0 to 5 (When set to 0, value of common parameter is applied)	R/W	1 byte	UInteger8	-
	6	Position specification method	0: Absolute 1: Incremental	R/W	1 byte	UInteger4	-
	7	Operation method	0: Positioning operation 1: Pressing operation 1 2: Pressing operation 2	R/W	1 byte	UInteger4	-
	8	Stop method	0: Common 1: Control 2: Fixed excitation 3: Automatic servo OFF 1 4: Automatic servo OFF 2 5: Automatic servo OFF 3	R/W	1 byte	UInteger4	-
	9	Point zone (+) (0.01 mm)	− stroke to + stroke	R/W	2 bytes	Integer16	-
	10	Point zone (−) (0.01 mm)	− stroke to + stroke	R/W	2 bytes	Integer16	-

Note 1: "●" indicates that the item is included in data storage.

> ✏ Access the point data after setting Point data number specification (Index = 0x1000) and while that point number is specified. (Initial value at power-on = 1)
> Depending on the PLC development tool, items such as the position may be displayed as a value (unit) with a decimal part

Individual specifications 3

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS Note 1
0x0302	0	Soft limit + (0.01 mm)	Soft limit (−) to + stroke	R/W	2 bytes	Integer16	●
0x0304	0	Soft limit − (0.01 mm)	− stroke to soft limit (+)	R/W	2 bytes	Integer16	●
0x0310	0	Home position return speed (mm/s)	1 to 5	R/W	1 byte	UInteger8	●
0x0312	0	Home position offset amount (0.01 mm)	− stroke to + stroke	R/W	2 bytes	Integer16	●
0x0313	0	Home position return direction	0: Normal (opening direction) 1: Opposite (closing direction)	R/W	1 byte	UInteger8	●
0x0314	0	G1 gain (response)	0 to 15	R/W	1 byte	UInteger8	●
0x0315	0	G2 gain (load magnification)	0 to 15	R/W	1 byte	UInteger8	●
0x0316	0	JOG/INCH speed (mm/s)	1 to 5	R/W	1 byte	UInteger8	●
0x0317	0	INCH distance (0.01mm)	1 to 1000	R/W	2 bytes	UInteger16	●
0x0329	0	Holding current at stop (%)	0 to 80	R/W	1 byte	UInteger8	●
0x032B	0	Pressing judgment time (ms)	0 to 9999	R/W	2 bytes	UInteger16	●
0x032C	0	Automatic servo OFF time 1 (sec)	0 to 9999	R/W	2 bytes	UInteger16	●
0x032D	0	Automatic servo OFF time 2 (sec)	0 to 9999	R/W	2 bytes	UInteger16	●
0x032E	0	Automatic servo OFF time 3 (sec)	0 to 9999	R/W	2 bytes	UInteger16	●
0x032F	0	Stop input	0: Enabled 1: Disabled	R/W	1 byte	UInteger8	●
0x0330	0	Automatic point zone (pressing) Note 2	0: Disabled 1: Enabled	R/W	1 byte	UInteger8	●
0x0331	0	Automatic point zone position 1	0 to + stroke	R/W	2 bytes	UInteger16	●
0x0332	0	Automatic point zone position 2	0 to + stroke	R/W	2 bytes	UInteger16	●

Note 1: "●" indicates that the item is included in data storage.
Note 2: When enabled, the point zone is output in the range from "position 1" to "position 2" in the direction of travel from the pressing start point. (Valid only when the point data "Point zone (+)/(−)" is "0").

Individual specifications 4

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS
0x0386	0	Stroke	Actuator stroke	R	2 bytes	UInteger16	-
0x070A	0	Alarm code	Refer to "5.2 Alarm Code" for details on the alarm codes.	R	2 bytes	UInteger16	-

Individual specifications 5

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS Note 1
0x0319	0	Common positioning width (0.01 mm)	1 to 999	R/W	2 bytes	UInteger16	●
0x031A	0	Common speed (mm/s)	1 to 10	R/W	1 byte	UInteger8	●
0x031B	0	Common acceleration (0.01 G)	1 to 5	R/W	1 byte	UInteger8	●
0x031C	0	Common deceleration (0.01 G)	1 to 5	R/W	1 byte	UInteger8	●
0x031D	0	Common pressing rate (%)	30 to 100	R/W	1 byte	UInteger8	●
0x031E	0	Common pressing speed (mm/s)	1 to 5	R/W	1 byte	UInteger8	●
0x031F	0	Common pressing distance (0.01 mm)	− stroke to + stroke	R/W	2 bytes	Integer16	●
0x0320	0	Common stop method	1: Control 2: Fixed excitation 3: Automatic servo OFF 1 4: Automatic servo OFF 2 5: Automatic servo OFF 3	R/W	1 byte	UInteger8	●

Note 1: "●" indicates that the item is included in data storage.

Individual specifications 6

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS
0x0400	0	Actuator mode number	FFLD-****NCN30-LK	R	40 bytes	String	-
0x0401	0	Actuator serial number	****-***	R	16 bytes	String	-
0x0451	0	Integrated number of travels (times)	0 to 999999999	R	4 bytes	UInteger32	-
0x0452	0	Integrated operating time (sec)	0 to 999999999	R	4 bytes	UInteger32	-
0x047F	0	Alarm history number specification	0 to 63 with newest data being 0	R/W	1 byte	UInteger8	-
0x0480	0	Alarm history		R	6 bytes	Record	-
	1	Alarm code		R	2 bytes	UInteger16	-
	2	Time information	[sec]	R	4 bytes	UInteger32	-
0x0505	0	Data initialization	0x999n: Data initialization n: Bit is set as follows. Bit 0 (LSB): 1: Initialize all parameter data Bit 1: (Unused) Bit 2: 1: Initialize all point data Bit 3: (Unused) 0 if read Note 1	R/W	2 bytes	UInteger16	-
0x0520	0	Software reset	9999: Software reset 0 if read Note 2	R/W	2 bytes	UInteger16	-
0x0531	0	Threshold of integrated number of travels (times)	0 to 999999999	R/W	4 bytes	UInteger32	-
0x0532	0	Threshold of integrated operating time (sec)	0 to 999999999	R/W	4 bytes	UInteger32	-

Note 1: A response indicating successful completion is returned when the acceptation of the process is successfully completed. The completion of the process is confirmed by referencing data initialization executing (Index = 0x0044). Common point data such as "Common speed" becomes parameter data. Power cycling or software reset is required after initialization.

Note 2: A response indicating successful completion is returned when the acceptation of the process is successfully completed. Since initialization of communication and other items is executed with the reset process, the completion is determined from the OFF/ON of the IO-Link master port status. To prevent malfunction, do not execute this item while the actuator is operating and do not operate the actuator or write data while resetting.

To read the alarm history, write the alarm history number specification first. Since the system time at the time of the occurrence of the alarm (time elapsed since power-on) is set to the time information, the time information of the latest alarm may not always be a large value.

Process data input

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS
0x0028 Note 1	0	Process data input	All items (Read in the following order)	R	5 bytes	Record	-
	12	Operation preparation complete	0: Incomplete 1: Complete	R	1 byte	UInteger8	-
	11	Warning	0: Triggered 1: Not triggered	R	1 byte	UInteger8	-
	10	Alarm	0: Triggered 1: Not triggered	R	1 byte	UInteger8	-
	9	Servo ON state	0: OFF state 1: ON state	R	1 byte	UInteger8	-
	8	Home position return complete	0: Incomplete 1: Complete	R	1 byte	UInteger8	-
	7	Travel complete	0: Incomplete 1: Complete	R	1 byte	UInteger8	-
	6	Traveling	0: Stopped 1: Traveling	R	1 byte	UInteger8	-
	5	Point zone	0: Inside zone 1: Outside zone	R	1 byte	UInteger8	-
	4	Direct value travel status	0: Point travel 1: Direct value travel	R	1 byte	UInteger8	-
	3	Point number confirmation	0 to 63	R	1 byte	UInteger8	-
	2	Present position	−9999 to 9999	R	2 bytes	Integer16	-
	1	Selection monitor Note 2	Current, speed, Alarm (high-order) or Alarm (low-order) (Depends on "Monitor selection" of process data output)	R	1 byte	UInteger8	-

Note 1: When read with Subindex = 0, it is read as a data where Subindex = 3 and 4 is 1 byte and Subindex = 5 to 12 is 1 byte.
(Refer to "3.4.1 Process data" <Byte 0: Status monitor>.)
Note 2: The "Alarm (high-order)" and "Alarm (low-order)" settings are available from software Ver.1.01.00 or later.

Process data output

Index (Hex)	Sub index	Item	Value (Dec)	Access	Data length	Format	DS
	0	Process data output	All items (Read in the following order)	R	15 bytes	Record	-
	21	Stop	0: Stop 1: Release	R	1 byte	UInteger8	-
	20	Alarm reset	1: Reset	R	1 byte	UInteger8	-
	19	Servo ON	0: Servo OFF 1: Servo ON	R	1 byte	UInteger8	-
	18	Home position return start	1: Home position return start	R	1 byte	UInteger8	-
	17	Travel start	1: Start	R	1 byte	UInteger8	-
	16	Direct value travel selection	0: Point travel 1: Direct value travel	R	1 byte	UInteger8	-
	15	Point number selection	0 to 63	R	1 byte	UInteger8	-
	14	Position (0.01 mm)	− stroke to + stroke	R	2 bytes	Integer16	-
	13	Speed (mm/s)	0 to 10	R	1 byte	UInteger8	-
	12	Pressing rate (%)	0 to 100	R	1 byte	UInteger8	-
0x0029 Note 1 Note 2 Note 3	11	Pressing distance (0.01 mm)	− stroke to + stroke	R	2 bytes	Integer16	-
	10	Pressing speed (mm/s)	0 to 5	R	1 byte	UInteger8	-
	9	Position specification method	0: Absolute 1: Incremental	R	1 byte	UInteger8	-
	8	Operation method	0: Positioning operation 1: Pressing operation 1 2: Pressing operation 2	R	1 byte	UInteger8	-
	7	Stop method	0: Common 1: Control 2: Fixed excitation 3: Automatic servo OFF 1 4: Automatic servo OFF 2 5: Automatic servo OFF 3	R	1 byte	UInteger8	-
	6	Point zone (+) (0.01 mm)	− stroke to + stroke	R	2 bytes	Integer16	-
	5	Point zone (−) (0.01 mm)	− stroke to + stroke	R	2 bytes	Integer16	-
	4	INCH selection	0: JOG 1: INCH	R	1 byte	UInteger8	-
	3	JOG/INCH (+) travel start	0: Stop (JOG) 1: Travel start	R	1 byte	UInteger8	-
	2	JOG/INCH (−) travel start	0: Stop (JOG) 1: Travel start	R	1 byte	UInteger8	-
	1	Monitor selection Note 4	0: Current 1: Speed 2: Alarm (high-order) 3: Alarm (low-order)	R	1 byte	UInteger8	-

Note 1: When read with Subindex = 0, it is read as a data where Subindex = 21 to 16 is 1 byte.
(Refer to "3.4.1 Process data" <Byte 0: Control 1>.)
Note 2: When read with Subindex = 0, it is read as a data where Subindex = 9 to 7 is 1 byte.
(Refer to "3.4.1 Process data" <Byte 9: Mode selection (direct value travel)>.)
Note 3: When read with Subindex = 0, it is read as a data where Subindex = 4 to 1 is 1 byte.
(Refer to "3.4.1 Process data" <Byte 14: Control 2>.)
Note 4: The "Alarm (high-order)" and "Alarm (low-order)" settings are available from software Ver.1.01.00 or later.

■ Return error

When reading/writing data, following error codes are set as FB output parameters for the set input parameters.

If CoE object is used, the error codes are set to Subindex = 0x07 (Errorcode) of the corresponding Index (such as 0x4000).

Error code	Incident	Remark
0x8000	Application error	
0x8011	Index not available	
0x8012	Subindex not available	
0x8020	Service temporarily not available	
0x8021	Service temporarily not available	
0x8022	Service temporarily not available	
0x8023	Not writeable	
0x8030	Parameter value out of range	
0x8031	Parameter value above limit	Either 0x8031 or 0x8131
0x8032	Parameter value below limit	Either 0x8032 or 0x8132
0x8033	Data length overrun	
0x8034	Data length underrun	
0x8035	Function not available	
0x8040	Invalid parameter set	
0x8041	Inconsistent parameter set	
0x8101	Unable to accept due to writing from setting tool, etc.	
0x8104	Error in internal processing of read/write (retry operation)	
0x8105	Error in internal processing of read/write (function)	
0x8106	Error in internal processing of read/write (other 1)	
0x8107	Error in internal processing of read/write (other 2)	
0x8108	Device failure	Failure of device inside the unit
0x8109	Waiting to process write	Multiple write commands are executed at short intervals. Lengthen the interval.
0x8131	Parameter value above limit	
0x8132	Parameter value below limit	

✎ The IO-Link master unit does not have an internal processing function for resetting errors. Note that if an error occurs in accessing data, the error may only be cleared by power cycling.

3.5   Data Storage (DS) Function

Data Storage function is a function that backs up the IO-Link device setting parameter data for each port of the IO-Link master. With this function, the backup data can be restored as necessary, such as when the IO-Link device is replaced due to a failure.

3.5.1   IO-Link master settings

Following items are set for each port of the IO-Link master using the PLC development tool.

- Device comparison function for checking whether the connected IO-Link device matches the set Device ID.
- Backup function for backing up the IO-Link device setting parameters.
- Restore function for restoring backup data of IO-Link devices.
- IO-Link device configuration settings such as Vendor ID, Device ID, Revision, and Process Data Input/Output Length.

By making these settings, the IO-Link master can backup data, restore data, and support data backup requested by the IO-Link device. Refer to the manual provided by the PLC manufacturer for details.

✏	• If the Data Storage function of the IO-Link master is enabled, the backup data will be restored (downloaded) immediately after power-on if any difference is found in the data being processed. • When replacing the actuator with a different one, disable the restore function or delete the backup data.

3.5.2 Download/Upload

■ Download

If the backup data stored in the IO-Link master does not match the parameter data set in the connected IO-Link device at startup, the IO-Link master downloads the stored backup data. Therefore, if the controller is replaced with a backup controller for reasons such as a controller failure, the minimum setting data required for operation can be written to the new controller.

- Conditions are checked before upload is processed.
- Data download is executed by the IO-Link master when the execution conditions are met. Execution cannot be requested from the controller to the IO-Link master as needed.

- Do not access service data while downloading.

- Disable the "Restore function setting" of the IO-Link master before connecting a controller for which downloading is not to be executed.

- If the serial number check is also included in the device comparison settings, an error will occur when the controller is replaced. To download the backup data after replacing the controller, exclude the serial number check from the device comparison settings or change the setting to the serial number of the new unit.

For details on the backup data deletion function and download execution conditions, refer to the manual provided by the PLC manufacturer.

■ Upload

Under the following conditions, the IO-Link device setting parameters are uploaded for use as backup data.

- The IO-Link master does not have backup data stored at startup.
- The backup data was cleared with the controller connected.
- The request was made from the IO-Link device.

- Do not access service data while uploading.

- If upload is not enabled in the PLC settings, upload will not be executed even if forced upload (Index = 0x0042) is instructed.

For details on the backup data deletion function and upload execution conditions, refer to the manual provided by the PLC manufacturer.

■ Items that can be uploaded/downloaded

Item	Data length
Device Access Locks	2 bytes
Application Specific Tag	32 bytes
Soft limit (+)	2 bytes
Soft limit (−)	2 bytes
Home position return speed	1 byte
Home position offset amount	2 bytes
Home position return direction	1 byte
G1 gain (response)	1 byte
G2 gain (load magnification)	1 byte
JOG/INCH speed	1 byte
INCH distance	2 bytes
Holding current at stop	1 byte
Pressing judgment time	2 bytes
Automatic servo OFF time 1	2 bytes
Automatic servo OFF time 2	2 bytes
Automatic servo OFF time 3	2 bytes
Stop input	1 byte
Automatic point zone (pressing)	1 byte
Automatic point zone position 1	2 bytes
Automatic point zone position 2	2 bytes
Common positioning width	2 bytes
Common speed	2 bytes
Common acceleration	1 byte
Common deceleration	1 byte
Common pressing rate	1 byte
Common pressing speed	1 byte
Common pressing distance	2 bytes
Common stop method	1 byte
Point data 0 to 63	14 bytes/point

3.6   Parameters

Parameter settings and changes are executed by accessing service data.
Settings and changes can also be executed with the setting software (S-Tools). Refer to the Instruction Manual for S-Tools (SM-A11147) for details.

3.6.1   List of parameters

Name Note 1	Description	Setting range	Initial value	Unit
☆Soft limit (+)	This is for setting the movable range in the + direction (fingers close). Setting range is soft limit (−) to + stroke + margin. If both the soft limit (+) and soft limit (−) settings are 0, the stroke range becomes the movable range. Refer to "3.6.2 Soft limits" for details.	Soft limit (−) to + stroke	0	0.01 mm
☆Soft limit (−)	This is for setting the movable range in the − direction (fingers open). Setting range is − stroke − margin to soft limit (+). If both the soft limit (+) and soft limit (−) settings are 0, the stroke range becomes the movable range. Refer to "3.6.2 Soft limits" for details.	− stroke to soft limit (+)	0	0.01 mm
☆Home position return direction	This is for setting the direction of home position return to "normal" or "opposite". Refer to "3.6.3 Home position return operation" for details.	Normal, Opposite	Normal	None
Home position return speed	This is for setting the speed of home position return.	1 to 5	5	mm/s
☆Home position offset amount	This is for setting the amount of offset of the home position. Refer to "3.6.3 Home position return operation" for details.	− stroke to + stroke	0	0.01 mm
Pressing judgment time	Set the time until it is judged that the pressing is complete in the pressing zone of the pressing operation 1. During the pressing judgment time, when the current value reaches the one corresponding to the value set in the pressing rate, it is judged that pressing is complete.	0 to 9999	200	ms
Holding current at stop	This is for setting the value of current for holding the workpiece when a stop is made.	0 to 80	65	%
Automatic servo OFF 1	This is enabled when automatic servo OFF 1 is selected in the point data "Stop method". The servo turns off after the set time has elapsed since the actuator completed traveling.	0 to 9999	0	sec
Automatic servo OFF 2	This is enabled when automatic servo OFF 2 is selected in the point data "Stop method". The servo turns off after the set time has elapsed since the actuator completed traveling.	0 to 9999	0	sec
Automatic servo OFF 3	This is enabled when automatic servo OFF 3 is selected in the point data "Stop method". The servo turns off after the set time has elapsed since the actuator completed traveling.	0 to 9999	0	sec
☆Stop input	This is for enabling or disabling Stop (process data output).	Enabled, Disabled	Enabled	None

Note 1: To reflect the settings of the parameters with "☆" in the name, power cycling or software reset is required.

Name	Description	Setting range	Initial value	Unit
Automatic point zone (pressing)	This is for setting the point zone automatic setting during pressing operation to "Enabled" or "Disabled". If the point data "Point zone (+)/(−)" is set, the point data has priority. Refer to "3.6.4 Automatic point zone" for details.	Enabled, Disabled	Disabled	None
Automatic point zone position 1	This is for setting the output range of the automatic point zone. The point zone is output in the range from "pressing start point + position 1" to "pressing start point + position 2".	0 to + stroke	0	0.01 mm
Automatic point zone position 2	If the point data "Point zone (+)/(−)" is set, point data has priority. Refer to "3.6.4 Automatic point zone" for details.	0 to + stroke	0	0.01 mm
Threshold of integrated number of travels (actuator)	A warning is output if the integrated number of travels of the actuator exceeds the set threshold. If the threshold is 0, no warning is output.	0 to 999999999	0	times
Threshold of integrated operating time (motor)	A warning is output if the integrated operating time of the motor exceeds the set threshold. If the threshold is 0, no warning is output.	0 to 999999999	0	sec
Common positioning width	This is for setting the allowable value for the positioning completion output.	1 to 999	10	0.01 mm
Common speed	This is for setting the common speed in the transfer zone. If 0 is set in the point data, this value is referenced.	1 to 10	10	mm/s
Common acceleration	This is for setting the acceleration in the transfer zone.	1 to 5	5	0.01 G
Common deceleration	This is for setting the deceleration in the transfer zone.	1 to 5	5	0.01 G
Common pressing rate	Set the common pressing rate for the pressing zone. If 0 is set in the point data, this value is referenced.	30 to 100	50	%
Common pressing speed	This is for setting the common pressing speed in the transfer zone. If 0 is set in the point data, this value is referenced.	1 to 5	5	mm/s
Common pressing distance	This is for setting the common pressing distance in the transfer zone. If 0 is set in the point data, this value is referenced.	− stroke to + stroke	1000	0.01 mm
Common stop method	This is for setting the common stop method after the actuator completes positioning. If "Common" is set in the point data, this setting is referenced.	Control, Fixed excitation, Automatic servo OFF 1, Automatic servo OFF 2, Automatic servo OFF 3	Control	None
JOG/INCH speed	This is for setting the speed of JOG/INCH (−) travel start and JOG/INCH (+) travel start signals.	1 to 5	5	mm/s
INCH distance	This is for setting the distance during inch operation for JOG/INCH (−) travel start and JOG/INCH (+) travel start signals.	10 to 1000	100	0.01 mm
G1 gain (response)	This is for adjusting the convergence time of the speed waveform. As the set value increases, the position proportional gain, speed proportional gain, and speed integral gain increase. It improves command tracking but oscillation is more likely to occur. If set to 0, the internal factory setting will be applied. Use the initial value unless there is a problem.	0 to 15	0	None
G2 gain (load magnification)	This is adjusted according to the actuator load. As the set value increases, the speed proportional gain and speed integral gain increase. Increasing the G2 gain reduces speed ripple. If the load is large, increase the set value. If set to 0, the internal factory setting will be applied. Use the initial value unless there is a problem.	0 to 15	0	None

3.6.2 Soft limits

The movable range can be set for the transfer operation and the pressing operation.
If the range of the soft limit is exceeded during those operations, an alarm is output.
If the operation completion position is outside the range of the soft limit, an alarm is output at the start of the operation.

The finger opening direction is "−", the finger closing direction is "+", and the home position is "0.00 mm".
Set the soft limit within the range that is outside the "distance of travel (target positions 1 and 2)" and inside the "mechanical movable range of the actuator".

3.6.3 Home position return operation

If the home position return direction is "normal", the home position return is performed by pressing against the mechanical end of the finger opening direction.
If the home position return direction is "opposite", the home position return is performed by pressing against the mechanical end of the finger closing direction.
In either case, "home position = 0.00 mm", the finger closing direction is "+", and the finger opening direction is "−".

The home position can be offset by setting the home position offset amount.

Example) Parameter settings and effective stroke

Home position return direction: Normal
Home position offset amount: 10.00 mm
Effective stroke: −10.00 mm to 40.00 mm

Home position return direction: Opposite
Home position offset amount: −40.00 mm
Effective stroke: −10.00 mm to 40.00 mm

In both cases, they operate in the same coordinate system after returning to the home position (the mechanical ends pressed in the home position return operation are reversed).

█ 3.6.4 Automatic point zone

For the pressing operation, a point zone can be set at the position of "pressing start point" + "automatic point zone position" with respect to the traveling direction.
The offset position from the pressing start point is set to "automatic point zone position".
When this setting is "Enabled", it is valid for all pressing operations.

If the point data "Point zone (+)/(−)" is set, that setting will be valid.
Refer to "3.7.7 Point zone" for setting the point data.

Example) Parameter settings and point zone output range

Point data
    Position: 40.00 mm
    Pressing distance: 10.00 mm

Automatic point zone position 1:   3.00 mm
Automatic point zone position 2:   5.00 mm

3.7 Point Data

Point data settings and changes are executed by accessing service data.
Settings and changes can also be executed with the setting software (S-Tools). Refer to the Instruction Manual for S-Tools (SM-A11147) for details.

3.7.1 Number of point data

The number of point data that can be set for the actuator is 64 points.
When operating the actuator with direct values (direct value travel), there is no limit on the number of points since the values can be set from the process data. (The limit depends on the upper level equipment.)

3.7.2 List of point data

Setting item	Description	Setting range	Initial value	Unit
Position specification method	This is for selecting between absolute and incremental. Refer to "3.7.3 Position specification method" for details.	0: Absolute 1: Incremental	Absolute	None
Operation method	This is for selecting among positioning operation, pressing operation 1, and pressing operation 2. Refer to "3.7.4 Operation method" for details.	0: Positioning operation 1: Pressing operation 1 2: Pressing operation 2	Positioning operation	None
Position	This is for setting the final target position (mm) when the operation method is set to positioning operation. If the operation method is set to pressing operation 1 or pressing operation 2, the final target position is determined according to the pressing distance. Refer to "3.7.5 Position" for details	− stroke to + stroke	0.00	mm
Speed	This is for setting the speed (mm/s) in the transfer pone.	0 to 10	0	mm/s
Stop method	This is for selecting the either control or fixed excitation for stopping the actuator. Refer to "3.7.6 Stop method" for details.	0: Common 1: Control 2: Fixed excitation 3: Automatic servo OFF 1 4: Automatic servo OFF 2 5: Automatic servo OFF 3	Common	None
Point zone (+)	This is for setting the point zone (+) (mm). Refer to "3.7.7 Point zone" for details.	− stroke to + stroke	0.00	mm
Point zone (−)	This is for setting the point zone (−) (mm). Refer to "3.7.7 Point zone" for details.	− stroke to + stroke	0.00	mm
Pressing rate	Set the upper limit of the pressing force in a pressing zone as a ratio to the maximum pressing force.	0 or 30 to 100	0	%
Pressing speed	This is for setting the speed (mm/s) in the pressing zone.	0 to 5	0	mm/s
Pressing distance	This is for setting the pressing zone width (mm).	− stroke to + stroke	0.00	mm

Following items always use common setting values for operating the actuator. Refer to "3.6 Parameters" for the setting range.

Setting item	Description
Positioning width	This is for setting the width (per finger) (mm) with respect to the final target position as the output range of Travel complete output signal. Refer to "3.7.8 Positioning width" for details.
Acceleration	This is for setting the acceleration (G) in the transfer zone.
Deceleration	This is for setting the deceleration (G) in the transfer zone.

3.7.3 Position specification method

Absolute or incremental can be selected for the position specification method.

Position specification	Description	Setting example
Absolute	Distance from the home position is set using the home position (0 mm) as reference point.	Example) Point 1 position: +30 mm is set Positioning completion point of Point 1 is 30 mm from the home position.
Incremental	Distance from the present position is set using the present position as reference point. Input a – value for the motor side and input a + value for the side opposite the motor.	Example) Point 1 position: +30 mm is set Point 2 position: −30 mm is set Positioning completion point of Point 1 is 80 mm from the home position. Positioning completion point of Point 2 is 20 mm from the home position.

3.7.4 Operation method

Positioning operation, pressing operation 1, or pressing operation 2 can be selected for the operation method.

Operation	Description
Positioning operation	This operation is used for general transfer. When the actuator is within the positioning width, Travel complete signal is output. When the positioning completion point is reached, the actuator stops.
Pressing operation 1	In the pressing operation, the workpiece is continuously pressed until the pressing completion point is reached. During this time, the alarm is not detected even if it is stopped halfway due to an external force. When the set pressing rate is reached, the point travel complete signal is output. When the pressing completion point is reached, the pressing operation is terminated and the actuator stops. This operation is used for gripping.
Pressing operation 2	In the pressing operation, the workpiece is continuously pressed until the pressing completion point is reached. During this time, the alarm is not detected even if it is stopped halfway due to an external force. It operates at the set pressing rate, and when it reaches within the positioning width, the point travel complete signal is output. When the pressing completion point is reached, the pressing operation is terminated and the actuator stops. This operation is used for press fitting.

<Pressing operation 1>

Horizontal axis: Time

Pressing operation
Start position

Displacement

Operation
Start position

Set transfer speed

Speed

Pressing speed

Current
according to
pressing rate

Current

Output
signal

Pressing
operation 1
Point travel
complete

ON

OFF

Automatic servo OFF time

Pressing judgment time

Transfer zone

Pressing
zone

Workpiece is gripped

In the pressing zone, the operation is performed by limiting the current according to point data "Pressing rate" with maximum current.
Travel complete is determined from the rise in the current value caused by gripping the workpiece.
Travel complete signal is output when the current according to point data "Pressing rate" flows continuously during the user parameter "Pressing judgment time".

The "Pressing current" will continue to flow even after the actuator has completed traveling.
If "Automatic servo OFF" is selected for the point data "Stop method", the servo will turn off at the desired time.
(The servo can also be turned off manually as needed.)

<Pressing operation 2>

Horizontal axis: Time

In the pressing zone, the operation is performed by limiting the current according to point data "Pressing rate" with maximum current.
The operation will continue even after coming in contact with the workpiece, and Travel complete signal is output when the set distance is traveled.

A current according to "Stop method" will flow after the actuator has completed traveling.
If "automatic servo OFF" is selected for the point data "Stop method", the servo will turn off at the desired time.
(The servo can also be turned off manually as needed.)

3.7.5 Position

Position of point operation is set.
The implications change depending on the operation method.

Operation	Setting example
Positioning operation	Example Set to Point 1 Position (absolute): +50 mm Set position is the final target position.

Pressing operation 1
Pressing operation 2
Note 1
	Example Set to Point 1 Position (absolute): +40 mm
	   Pressing distance: +10 mm
	
	Example Set to Point 2 Position (absolute): +40 mm
	   Pressing distance: −10 mm
	
	Example Set to Point 3 Position (absolute): +40 mm
	   Pressing distance: −10 mm
	
	"Position + Pressing distance" is the final target position.
	Pressing operation is performed to the final target position for the pressing distance.
	If used for gripping, set the final target position so that it is 5 mm forward from the gripping point.

Note 1: When "Position specification method" is set to incremental, "Position + Pressing distance" forward from the present position is the final target position.

3.7.6 Stop method

The stop method applied upon completion of the positioning operation and pressing operation (pressing operation 2) is set.
Either Common, Control, Fixed excitation, or Automatic servo OFF 1 to 3 can be selected for the stop method.

Stop method	Description
Common	The stop method set in the parameter data "Common stop method" is applied.
Control	After completing the positioning or pressing operation, the actuator is controlled with a current that can retain the completion position and held stopped.
Fixed excitation	After completing the positioning or pressing operation, the actuator is held stopped with the user parameter "Holding current at stop".
Automatic servo OFF 1	After completing the positioning or pressing operation, the actuator is controlled to a stop. The servo turns off after the time set in user parameter "Automatic servo OFF time 1" has elapsed.
Automatic servo OFF 2	After completing the positioning or pressing operation, the actuator is controlled to a stop. The servo turns off after the time set in user parameter "Automatic servo OFF time 2" has elapsed.
Automatic servo OFF 3	After completing the positioning or pressing operation, the actuator is controlled to a stop. The servo turns off after the time set in user parameter "Automatic servo OFF time 3" has elapsed.

3.7.7 Point zone

The point zone output signal can be set by the distance from the home position where the boundary value for switching from OFF to ON as the point zone (−) and the boundary value for switching from ON to OFF as the point zone (+).
When performing a pressing operation, it can be used simply to judge whether a workpiece is defective or not.

Example) Point zone settings and output signal

Point zone (−):   39.00 mm
Point zone (+):   41.00 mm

*   Even when point zone (−) < point zone (+) < 0, the point zone output signal is turned ON between point zone (+) and point zone (−) and is turned OFF outside that zone.

> • When point zone (−) > point zone (+), the point zone output signal is turned OFF between point zone (+) and point zone (−) and is turned ON outside that zone.
> • When point zone (+) = point zone (−), the point zone output signal is always turned OFF.

3.7.8 Positioning width

The output range of Travel complete output signal is set.
It is the width (per finger) (mm) with respect to the operation completion position.
The positioning width can only be changed by the common setting.

Operation	Setting example
Positioning operation	Example Set to Point 1 Position (absolute): +50 mm Positioning width: 5 mm Present position Point 1 Positioning completion point Speed Distance −5 mm +5 mm 45 mm 50 mm 55 mm Travel complete signal ON / OFF Travel complete signal is output when the actuator is within the range of 45 mm to 55 mm. Travel complete signal is retained even if the actuator is outside the positioning width due to reasons such as an overshoot.
Pressing operation 1	Since Travel complete signal is determined from the set pressing rate, the setting made to the positioning width is not reflected.
Pressing operation 2	Example Set to Point 1 Position (absolute): +40 mm Pressing distance: +10 mm Positioning width: 5 mm Present position Point 1 Pressing completion point Speed Distance −5 mm +5 mm 40 mm 45 mm 50 mm 55mm Travel complete signal ON / OFF Travel complete signal is output when the actuator is within the range of 45 mm to 55 mm. After the Travel complete signal is output, the signal is retained even if the actuator is outside the positioning width due to reasons such as being pushed back.

3.8   Manual Operation

> ⚠ **CAUTION**
>
> **Before performing manual operation, make sure that the servo is turned off.**
>   The product may become damaged or malfunction.
>
> **Do not apply any excess force to the manual operation shaft.**
>   A damage or operation fault may occur.

✎ Manual operation is mainly intended for use during startup, maintenance, and inspection.
Frequent use may cause the actuator to operate in an unexpected way.

3.8.1   FFLD-08,30,04H,12H,30H

■ Operation

Remove the manual operation cover and turn the manual operation shaft with a flat blade screwdriver.

Manual operation shaft

Remove manual
operation cover

Manual operation shaft dimensions

■ Direction of operation and rotation

CCW: The fingers close.

CW: The fingers open.

Fingers
close

CCW

Fingers
open

CW

3.8.2 FFLD-50, FFLD-50H

■ Operation

Remove the manual operation cover and turn the manual operation shaft with a flat blade screwdriver.

Manual operation shaft

Remove manual
operation cover

Manual operation shaft dimensions

$\phi 4$

■ Direction of operation and rotation

CW: The fingers close.

CCW: The fingers open

Fingers
close

CW

Fingers
open

CCW

4. MAINTENANCE AND INSPECTION

⚠ **WARNING**

Install the product before wiring.
An electric shock may occur.

Do not work with wet hands.
An electric shock may occur.

Before performing wiring and inspection, wait five minutes or longer after turning off the power and check the voltage with a tester.
An electric shock may occur.

Do not attach or remove wires and connectors with the power turned on.
A malfunction, failure, or electric shock may occur.

Do not disassemble or modify the product.
An injury, accident, malfunction, or failure may occur.

⚠ **CAUTION**

Wiring and inspection must be performed by specialists.

For the lead wires used for the power cable, use wires with a sufficient diameter that can allow the instantaneous maximum current to flow.
A heat generation or damage may occur during operation.

Perform periodic inspections (two to three times a year) to confirm that the product operates properly.

Turn off the power immediately if abnormal heat, smoke, odor, sound, or vibration occurs in the product.
The product may become damaged or the continuous flow of currents may cause a fire.

Stop supplying power to the product before performing maintenance, inspection, and repair.
Take measures to prevent a third person from turning on the power unexpectedly.

4.1   Periodic Inspection

In order to use the product under optimum conditions, perform a periodic inspection two to three times a year.

4.1.1   Inspection item

Turn off the power before performing items 1, 2, and 3 below.

No.	Inspection item	Inspection method	Action
1	Check that the mounting bolts on the product, the screws on the terminal block, and the connectors are not loose.	Looseness check	Tighten the loose parts.
2	Check that there are no scratches and cracks on the cables.	Visual inspection	Replace the cable.
3	Check that foreign matters are not accumulating or are not stuck in the guide section.	Visual inspection	Clean the parts. Note 1
4	Check that there are no vibrations or abnormal sounds while the product is stopped or operated.	Noise inspection	Contact your dealer.
5	Check that the power supply voltage is normal.	Tester	Check the power system and use the product within the power supply voltage range described in the Specifications.

Note 1:   Use a soft cloth for cleaning and make sure not to leave foreign matters on the movable section.

5. TROUBLESHOOTING

5.1   Items to Check When a Problem Occurs

When a problem occurs, ensure safety and follow the procedure below.

1	Check if there is a problem with the PLC.
2	Check the voltage of L+ (24 VDC) of the communication cable.
3	Check the details on the alarm. The details on the alarm can be checked with the setting software (S-Tools).
4	Check the status of process data. The status of process data can be checked with the setting software (S-Tools).
5	Check that there is no disconnection or pinching of the cables and that they are connected correctly. Before checking the continuity, turn off the power and remove the cables to prevent an electric shock.
6	Check that measures (such as connecting the ground wire and attaching the surge suppressor) have been taken against noise.
7	Check the course of events and the operating conditions at the time the problem occurred.
8	Check the serial number of the product.

If the problem persists, refer also to "5.3 Problems, Causes, and Solutions".

5.2 Alarm Code

■ Alarms

An alarm is output when an error that affects the operation of the actuator is detected. There are alarms that can be reset and alarms that require power cycling (turning off and then on again), depending on the degree of the error.

Alarm code	Alarm item	Description	Solution	Alarm reset
0x1000 to 0x1FFF	Memory (Read)	An error has been detected in reading data from memory at power-on.	"0x1300 to 0x13FF" indicates that there is an error in the parameter data. Initialize the parameter data and power cycle. "0x1500 to 0x15FF" indicates that there is an error in the point data. Initialize the point data and power cycle. "0x1700 to 0x170F" indicates that there is an error in the alarm data. Input the alarm reset signal and power cycle. "0x1800 to 0x180F" indicates that there is an error in the alarm data. Initialize the alarm data and power cycle. Other codes indicate that there is an error in the data inside. If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.	No
0x2000 to 0x2FFF	Memory (Write)	An error has been detected in writing data into memory when changing data.	If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.	No
0x3000 to 0x30FF	Temperature	The temperature in the controller is high.	Check the ambient temperature. If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.	No
0x3100 to 0x31FF	Current	An overcurrent has flown into the motor.	If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.	No
0x3800 to 0x38FF	TOOL not connected	There is a problem with the connector connection while using the product in TOOL mode.	Check the connection between the cable and the connector. If the connector is disconnected, connect the connector. After changing the mode to PLC mode, reset the alarm.	Yes
0x4000 to 0x40FF	Parameter data	There is an error in the parameter data.	For the following parameters, reconfigure the parameters and power cycle: Soft limit (+), Soft limit (−), Home position offset amount	No
			For the following parameters, reset the alarm: Home position return speed, Holding current at stop	Yes
0x4100 to 0x41FF	Point data (Position)	There is an error in the point data when a travel command is input to that point number.	The final target position is outside the range of the soft limit. Reconfigure the following point data and reset the alarm. Point data: Position, Pressing distance	Yes
0x4200 to 0x42FF	Point data (Speed)	There is an error in the point data when a travel command is input to that point number.	The point data setting is outside the setting range. Reconfigure the following point data and reset the alarm. Point data: Speed, Acceleration, Deceleration, Pressing speed	Yes
0x4300 to 0x43FF	Point data (Pressing)	There is an error in the point data when a travel command is input to that point number.	The point data setting is outside the setting range. Reconfigure the following point data and reset the alarm. Point data: Pressing current	Yes

Alarm code	Alarm item	Description	Solution	Alarm reset
0x4400 to 0x440F	IO-Link data error	There is an error in the data settings or IO-Link backup data.	Power cycle after reconfiguring the data or reconfiguring the data storage function.	No
0x6000 to 0x60FF	Servo ON	There is an error in the encoder data signal for exciting the motor when the servo is turned on for the first time after power-on.	Check the connection of the cable and the connector connecting the controller and the actuator. Check that the actuator is not restrained and reset the alarm.	Yes
0x6200 to 0x62FF	Home position return	The home position cannot be detected even after traveling a distance longer than the stroke of the actuator when returning to the home position.	Check the connection of the cable and the connector connecting the controller and the actuator. Check that there is no problem and reset the alarm.	Yes
0x6400 to 0x64FF	Outside soft limit	The present position is outside the range of the soft limit when traveling from point to point.	If the alarm occurs due to an overshoot when positioning close to the soft limit, check the load conditions. The alarm will also occur when a travel command from point to point is input from outside the range of the soft limit. In this case, move the actuator manually so that the present position is within the range of the soft limit. Check that there is no problem and reset the alarm.	Yes
0x6500 to 0x65FF	Overload (M)	The fingers cannot travel.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x6600 to 0x66FF	Overload (P)	The fingers have been pushed back to the pressing start point by external force when pressing.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x6700 to 0x67FF	Overload (S)	The fingers cannot stop.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x6800 to 0x68FF	Overload (H)	The fingers have become misaligned when stopping.	Check the load and operating conditions. Check the setting of the "Holding current at stop" in the parameter data. Check that there is no problem and reset the alarm.	Yes
0x6900 to 0x69FF	Overload (C)	An overcurrent has flown into the motor.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x6A00 to 0x6AFF	Overload (D)	There is a problem in controlling the position.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x6B00 to 0x6BFF	Overload (T)	Excessive torque output has continued.	Check the load and operating conditions. Check that there is no problem and reset the alarm.	Yes
0x7000 to 0x7FFF	Memory (Initialization)	An error has been detected in initializing memory data when changing data.	If the error reoccurs even after power cycling, contact your nearest CKD sales office or distributor.	No

■ **Warnings**

A warning is output when a slight error that does not affect the operation of the actuator is detected. It can be cleared by changing the controller settings.

Alarm code	Alarm item	Problem	Cause/Solution
0x0211	Maintenance data (Number of travels)	The integrated number of travels has exceeded the threshold.	The integrated number of travels has exceeded the threshold set in the user parameter. After performing maintenance, reconfigure the threshold. The warning is cleared when the threshold exceeds the integrated number of travels.
0x0221	Maintenance data (Operating time)	The integrated operating time has exceeded the threshold.	The integrated operating time has exceeded the threshold set in the user parameter. After performing maintenance, reconfigure the threshold. The warning is cleared when the threshold exceeds the integrated operating time.

5.3 Problems, Causes, and Solutions

If the product does not operate as intended, check the table below for a possible solution.

Problem	Cause	Solution
No operation standby completion signal is output.	No voltage is applied to P24 of the communication cable.	Apply voltage to P24 of the communication cable.
	Wiring is not correct.	Refer to "2.4 Wiring" and check the wiring.
Product does not operate as intended with signal from PLC.	Input signal is unstable.	Input from the higher system may be causing chattering. Maintain the input signal for 20 ms or more.
	Home position return cannot be completed or performed.	Transfer load may be too large. Check the Specifications.
	Setting of position, speed, acceleration, or pressing force is not correct.	Check the contents of the point data and user parameters.
	Wiring is not correct.	Refer to "2.4 Wiring" and check the wiring.
	Friction load is too large.	Check the friction load during transfer. Check that there is no jamming with the workpiece.
	Workpiece is in contact with the fingers.	Check how the device is assembled and set up.
	Internal resistance of product has increased.	Check the environment conditions and the conditions of use. Check how long the product has been in use (operation distance).
	Actuator body is damaged.	Repair or replace the product. Refer to "5.1 Items to Check When a Problem Occurs" and contact your nearest CKD sales office or distributor.
Product itself vibrates.	Connection to actuator is loose.	Tighten the bolts.
Product does not operate with PLC.	Mode is set to TOOL mode.	Change the mode to PLC mode using the setting tool (S-Tools).
	Wiring is not correct.	Refer to "2.4 Wiring" and check the wiring.
	Wiring is disconnected.	Check for pinching and disconnection of cables and check the connection of connectors and terminals.
	Overload error has occurred.	Check the transfer load and the speed.
	Power capacity is insufficient.	Check that the power capacity satisfies the required voltage and current.
Workpiece moves due to its own weight during an emergency stop.	Load exceeding holding force is applied.	Check whether an external force greater than the holding force is applied. Check the setting of the "Holding current at stop" in the parameter data.

Problem	Cause	Solution
Travel complete output does not turn off.	Positioning completion output width is too large for distance of travel.	Check the point data "Positioning width".
Pressing operation cannot be performed.	Operation method is not set to pressing operation.	Check the point data "Operation method".
Device is out of step.	Load or speed has exceeded limit.	Check that the workpiece weight and the operation speed satisfy the specified values.
Product cannot achieve desired speed (it is very slow).	Operation method is set to pressing operation instead of positioning operation.	Check the point data "Operation method". Adjust the gain.
Overshoot occurs.	Amount of deceleration is large because transfer weight is large.	Check that the workpiece weight and the operation speed satisfy the specified values. Adjust the gain.

If you have any other questions or concerns, contact your nearest CKD sales office or distributor.

6. PRODUCT COMPLIANCE

Products with the CE marking conform to European standards. Products without the CE marking do not conform to European standards.
This product is intended to be incorporated into the customer equipment and use as a part of equipment. The CE marking affixed to the product itself indicates that CKD has declared conformity to the EMC Directive under our limited conditions. If the customer equipment incorporating this product is to be shipped to or used in the European Economic Area as a final product, it is the responsibility of the customer to confirm compliance with the EU Directives.

6.1   EU Directives/European Standards

EMC Directive: 2014/30/EU
                    EN61000-6-2:2005
                    EN55011: 2016+A1: 2017+A11: 2020(Group 1 Class A)

RoHS Directive: 2011/65/EU and (EU)2015/863
                    EN 50581:2012

6.1.1   Environment

Condition	Temperature	Humidity
During use	0 to 40°C (no freezing)	35% to 80% RH (no condensation)
During storage	−10 to 50°C (no freezing)	35% to 80% RH (no condensation)
During transport	−10 to 50°C (no freezing)	35% to 80% RH (no condensation)

6.1.2 System structure

The following figure shows an example of how the system should be structured when using this product (FFLD Series) as a product conforming to the European standards.
A surge protector is required to comply with European standards.

<Example of an EMC Directive-compliant system structure>

Equipment and cables marked with an asterisk (*) must be provided by the customer.

Part required	Model number	Manufacturer
Surge protector	RSPD-250-Q4	Okaya Electric Industries Co., Ltd
	RSPD-250-U4	
	LT-CS32G801WS	Soshin Electric Co., Ltd.
	LT-C32G801WS	

7. WARRANTY PROVISIONS

7.1 Warranty Conditions

■ Warranty coverage

If the product specified herein fails for reasons attributable to CKD within the warranty period specified below, CKD will promptly provide a replacement for the faulty product or a part thereof or repair the faulty product at one of CKD's facilities free of charge.

However, following failures are excluded from this warranty:

- Failure caused by handling or use of the product under conditions and in environments not conforming to those stated in the catalog, the Specifications, or this Instruction Manual.
- Failure caused by use or management that violates the "DANGER", "WARNING", and "CAUTION" precautions and other instructions stated in the catalog, the Specifications, or this Instruction Manual.
- Failure not caused by the product.
- Failure caused by use not intended for the product.
- Failure caused by modifications/alterations or repairs not carried out by CKD.
- Failure that could have been avoided if the customer's machinery or device, into which the product is incorporated, had functions and structures generally provided in the industry.
- Failure caused by reasons unforeseen at the level of technology available at the time of delivery.
- Failure caused by acts of nature and disasters beyond control of CKD.

The warranty stated herein covers only the delivered product itself. Any loss or damage induced by failure of the delivered product is excluded from this warranty.

■ Confirmation of product compatibility

It is the responsibility of the customer to confirm compatibility of the product with any system, machinery, or device used by the customer.

■ Others

The terms and conditions of this warranty stipulate basic matters.
When the terms and conditions of the warranty described in individual specification drawings or the Specifications are different from those of this warranty, the specification drawings or the Specifications shall have a higher priority.

7.2 Warranty Period

The product is warranted for one (1) year from the date of delivery to the location specified by the customer.