

SUPER ECORICH

For machining center

Operation Manual



DAIKIN INDUSTRIES, LTD.

Oil Hydraulics Division

PIM00139

Introduction

Thank you for selecting the SUPER ECORICH of DAIKIN Hydraulic System.

This operation manual describes how to operate this SUPER ECORICH, and maintenance/inspection, troubleshooting procedure and specifications of this system. Before using this product, be sure to read through this manual carefully to ensure proper use of the system.

General Precautions

- Improper operation or handling of this product causes an accident, reduced service life or performance deterioration of the equipment.
- For explanation of the system components in detail, some of the figures and pictures given in this manual show the internal components without the cover or safety shield. During actual operation of this system, be sure to mount the cover and safety guard in the original conditions, and follow the operating procedure described in this manual.
- The contents of this manual are subject to change for the purpose of a change in product specifications or improvement of users' convenience.
- Keep this manual carefully in a place where users can refer to it whenever required.
- The figures given in this manual may be different from the conditions of the actual product because of product improvement.

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Chapter 1 Safety Instructions

1.1 To Ensure Safe Use of the Product

Before installation, operation or maintenance/inspection of this product, be sure to read through this operation manual and all other attached documents carefully, so that you can thoroughly understand this system, safety information and all other precautions to ensure proper use of this product.

This operation manual classifies safety precautions into the following two levels: “DANGER” and “CAUTION”.


 DANGER	Indicates potentially hazardous conditions that may result in death or serious injury, if the product is improperly handled.
 CAUTION	Indicates potentially hazardous conditions that may result in medium/minor injury or property damage, if the product is improperly handled.

Even a condition classified as “CAUTION” may result in a serious accident, depending on the situation. Since both levels of the safety instructions indicate important information, be sure to observe these instructions.


In addition to the above, “IMPORTANT” means the instructions that must be observed by users, although they do not correspond to “DANGER” or “CAUTION”.

“MEMO” provides information necessary for using this product.

1.1.1 Application of this product

 DANGER
<ul style="list-style-type: none"> ● This product is not designed or manufactured for the equipment or system (e.g. life-sustaining equipment) used under serious conditions that affect life of people, or not intended for special purposes such as ride-on mobile units, medical treatment or nuclear applications. ● This product has been manufactured under thorough quality control. However, if this product is applied to any equipment where a serious accident or damage can be expected due to a fault of this product, the applicable equipment must be provided with appropriate safety devices.

1.1.2 Precautions for using this product

 DANGER
<ul style="list-style-type: none"> ● Never attempt to modify this product by user. Do not disassemble this product for any purpose other than the inspections specified in this manual. Failure to observe this instruction may result in electric shock, fire or injury. ● To prevent hazardous conditions of the machine and equipment in case of a fault of this product, provide an emergency brake or other safety measures for the whole system. Failure to observe this instruction may result in injury or other accidents. ● If any part of the unit body is damaged or missing, do not install or operate this product. Failure to observe this instruction may result in an accident. ● Do not use this product in any conditions other than those specified in this manual. Failure to observe this instruction may result in damage, fire or injury.

1.1.3 Precautions for transportation



DANGER

- Before transportation, check the weight of the product. Failure to observe this instruction may result in injury.
- To transport this product, use the eyebolts. If this product is lifted by other parts (pump piping, etc.), it may overturn.



CAUTION

- This product is precision equipment. Be careful not to drop it or apply strong impact to it. Failure to observe this instruction may result in damage to the equipment.
- During transportation, do not hold the piping or solenoid valves. Failure to observe this instruction may result in damage or fall of the equipment.
- Avoid transporting this product with the tank filled with oil. Failure to observe this instruction may result in oil leak or air mixture, causing deterioration in safety and performance.
- When this product is in the packed condition, transport it with appropriate transportation tools. Otherwise, injury may occur.

1.1.4 Precautions for installation and wiring



DANGER

- Wiring work must be conducted by qualified technical experts. Failure to observe this instruction may result in electric shock or fire.
- During wiring work, wear protective gloves and long-sleeved clothes to prevent a scratch or other injury, and take safety measures.
- During wiring work, wear protective gloves and long-sleeved clothes to prevent electric shock or fire caused by static electricity, and take safety measures.
- Before wiring this system, complete the installation procedure. Failure to observe this instruction may result in electric shock or fire.
- Before conducting wiring work, turn OFF the input power supply. Failure to observe this instruction may result in electric shock.
- To restart wiring work after the power supply is turned ON once, make sure that the motor has stopped, and wait for at least five minutes after the power supply is turned OFF. Failure to observe this instruction may result in electric shock.
- Use a no-fuse breaker or earth leakage breaker conforming to EN60947-2. Failure to observe this instruction may result in electric shock or fire.
- Ground the unit securely. Failure to observe this instruction may result in electric shock or fire.
- Be careful not to allow a conductive foreign object (screw, metal chip, etc.) or flammable foreign object (wood chip, oil, etc.) to enter the controller. Failure to observe this instruction may result in electric shock, fire or other accidents.
- Never use this product in a place where it may be splashed with water, or in a place with corrosive or flammable gas atmosphere, or near a combustible material. Failure to observe this instruction may result in electric shock or fire.
- Do not allow damage or strong force to the harness. Do not put a heavy object on it, or pinch or bend it forcefully. Failure to observe this instruction may result in electric shock or damage.
- To transport this product, use the eyebolts. If this product is lifted by other parts (pump piping, etc.), it may overturn.
- If any part of the unit body is damaged or missing, do not install or operate this product. Failure to observe this instruction may result in an accident.


CAUTION

- Be sure to observe the specified mounting environment. Failure to observe this instruction may result in fire or other accidents
- Mount this equipment to a place that withstands the product weight. Failure to observe this instruction may result in an accident.
- Do not apply static electricity to the terminals. Failure to observe this instruction may result in fault of the equipment.
- Make sure that the power supply input voltage conforms to the specified voltage rating. Failure to observe this instruction may result in fire or other accidents.
- To ensure correct wiring, check the terminal assignment and terminal symbols.
- Separate the power line and the signal line. Do not bundle and wire them together in the same duct. Failure to observe this instruction may result in malfunction.
- Do not perform a withstand voltage test. Failure to observe this instruction may result in damage to the equipment.
- Do not perform a control circuit test by using a megohmmeter. Failure to observe this instruction may result in damage to the equipment.
- Take electromagnetic noise suppressing measures to prevent malfunction of a sensor or equipment around this system due to noise interference. Failure to observe this instruction may result in an accident.
- Do not apply strong impact to this product. Failure to observe this instruction may result in a fault of the product.
- Do not step on the product, or put a heavy object on it. Failure to observe this instruction may result in electric shock, damage or other accidents.
- Make sure that the ambient temperature/humidity is within the allowable temperature/humidity range of this product. Failure to observe this instruction may result in a fault or shortened service life of this product.

1.1.5 Precautions for operation


DANGER

- Do not operate any switch with a wet hand. Failure to observe this instruction may result in electric shock.
- When the power supply is ON, do not change the wiring, or connect/disconnect a terminal. Failure to observe this instruction may result in electric shock, damage or other accidents.
- Do not turn ON/OFF the power supply frequently. Failure to observe this instruction may result in a fault of the equipment.


CAUTION

- Specify the pressure command and velocity command so that the command values do not exceed the allowable pressure and velocity ranges of the machine. Failure to observe this instruction may result in an accident.
- Before operating the system, specify the parameters according to the machine being used. Failure to observe this instruction may result in injury or the failed machine.
- Before operating the system, make sure that the whole system is ready for emergency stop. Failure to observe this instruction may result in injury or the failed machine.
- When a power failure occurs, do not approach the machine, because the machine may abruptly start after recovery from the power failure. Failure to observe this instruction may result in injury. Set the machine to secure security even if it restarts.
- While the power supply is ON, or for a while after the power supply is turned OFF, do not touch the radiator fins or electronic components, because they are hot. Failure to observe this instruction may result in burns.

1.1.6 Precautions for maintenance and inspection



DANGER

- Maintenance and inspection must be conducted by qualified technical experts. Failure to observe this instruction may result in electric shock or injury.
- Before maintenance or inspection, make sure that the input power supply is OFF. Failure to observe this instruction may result in electric shock.
- Before maintenance or inspection, make sure that the motor has stopped, and wait for at least five minutes after the power supply is turned OFF. Failure to observe this instruction may result in electric shock.
- While the power supply is ON, do not change the wiring, or connect/disconnect a terminal. Failure to observe this instruction may result in electric shock, damage or other accidents.



CAUTION

- During maintenance or inspection, wear protective goggles and gloves.
- Do not touch the controller PCB directly. Failure to observe this instruction may result in electrostatic breakdown.
- Do not perform a withstand voltage test. Failure to observe this instruction may result in damage to this product.
- Do not perform a control circuit test by using a megohmmeter. Failure to observe this instruction may result in damage to this product.
- Do not disassemble this product. Failure to observe this instruction may result in electric shock or injury.

1.1.7 Precaution for product disposal



CAUTION

- A used product must be disposed of as general industrial waste. Otherwise, the solder material (lead) may cause environment pollution.

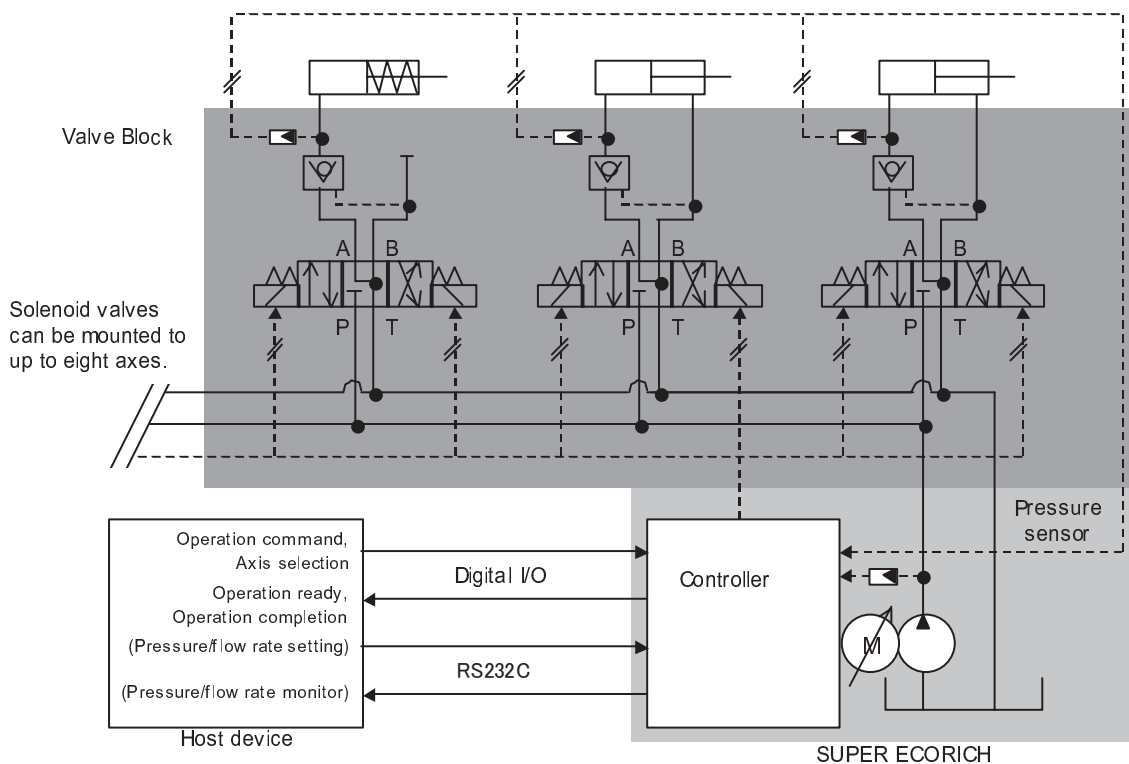
1.2 Exemptions from Manufacturer's Responsibility

- DAIKIN shall not be responsible for any damage attributable to a fire, earthquake, third party's action or other accident, or user's intentional or unintentional failure, improper use or use of the product under other abnormal conditions.
- DAIKIN shall not be responsible for any incidental damage attributable to use or impossibility of use of this product (e.g. loss of business profit or interruption of business operations).
- DAIKIN shall not be responsible for any accident or damage attributable to a failure to observe the instructions given in this manual or supply specifications.
- DAIKIN shall not be responsible for any damage attributable to malfunction caused by combination with other equipment.
- DAIKIN shall not be responsible for any accident or damage attributable to disassembly or modification of the product made by the user.

Chapter 2 Outline

2.1 Outline of the System

- ◆ This product provides the idle stop function that autonomously stops the pump in the pressure hold status after cylinder operation, thus ensuring ultimate energy-saving effect.
- ◆ The pre-charge pressure after cylinder operation can be retained with the non-leak type pilot check valve.
- ◆ This product monitors a decrease in pre-charge pressure with the monitor pressure sensor mounted to each axis. When a pressure decrease is detected, this product autonomously starts the pump to re-charge the pressure.
- ◆ The pressure, flow rate, acceleration/deceleration time can be individually set for the “SOL-a” energizing circuit and “SOL-b” energizing circuit of each axis.
- ◆ You can select control axes with the axis selection digital input signal from a host device.
- ◆ This product provides communication functions as standard features, allowing pressure and flow rate setup, and monitoring of pre-charge pressure.
- ◆ This product prepares “valve block mounted type” which mounted valve block on hydraulic unit and “valve block separated type” which installed valve block by user.
- ◆ Solenoid valves can be mounted to up to eight axes of this unit. With “valve block mounted type”, solenoid valves can be mounted to up to six axes of this unit.



2.2 Basic Usage

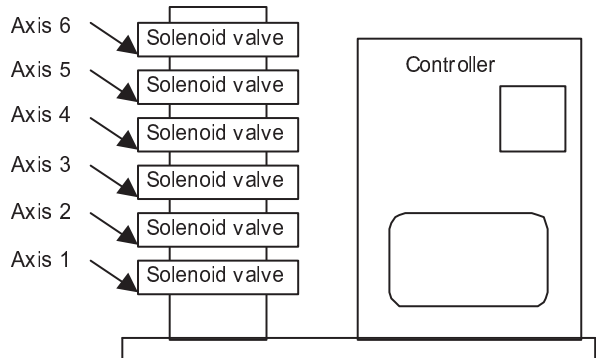
2.2.1 Control axis number

This product controls the solenoid valves mounted to the manifold block, with a number assigned to each valve.

In the case of “valve block mounted type”, axis numbers are assigned to the solenoid valves in sequence (Axis 1, Axis 2 …), from the bottom of the manifold block.

In the case of “valve block separated type”, make sure of the valve block specifications of the attached sheet.

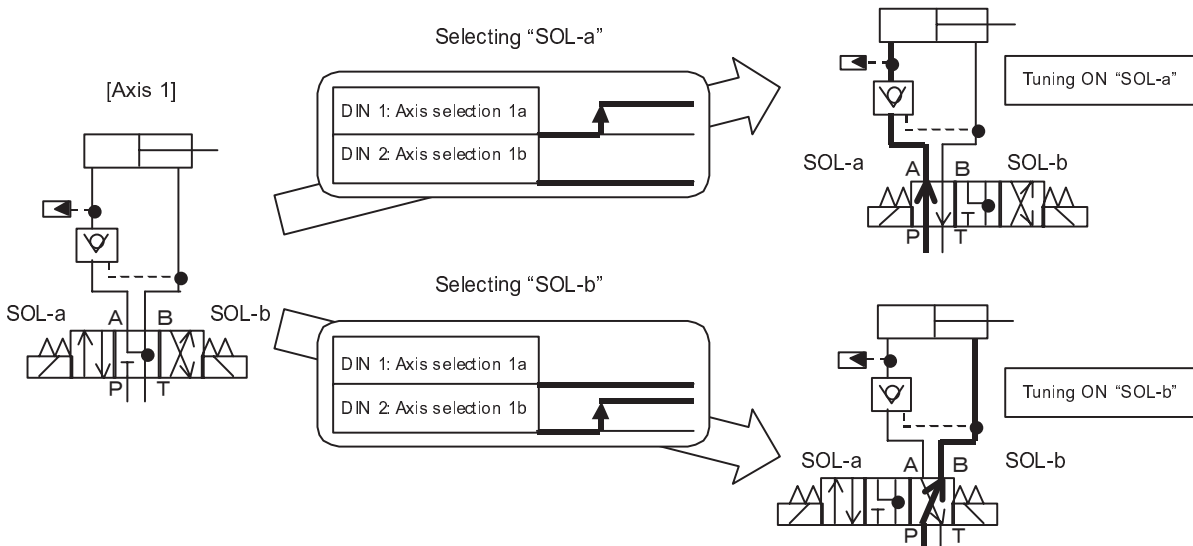
Setup and commands of all parameters and control axis selection numbers are based on these axis numbers.



2.2.2 Selection of control axis

To select a cylinder to be activated, use “axis selection” digital input signal from a host device. A solenoid valve corresponding to the “axis selection” signal will be energized.

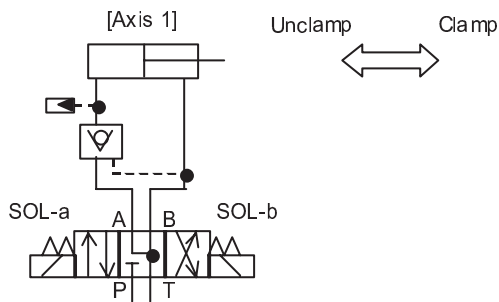
In the hydraulic circuit for “Axis 1” as shown below, the “SOL-a” and “SOL-b” solenoid valves will be energized with the “DIN1: Axis selection 1a” and “DIN2: Axis selection 1b” signals, respectively.



2.2.3 Control axis parameter setup

The pressure and flow rate parameters of a control axis can be individually specified for each axis number, and for each solenoid valve to be energized.

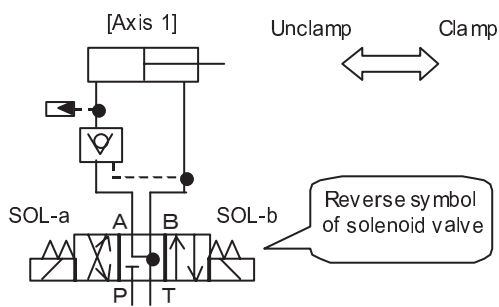
For details of the parameter settings, refer to “Chapter 10 Description on Parameters”.



In the hydraulic circuit as shown on the left, energizing the “SOL-a” valve executes clamp operation, and energizing the “SOL-b” valve executes unclamp operation.

Therefore, when the control axis is “Axis 1” as shown on the left, the parameter group of pressure and flow rate settings for clamp/unclamp operations are listed below.

Cylinder operation	Parameter group
Clamp	G00: Axis 1a
Unclamp	G01: Axis 1b



If the symbol of the solenoid valve is the reverse symbol as shown on the left, energizing the “SOL-a” valve executes unclamp operation, and energizing the “SOL-b” valve executes clamp operation.

Therefore, when the control axis is “Axis 1” as shown on the left, the parameter group of pressure and flow rate settings for clamp/unclamp operations are listed below.

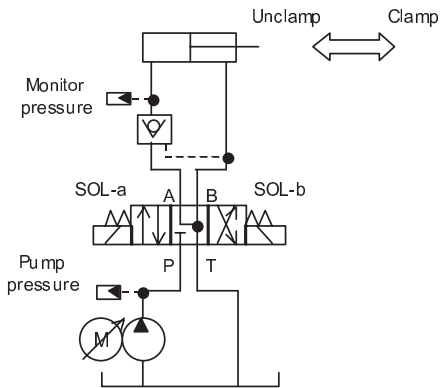
Cylinder operation	Parameter group
Clamp	G00: Axis 1b
Unclamp	G01: Axis 1a

2.3 Principal functions

2.3.1 Idle stop function

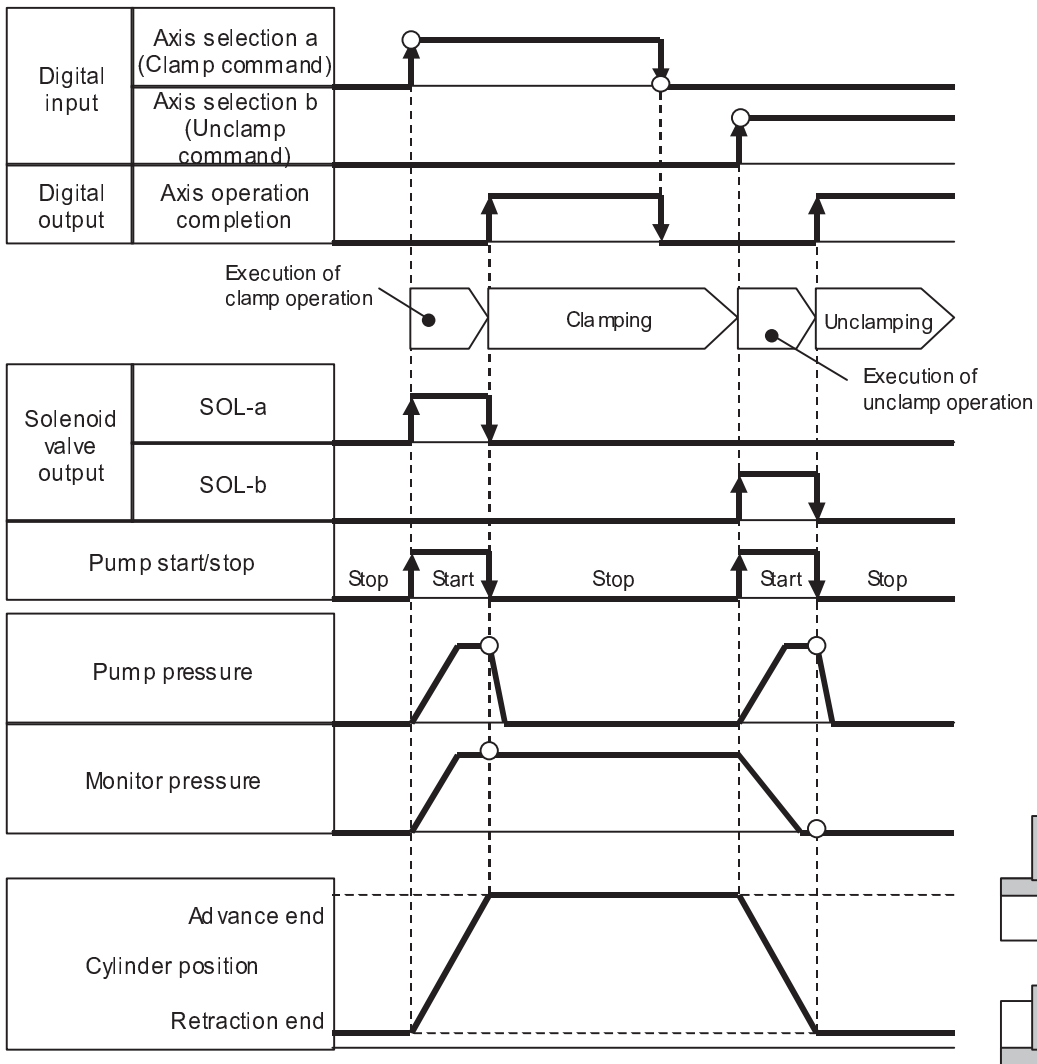
This product provides the idle stop function that autonomously stops the pump in the pressure hold status after cylinder operation.

After checking a pressure rise at the cylinder stroke end, the hydraulic unit holds the pressure with the non-leak type pilot check valve.



For example, when the hydraulic unit executes clamp operation by energizing “SOL-a” and executes unclamp operation by energizing “SOL-b” in the hydraulic circuit as shown on the left, the unit operates according to the following timing chart.

For details on the timing chart, refer to “12.2 Clamping and unclamping operations”.

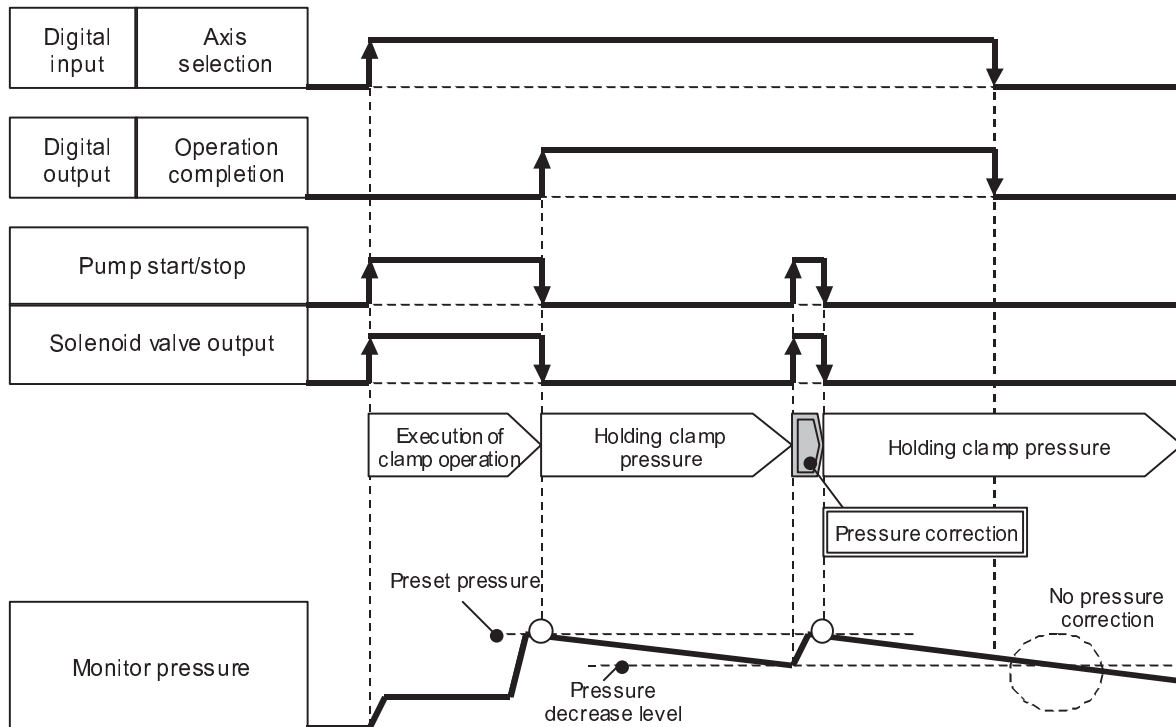


2.3.2 Pressure correcting function

This product provides the pressure correcting function that autonomously re-charges pressure when the pre-charge pressure decreases.

A pressure decrease is detected by the monitor pressure sensor mounted to each axis.

For details on pressure correction, refer to “10.6 Correcting pre-charge pressure drop”.



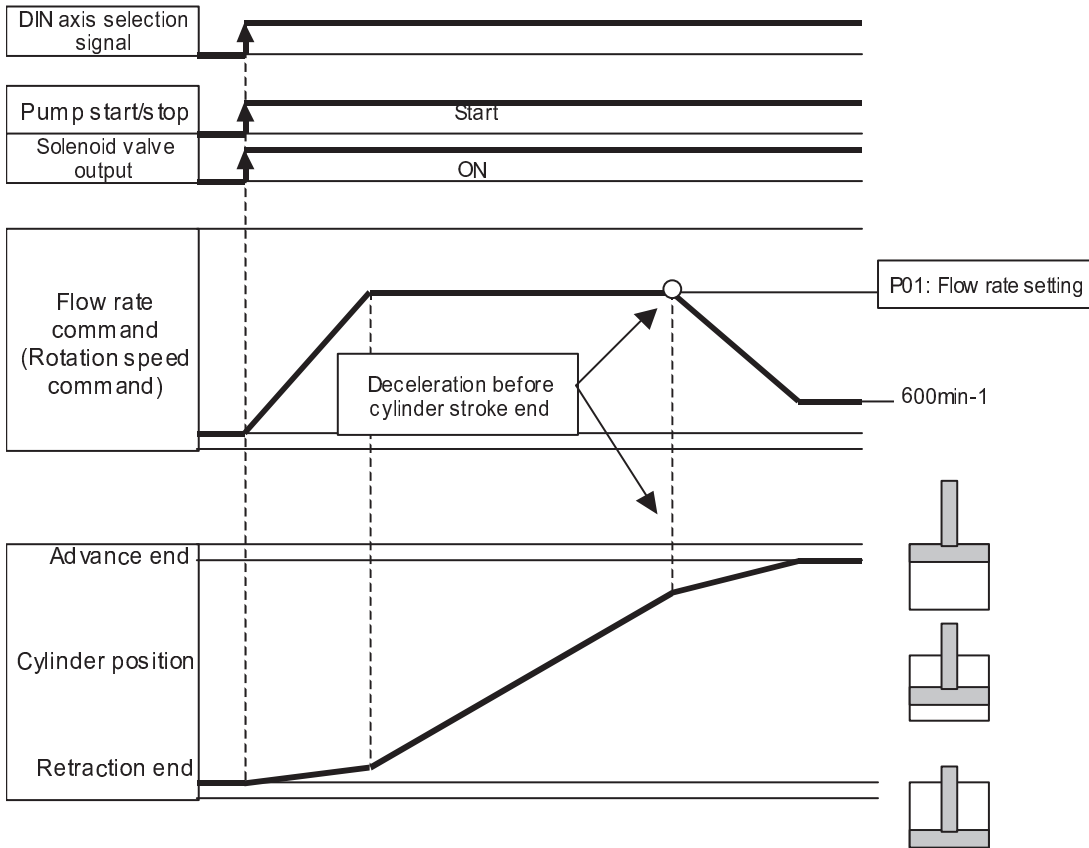
CAUTION

Pressure correction is applied only to the axis for which the axis selection signal is turned ON. For an application that needs to hold pressure of at least specified level (for clamping, etc.), be sure to keep the axis selection signal ON even after the clamp operation is completed. When the axis selection signal is OFF, the hydraulic unit does not re-charge pressure even if the pre-charge pressure decreases.

2.3.3 Surge suppressing function

With the surge suppressing function, this hydraulic unit can reduce pressure surge by decelerating the cylinder before the cylinder stroke end so that the cylinder head is pressed at a low speed. The unit autonomously decelerates the cylinder during cylinder operation, without necessity of designation of a decelerating point from the host device.

For details on the surge suppressing function, refer to “10.7.1 Surge suppressing function”.

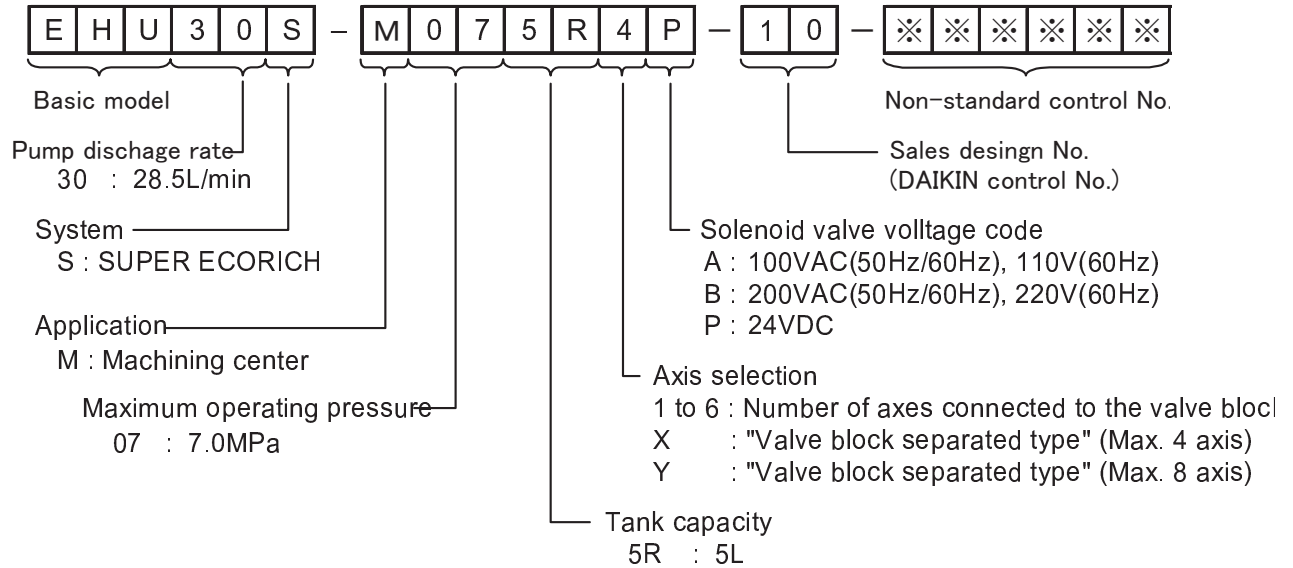


IMPORTANT	<ul style="list-style-type: none"> ● The surge suppressing function is suitable for an application where the cylinder operates in constant stroke (for clamping, etc.) ● If the cylinder stroke is not constant (e.g. with different sizes of workpieces), the surge suppressing function cannot sufficiently provide the performance.
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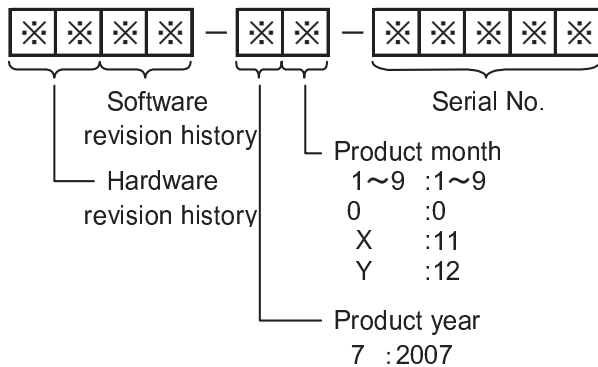
Chapter 3 Specifications

3.1 Model identification code

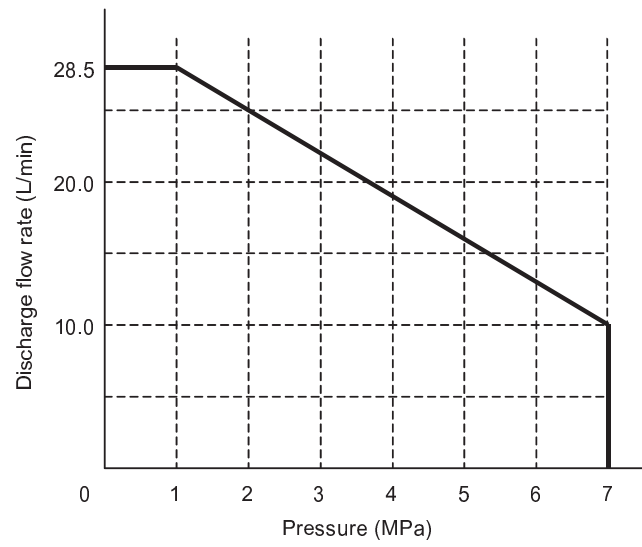
3.1.1 Product model



3.1.2 MFG.No



3.2 Pressure vs flow rate characteristic



* The above chart shows a theoretical area where the unit provides rated output in a short time.

3.3 Specifications

For details on specifications, refer to the delivery specifications (model drawing).

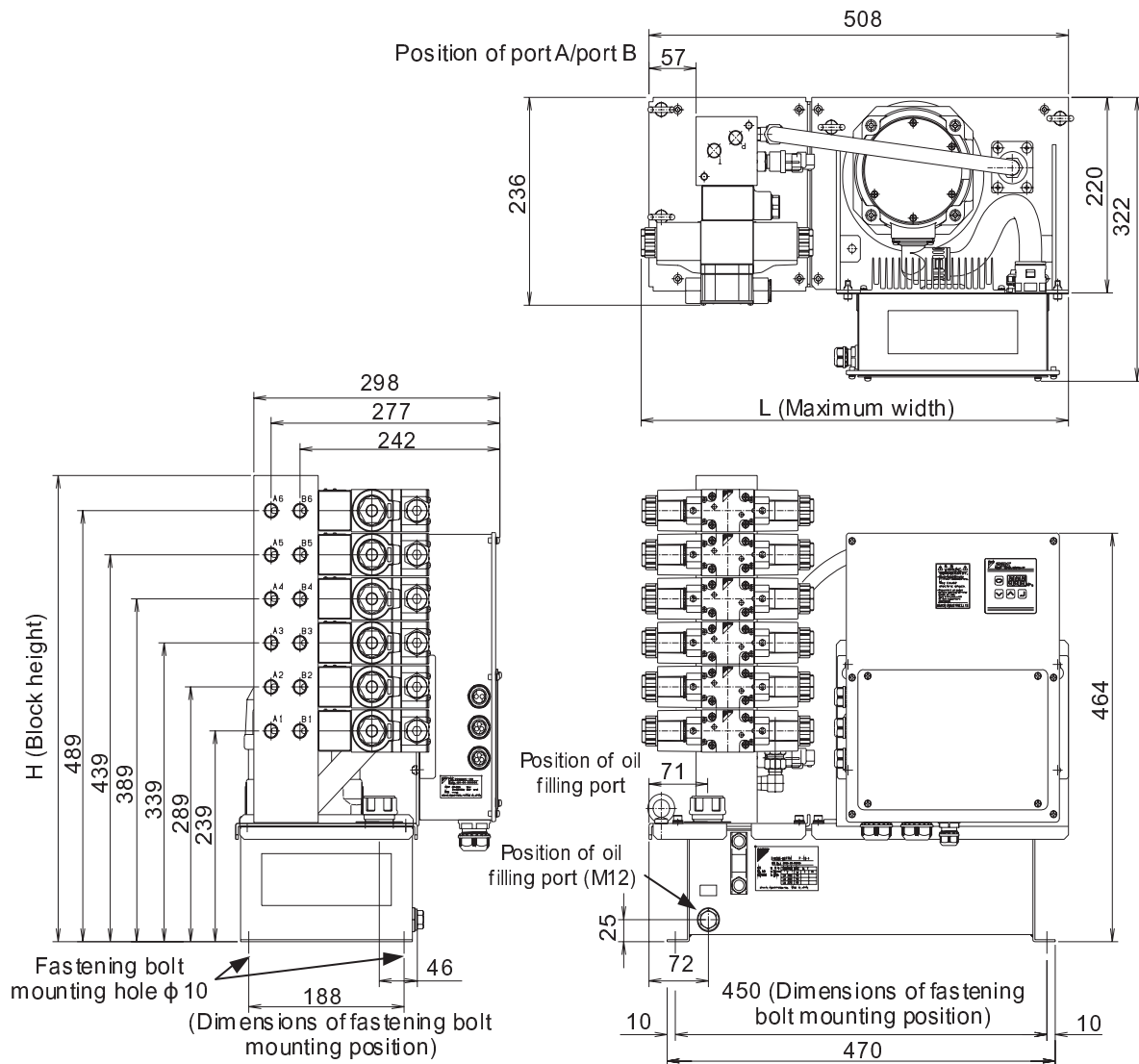
Item		Specifications																					
Maximum operating pressure (*1)		7.0[MPa]																					
Maximum flow rate (*2)		28.5[L/min]																					
Operating pressure adjusting range		1.5 - 7.0[MPa] (Factory-setting: 1.5)																					
Operating flow rate adjusting range		3.5 - 28.5[L/min] (Factory-setting: 3.5)																					
Pump		Single gear pump 5.7cc/rev																					
Operating specifications (*3)	Operation mode	Intermittent operation, Several axes cannot be simultaneously operated.																					
	Start/stop frequency	30 cycles/minute max.																					
Power supply (*4)	Main circuit power supply	1 φ 200VAC (50Hz/60Hz), 220V (60Hz) (Power supply voltage fluctuation tolerance range -15% - +10%)																					
	Control power supply	1 φ 200V (50Hz/60Hz) 220V (60Hz)																					
	Solenoid valve power supply	Model code: A	100VAC (50Hz/60Hz), 110V (60Hz)																				
		Model code: B	200VAC (50Hz/60Hz), 220V (60Hz)																				
	Model code: P	24VDC																					
External input signals	(20ch)	Insulated via photo-coupler, +24VDC (27V max.) 5mA/ch For plus common and minus common * Only transistor output can be connected.																					
	DIN1 - 16	Axis selection 1a to 8b																					
	DIN17	Operation ready																					
	DIN18	(Not used)																					
	DIN19	Speed change command																					
	DIN20	Alarm reset																					
External output signals	(11ch)	Photo-MOS relay output (insulated), +24 VDC, 50 mA max. For plus common and minus common																					
	DOUT1	Operation ready																					
	DOUT2	Alarm output (Normal: ON, Alarm:OFF)																					
	DOUT3	Warning output																					
	DOUT4 - 11	Operation completion Axis 1 - Axis 8																					
Tank capacity		5[L]																					
Weight		<table border="1"> <thead> <tr> <th>Model</th> <th>Weight</th> <th>Remarks</th> </tr> </thead> <tbody> <tr> <td>EHU30S-M075R1□-10</td> <td>48kg</td> <td rowspan="8">Excluding hydraulic oil</td> </tr> <tr> <td>EHU30S-M075R2□-10</td> <td>50kg</td> </tr> <tr> <td>EHU30S-M075R3□-10</td> <td>52kg</td> </tr> <tr> <td>EHU30S-M075R4□-10</td> <td>54kg</td> </tr> <tr> <td>EHU30S-M075R5□-10</td> <td>62kg</td> </tr> <tr> <td>EHU30S-M075R6□-10</td> <td>64kg</td> </tr> <tr> <td>EHU30S-M075RX□-10</td> <td>39kg</td> </tr> <tr> <td>EHU30S-M075RY□-10</td> <td>39kg</td> </tr> </tbody> </table>		Model	Weight	Remarks	EHU30S-M075R1□-10	48kg	Excluding hydraulic oil	EHU30S-M075R2□-10	50kg	EHU30S-M075R3□-10	52kg	EHU30S-M075R4□-10	54kg	EHU30S-M075R5□-10	62kg	EHU30S-M075R6□-10	64kg	EHU30S-M075RX□-10	39kg	EHU30S-M075RY□-10	39kg
Model	Weight	Remarks																					
EHU30S-M075R1□-10	48kg	Excluding hydraulic oil																					
EHU30S-M075R2□-10	50kg																						
EHU30S-M075R3□-10	52kg																						
EHU30S-M075R4□-10	54kg																						
EHU30S-M075R5□-10	62kg																						
EHU30S-M075R6□-10	64kg																						
EHU30S-M075RX□-10	39kg																						
EHU30S-M075RY□-10	39kg																						
Number of control axes	Valve block mounted type	Up to six axes																					
	Valve block separated type	Up to eight axes																					
Driver moter		3-pulse SR motor, 1.5kW																					
Paint color		Ivory white (munsell code 5Y7.5/1)																					

Item		Specifications
Hydraulic oil (*5)	Oil type	Special mineral hydraulic oil / Wear-resistant hydraulic oil
	Viscosity grade	ISO VG32 - 68
	Viscosity range	15 - 400mm ² /s
	Pollution degree	NAS class 9 or lower level
Operating environment	Installation place	Indoors (Be sure to fasten the hydraulic unit with bolts.)
	Tank oil temperature	0 - 60[°C] (Recommended temperature range: 15 to 50 °C)
	Operating ambient temperature	0 - 35[°C] (No freezing, No condensation)
	Operating ambient humidity	85% RH or less (no condensation)
	Storing temperature	-20 - 60[°C] (No freezing, No condensation)
	Storing humidity	85% RH or less (no condensation)
	Atmosphere	No corrosive gas, No inflammable gas
IP rating	Controller	IP54
	Motor	IPX4
Pump start preparation time		10 seconds max.
Applied standard		EU Directives: EMC Directive [Emission] EN5501, [Immunity] EN61000-6-2 Low-voltage Directive EN61800-5-1
Earth leakage current		1.8 mA
Type of electrical supply system		TN, IT

- *1. This product incorporates a safety valve. The valve has been adjusted to approx. +0.5 MPa of the maximum operating pressure.
- *2. The flow rate is a theoretical value, not a guaranteed value.
- *3. This product cannot execute continuous operation. Several axes cannot be simultaneously operated.
- *4. The power supply voltage fluctuation tolerance range is -15% to +10%. If the power supply voltage fluctuates to the negative (-) direction even within the tolerance range, the output characteristic cannot be guaranteed. For the main circuit and the control circuit, use separate power supply inputs.
- *5. Hydraulic oil other than the mineral type (water-containing/synthetic type) cannot be used. (e.g. water-glycol)
If hydraulic oil is used out of the recommended operating temperature range, pressure surge increase or flow rate decrease may occur. However, such a phenomenon does not indicate an abnormal condition. For recommended hydraulic oil brands, refer to “DAIKIN Hydraulic Equipment General Catalog” (Reference No. HK196).

3.4 Outside dimensions

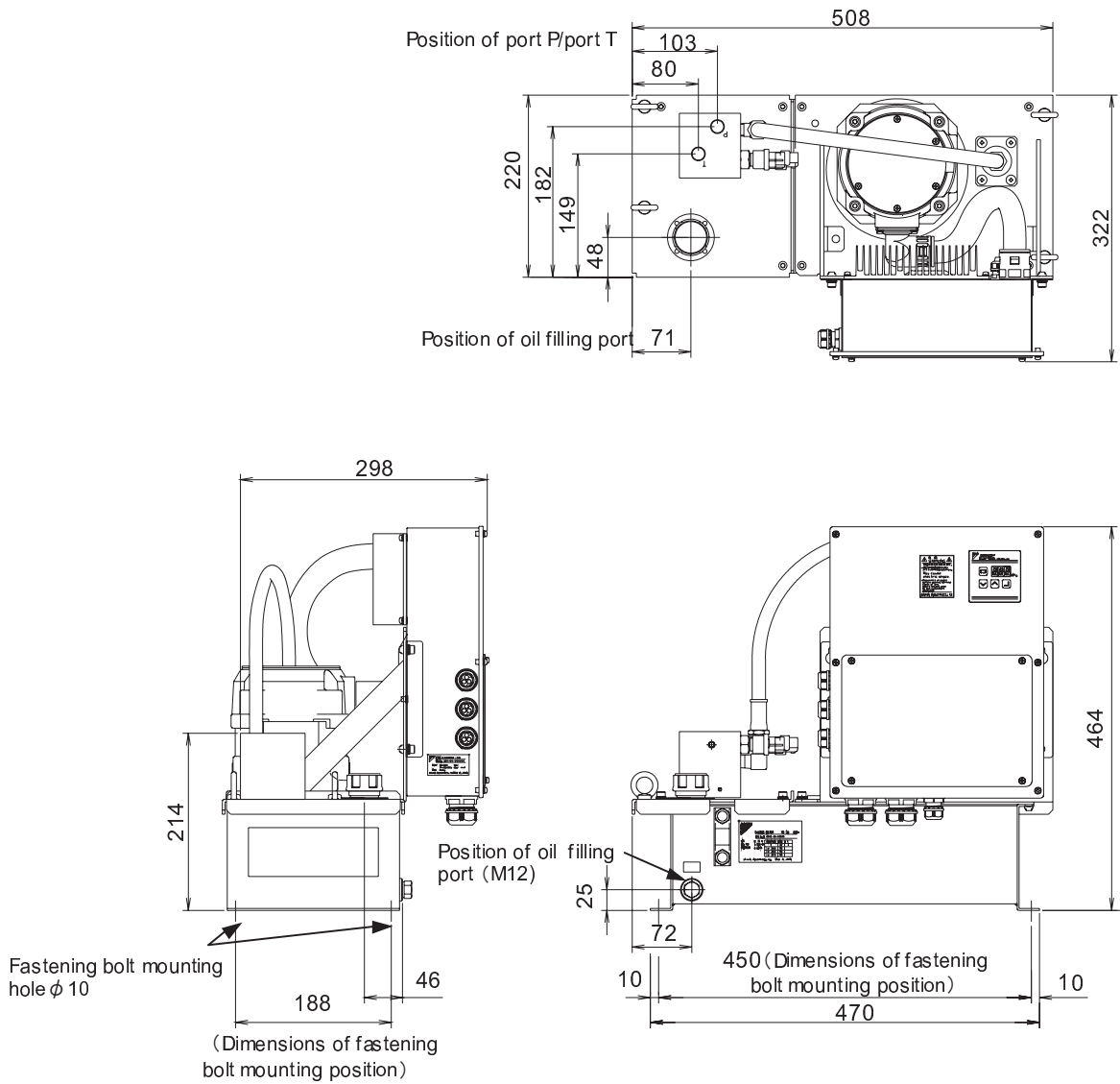
3.4.1 “Valve block mounted type”



Number of axes	H (Block high)
Axes 1 to 4	429mm
Axes 5 to 6	529mm

Solenoid valve power supply	L (Maximum width)
DC type	507.5mm
AC typr	516.5mm

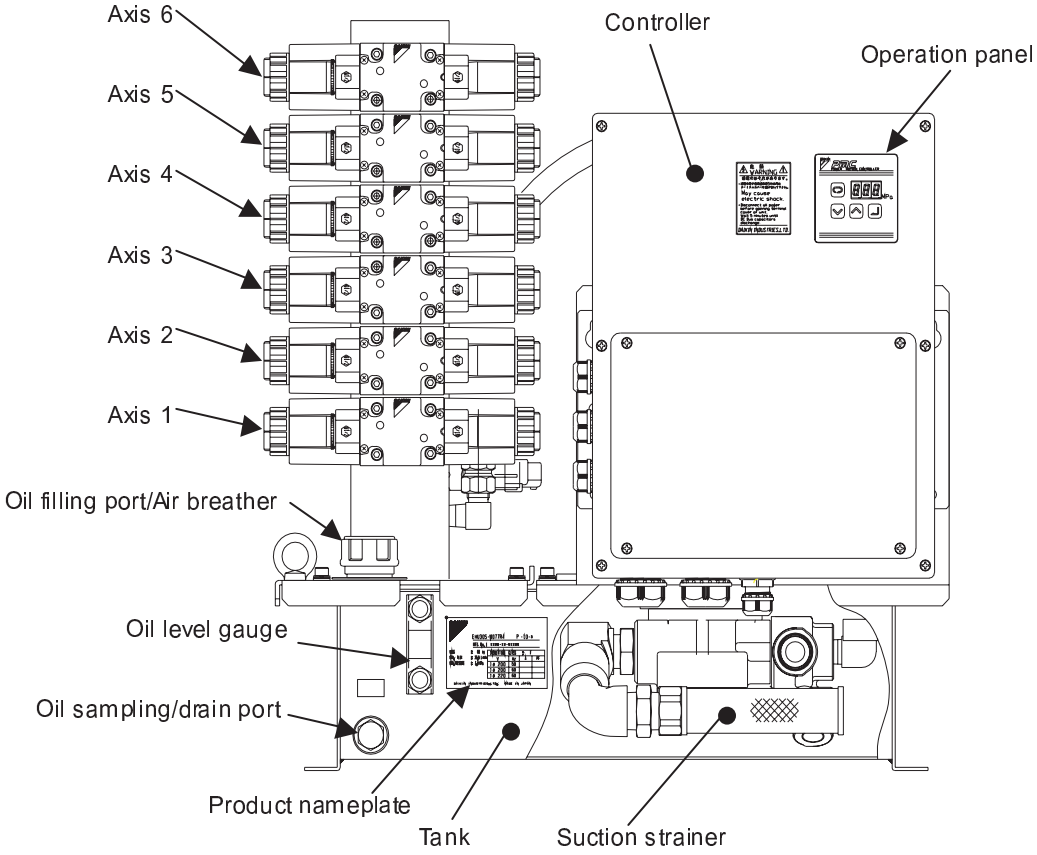
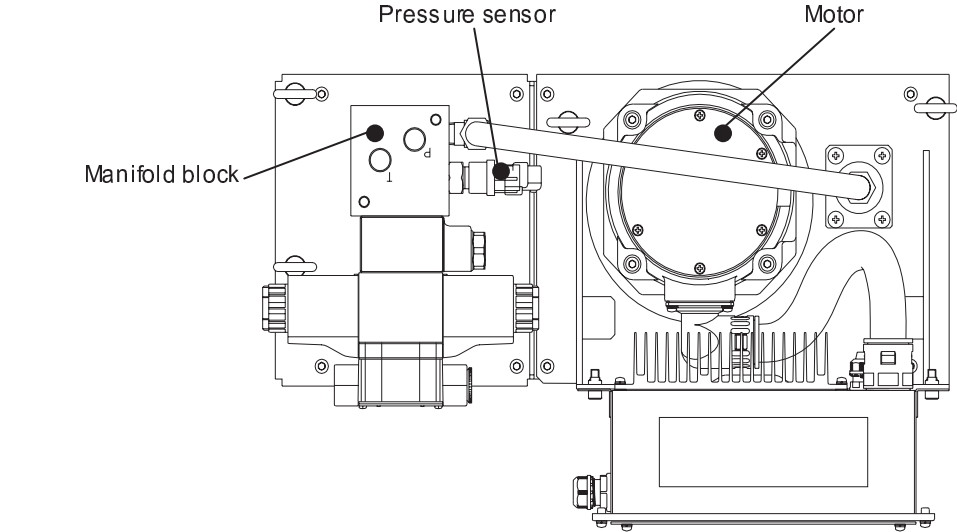
3.4.2 "Valve block separated type"



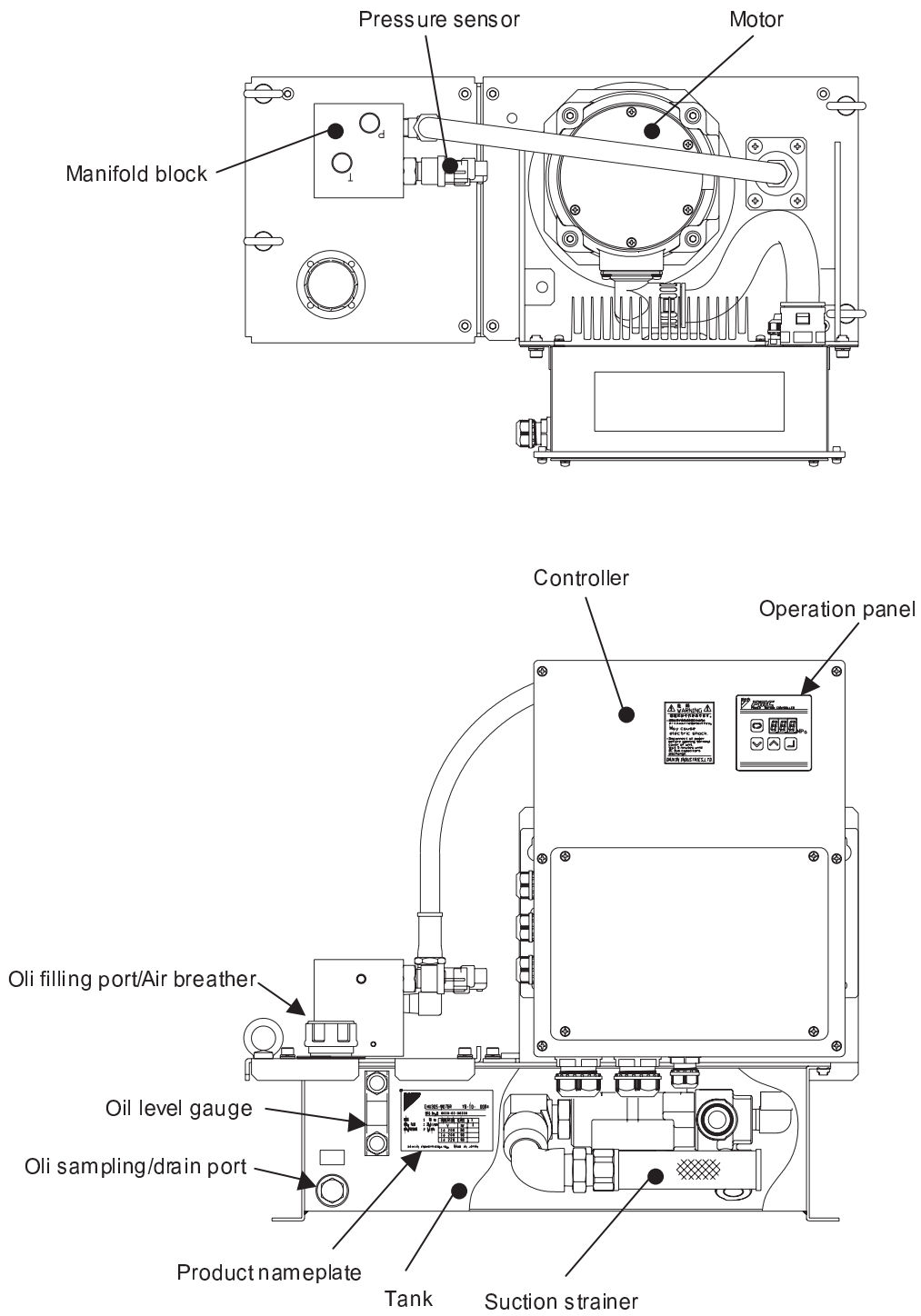
Chapter 4 Part Names

4.1 Part names of the hydraulic unit

4.1.1 "Valve block mounted type"

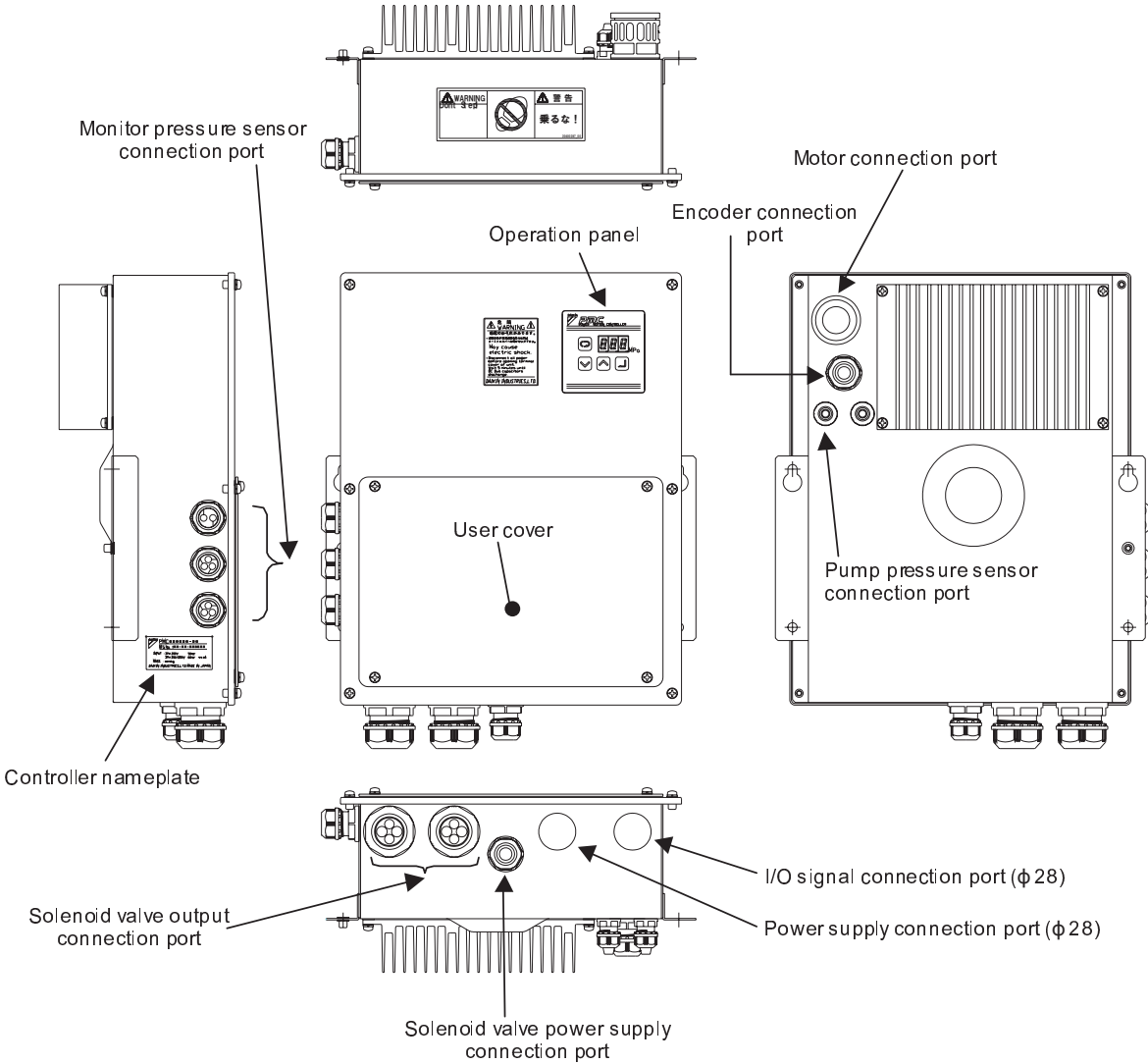


4.1.2 "Valve block separated type"



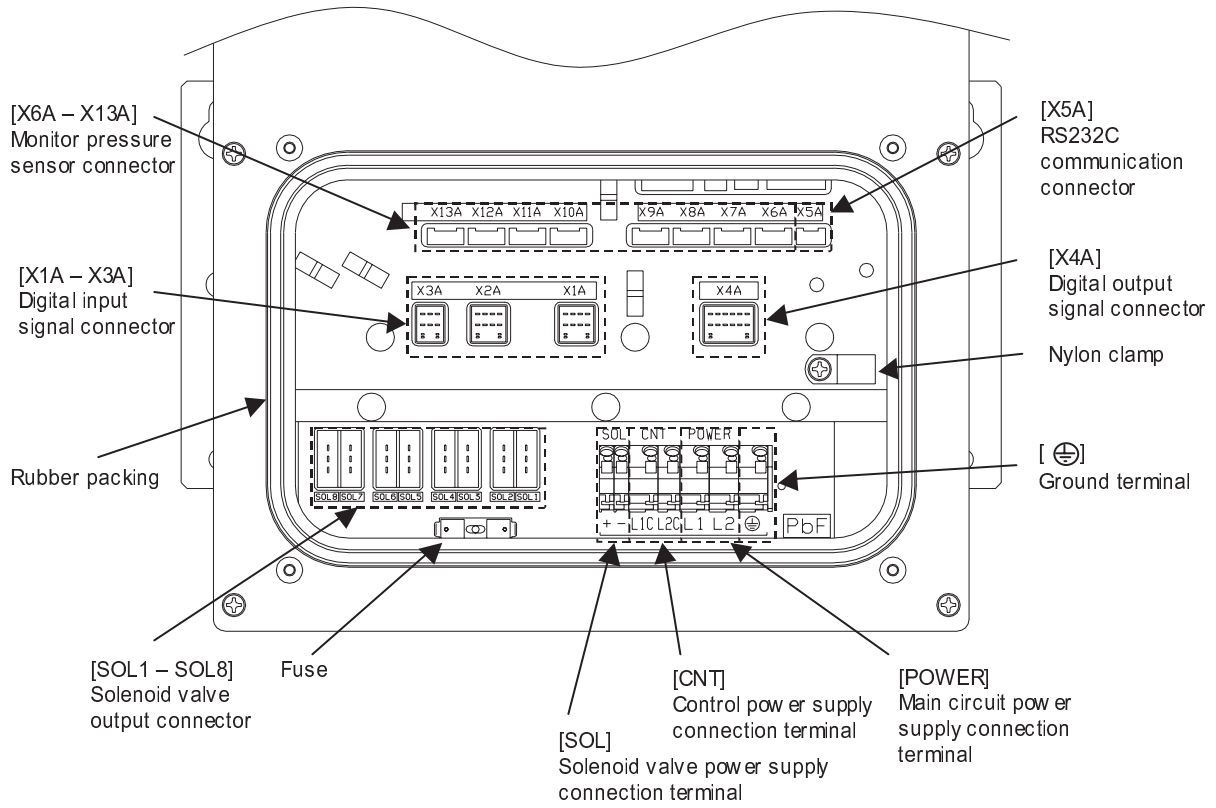
4.2 Part names of the controller

4.2.1 Part names of the controller



4.2.2 Controller: Part names of the user cover inside

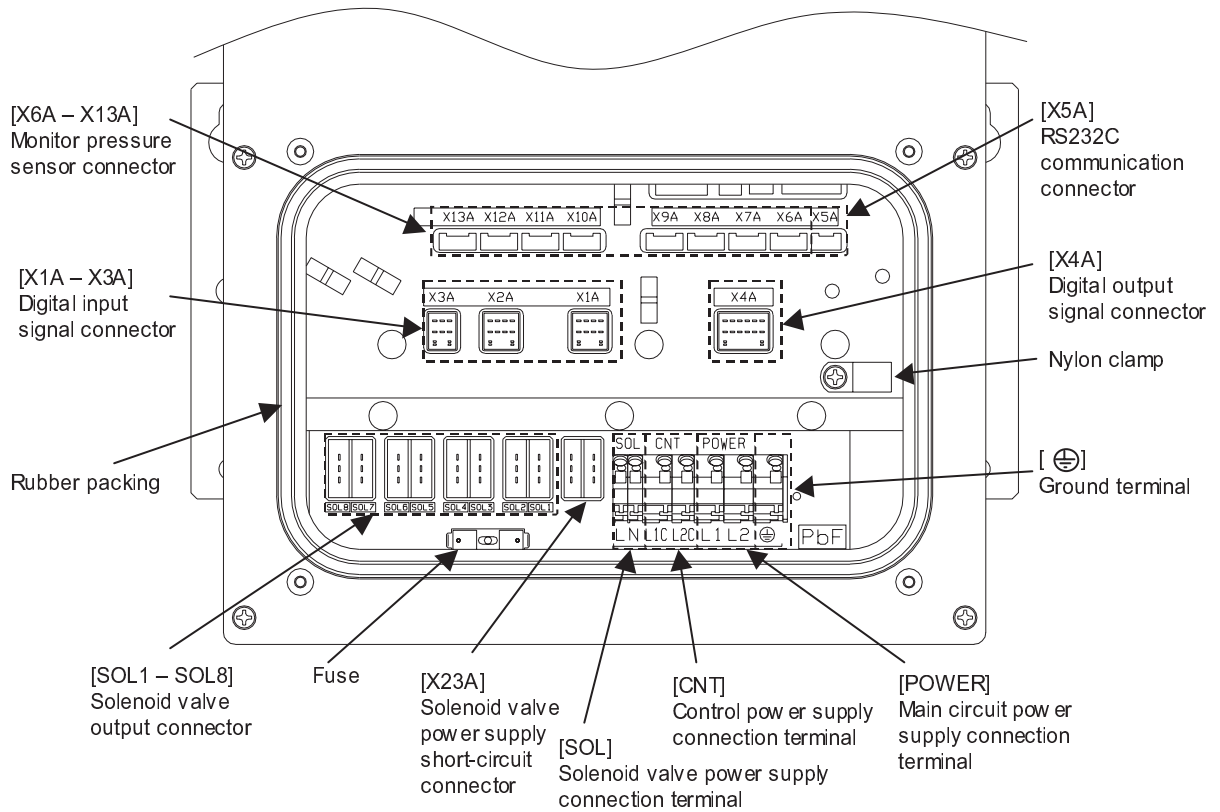
■ 24 VDC solenoid valve power supply (Model EHU30S-M075R□P-10)



* The above figure shows the controller with 5 to 8 control axes mounted to the valve block.
 The connectors mounted to the controller of 1 to 4 axes type are different from those of the 5 to 8 axes type.
 For details, refer to the following table.

Connector	1 to 4 axes type	5 to 8 axes type	Connector position
[X10A - X13A] Monitor pressure sensor connector	No provided	Provided	
[SOL5 - SOL8] Solenoid valve output connector	No provided	Provided	

■ AC type solenoid valve power supply (Model: EHU30S-M075□A (B)-10)



* The above figure shows the controller with 5 to 8 control axes mounted to the valve block.
 The connectors mounted to the controller of 1 to 4 axes type are different from those of the 5 to 8 axes type.
 For details, refer to the following table.

Connector	1 to 4 axes type	5 to 8 axes type	Connector position
[X10A - X13A] Monitor pressure sensor connector	No provided	Provided	

Chapter 5 Startup Procedure

The start-up procedure for this product is as follows:

1. Checking

.....Refer to “Chapter 6 Checking the Product on Delivery”.

Check the package contents and the product model.

2. Installation and Piping

.....Refer to “Chapter 7 Installation and Piping”.

After installation is completed, conduct piping work.

3. Filling Hydraulic Oil

.....Refer to “7.3 Filling hydraulic oil”.

Fill hydraulic oil into the tank.

4. Wiring

.....Refer to “Chapter 8 Wiring”.

Connections of the power supply, solenoid valve power supply and I/O signals are required.

With “valve block separate type”, connections of solenoid valve output and pressure sensor are required.

5. Turning Power ON

.....Refer to “Chapter 11 Operation”.

Before turning ON the power supply, be sure to check the following items:

- Check if the hydraulic unit is properly installed.
- Check if the piping is properly connected.
- Check if the hydraulic oil is filled.
- Check if the cables are properly connected.
- Check if the digital input signal is OFF. (= Check if the signal from the host device is OFF.)
- Check if the power supply voltage is proper.

6. Setting Parameters

.....Refer to “Chapter 9 Operating the panel”, “Chapter 10 Description on Parameters”.

After the power supply is turned ON, you can set up the parameters. Set up the pressure, flow rate and other parameters.

7. Host Device Setup

.....Refer to “Chapter 12 Host Sequence”

This product can be operated with the signal from a host device. To operate the actuator, programming on the host device is required.

8. Flushing

.....Refer to “9.6.7 Continuous operation”.

Execute flushing. To execute flushing, connect all pipes (except for the actuator piping) in a loop, and flush the unit through the filter. During flushing operation, check for a loose pipe or oil leak.

9. Replacement with New Oil

.....Refer to “13.5.1 Hydraulic oil replacement procedure”.

After flushing is completed, replace the hydraulic oil.

10. Air Bleeding

.....Refer to “9.6.7 Continuous operation”.

Bleed air from the hydraulic circuit completely. Incomplete air bleeding may cause actuator malfunction or abnormal sound from the pump or valve.

11. Teaching

.....Refer to “9.6.6 Teaching operation”.

This product provides the surge suppressing function. To enable the surge suppressing function, teaching is required.

12. Operation check

Operate the hydraulic unit with the signal from a host device, and check the actuator operation.

Chapter 6 Checking the Product on Delivery

6.1 Checking the package contents



CAUTION

- Before unpacking the product, confirm the top and bottom of the product.

After unpacking the product, make sure that the following items are included:

Hydraulic unit	1 unit
Operation manual	1 copy

6.2 Confirming the product model



CAUTION

- Check the product nameplate to confirm that the delivered product conforms to your ordered model. Using an improper product causes damage.


Check the product nameplate to confirm that the delivered product conforms to your ordered model. For product models, refer to “3.1 Model identification code”.

Chapter 7 Installation and Piping

7.1 Installation

7.1.1 Storing


Selecting an improper storing place causes a fault of the equipment.

 CAUTION	
● Store this product in the following environmental conditions.	
Storing ambient temperature/humidity	-20 to +60° C/85% RH or less (No freezing, No condensation)
Atmosphere	Indoors (No exposure to direct sunlight) Free from corrosive gas, flammable gas, oil mist or dust
Altitude	1000 m max.

7.1.2 Installation place


Selecting an improper installation place or installation method causes a fault of the equipment.


 DANGER	
● Never use this product in a place where it may be splashed with water, or in a place with corrosive or flammable gas atmosphere, or near a combustible material. Failure to observe this instruction may result in electric shock or fire.	

 CAUTION	
● Use this product within the range of the following environmental conditions. Using this product in an improper condition can jeopardize safety or deteriorate performance.	
Operating ambient temperature/humidity	0 to +35° C/85% RH or less (No freezing, No condensation)
Atmosphere	Indoors (No exposure to direct sunlight) Free from corrosive gas, flammable gas, oil mist or dust
Altitude	1000 m max.
● Install this product on the horizontal table or the horizontal floor.	

7.1.3 Installation work

For outside dimension/mounting dimension, refer to “3.4 Outside dimensions”.

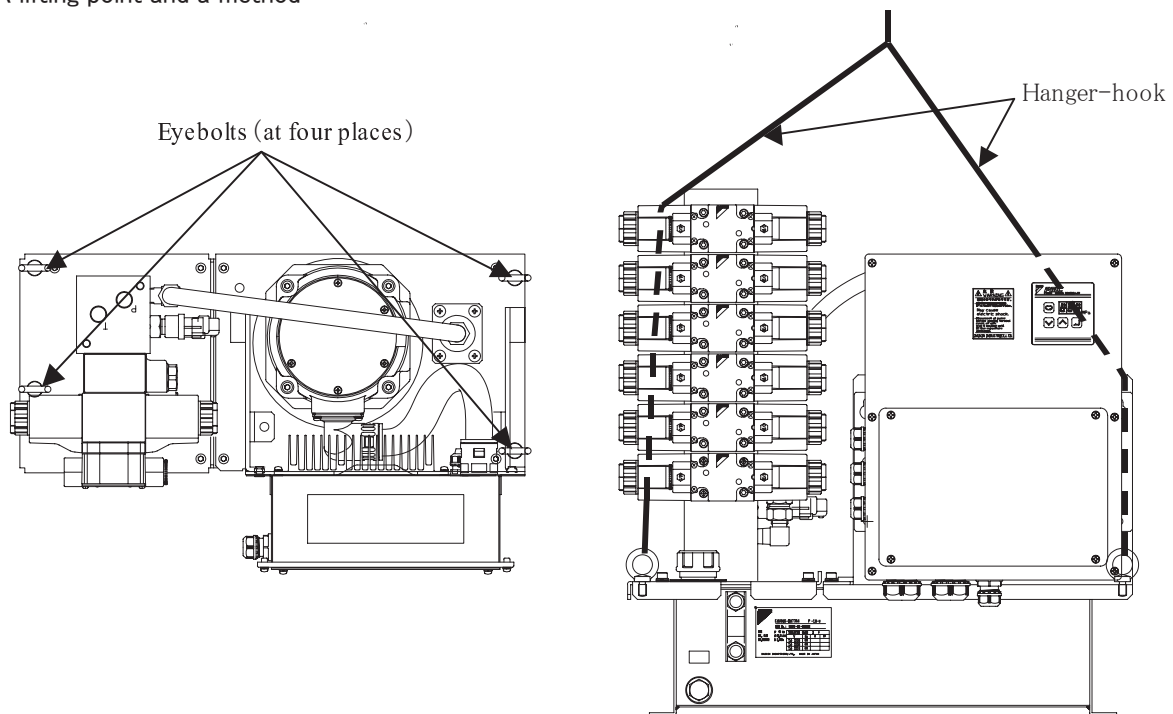
 DANGER
<ul style="list-style-type: none"> ● Before transportation, check the weight of the product. Failure to observe this instruction may result in injury. ● To transport this product, use the eyebolts. If this product is lifted by other parts (pump piping, etc.), it may overturn.

 CAUTION
<ul style="list-style-type: none"> ● If any part of the unit body is damaged or missing, do not install or operate this product. Failure to observe this instruction may result in an accident. ● During transportation, do not hold the piping, harness or solenoid valves. Failure to observe this instruction may result in damage or fall of the equipment. ● Be careful not to drop it or apply strong impact to it. ● Do no step on the product, or put a heavy object on it. Failure to observe this instruction may result in damage or other accidents. ● So be sure to fix this product not to move. Tighten installation volt enough not to have it loose by vibration.

For weight of this product, refer to the following table.

Model	Weight	Model	Weight	Remarks
EHU30S-M075R1□-10	48kg	EHU30S-M075R5□-10	62kg	Excluding hydraulic oil
EHU30S-M075R2□-10	50kg	EHU30S-M075R6□-10	64kg	
EHU30S-M075R3□-10	52kg	EHU30S-M075RX□-10	39kg	
EHU30S-M075R4□-10	54kg	EHU30S-M075RY□-10	39kg	

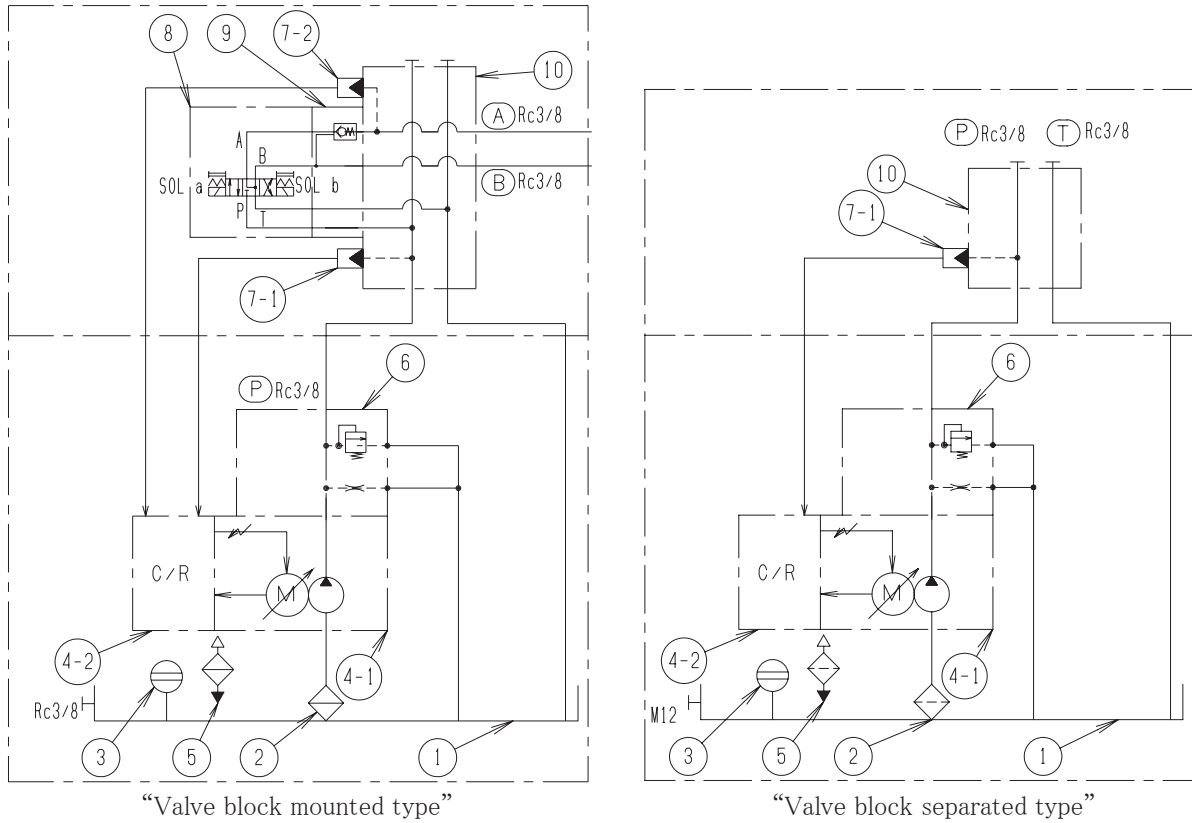
■ A lifting point and a method



7.2 Piping

7.2.1 Hydraulic circuit

■ Hydraulic circuit diagram



■ Components

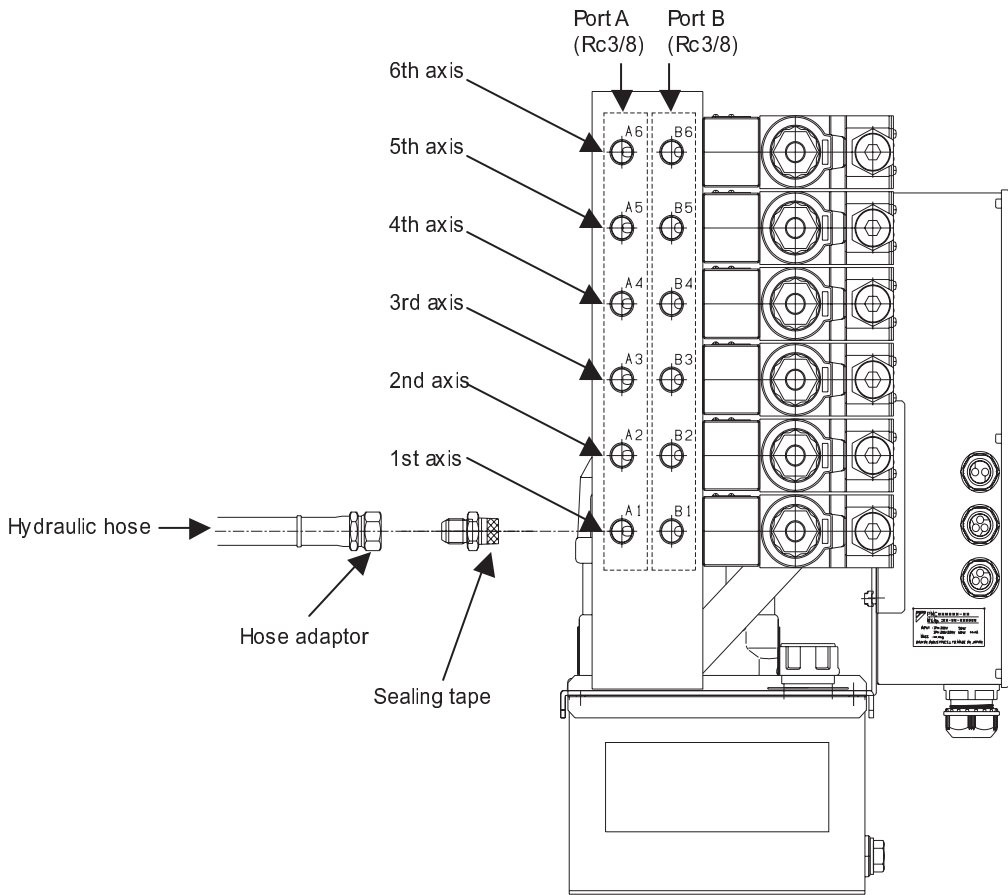
Part No.	Name	Quantity
1	Tank	1
2	Suction strainer	1
3	Oil level gauge	1
4	Motor pump	1
	Controller	1
5	Oil filling port / Air breather	1
6	Relief valve block	1
7	Pump pressure sensor	1
	Monitor pressure sensor	1
8	Solenoid valve	1
9	Non-leak valve	1
10	Manifold block	1

MEMO The above diagram shows a single-axis hydraulic circuit. The number of monitor pressure sensors, solenoid valves and non-leak valves corresponds to the axis selection number

7.2.2 Piping work

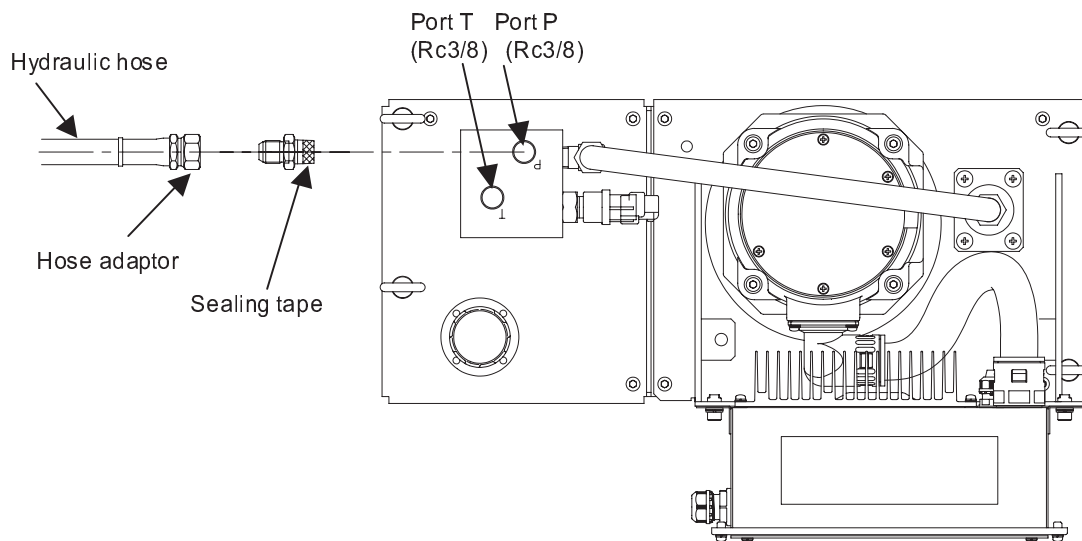
■ “Valve block mounted type”

Port A and Port B are located on the left side of the manifold block. For both Port A and Port B, the port size is Rc3/8.



■ “Valve block separated type”

Port P and Port T are located on the top surface of the manifold block. For both Port P and Port T, the port size is Rc3/8. Connect to the valve block.



Both piping ports have been covered with resin plug (with O-ring) before shipment. Remove the resin plug (with O-ring) from each piping port, and connect the hydraulic hose. Wrap sealing tape around the hose to tighten the connection.

IMPORTANT	<ul style="list-style-type: none">● For piping of this product, use hoses.● Flexible hoses should not be bent with a radius smaller than the recommended minimum-bending radius.● Minimize torsional deflection of the hose during the installation and use.● Be supported, if the weight of the hose assembly could cause under strain.
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7.3 Filling hydraulic oil

CAUTION

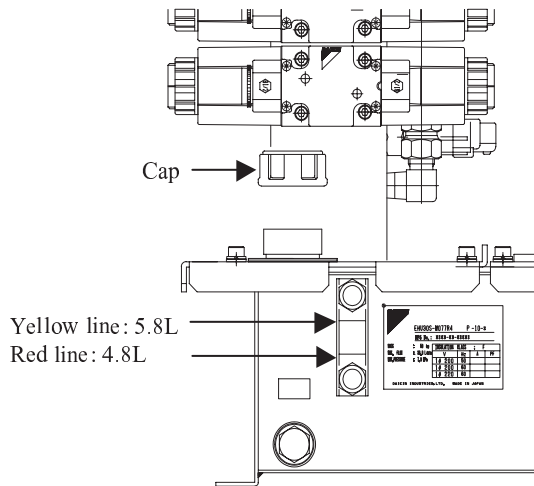
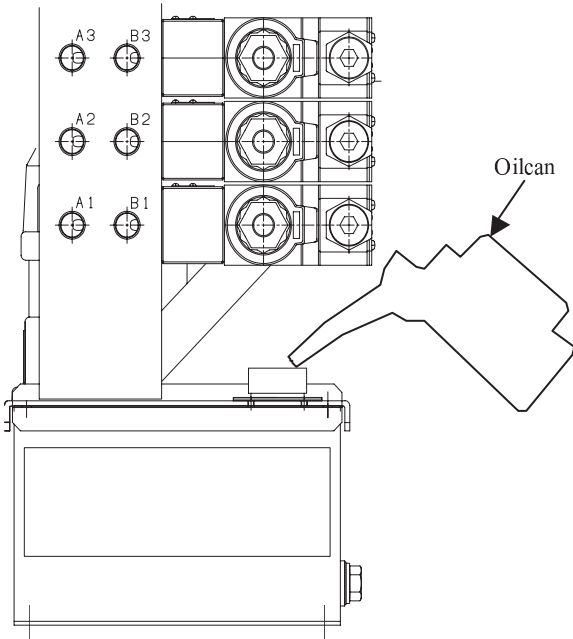
- Use hydraulic oil under the conditions specified below. Otherwise, safety and performance of the hydraulic unit may deteriorate.

Oil type	Special mineral hydraulic oil / Wear-resistant hydraulic oil
Viscosity grade	ISO VG32 to 68
Viscosity range	15 to 400 mm ² /s
Pollution degree	NAS Class 9 or lower level

- If the hydraulic unit is operated with no oil filled in the tank, the pump will be seized up or worn out, causing damage.
- During initial operation of a machine, hydraulic oil will be supplied into the hydraulic circuit of the machine. Pay attention to a decrease in the hydraulic oil level in the tank.
- Fluctuations in oil level in the tank may become large, depending on the hydraulic oil circuit of the machine. Pay attention to oil overflow from the tank or oil level decrease.

Model	Tank capacity	Oil level range	
		Yellow line (upper)	Red line (lower)
EHU30S-M075R□□-10	5L	5.8L	4.8L

- ① Remove the cap from the oil filling port/air breather by turning the cap counterclockwise.
- ② Pour new hydraulic oil through the oil filling port by using an oilcan. Make sure that the oil level is between the red and yellow marks of the oil level gauge.
- ③ After pouring hydraulic oil, mount the cap to the oil filling port/air breather by turning the cap clockwise.



Chapter 8 Wiring

**DANGER**

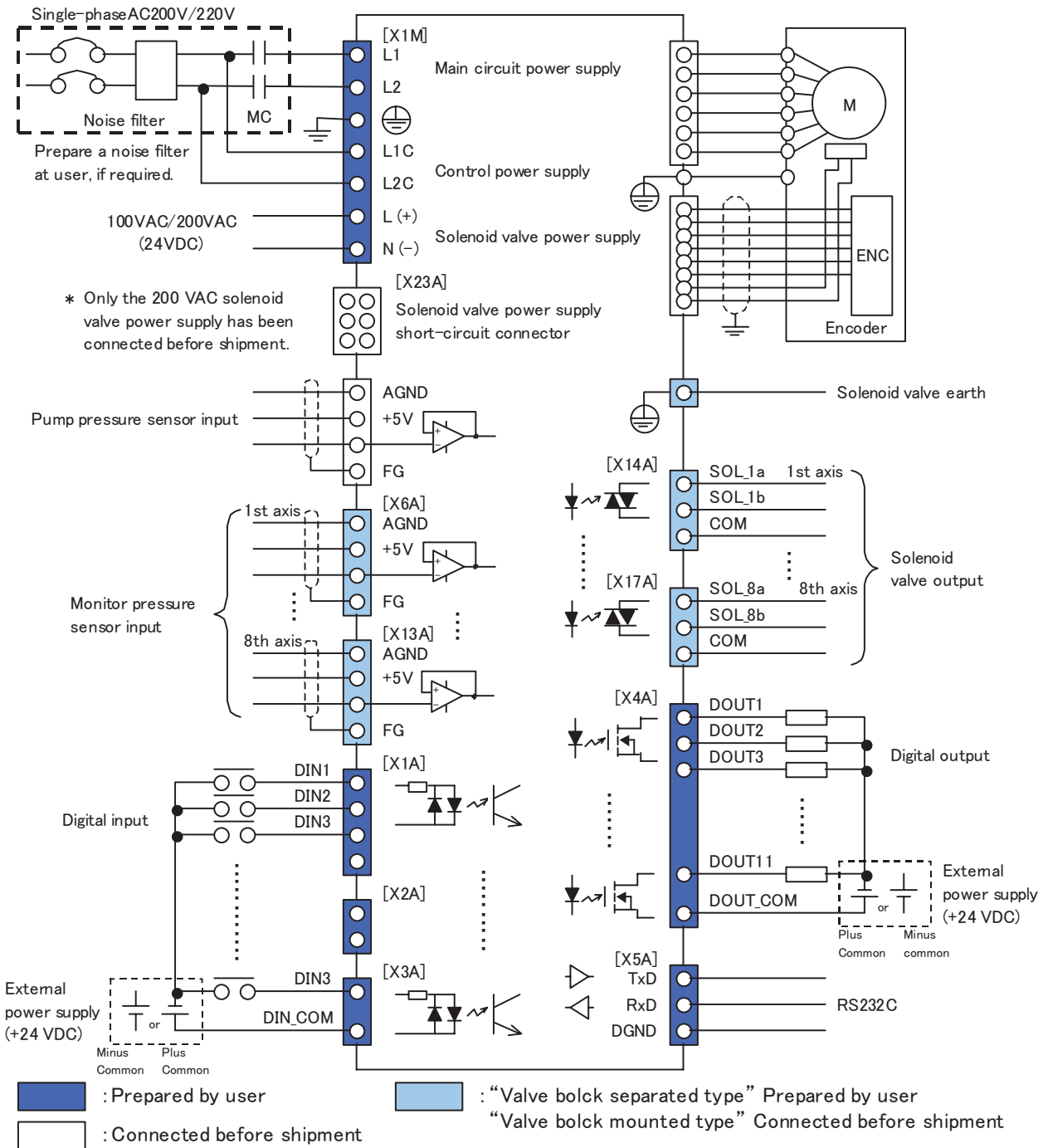
- Wiring work must be conducted by qualified technical experts. Failure to observe this instruction may result in electric shock or fire.
- Before wiring work, complete the installation procedure. Failure to observe this instruction may result in electric shock or fire.
- Before wiring work, make sure that the input power supply is OFF. Failure to observe this instruction may result in electric shock.
- To restart wiring work after the power supply is turned ON once, make sure that the motor has stopped, and wait for at least five minutes after the power supply is turned OFF. Failure to observe this instruction may result in electric shock.
- Use a no-fuse breaker or earth leakage breaker conforming to EN60947-2. Failure to observe this instruction may result in electric shock or fire.
- Ground the unit securely. Failure to observe this instruction may result in electric shock or fire.
- When unsheathing the cable, be careful not to damage the conductors.
- Use thorough caution so that the cable inserted in the terminal block has no protruding wire. Failure to observe this instruction may result in short-circuits.
- Use an appropriate tool for crimp terminals. Improper crimping causes a wire to come off the terminal during use, which may result in short-circuit.

**CAUTION**

- Do not allow entry of a conductive foreign object (metal chip, etc.) or a combustible foreign object (oil, etc.) into the controller.
- Make sure that the input power supply voltage conforms to the rated voltage. Failure to observe this instruction may result in damage or fire.
- To ensure correct wiring, check the terminal assignment and terminal symbols.
- Separate the power line and the signal line. Do not bundle and wire them together in the same duct. Failure to observe this instruction may result in malfunction.

- With this product, connections of power supplies, solenoid valve power supply and I/O signals are required. For the main circuit and the control circuit, use separate power supply inputs. For details, “8.5 Connecting power supplies” and “8.6 Connecting I/O signals”.
- With “valve block separate type”, connections of solenoid valve output and pressure sensor are required. For details, “8.7 Wiring of “valve block separated type””.
- Wiring of this product must be conducted in the user cover of the controller. For details, refer to “8.3 Mounting/removing the user cover”.
- For recommended cable types, sizes and connecting methods, refer to “8.5 Connecting power supplies” and “8.6 Connecting I/O signals”.

8.1 Overall wiring diagram



IMPORTANT

- The terminal symbols of the solenoid valve power supply vary depending on the type of power supply. With the 100/200 VAC type, the solenoid valve symbols are [L] and [N]. With the 24 VDC type, the symbols are [+] and [-].
- With the 200 VAC type solenoid valve, connections of the [L] and [N] terminals of the terminal block are not required. For details, refer to "8.5.5 Solenoid valve power supply short-circuit connector".
- For digital input signals, only transistor output can be connected.
- The digital input/output signals can use both plus common and minus common terminals.

8.2 Peripheral equipment

8.2.1 Circuit breaker capacity

For the prevention of accident associated with power supply, use a no-fuse breaker or earth leakage breaker conforming to EN60947-2. Following table shows the capacity of circuit breaker for wiring or fuse per each driver.

Model	Breaker setup value
EHU30S-M075R□□-10	15A

8.2.2 Noise filter

Use the noise filter for the sake of controlling the malfunction due to noise from power line or effect of noise emitted by this product on the outside. Following table shows the type of recommended noise filter.

Name	Model	Manufacturer
EMC filter for AC line supply	ZRAC2210-11	TDK Corporation.

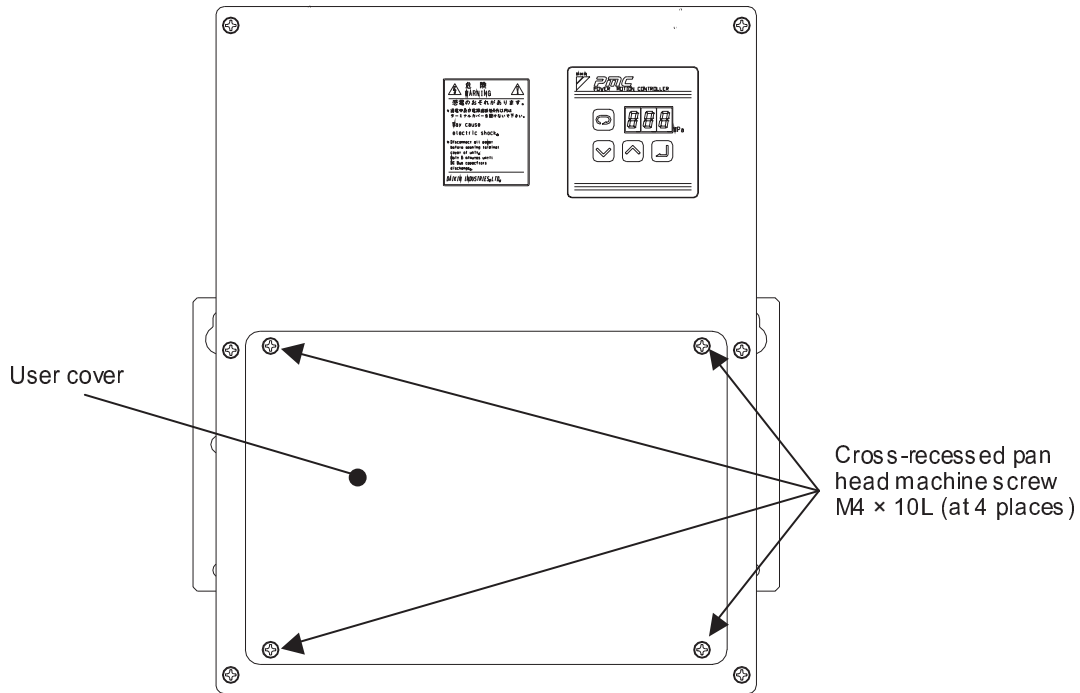
IMPORTANT	<ul style="list-style-type: none"> ● Keep the ground wire of the noise filter away from output side wiring as much as possible. ● Separate the input side wiring and output side wiring of the noise filter. Do not bundle and wire them together in the same duct. Failure to observe this instruction may result in malfunction. ● Grounding of the driver and that of other equipment shall be arranged so that they constitute one-point grounding.
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8.3 Mounting/removing the user cover

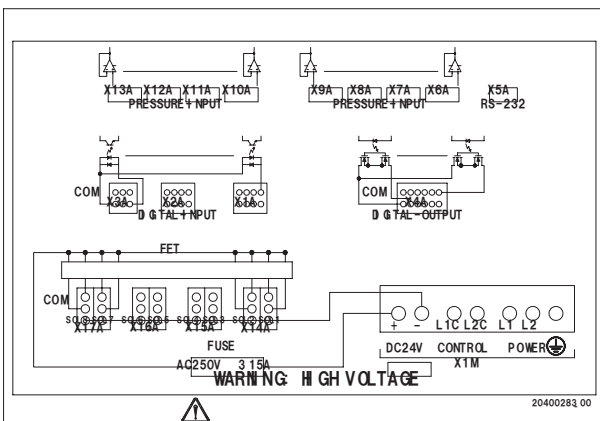
Wiring of this product must be conducted in the user cover of the controller. You can remove the user cover by loosening four screws of the user cover.

A wiring diagram is attached to the rear panel of the user cover. During wiring work, refer to this drawing.

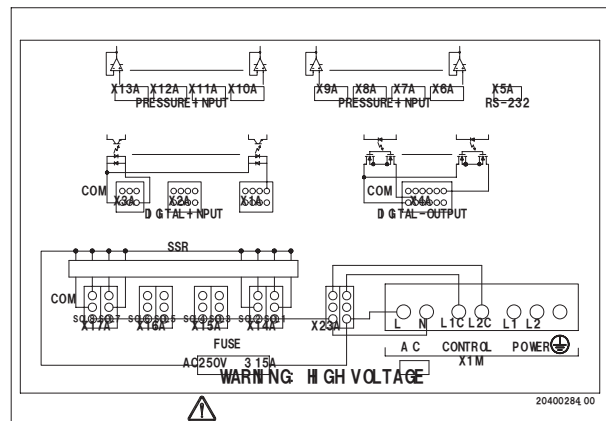
- Screws: Cross-recessed pan head machine screw M4 × 10L
- Recommended tightening torque: 1.0[N·m]



● Wiring diagram for 24 VDC solenoid valve power supply **TERMINAL WIRING DIAGRAM**



● Wiring diagram for 100/200 VAC solenoid valve power supply **TERMINAL WIRING DIAGRAM**

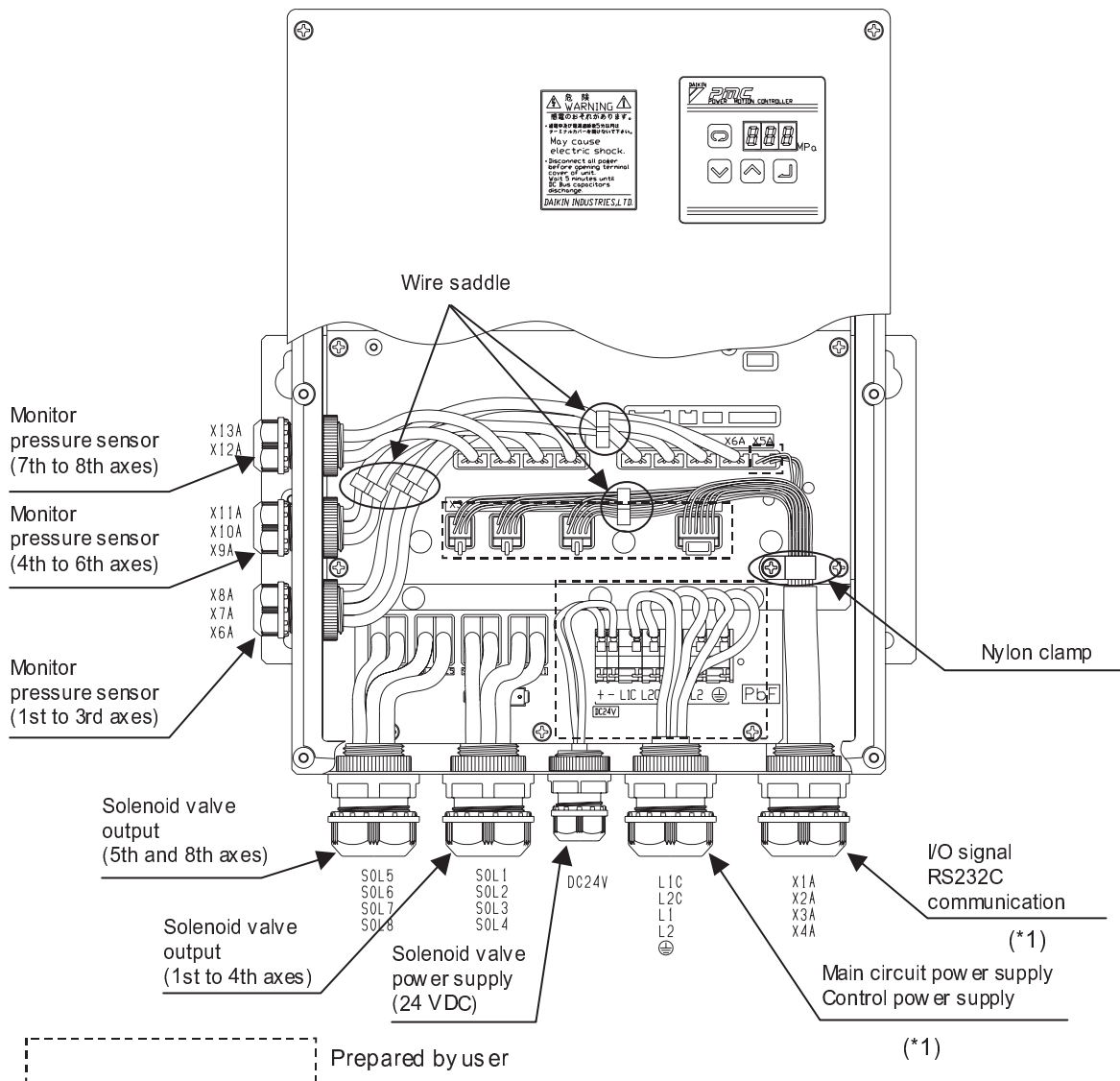


CAUTION

- Do not mount the cover with the rubber packing removed. Do not allow damage to the rubber packing or insertion of a foreign object. Otherwise, water or dust enters the controller, causing a fault of the controller.

8.4 Appearance of controller wiring

8.4.1 24 VDC solenoid valve power supply (Model EHU30S-M075R6P-10)



* With "valve block mounted type", connections of solenoid valve output and monitor pressure sensor are not required.

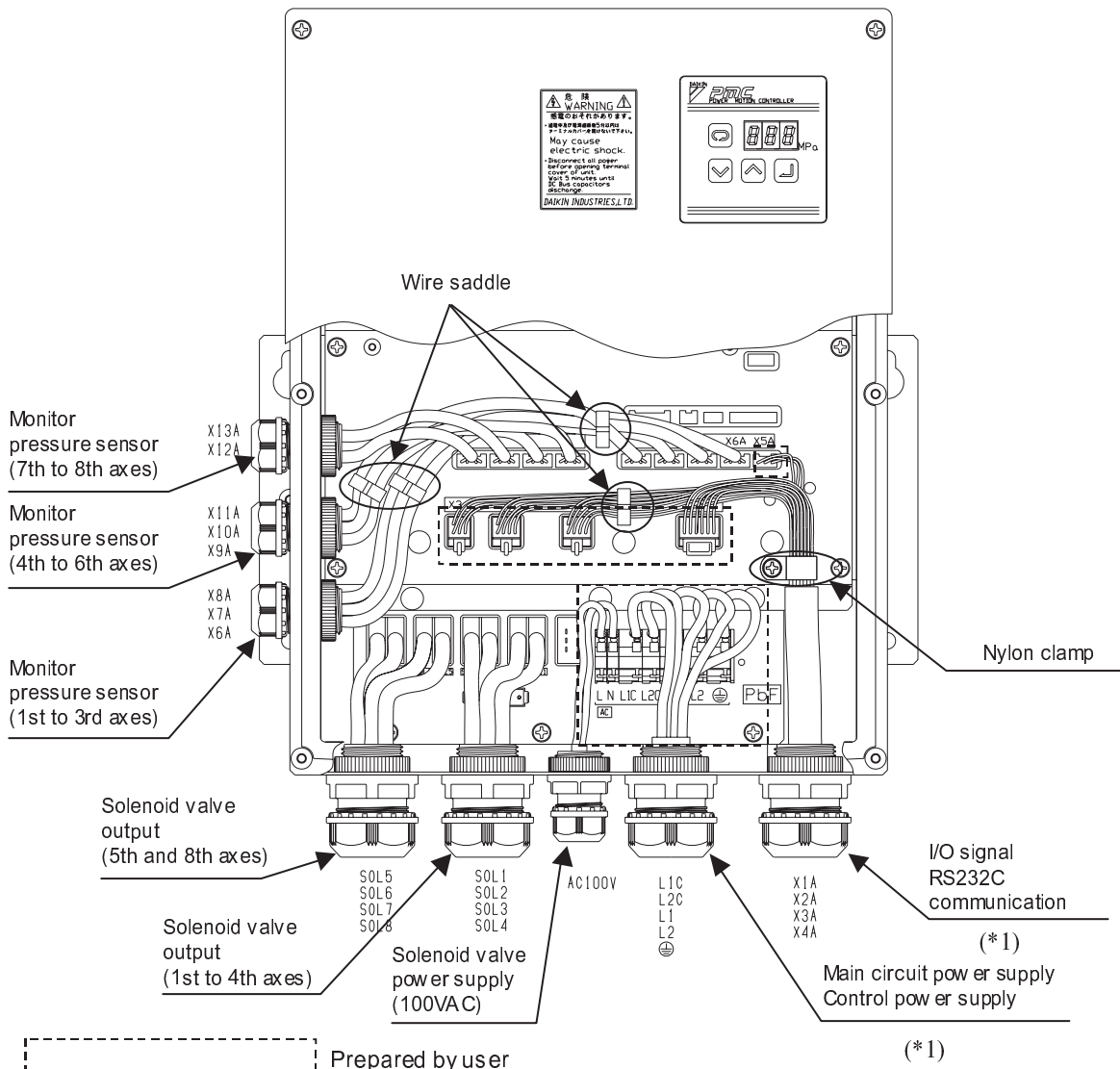
CAUTION

- Pass each cable through the specified cable clamp, and tighten the fastening cap after wiring.
- Pass the I/O signal cables through the nylon clamp and the wire saddle as shown above, and fasten them so that they will not hang down toward the main circuit and solenoid valve output cables. Otherwise, they may cause noise interference, resulting in malfunction.

IMPORTANT

*1. The cable clamps for the power supply cables and I/O signal cables are not included in the product. Prepare suitable cable clamps at user. The mounting hole diameter is 28 mm.

8.4.2 100VAC solenoid valve power supply (Model EHU30S-M075R6A-10)

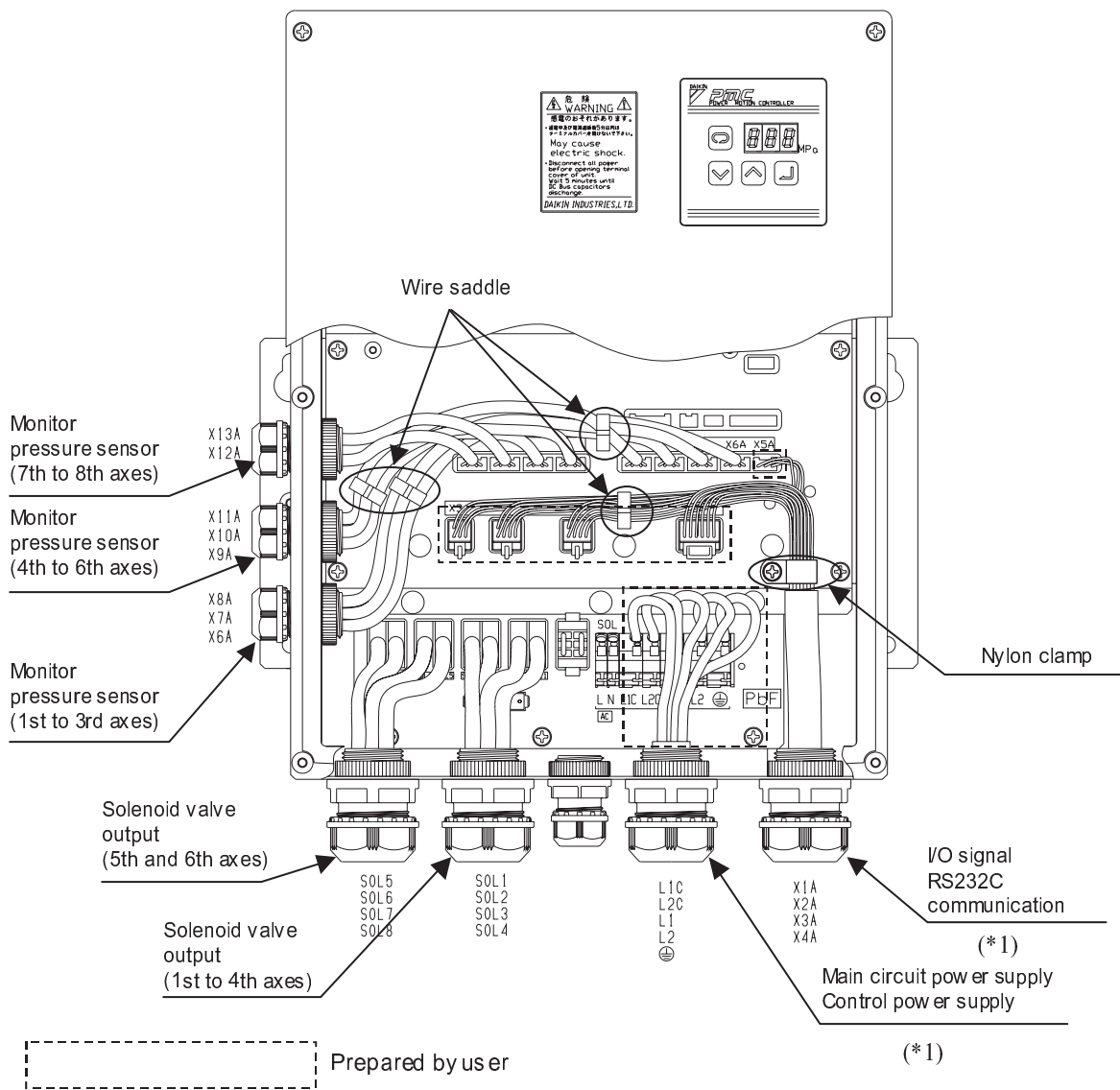


* With "valve block mounted type", connections of solenoid valve output and monitor pressure sensor are not required.

CAUTION
<ul style="list-style-type: none"> ● Pass each cable through the specified cable clamp, and tighten the fastening cap after wiring. ● Pass the I/O signal cables through the nylon clamp and the wire saddle as shown above, and fasten them so that they will not hang down toward the main circuit and solenoid valve output cables. Otherwise, they may cause noise interference, resulting in malfunction.

<p>IMPORTANT</p>	<p>*1. The cable clamps for the power supply cables and I/O signal cables are not included in the product. Prepare suitable cable clamps at user. The mounting hole diameter is 28 mm.</p>
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8.4.3 100VAC solenoid valve power supply (Model EHU30S-M075R6B-10)



* With "valve block mounted type", connections of solenoid valve output and monitor pressure sensor are not required.

CAUTION

- Pass each cable through the specified cable clamp, and tighten the fastening cap after wiring.
- Pass the I/O signal cables through the nylon clamp and the wire saddle as shown above, and fasten them so that they will not hang down toward the main circuit and solenoid valve output cables. Otherwise, they may cause noise interference, resulting in malfunction.

IMPORTANT

*1. The cable clamps for the power supply cables and I/O signal cables are not included in the product. Prepare suitable cable clamps at user. The mounting hole diameter is 28 mm.

8.5 Connecting power supplies

 **DANGER**

● Before wiring work, turn OFF the input power supply. Failure to observe this instruction may result in electric shock.

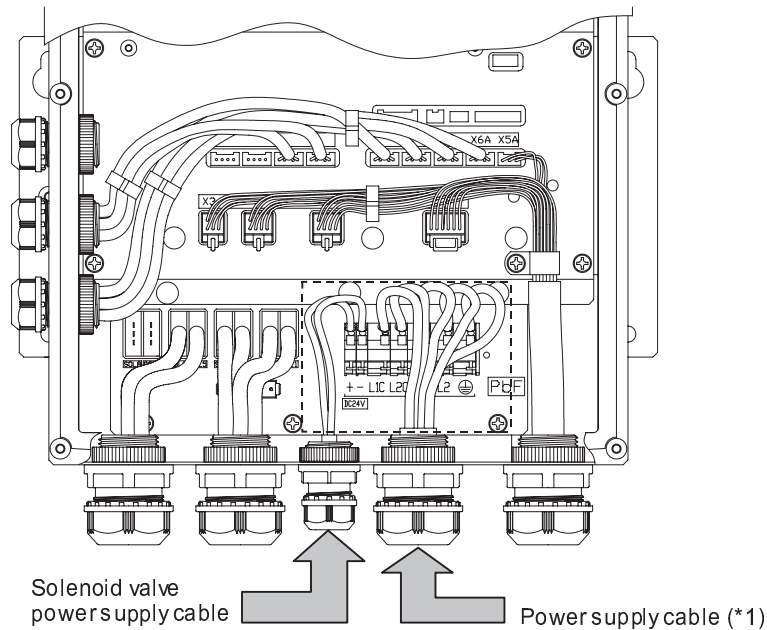
 **CAUTION**

● To insert a cable into a cable clamp, use a multi-core cable. If two or more cables are inserted into a cable clamp, there is a clearance between each cable and the cable clamp. In such a condition, the cable clamp will not effectively function.

IMPORTANT	<ul style="list-style-type: none"> ● For connection with the ground terminal, use a cable with the recommended size or larger size. ● With the 24 VDC solenoid valve power supply, connect the DC line from the AC line separately by using the solenoid valve power supply connection port.
------------------	--

The controller provides the power supply connection port and the solenoid valve power supply connection port. Connect the power supplies through individual connection ports. For the solenoid valve power supply connection port, a cable clamp is included in the product. However, for the power supply connection port, no cable clamp comes with the product.

8.5.1 Power supply connection procedure



1) Prepare the power supply cable and the solenoid valve power supply cable.

Power supply cable	Core wire cross-section area: 2.0 - 2.5mm ² Recommended: CE362 2.5mm ² × 5 core wires (Manufactured by Kuramo Electric)
Solenoid valve power supply cable	Core wire cross-section area: 0.5mm ² or more Recommended: CE362 0.5mm ² × 2 core wires (Manufactured by Kuramo Electric)

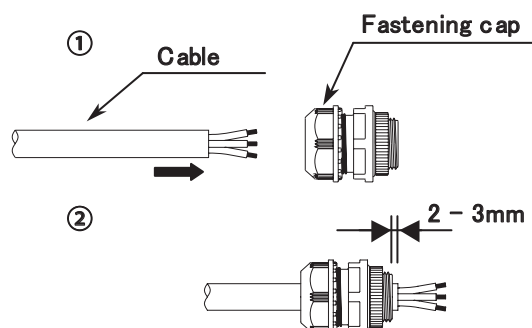
With the 200 VAC solenoid valve power supply, connections with the [L] and [N] terminals on the terminal block are not necessary. For details, refer to “8.5.5 Solenoid valve power supply short-circuit connector”.

- 2) For wiring, use a cable clamp suitable for the connection port, so that the cable meets IP54 or higher protection rating.
- *1. The cable clamp for the power supply cable is not included in the product. Prepare a suitable cable clamp at user. The mounting hole diameter is 28 mm.

Cable clamp for power supply connection port	Recommended: OA-W2216 (Manufactured by Ohm) Electric compatible cable diameter: 11 to 16 mm
Cable clamp for solenoid valve power supply connection port	Recommended: OA-W1608-BB (Manufactured by Ohm) Electric compatible cable diameter: 6 to 8 mm

- 3) Fasten the cable with the cable clamp according to the following procedure. The cable clamp for the solenoid valve power supply connection port is the blind type. To use the cable clamp, cut out the tip of the rubber bushing.

- ① Loosen the fastening cap, and pass the cable.
- ② Tighten the fastening cap to fasten the cable. The cable sheath protruding length should be as short as possible (approx. to 3 mm).



- 4) Connect the cable to the terminal block. For connection with the terminal block, refer to “8.5.3 Connection with the power supply terminal block”.

8.5.2 Specifications of the power supply terminal block

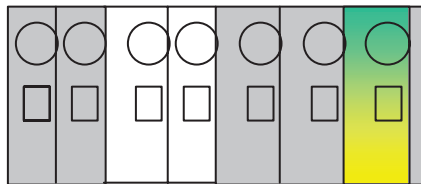
■ 24 VDC solenoid valve power supply

Terminal block	Terminal symbol	Name	Rated capacity	Function
X1M	L1	Main circuit power supply	15A	Connect the main circuit power supply cable.
	L2			
	⊕			
	L1C	Control power supply	1A	Connect the control circuit power supply cable.
	L2C			
	+	Solenoid valve power supply	24 VDC: 1.22A	Connect the solenoid valve power supply cable.
-				

■ 100/200 VAC solenoid valve power supply

Terminal block	Terminal symbol	Name	Rated capacity	Function
X1M	L1	Main circuit power supply	15A	Connect the main circuit power supply cable.
	L2			
	⊕			
	L1C	Control power supply	1A	Connect the control circuit power supply cable.
	L2C			
	L	Solenoid valve power supply (*1)	100 VAC: 0.51A 200 VAC: 0.26A	Connect the solenoid valve power supply cable.
N				

*1. With the 200 VAC solenoid valve power supply, connections with the [L] and [N] terminals on the terminal block are not necessary. For details, refer to “8.5.5 Solenoid valve power supply short-circuit connector”.



DC type solenoid valve power supply: + - L1C L2C L1 L2 ⊕

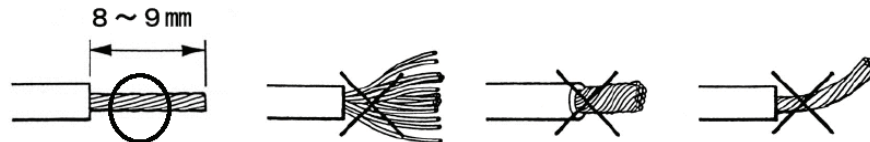
AC type solenoid valve power supply: L N L1C L2C L1 L2 ⊕

Terminal block	Terminal symbol		Model	Manufacturer
	DC type solenoid valve power supply	AC type solenoid valve power supply		
X1M	L1	L1	745-821	WAGO Company of Japan, Ltd.
	L2	L2	745-821	
	⊕	⊕	745-827	
	L1C	L1C	745-823	
	L2C	L2C	745-813	
	+	L	745-801	
	-	N	745-801	

8.5.3 Connection with the power supply terminal block

The procedure for connecting the power supply to the power supply terminal block [X1M] is as follows:

- When connecting the power supply to the power supply terminal block, be careful not to apply excessive force to the board or other parts.
- The cable can be inserted into the terminal block in unsheathed condition. The maximum outer diameter of the cable sheath should be 4.3 mm or less. When inserting the cable, be careful not to allow protrusion of a core wire. If wire tip loosening prevention is required, refer to “8.5.4 Mounting the ferrule”.
- The length of the cable unsheathed portion should be 8 to 9 mm.



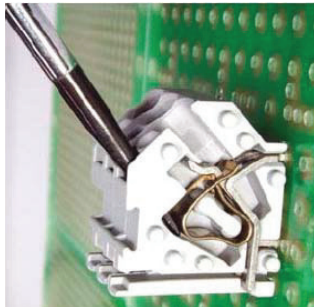
- To insert the cable into the terminal block, a special tool is required. Use the recommended tool listed below.



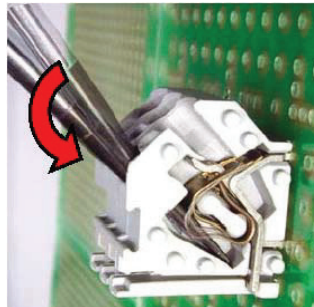
Model	Manufacturer
210-120J (Standard type)	WAGO Company of Japan, Ltd.
210-350/01 (Short type)	
210-258J (Angle type)	

- Connecting

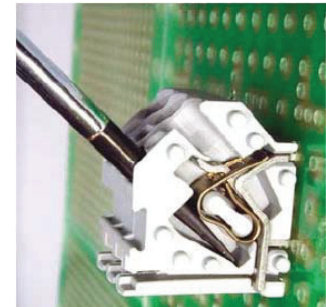
① Put a screwdriver to the operation slot.



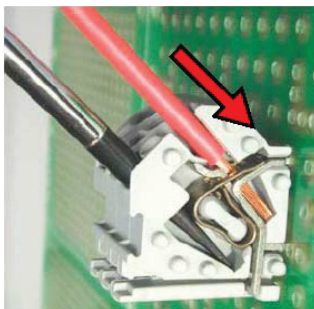
② Insert a screwdriver to the inside of the terminal block.



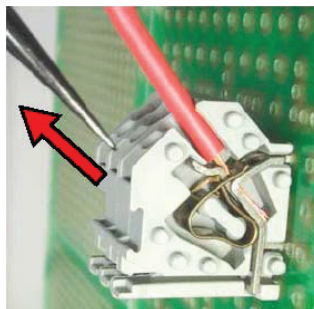
③ The screwdriver will be fixed when operated correctly.



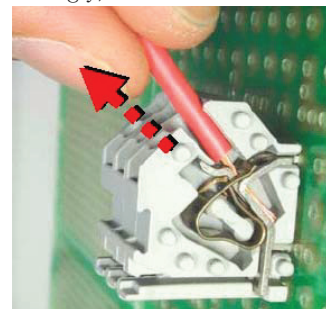
④ Insert a wire to the wire hole.



⑤ Pull out a screwdriver from the operating slot. (Please hold a wire)




⑥ Pull a wire slightly to check if connecting has been done completely. (Do not pull strongly)

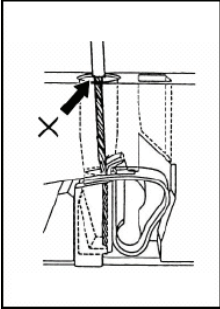
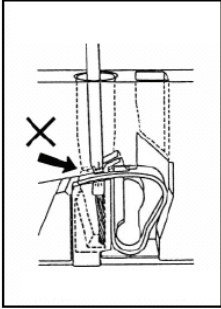
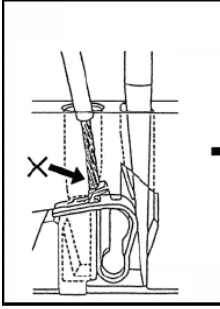
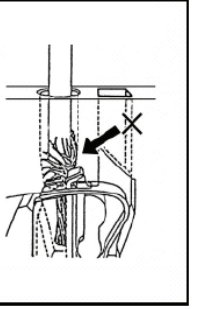


- Removal

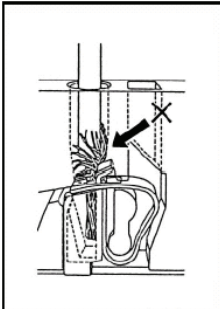
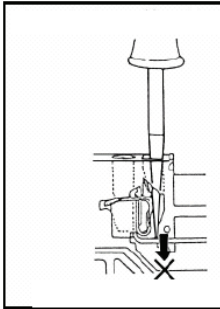
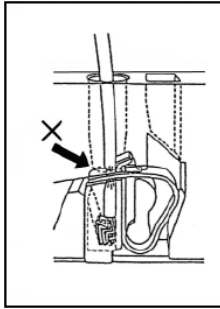
Operate a screwdriver in the same way with connecting open a spring and pull out wire.


CAUTION

①Connecting wire with incorrect strip length causes disconnecting. ②Incomplete insert causes bad connection.

③Please fix splayed wire. ④Do not push in a driver too much to prevent terminal block from damage. ⑤Do not push too much to prevent insulation from getting caught smaller wire.






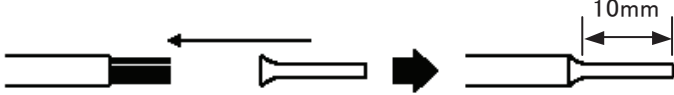
8.5.4 Mounting the ferrule

If wire tip loosening prevention is required, use the following ferrule (with insulation collar attached), or equivalent parts.

For the ferrule handling procedure, refer to the catalog provided by the manufacturer (Wago Company of Japan).

Name	Model	Remarks	Manufacturer
Ferrule with insulation collar	216-246	For AWG14 2.0 to 2.5 mm ² (Color: blue)	WAGO Company of Japan, Ltd.
Vario Crimp	206-204	Crimping tool for the ferrule	


DANGER



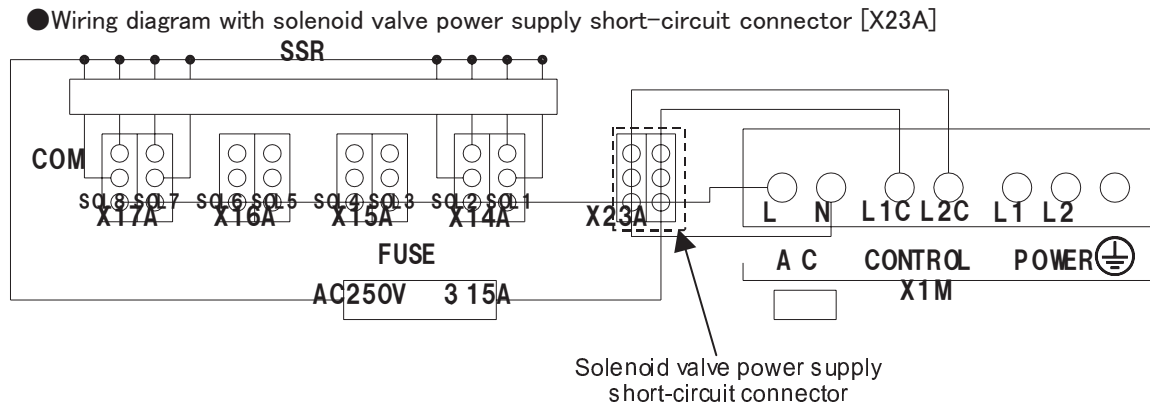
- Select a ferrule with 10 mm length. If the ferrule is shorter than 10 mm, the tip of the ferrule cannot securely fit in the terminal block. If the ferrule is too long, adjacent pins touch each other, causing the power supply to short-circuit.
- Use the ferrule with insulation collar. To use a ferrule without insulation collar or equivalent rod terminal, cover the ferrule or terminal with an insulation tube to prevent adjacent terminals from touching each other. Failure to observe this instruction may result in electric shock or fire.
- Use a ferrule or equivalent rod terminal suitable for the wire size. Failure to observe this instruction may result in electric shock or fire.
- Use an appropriate tool for the crimp terminals. Otherwise, improper crimping causes the wire to come off the terminal during use, resulting in short-circuit.

8.5.5 Solenoid valve power supply short-circuit connector

Only with the 200 VAC solenoid valve power supply, the solenoid valve power supply short-circuit connector [X23A] has been connected before shipment.

When the solenoid valve power supply short-circuit connector is connected, the solenoid valve is energized from the control power supply terminals ([L1C] and [L2C]). In this case, connections of the solenoid valve power supply with the terminals ([L] and [N]) on the power supply terminal block are not required.

To input power to the solenoid valve power supply and control power supply individually, disconnect the solenoid valve power supply short-circuit connector.




⚠ DANGER

- With the 100 VAC solenoid valve power supply, the solenoid valve power supply short-circuit connector [X23A] has not been connected. If the solenoid valve power supply short-circuit connector [X23A] is connected for the 100 VAC type, the control power supply terminals ([L1C] and [L2C], 200 VAC) and the solenoid valve power supply terminals ([L] and [N], 100 VAC) will be short-circuited in the controller, resulting in fire or smoke.

8.6 Connecting I/O signals

 **DANGER**

- Before connecting I/O signals, make sure that the input power supply is OFF.

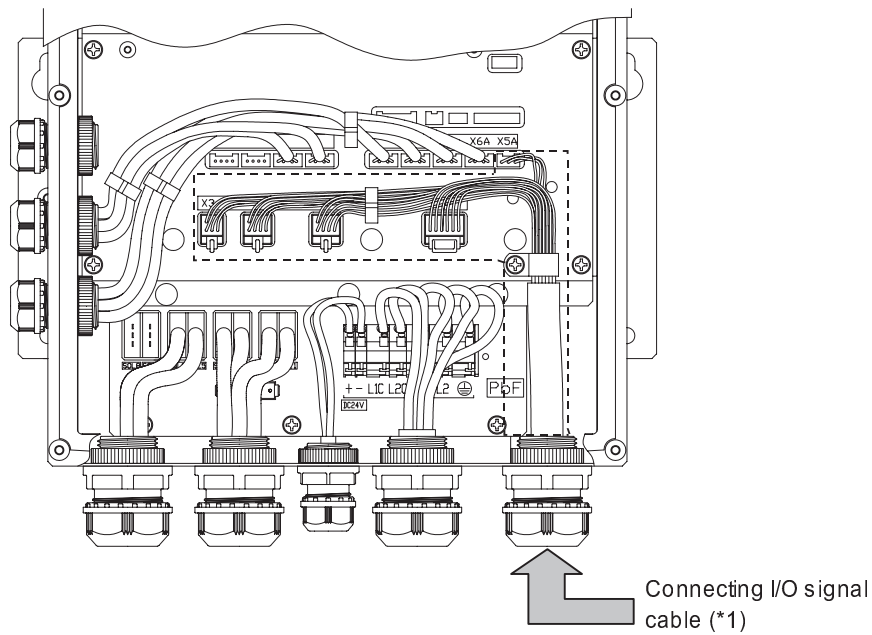
 **CAUTION**

- To insert a cable into a cable clamp, use a multi-core cable. If two or more cables are inserted into a cable clamp, there is a clearance between each cable and the cable clamp. In such a condition, the cable clamp will not effectively function.

IMPORTANT The shielded cable must be securely terminated. The cable connected on the machine side must be shielded.

The controller provides an I/O signal connection port. Connect the I/O signal through the connection port.

8.6.1 I/O signal connecting procedure



- 1) Prepare the I/O signal cable.

I/O signal cable	Core wire cross-section area: 0.3 mm ² Recommended: KVC-36SB 0.3 mm ² × 40 core wires (Manufactured by Kuramo Electric)
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- 2) For wiring, use a cable clamp suitable for the connection port, so that the cable meets IP54 or higher protection rating.

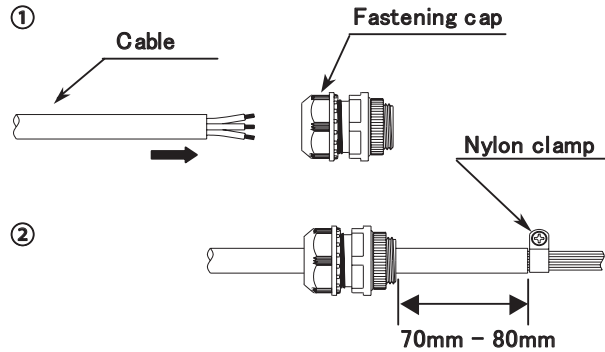
*1. The cable clamp for the I/O signal cable is not included in the product. Prepare a suitable cable clamp at user. The mounting hole diameter is 28 mm.

Cable clamp for I/O signal connection port	Recommended: OA-W2216 (Manufactured by Ohm) ElectricCompatible cable diameter: 11 to 16 mm
--	---

3) The I/O signals are connected with a connector. Prepare a compatible connector as required. For details, refer to “8.6.2 Specifications of digital input signal connector”, “8.6.3 Specifications of digital output signal connector” and “8.6.4 Specifications of RS232C communication connector”.

4) Fasten the cable with the cable clamp according to the following procedure.

① Loosen the fastening cap, and pass the cable.

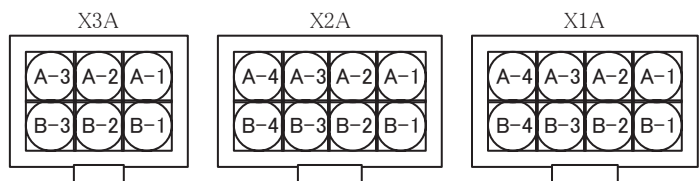


② Pass the cable through the nylon clamp, and tighten the fastening cap to fasten the cable.

5) Connect the power supply to the connector.

8.6.2 Specifications of digital input signal connector

Connector	Pin No.	Terminal symbol	Name	Rated capacity	Function
X1A	A-1	DIN1	Axis selection 1a	24 VDC 5 mA	Energizes “SOL-a” for Axis 1.
	A-2	DIN2	Axis selection 1b		Energizes “SOL-b” for Axis 1.
	A-3	DIN3	Axis selection 2a		Energizes “SOL-a” for Axis 2.
	A-4	DIN4	Axis selection 2b		Energizes “SOL-b” for Axis 2.
	B-1	DIN5	Axis selection 3a		Energizes “SOL-a” for Axis 3.
	B-2	DIN6	Axis selection 3b		Energizes “SOL-b” for Axis 3.
	B-3	DIN7	Axis selection 4a		Energizes “SOL-a” for Axis 4.
	B-4	DIN8	Axis selection 4b		Energizes “SOL-b” for Axis 4.
X2A	A-1	DIN9	Axis selection 5a		Energizes “SOL-a” for Axis 5.
	A-2	DIN10	Axis selection 5b		Energizes “SOL-b” for Axis 5.
	A-3	DIN11	Axis selection 6a		Energizes “SOL-a” for Axis 6.
	A-4	DIN12	Axis selection 6b		Energizes “SOL-b” for Axis 6.
	B-1	DIN13	Axis selection 7a		Energizes “SOL-a” for Axis 7.
	B-2	DIN14	Axis selection 7b		Energizes “SOL-b” for Axis 7.
	B-3	DIN15	Axis selection 8a		Energizes “SOL-a” for Axis 8.
	B-4	DIN16	Axis selection 8b		Energizes “SOL-b” for Axis 8.
X3A	A-1	DIN17	Operation command	Defines operation command enable/disable status. Operation command enable/disable status can be specified with the parameter. Refer to “10.2.1 Operation command enable”.	
	A-2	DIN18	(Not used)		
	A-3	DIN19	Speed change command	Changes a flow rate.	
	B-1	DIN20	Alarm reset	Resets an alarm.	
	B-2	NC	(No connection)		
	B-3	DIN_COM	Digital input common	For plus common and minus common	



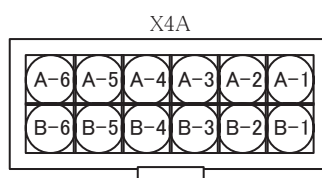
Connector	Model		Manufacturer
	Board connector	Compatible connector	
X1A	1318125-1	Housing: 1-1318119-4 Contact: 1318107-1	Tyco Electronics AMP K.K.
X2A	1318125-2	Housing: 2-1318119-4 Contact: 1318107-1	
X3A	1318124-1	Housing: 1-1318119-3 Contact: 1318107-1	

CAUTION

● For digital input signals, only transistor output can be connected.

8.6.3 Specifications of digital output signal connector

Connector	Pin No.	Terminal symbol	Name	Rated capacity	Function
X4A	A-1	DOUT1	Operation redy	24 VDC 50 mA MAX	Outputs pump operation ready status.
	A-2	DOUT2	Alarm output		Outputs alarm status. (Normal: ON, Alarm: OFF)
	A-3	DOUT3	Warning output		Outputs warning status. The output logic can be changed with the parameter. Refer to “10.2.2 Change warning output logic”.
	A-4	DOUT4	Axis 1 operation completion		Outputs Axis 1 operation status.
	A-5	DOUT5	Axis 2 operation completion		Outputs Axis 2 operation status.
	A-6	DOUT6	Axis 3 operation completion		Outputs Axis 3 operation status.
	B-1	DOUT7	Axis 4 operation completion		Outputs Axis 4 operation status.
	B-2	DOUT8	Axis 5 operation completion		Outputs Axis 5 operation status.
	B-3	DOUT9	Axis 6 operation completion		Outputs Axis 6 operation status.
	B-4	DOUT10	Axis 7 operation completion		Outputs Axis 7 operation status.
	B-5	DOUT11	Axis 8 operation completion		Outputs Axis 8 operation status.
	B-6	DOUT_COM	Digital output common		For plus common and minus common



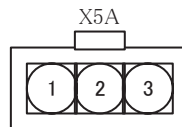
Connector	Model		Manufacturer
	Board connector	Compatible connector	
X4A	1318126-1	Housing: 1-1318118-6 Contact: 1318107-1	Tyco Electronics AMP K.K.



- To connect a digital output signal via a relay, provide surge-suppressing measures, or use a surge-suppressing component.

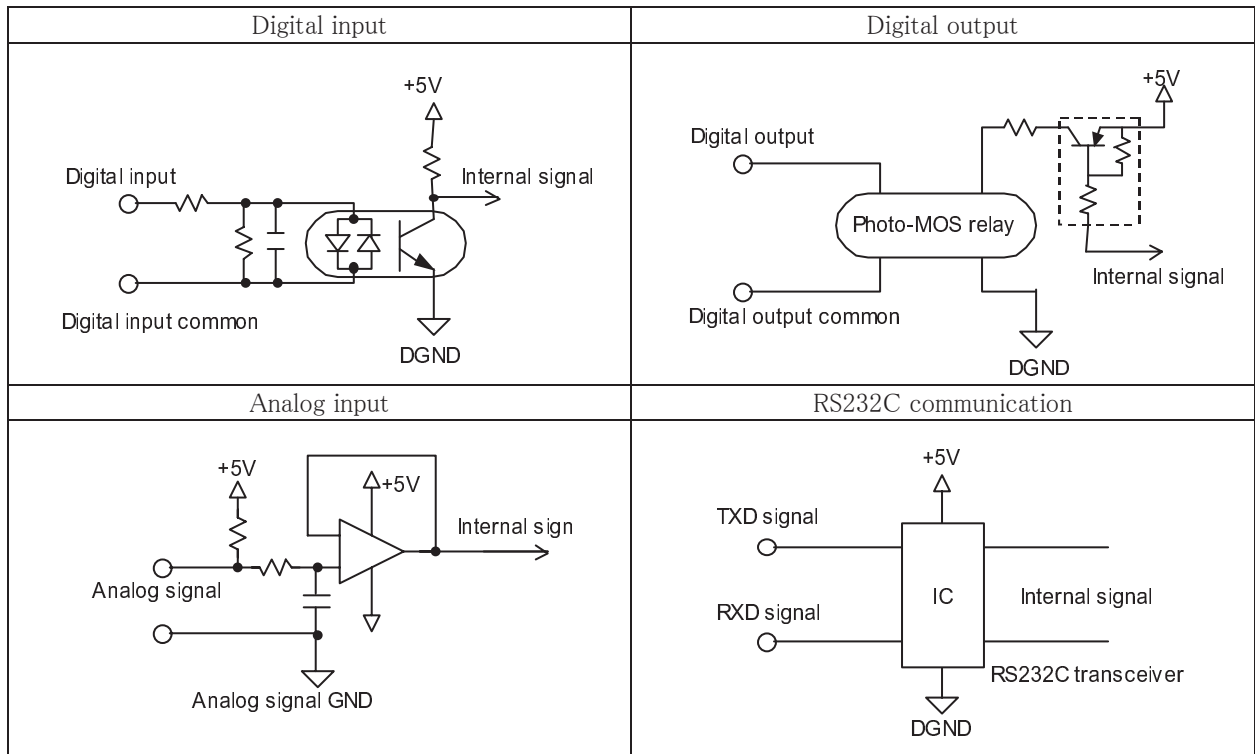
8.6.4 Specifications of RS232C communication connector

Connector	Pin No.	Terminal symbol	Name	Function
X5A	1	GND	GND	User serial communication
	2	TXD	Transmission	
	3	RXD	Reception	

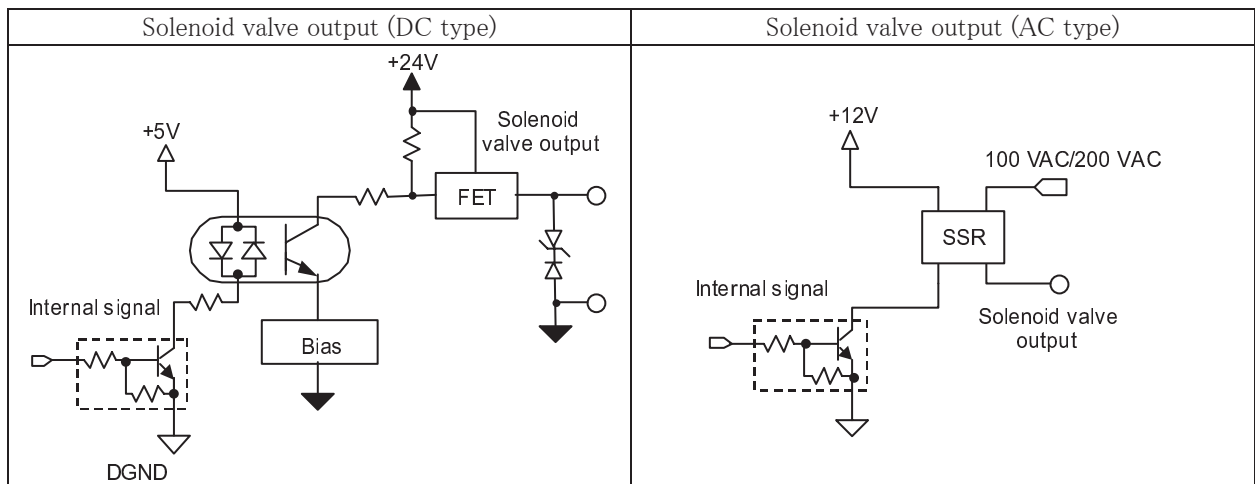


Connector	Model		Manufacturer
	Board connector	Compatible connector	
X5A	BH03B-XASK-BN	Housing: XAP-03V-1 Contact: SXA-001T-P0.6	JST Mfg. Co., Ltd.

8.6.5 I/O signal equivalent circuit



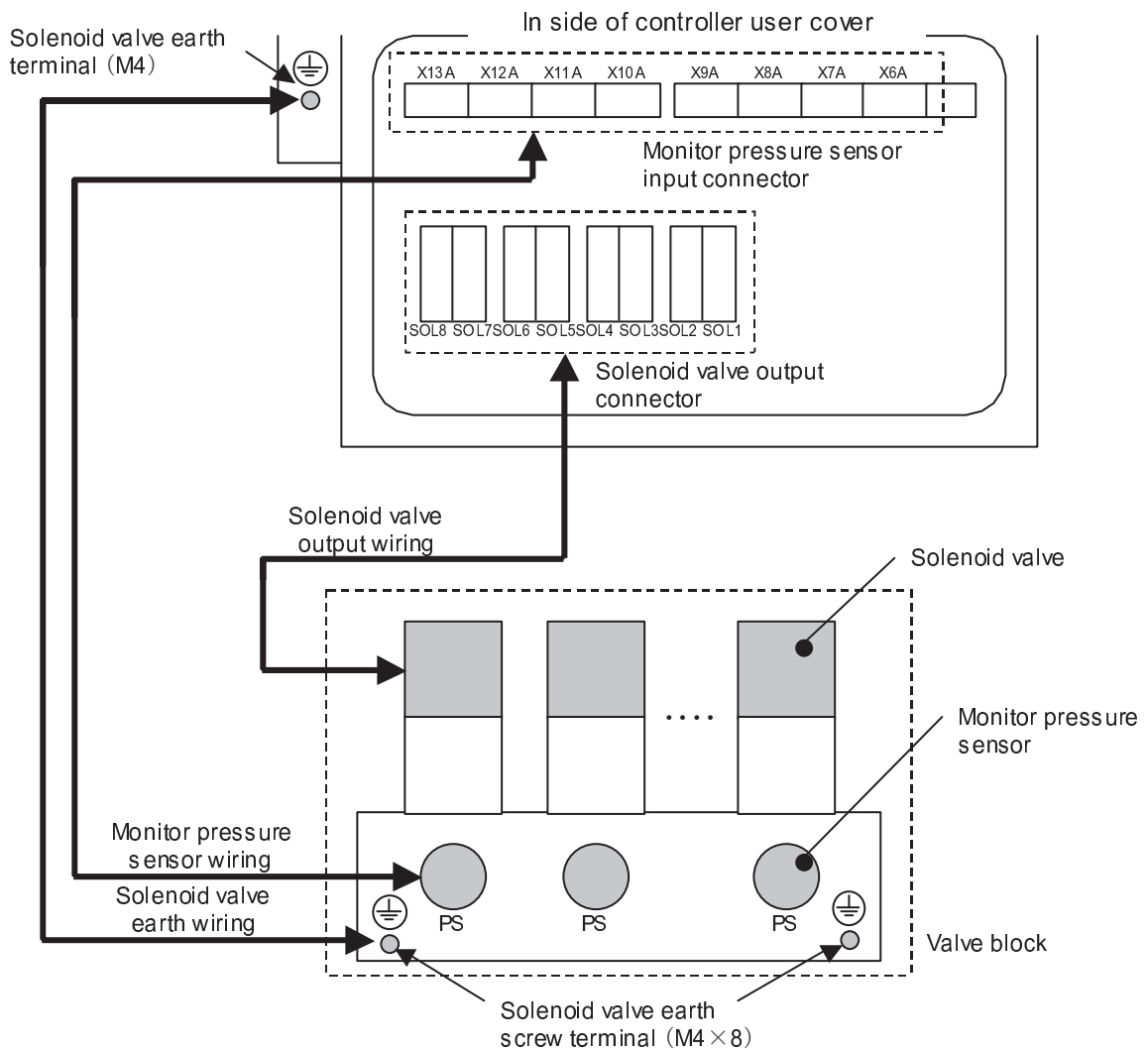
NOTE) In the above diagram, “DGND” and the analog signal GND have the same potential.



8.7 Wiring of “valve block separated type”

- With “valve block separated type”, connections of between hydraulic unit and valve block is required. For details, “8.8 Connecting solenoid valve output wiring” and “8.9 Connecting monitor pressure sensor wiring”
- For recommended cable types, sizes and connecting methods refer to “8.8 Connecting solenoid valve output wiring” and “8.9 Connecting monitor pressure sensor wiring”.
- With “valve block mounted type”, the wiring mentioned above has been connected before shipment. In such case, the wiring mentioned above is not required.

8.7.1 Outline of wiring



8.8 Connecting solenoid valve output wiring



- Before connecting solenoid valve outputs, make sure that the input power supply is OFF.



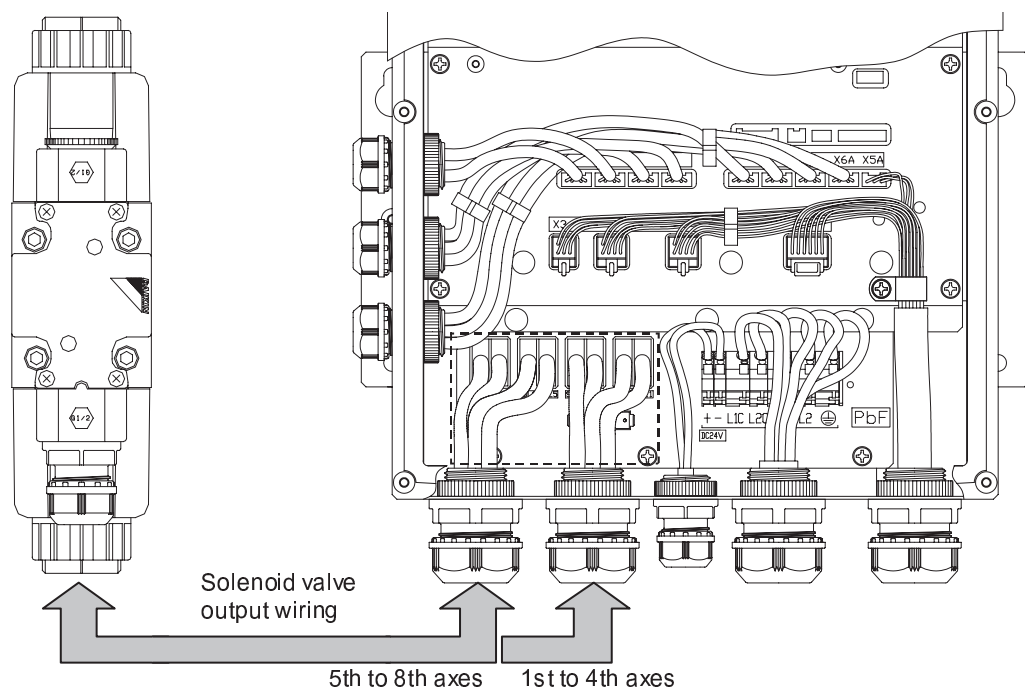
- To insert a cable into a cable clamp, use a multi-core cable. If the numbers of holes or more cables are inserted into a cable clamp, there is a clearance between each cable and the cable clamp. In such a condition, the cable clamp will not effectively function.
- Clamp unused hole of a cable clamp with blind bar. In such a condition, the cable clamp will not effectively function.
- Separate the solenoid valve output wiring and the monitor pressure sensor wiring. Do not bundle and wire them together in the same duct. Failure to observe this instruction may result in malfunction.

With solenoid valve output wiring, connections of solenoid valve output and solenoid valve earth. For details, “8.8.1 Solenoid valve output connecting procedure” and “8.8.3 Solenoid valve earth connecting procedure”.

8.8.1 Solenoid valve output connecting procedure

The controller provides a solenoid valve output connection. Connect the solenoid valve output through the connection port.

For the solenoid valve output connection port, a cable clamp of multi type is included in the product.



- 1) Prepare the solenoid valve output harness.

Solenoid valve output harness	Core wire cross-section area: 0.5 mm ² Recommended: SUNREX24 2464-1007/ II 0.5 mm ² × 3 core wires (Manufactured by TAIYO ELECTRIC WIRE & CABLE CO., LTD.)
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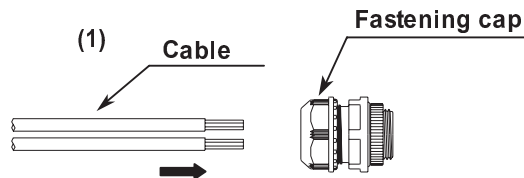
2) For wiring, use an attached cable clamp, so that the cable meets IP54 or higher protection rating.

Cable clamp for solenoid valve output connection port	Compatible cable diameter: 6 to 7mm Number of holes: 4 *Four blind bars are attached. Clamp unused hole of a cable clamp with blind bar.
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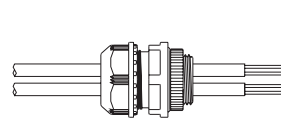
3) The solenoid valve outputs are connected with a connector. Prepare a compatible connector as required. For details, refer “8.8.2 Specifications of solenoid valve output connector”.


4) Fasten the cable with the cable clamp according to the following procedure.

(1) Loosen the fastening cap, and pass the cable.

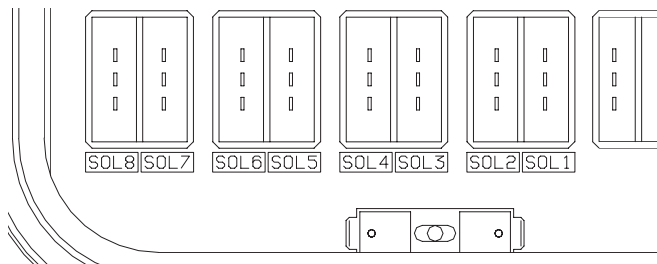


(2) Tighten the fastening cap to fasten the cap.



MEMO		Rubber Bush receives a cut.
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5) Connect the cable to the connector. The axis specifications of the connector are as follows.



Connector	Axis number
SOL1	1st axis
SOL2	2nd axis
SOL3	3rd axis
SOL4	4th axis
SOL5	5th axis
SOL6	6th axis
SOL7	7th axis
SOL8	8th axis

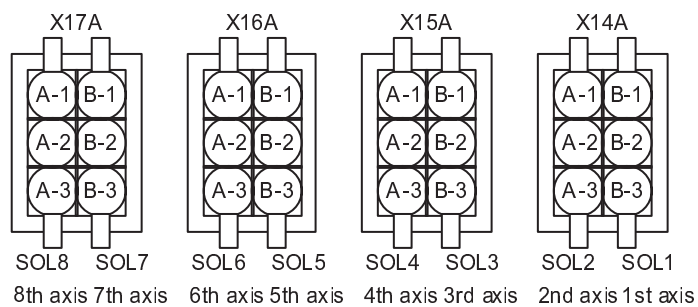
6) Connect the cable to the solenoid valve. Connect the cable depending on the control axis's number. About the number of the control axis of the solenoid valve, make sure of the specifications of the valve block.

MEMO	You can check operation of the solenoid valve manually with the operation panel. Refer “9.6.4 Solenoid valve operation”.
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⚠ CAUTION
<p>● Confirm an axis number, a connection connector, and connect without the mistake. A solenoid valve that was different from solenoid valve to at aim is energized when wired by mistake, causing unexpected operation.</p>

8.8.2 Specifications of solenoid valve output connector

Connector	Pin No.	Terminal symbol	Name	Function	
X14A	A-1	SOL_2a	SOL2-a axis output	Connect 2nd axis solenoid valve.	
	A-2	SOL_2b	SOL2-b axis output		
	A-3	COM	Common		
	B-1	B-1	SOL_1a	SOL1-a axis output	Connect 1st axis solenoid valve.
		B-2	SOL_1b	SOL1-b axis output	
		B-3	COM	Common	
X15A	A-1	SOL_4a	SOL4-a axis output	Connect 4th axis solenoid valve.	
	A-2	SOL_4b	SOL4-b axis output		
	A-3	COM	Common		
	B-1	B-1	SOL_3a	SOL3-a axis output	Connect 3rd axis solenoid valve.
		B-2	SOL_3b	SOL3-b axis output	
		B-3	COM	Common	
X16A	A-1	SOL_6a	SOL6-a axis output	Connect 6th axis solenoid valve.	
	A-2	SOL_6b	SOL6-b axis output		
	A-3	COM	Common		
	B-1	B-1	SOL_5a	SOL5-a axis output	Connect 5th axis solenoid valve.
		B-2	SOL_5b	SOL5-b axis output	
		B-3	COM	Common	
X17A	A-1	SOL_8a	SOL8-a axis output	Connect 8th axis solenoid valve.	
	A-2	SOL_8b	SOL8-b axis output		
	A-3	COM	Common		
	B-1	B-1	SOL_7a	SOL7-a axis output	Connect 7th axis solenoid valve.
		B-2	SOL_7b	SOL7-b axis output	
		B-3	COM	Common	



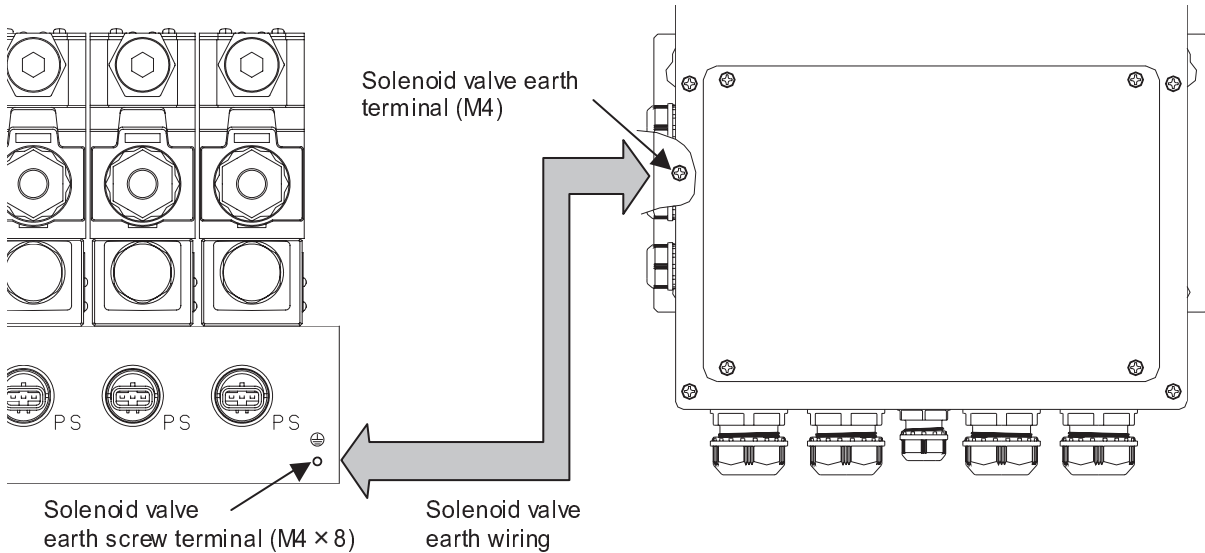
Connector	Model		Manufacturer
	Board connector	Compatible connector	
X14A to X17A	B06B-F31MK-GGXXR	Housing:F31FSS-03V-KX Contact:LF3F-41GF-P2.0	JST Mfg. Co., Ltd.

IMPORTANT	Give the length of the solenoid valve output harness for 10m at the maximum.
------------------	--

8.8.3 Solenoid valve earth connecting procedure

Connect the solenoid valve earth connection terminal of the controller to a manifold block.

In total four places of screw terminal are made for manifold block for the connection of the solenoid valve earth.

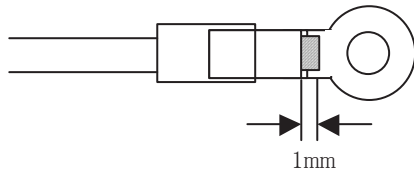


- 1) Prepare the solenoid valve earth harness.

Solenoid valve earth harness	Core wire cross-section area: 3.5 mm ² Recommended: UL1015 wires
------------------------------	--

- 2) The solenoid valve earth is connected with a crimp terminal. Prepare a compatible crimp terminal as required.

- Use a crimp terminal with the insulation sleeve of M4.
- Pressure bonding in the state that the core line part of the wire went for about 1mm from a terminal.



- 3) Connect a cable to the terminal of the controller.

- Screw: Cross-recessed pan head machine screw M4×10L
- Recommended tightening torque: 1.0[N·m]

- 4) Connect a cable to the manifold block.

- Screw terminal: M4×8
- Recommended tightening torque: 1.0[N·m]

8.9 Connecting monitor pressure sensor wiring



- Before connecting solenoid valve outputs, make sure that the input power supply is OFF.

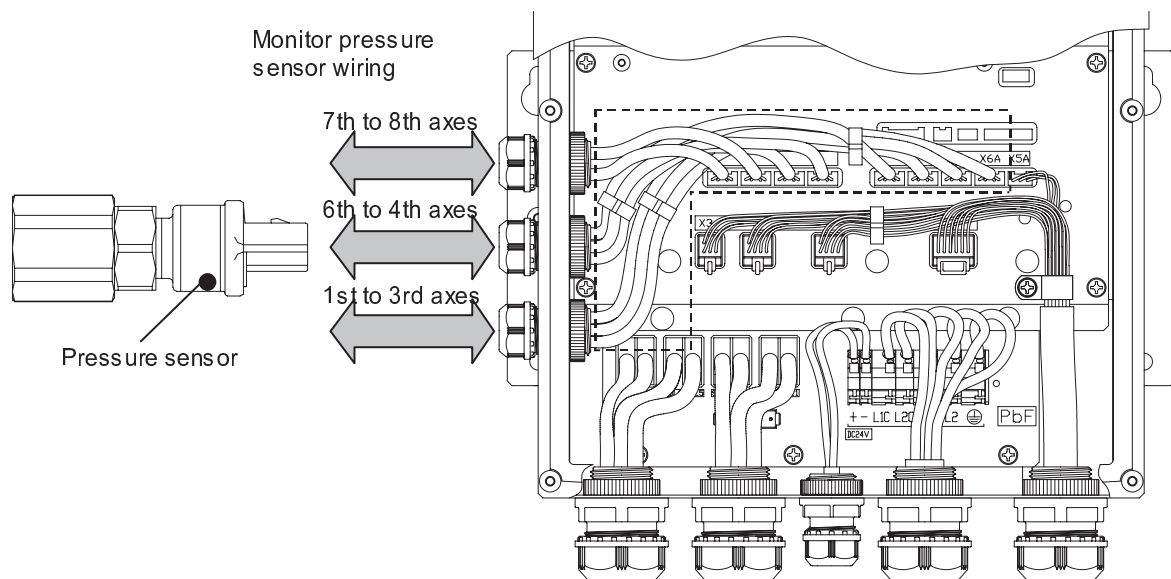


- To insert a cable into a cable clamp, use a multi-core cable. If the numbers of holes or more cables are inserted into a cable clamp, there is a clearance between each cable and the cable clamp. In such a condition, the cable clamp will not effectively function.
- Clamp unused hole of a cable clamp with blind bar. In such a condition, the cable clamp will not effectively function.
- Separate the solenoid valve output wiring and the monitor pressure sensor wiring. Do not bundle and wire them together in the same duct. Failure to observe this instruction may result in malfunction.

The controller provides a monitor pressure sensor connection. Connect the monitor pressure sensor through the connection port.

For the monitor pressure sensor connection port, a cable clamp of multi type is included in the product.

8.9.1 Monitor pressure sensor connecting procedure



- 1) Prepare the monitor pressure sensor harness.

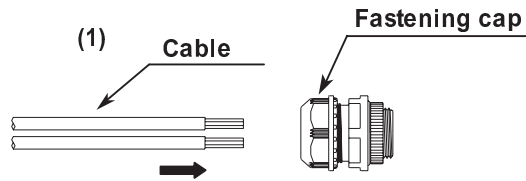
Monitor pressure sensor harness	Core wire cross-section area: 0.5 mm ² Recommended: KVC-36SBT 0.5 mm ² × 3 core wires (Manufactured by Kuramo Electric)
---------------------------------	---

- 2) For wiring, use an attached cable clamp, so that the cable meets IP54 or higher protection rating.

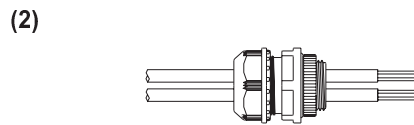
Cable clamp for solenoid valve output connection port	Compatible cable diameter: 6 to 7mm Number of holes: 3 *Three blind bars are attached. Clamp unused hole of a cable clamp with blind bar.
---	---


- 3) The monitor pressure sensors are connected with a connector. Prepare a compatible connector as required. For details, refer “8.9.2 Specifications of monitor pressure sensor connector”.
- 4) Fasten the cable with the cable clamp according to the following procedure.

(1) Loosen the fastening cap, and pass the cable.

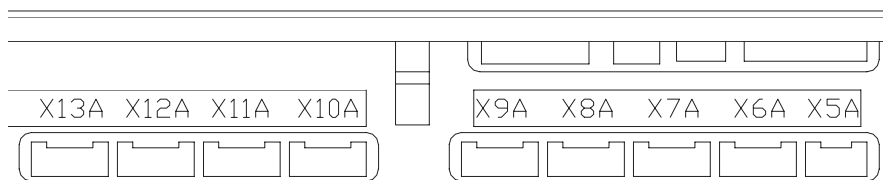


(2) Tighten the fastening cap to fasten the cap.



MEMO		Rubber Bush receives a cut.
-------------	---	-----------------------------

- 5) Connect the cable to the connector. The axis specifications of the connector are as follows.



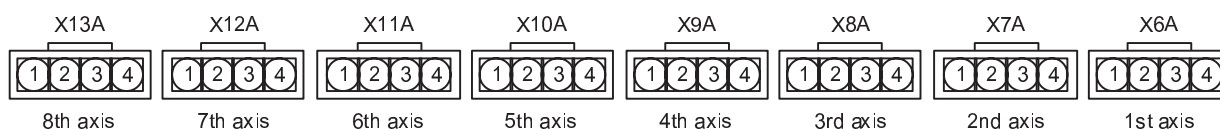
Connector	Axis number
X6A	1st axis
X7A	2nd axis
X8A	3rd axis
X9A	4th axis
X10A	5th axis
X11A	6th axis
X12A	7th axis
X13A	8th axis

- 6) Connect the cable to the pressure sensor. Connect the cable depending on the control axis’s number. About the number of the control axis of the monitor pressure sensor, make sure of the specifications of the valve block.

IMPORTANT	<p>Confirm an axis number, a connection connector, and connect without the mistake. This unit does not normally work when wired by mistake. In addition, cylinder pressure does not rise, and it operates continually, and overload alarm may occur.</p>
------------------	--

8.9.2 Specifications of monitor pressure sensor connector

Connector	Pin No.	Terminal symbol	Name	Function
X6A	1	AGND	ANALOG GND	Connect 1st axis solenoid valve.
	2	+5V	Sensor supply	
	3	PRESS1	Sensor output	
	4	FG	FRAME GND	
X7A	Specifications are the same as those for "X6A".			Connect 2nd axis solenoid valve.
X8A	Specifications are the same as those for "X6A".			Connect 3rd axis solenoid valve.
X9A	Specifications are the same as those for "X6A".			Connect 4th axis solenoid valve.
X10A	Specifications are the same as those for "X6A".			Connect 5th axis solenoid valve.
X11A	Specifications are the same as those for "X6A".			Connect 6th axis solenoid valve.
X12A	Specifications are the same as those for "X6A".			Connect 7th axis solenoid valve.
X13A	Specifications are the same as those for "X6A".			Connect 8th axis solenoid valve.

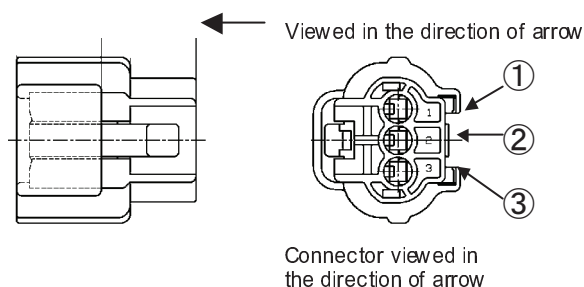


Connector	Model		Manufacturer
	Board connector	Compatible connector	
X6A to X13A	BH04B-XASK-BN	Housing: XAP-04V-1 Contact: SXA-001T-P0.6	JST Mfg. Co., Ltd.

IMPORTANT	● The cable connected on the controller side must be shielded.
	● Give the length of the pressure sensor harness for 10m at the maximum.

8.9.3 Specifications of pressure sensor connector





Connector	Pin No.	Name	Function
1	AGND	ANALOG GND	Monitor pre-charge pressure.
2	PRESS1	Sensor output	
3	+5V	Sensor supply	

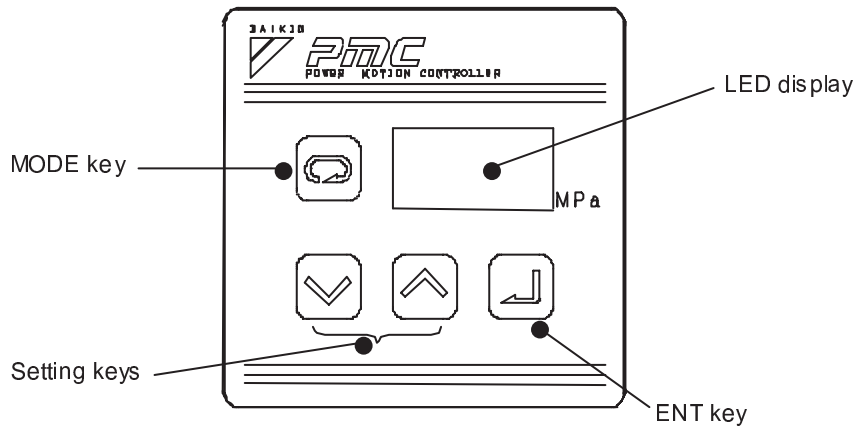






Model	Manufacturer
Housing: 174357-2 Contact: 171630-1 Rubber cover: 172746-1 Double-lock plate: 1-174358-1	Tyco Electronics AMP K.K.

Chapter 9 Operating the panel

9.1 Part names and principal functions of the operation panel

The operation panel is comprised of the LED display, [MODE]  key, Setting [UP/DOWN]   keys and [ENT]  key.

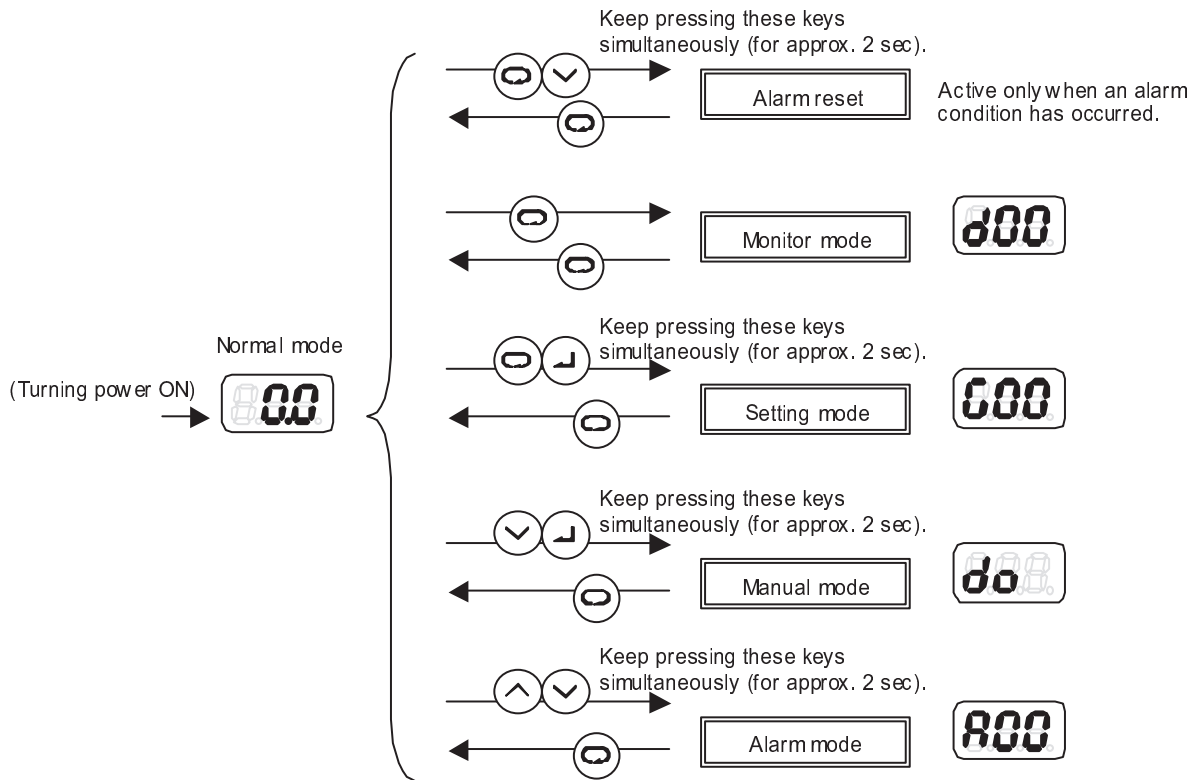


Name		Principal function	
LED display		Displays a monitor value (control pressure, etc.) and set values for various functions.	
MODE key		Used to display control pressure, or to select monitor mode, etc.	
Setting key	DOWN key		Used to select monitor data and parameter number, or to change a parameter value, etc. Pressing the [UP] key increases a preset value, and pressing the [DOWN] Key decreases a preset value.
	UP key		
ENT key		Used to register monitor data, parameter number and parameter set value.	

9.2 Functions of the operation panel

9.2.1 Outline of the functions

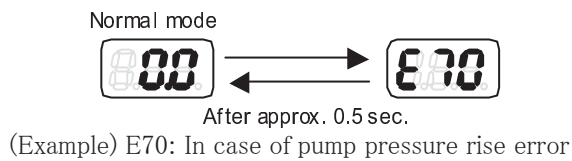
Mode	Description
Normal mode	Displays command input status, main circuit power supply input status, and pump pressure. When an alarm condition occurs, you can reset the alarm in this mode.
Monitor mode	You can check pump pressure, monitor pressure and digital input/output status.
Setting mode	You can set up various parameters.
Manual mode	Through panel operations, you can execute digital output operation, solenoid valve operation, manual operation, teaching operation and continuous operation.
Alarm mode	Displays alarm codes that occurred in the past. You can check up to 8 alarm events in the past.



IMPORTANT	Do not operate any key other than those specified in this manual.
------------------	---

9.2.2 Indication of alarm and warning conditions

Once an alarm condition occurs, the display shifts to the normal mode from any mode. The LED display alternately shows the corresponding alarm code and status. For details of the alternately displayed status, refer to “9.3.1 Indication of the normal mode screen”.



MEMO	Even when an alarm code is displayed, you can perform mode changing operations as usual.
-------------	--

During occurrence of a warning condition, the warning code is alternately displayed in the currently selected mode.

9.3 Nomal mode

9.3.1 Indication of the normal mode screen

The normal mode displays command input status, main circuit power supply input status, and pump pressure. The relationship between the displayed code and the status is as follows:

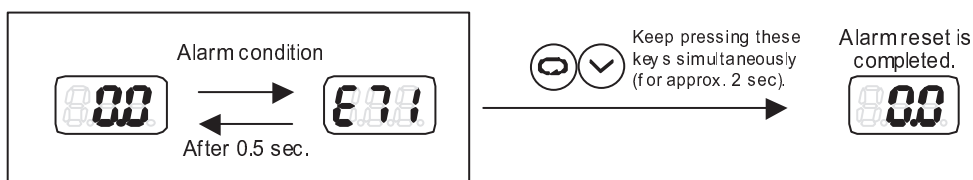
Display	Status	Status		Description
		Main circuit power supply	DIN17 operation command	
	During initialization	—	—	Indicates that the control power supply has turned ON and the controller initialization is in progress.
	Standby 1	OFF	OFF	Indicates that both main circuit power supply and operation command are OFF.
	Standby 2	ON	OFF	Indicates that the main circuit power supply has turned ON.
	Standby 3	OFF	ON	Indicates that the operation command is ON although the main circuit power supply is OFF.
	Charging	ON	—	Indicates that the main circuit power supply has turned ON and the capacitor is being charged.
	Preparation for standup	ON	ON	Indicates that pump is being prepared for startup. For pump startup preparation, refer to “12.1.3 Pump startup preparation”.
	Ready			When the pump startup preparation is completed, the pump pressure is displayed.

MEMO	<p>If the pump startup preparation is not executed due to an alarm condition although both main circuit power supply and operation command are ON, the display shows , as with the “Standby 2” status.</p>
-------------	---

9.3.2 Resetting an alarm on the panel

During occurrence of an alarm condition, you can reset the alarm through panel operations in the normal mode.

Keep pressing the [MODE] and [DOWN] keys simultaneously (for approx. 2 seconds) during occurrence of an alarm condition to execute alarm reset.



CAUTION

If alarm reset is executed when the operation command signal and the axis selection signal are ON, the hydraulic unit starts running after the alarm is reset. Before executing alarm reset, make sure that the operation command signal and the axis selection signal are OFF.

MEMO	<ul style="list-style-type: none"> Alarm reset may be disabled depending on the alarm condition. For details, refer to “Chapter 13 Maintenance and Inspection”. If alarm reset is executed with no alarm condition, the alarm reset operation is ignored.
-------------	---

9.4 Monitor mode

9.4.1 Monitor mode display items

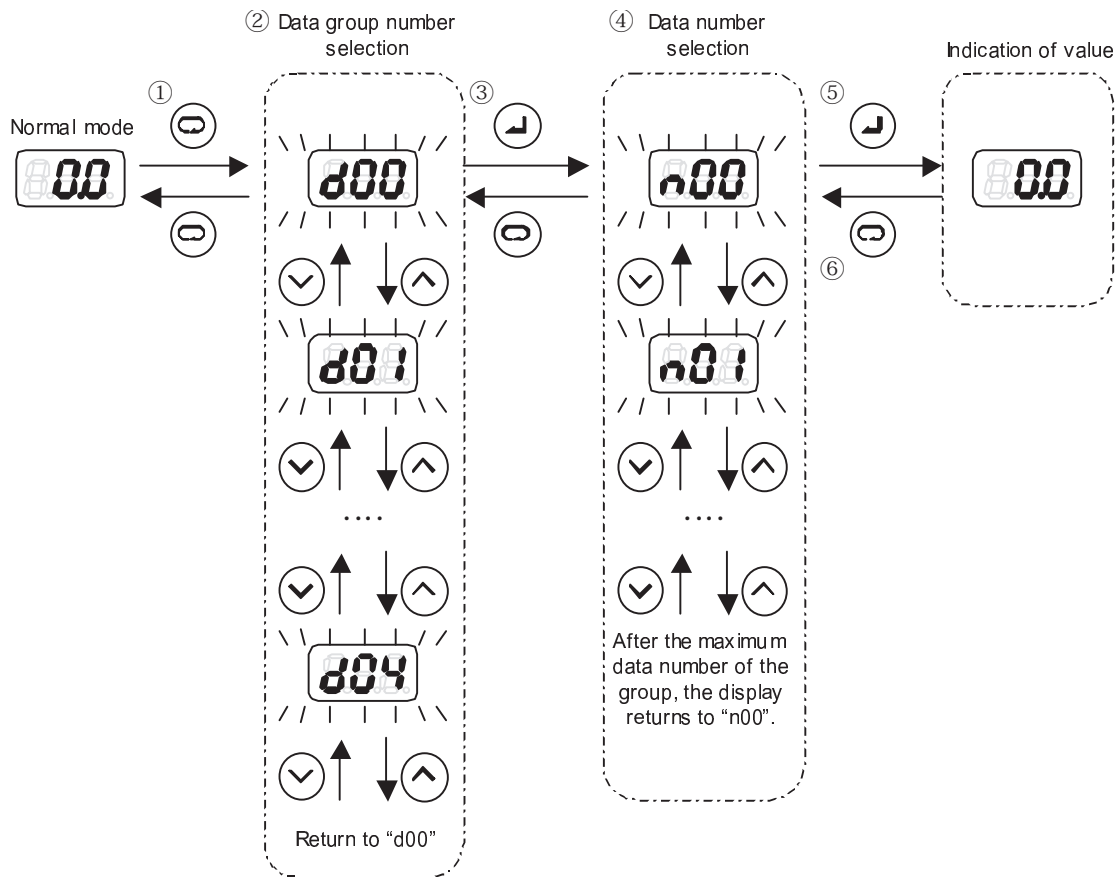
The monitor mode allows you to check the current pressure, speed command value and digital input/output status.









The data that can be monitored are listed below.

Group No.	Date No.	Name	Unit	Description																
d00 Pressure monitor	n00	Pump pressure	MPa	Displays a pump pressure. (The displayed value is rounded off to the digit of 0.01 MPa.)																
	n01	Axis 1 monitor pressure	MPa	Displays pressure for each axis. (The displayed value is rounded off to the digit of 0.01 MPa.) For an axis with no pressure sensor connected, “0.0” is displayed.																
	n02	Axis 2 monitor pressure	MPa																	
	n03	Axis 3 monitor pressure	MPa																	
	n04	Axis 4 monitor pressure	MPa																	
	n05	Axis 5 monitor pressure	MPa																	
	n06	Axis 6 monitor pressure	MPa																	
	n07	Axis 7 monitor pressure	MPa																	
	n08	Axis 8 monitor pressure	MPa																	
d01 DIO status	n00	Digital input status 1 DIN1 – DIN12	—		Displays digital input status. For the displayed code, refer to “9.4.3 Indication of digital I/O status”.															
	n01	Digital input status 2 DIN13 – DIN20	—																	
	n02	Digital output status DOUT1 – DOUT11	—																	
	n03	Solenoid valve output status 1 1a – 4b	—	Displays solenoid valve output status. For the displayed code, refer to “9.4.4 Indication of solenoid valve output status”.																
	n04	Solenoid valve output status 2 5a – 8b	—																	
d02 system status	n00	Control axis	—	Displays an axis under control. “Under control” means that the axis is currently under operation and pressure control and the pump is running. <table border="1" style="margin-top: 10px; width: 100%;"> <thead> <tr> <th>Display</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>off</td> <td>Control OFF status</td> </tr> <tr> <td>1A</td> <td>Axis 1 “SOL-a” is under control.</td> </tr> <tr> <td>1b</td> <td>Axis 1 “SOL-a” is under control.</td> </tr> <tr> <td>2A</td> <td>Axis 2 “SOL-a” is under control.</td> </tr> <tr> <td>2b</td> <td>Axis 2 “SOL-a” is under control.</td> </tr> <tr> <td>••</td> <td></td> </tr> <tr> <td>8b</td> <td>Axis 8 “SOL-a” is under control.</td> </tr> </tbody> </table>	Display	Description	off	Control OFF status	1A	Axis 1 “SOL-a” is under control.	1b	Axis 1 “SOL-a” is under control.	2A	Axis 2 “SOL-a” is under control.	2b	Axis 2 “SOL-a” is under control.	••		8b	Axis 8 “SOL-a” is under control.
	Display	Description																		
off	Control OFF status																			
1A	Axis 1 “SOL-a” is under control.																			
1b	Axis 1 “SOL-a” is under control.																			
2A	Axis 2 “SOL-a” is under control.																			
2b	Axis 2 “SOL-a” is under control.																			
••																				
8b	Axis 8 “SOL-a” is under control.																			
n01	Motor rotation speed	10min ⁻¹	Displays the current motor rotation speed.																	

Group No.	Date No.	Name	Unit	Description
	n02	Pump discharge rate	L/min	Displays the current pump discharge rate. The pump discharge rate is a theoretical value.
	n03	Motor current	Arms	Displays the current motor current.
	n04	Motor load factor	%	Displays the current motor load factor.
	n05	Motor temperature	°C	Displays the current motor temperature.
	n06	Controller temperature	°C	Displays the current temperature in the controller.
	n07	Radiator fin temperature	°C	Displays the current radiator fin temperature.
	n08	Main circuit DC voltage	V	Displays the current DC voltage of the main circuit.
	n09	Motor overload factor	%	Displays the current motor overload factor. The overload factor indicates total load of the electronic thermal relay.
	n10	Controller overload factor	%	Displays the current controller overload factor. The overload factor indicates total load of the electronic thermal relay.
	d03 Alarm status	n00	Alarm status 1	—
n01		Alarm status 2	—	
n02		Alarm status 3	—	
n03		Alarm status 4	—	
n04		Alarm status 5	—	
n05		Alarm status 6	—	
n06		Warning status 1	—	Displays warning status. You can check several warning statuses simultaneously. For the displayed code, refer to “9.4.6 Indication of warning status”.
d04 Program information	n00	Program type	—	Displays the program type. 000: Standard program
	n01	Revision	—	Displays program revision information.
	n02	Non-standard revision	—	Displays non-standard program revision information.
	n03	Model setting No.	—	Displays the model setting No.

9.4.2 Operations of the monitor mode



- ① Press the [MODE]  key in the normal mode. Then, the display shifts to the monitor mode.
- ② Select a data group number with the [UP]  or [DOWN]  key. During selection of a data group number, the display blinks.
- ③ Press the [ENT]  key to register the data group number. Then, select a data number.
- ④ Select a data number with the [UP]  or [DOWN]  key. During selection of a data number, the display blinks.
- ⑤ Press the [ENT]  key to register the data number. Then, the display shows a value.
- ⑥ Return to the data number selection screen with the [MODE]  key.

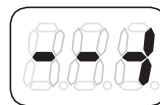
9.4.3 Indication of digital I/O status

The digital input/output signal ON/OFF status is assigned to each LED as shown below. The signal ON/OFF status is indicated by the lit and unlit conditions of the corresponding LEDs, respectively.

LED number	Digital input status 1 (d01-n00)	Digital input status 2 (d01-n01)	Digital output status (d01-n02)
1	DIN1 (Axis selection 1a)	DIN13 (Axis selection 7a)	DOUT1 (Operation ready)
2	DIN2 (Axis selection 1b)	DIN14 (Axis selection 7b)	DOUT2 (Alarm output)
3	DIN3 (Axis selection 2a)	DIN15 (Axis selection 8a)	DOUT3 (Warning output)
4	DIN4 (Axis selection 2b)	DIN16 (Axis selection 8b)	DOUT4 (Axis 1 operation completion)
5	DIN5 (Axis selection 3a)	DIN17 (Operation command)	DOUT5 (Axis 2 operation completion)
6	DIN6 (Axis selection 3b)	DIN18 (Not used)	DOUT6 (Axis 3 operation completion)
7	DIN7 (Axis selection 4a)	DIN19 (Speed change command)	DOUT7 (Axis 4 operation completion)
8	DIN8 (Axis selection 4b)	DIN20 (Alarm reset)	DOUT8 (Axis 5 operation completion)
9	DIN9 (Axis selection 5a)	/	DOUT9 (Axis 6 operation completion)
10	DIN10 (Axis selection 5b)		DOUT10 (Axis 7 operation completion)
11	DIN11 (Axis selection 6a)		DOUT11 (Axis 8 operation completion)
12	DIN12 (Axis selection 6b)		

(Example 1)

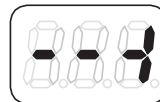
Indication of digital input status when DIN1 and DIN2 are ON and other inputs are OFF



(Digital input status 1)

(Example 2)

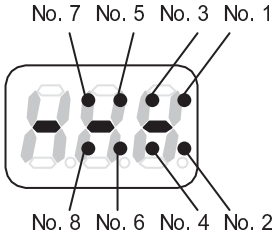
Indication of digital output status when DOUT1 is ON and the unit is in normal condition



(Digital output status)

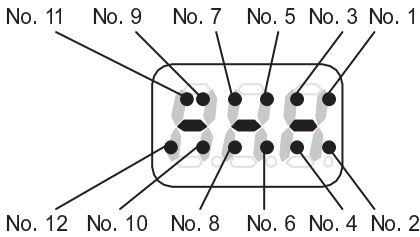
9.4.4 Indication of solenoid valve output status

The solenoid valve output signal monitor indication is assigned to each LED as shown below. The solenoid valve ON/OFF status is indicated by the lit and unlit conditions of the corresponding LEDs, respectively.

	LED number	Solenoid valve output status 1 (d01-n03)	Solenoid valve output status 2 (d01-n04)
	1	SOL-1a	SOL-5a
	2	SOL-1b	SOL-5b
	3	SOL-2a	SOL-6a
	4	SOL-2b	SOL-6b
	5	SOL-3a	SOL-7a
	6	SOL-3b	SOL-7b
	7	SOL-4a	SOL-8a
	8	SOL-4b	SOL-8b

9.4.5 Indication of alarm status

The alarm status monitor indication is assigned to each LED as shown below. The alarm status is indicated by the lit and unlit conditions of the corresponding LEDs. The lit LED indicates occurrence of an alarm condition. The unlit LED indicates no alarm condition.

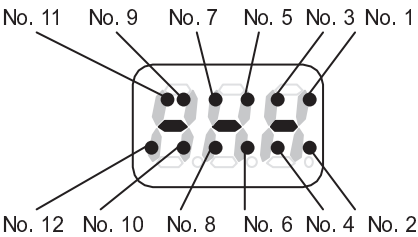
			
LED number	Alarm status 1 (d03-n00)	Alarm status 2 (d03-n01)	Alarm status 3 (d03-n02)
1	Inverter initialization	(Reserve)	(Reserve)
2	CPU error	Output device error	Controller thermistor cable break/short-circuit
3	(Reserve)	Motor over-current	Controller overload
4	Parameter error	Motor over-speed	Controller overheat
5	Radiator fin thermistor cable break/short circuit	Pump startup preparation error	Solenoid valve short-circuit
6	Encoder cable break	(Reserve)	Main circuit power supply error
7	Motor cable break	Motor thermistor cable break/short circuit	Motor synchronization error
8	(Reserve)	Motor overheat	
9	Radiator fin overheat	(Reserve)	
10	Main circuit under-voltage	(Reserve)	
11	Main circuit over-voltage	(Reserve)	
12	Motor overload	(Reserve)	

LED number	Alarm status 4 (d03-n03)	Alarm status 5 (d03-n04)	Alarm status 6 (d03-n05)
1	Speed deviation error	Monitor pressure sensor 4 cable break/short-circuit	Axis 8 pressure rise error
2	(Reserve)	Monitor pressure sensor 5 cable break/short-circuit	Parameter setting error
3	(Reserve)	Monitor pressure sensor 6 cable break/short-circuit	
4	(Reserve)	Monitor pressure sensor 7 cable break/short-circuit	
5	(Reserve)	Monitor pressure sensor 8 cable break/short-circuit	
6	Pump pressure sensor cable break/short-circuit	Axis 1 pressure rise error	
7	Dry run error	Axis 2 pressure rise error	
8	Pump pressure rise error	Axis 3 pressure rise error	
9	(Reserve)	Axis 4 pressure rise error	
10	Monitor pressure sensor 1 cable break/short-circuit	Axis 5 pressure rise error	
11	Monitor pressure sensor 2 cable break/short-circuit	Axis 6 pressure rise error	
12	Monitor pressure sensor 3 cable break/short-circuit	Axis 7 pressure rise error	

9.4.6 Indication of warning status

The warning status monitor indication is assigned to each LED as shown below. The warning status is indicated by the lit and unlit conditions of the corresponding LEDs. The lit LED indicates occurrence of a warning condition. The unlit LED indicates no warning condition.

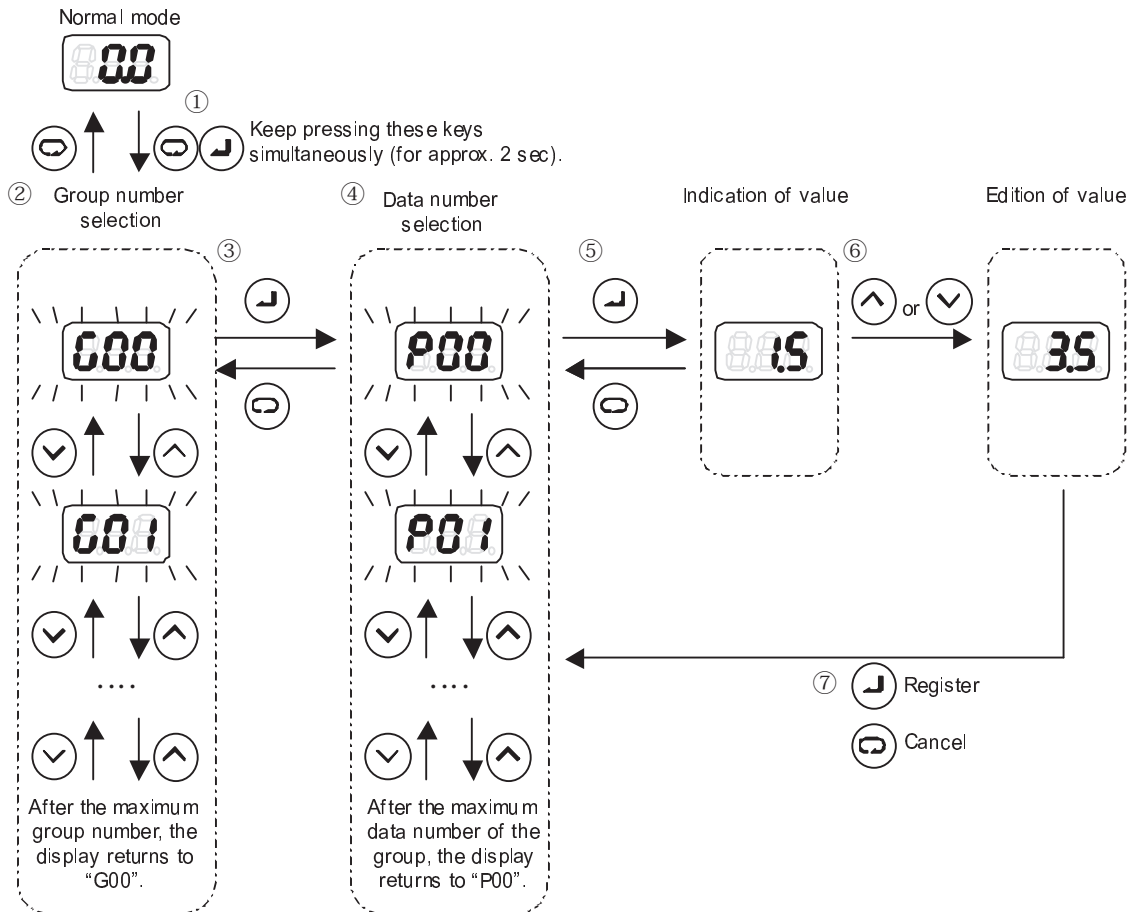
LED number	Warning status 1 (d03-n06)
1	Radiator fin overheat warning
2	Motor overheat warning
3	Motor overload warning
4	(Reserve)
5	(Reserve)
6	Waiting for pump startup
7	(Reserve)
8	(Reserve)
9	Controller overheat warning
10	Controller overload warning
11	
12	



9.5 Setting mode



The setting mode allows you to set up parameters. For details on the parameters, refer to Chapter 10 “Description on Parameters”.

9.5.1 Operations of the setting mode



- ① Keep pressing the [MODE] and [ENT] keys simultaneously (for approx. 2 seconds) in the normal mode. Then, the display shifts to the setting mode.
- ② Select a group number with the [UP] or [DOWN] key. During selection of a data group number, the display blinks.
- ③ Press the [ENT] key to register the group number.
- ④ Select a parameter number with the [UP] or [DOWN] key. During selection of a parameter number, the display blinks.
- ⑤ Press the [ENT] key to register the parameter number. Then, the display shows a set value.
- ⑥ Edit the value with the [UP] or [DOWN] key.

MEMO	If you keep pressing the [DOWN] or [UP] key for 2 seconds or longer in the value edition screen, the displayed value increases or decreases by ten.
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- ⑦ Press the [ENT]  key to register the set value, and return to the parameter number selection screen.
- Quit the setting mode with the [MODE]  key, and return to the parameter number selection screen.

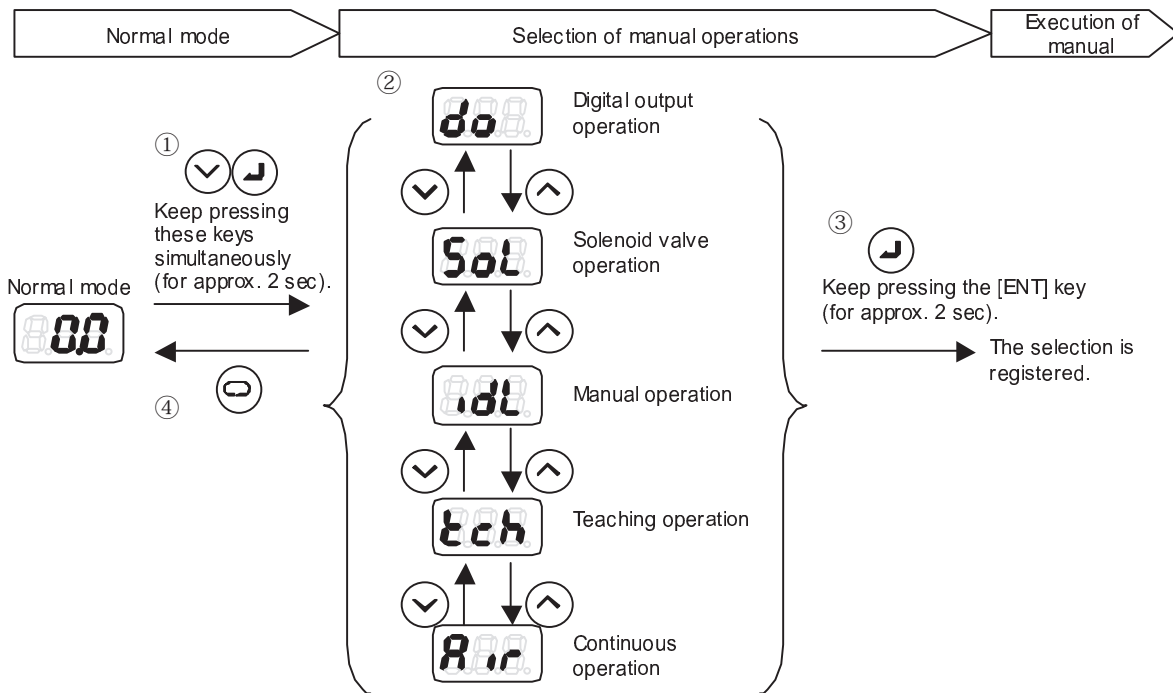
9.6 Manual mode







The manual mode enables the following operations:

Operation	Description
Digital output operation	You can individually turn ON/OFF the digital output terminals. This function can be used to check wiring of each digital output signal.
Solenoid valve operation	You can individually turn ON/OFF the “SOL-a” and “SOL-b” solenoid valves of each axis. This function can be used to check operation of the solenoid valves.
Manual operation	You can operate the hydraulic unit manually with the operation panel, even if the digital input signal is not connected.
Teaching operation	Through teaching operation for each axis, the hydraulic unit can apply pressure during cylinder stroke while reducing pressure surge. Be sure to execute teaching operation.
Continuous operation	The hydraulic unit continuously operates under constant pressure. This function can be used for air bleeding.

IMPORTANT	<ul style="list-style-type: none"> ● In the manual mode, digital input signals are disabled. To enable digital input signals, quit the manual mode, and return to the normal mode. ● In the manual mode, digital output signals other than DOUT1 to DOUT3 are OFF. To restore them to the original output status, quit the manual mode, and return to the normal mode. ● The manual mode includes selection of manual operations described in “9.6.1 Selection of manual operations”.
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9.6.1 Selection of manual operations

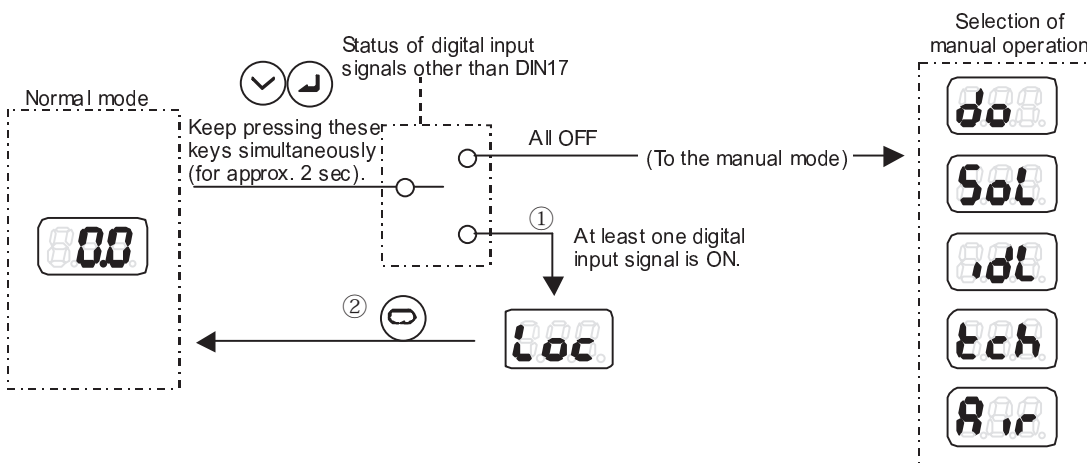



- ① Keep pressing the [DOWN]  and [ENT]  keys simultaneously (for approx. 2 seconds) in the normal mode.
- ② The manual operation menu appears. Select a desired manual operation with the [UP]  or [DOWN]  key.
- ③ Keep pressing the [ENT]  key (for approx. 2 seconds) to register the selection.
- ④ To return to the normal mode, press the [MODE]  key on the manual operation selection screen.

9.6.2 Manual operation lock

If at least one of the digital input signals other than “DIN17: Operation command” is ON, manual operation is disabled.

Before selecting manual operation, turn OFF all digital input signals other than “DIN17: Operation command”.




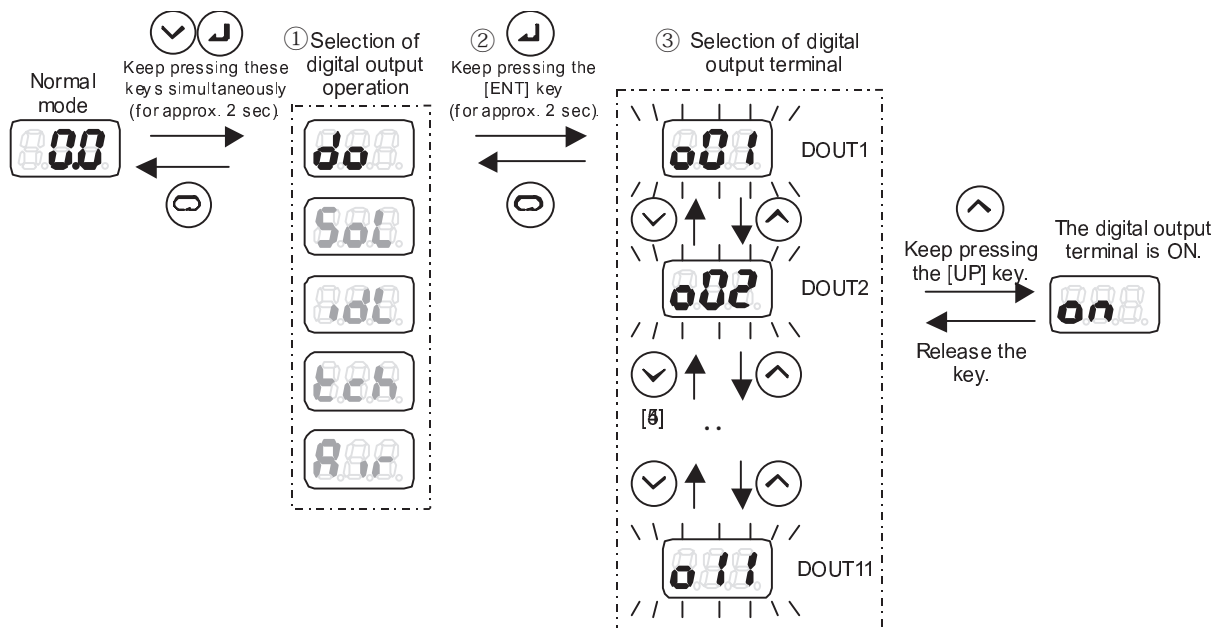
① During selection of the manual mode from the normal mode, if at least one of the digital input signals other than “DIN17: Operation command” is ON, the LED display shows .


② If  is displayed, press the [MODE]  key to return to the normal mode, and turn OFF all digital input signals other than “DIN17 Operation command”. Then, select the manual mode again.

9.6.3 Digital output operation



Through panel operations, you can turn ON/OFF the digital output terminals individually. Use this function to check wiring of each digital output signal.

IMPORTANT	<ul style="list-style-type: none"> ● Digital input signals activated in manual operation (axis selection signal, etc.) are disabled. ● When the digital output operation is selected and registered, all digital output terminals turn OFF. ● If  is displayed during selection of the manual operation, any digital input signal other than “DIN17 Operation command” is ON. Refer to “9.6.2 Manual operation lock”.
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- ① Select “do” (digital output signal operation) in the manual mode.
- ② Keep pressing the [ENT]  key (for approx. 2 seconds). The digital output terminal selection screen appears.

IMPORTANT	In this status, all digital output terminals are OFF.
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- ③ With the [UP]  or [DOWN]  key, select a digital output terminal to be manually operated. The displayed codes and the corresponding output terminals are as listed below.

Displayed code	Output terminal	Displayed code	Output terminal	Displayed code	Output terminal
o01	DOUT1	o05	DOUT5	o09	DOUT9
o02	DOUT2	o06	DOUT6	o10	DOUT10
o03	DOUT3	o07	DOUT7	o11	DOUT11
o04	DOUT4	o08	DOUT8		


- ④ If you keep pressing the [UP]  key, the selected digital output terminal turns ON, and the display shows “on”. When the key is released, the output signal turns OFF, and the display returns to the terminal selection screen.
- ⑤ Press the [MODE]  key to return to the manual operation selection screen.

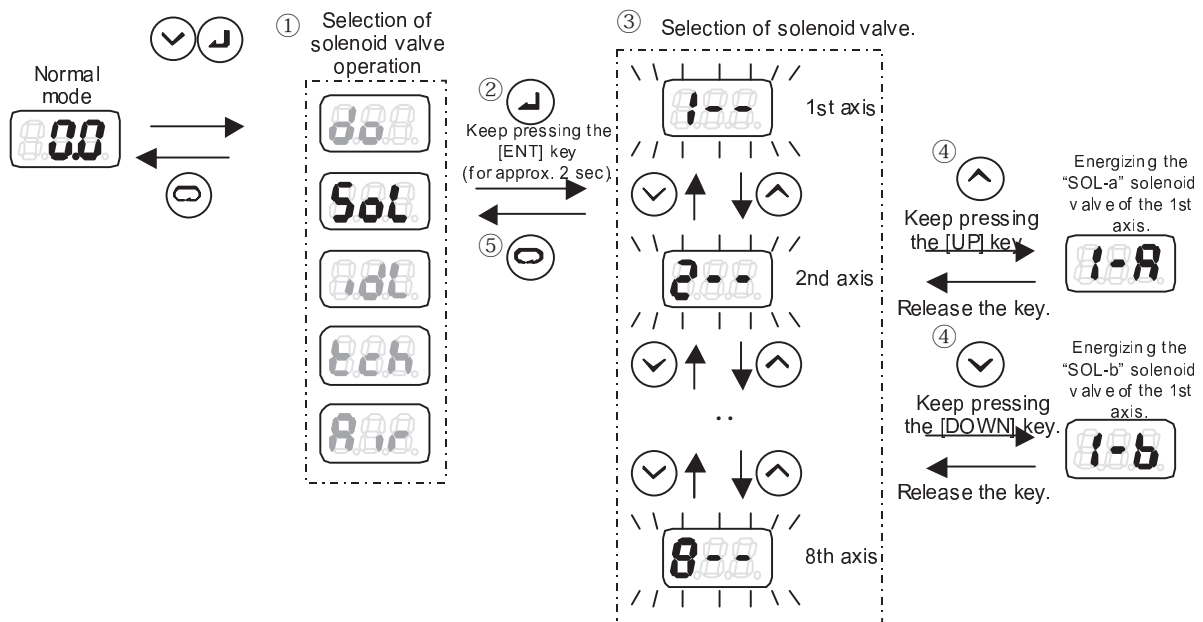
IMPORTANT	When the display returns to the manual operation selection screen, the digital output terminals are restored to the original output status.
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9.6.4 Solenoid valve operation

You can individually turn ON/OFF the “SOL-a” and “SOL-b” solenoid valves of each axis. Use this function to check operation of the solenoid valves.

The solenoid valve operation turns ON/OFF the solenoid valves only. (It does not start the pump.)


IMPORTANT	<ul style="list-style-type: none"> ● Digital input signals activated in manual operation (axis selection signal, etc.) are disabled. ● If  is displayed during selection of the manual operation, any digital input signal other than “DIN17 Operation command” is ON. Refer to “9.6.2 Manual operation lock”.
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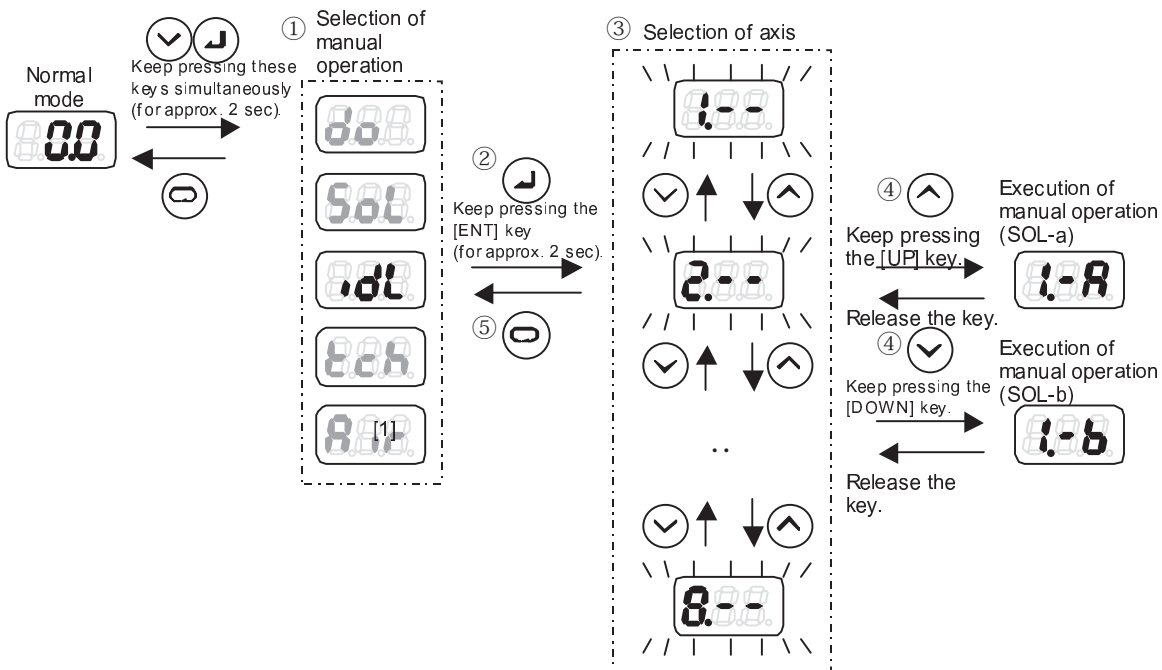


- ① Select “SoL” (solenoid valve operation) in the manual mode.
- ② Keep pressing the [ENT]  key (for approx. 2 seconds).
- ③ With the [UP]  or [DOWN]  key, select a solenoid valve to be manually operated.
The axis numbers are assigned as 1st axis, 2nd axis, ... in sequence from the bottom of the manifold block mounted to the hydraulic unit.
For the axis numbers, refer to “2.2.1 Control axis number”.
- ④ If you keep pressing the [UP]  key, the “SOL-a” solenoid valve turns ON. If you keep pressing the [DOWN]  key, the “SOL-b” solenoid valve turns ON.
- ⑤ Return to the manual operation selection screen with the [MODE]  key.

9.6.5 Manual operation



You can operate the hydraulic unit manually with the operation panel. Even when digital I/O signals are not connected, you can check the hydraulic piping and cylinder operation.

IMPORTANT	<ul style="list-style-type: none"> ● Digital input signals activated in manual operation (axis selection signal, etc.) are disabled. ● If  is displayed during selection of the manual operation, any digital input signal other than “DIN17 Operation command” is ON. Refer to “9.6.2 Manual operation lock”.
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① Select “idL” (manual operation) in the manual mode.


② Keep pressing the [ENT]  key (for approx. 2 seconds).

With the [UP]  or [DOWN]  key, select an axis to be manually operated.

During selection of an axis in manual operation, the dot at the left end of the display panel lights up. The axis numbers are assigned as 1st axis, 2nd axis, ... in sequence from the bottom of the manifold block mounted to the hydraulic unit.

For the axis numbers, refer to “2.2.1 Control axis number”.

③ If you keep pressing the [UP]  key, “SOL-a” of the selected axis turns ON, and manual operation is enabled.

If you keep pressing the [DOWN]  key, “SOL-b” of the selected axis turns ON, and manual operation is enabled.

When each key is released, the axis selection is canceled, and manual operation is disabled.


④ Return to the manual operation selection screen with the [MODE]  key.

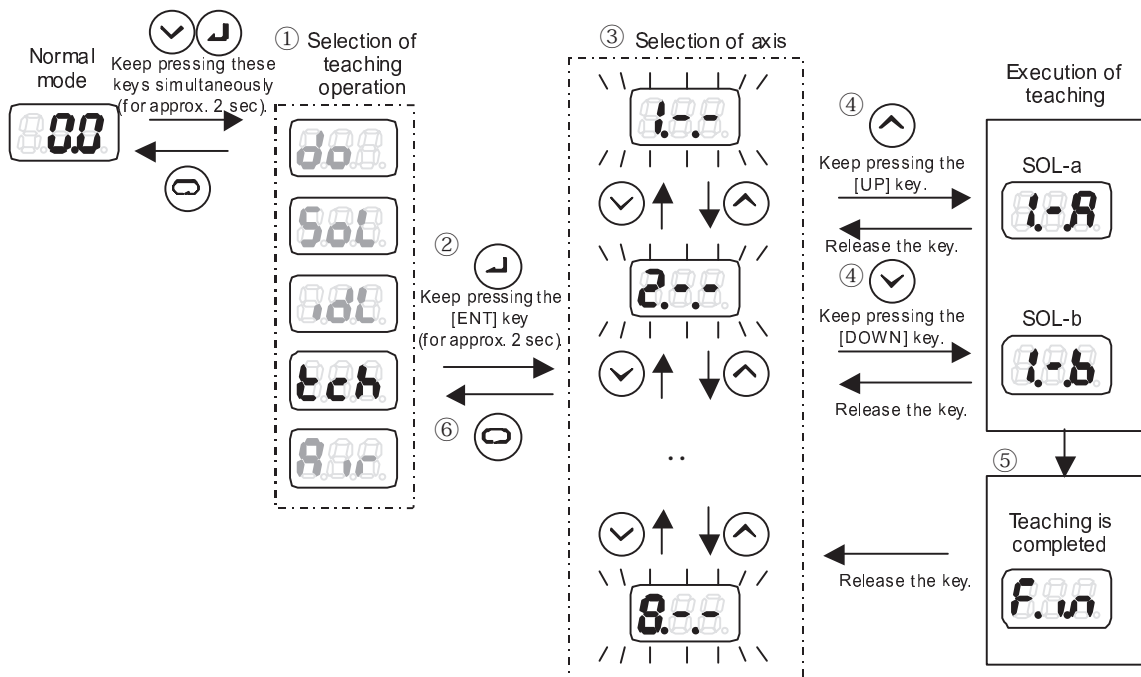
IMPORTANT	<ul style="list-style-type: none"> ● In manual operation, the “operation completion” digital output signals remains OFF even after the operation is completed. ● Selection of an unused axis is invalid, disabling manual operation.
------------------	--






MEMO	Manual operation is based on the pressure and flow rate of each axis specified with the parameters.
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9.6.6 Teaching operation

If teaching operation is executed for the “SOL-a” and “SOL-b” solenoid valves for all axes being used, the surge suppressing function that reduces pressure surge is enabled.

IMPORTANT	<ul style="list-style-type: none"> ● Digital input signals activated in manual operation (axis selection signal, etc.) are disabled. ● If  is displayed during selection of the manual operation, any digital input signal other than “DIN17 Operation command” is ON. Refer to “9.6.2 Manual operation lock”.
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- ① Select “tch” (teaching operation) in the manual mode.
- ② Keep pressing the [ENT]  key (for approx. 2 seconds).
- ③ With the [UP]  or [DOWN]  key, select the axis subject to teaching. During selection of an axis for teaching operation, the dots at the left end and center of the display panel light up. The axis numbers are assigned as 1st axis, 2nd axis, ... in sequence from the bottom of the manifold block mounted to the hydraulic unit. For the axis numbers, refer to “2.2.1 Control axis number”.
- ④ If you keep pressing the [UP]  key, teaching is executed for the “SOL-a” solenoid valve of the selected axis. If you keep pressing the [DOWN]  key, teaching is executed for the “SOL-b” solenoid valve of the selected axis.


- ⑤ When the teaching operation is completed, the display shows “Fin”, the pump stops, and the solenoid valve turns OFF. When the key is released, the display returns to the axis selection screen of Step ③.
- ⑥ Return to the manual operation selection screen with the [MODE]  key.

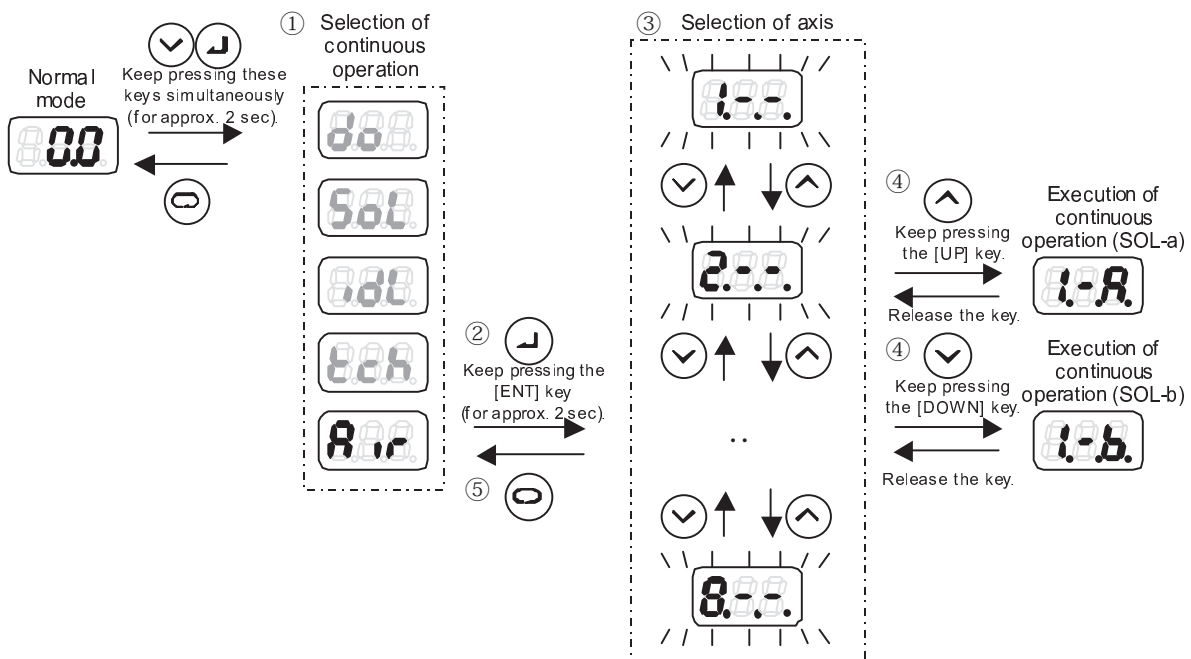
IMPORTANT	<ul style="list-style-type: none"> ● To use the surge suppressing function, execute the teaching operation for all axes. ● Be sure to move the cylinder to the full stroke end. Otherwise, teaching operation cannot be normally executed. ● Even after teaching operation is completed, the “operation completion” digital output signal remains OFF. Confirm completion of teaching operation with the “Fin” indication on the display panel. ● If an alarm condition occurs during teaching operation, the teaching operation is not normally completed. Re-execute the teaching operation. ● If the display shows “Fin” to indicate completion of teaching operation although the cylinder stops in the middle of the stroke during teaching operation, the cylinder operating load pressure may be larger than the preset pressure. In this case, increase the pressure setting temporarily to move the cylinder to the stroke end.
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MEMO	During teaching operation, the hydraulic unit operates at the minimum flow rate regardless of the flow rate setting for each axis. The minimum flow rate is 3.5 L/min.
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9.6.7 Continuous operation

Use this function to bleed air from piping.

IMPORTANT	<ul style="list-style-type: none"> ● Digital input signals activated in manual operation (axis selection signal, etc.) are disabled. ● If  is displayed during selection of the manual operation, any digital input signal other than “DIN17 Operation command” is ON. Refer to “9.6.2 Manual operation lock”.
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- ① Select “Air” (continuous operation) in the manual mode.
- ② Keep pressing the [ENT]  key (for approx. 2 seconds).
- ③ With the [UP]  or [DOWN]  key, select the axis subject to continuous operation.
 During selection of an axis in continuous operation, the dots for all digits on the display panel light up.
 The axis numbers are assigned as 1st axis, 2nd axis, ... in sequence from the bottom of the manifold block mounted to the hydraulic unit.
 For the axis numbers, refer to “2.2.1 Control axis number”.
- ④ If you keep pressing the [UP]  key, continuous operation is executed for the “SOL-a” solenoid valve of the selected axis.

 If you keep pressing the [DOWN]  key, continuous operation is executed for the “SOL-b” solenoid valve of the selected axis.
 When each key is released, continuous operation stops, and the display returns to the axis selection screen of Step ③.
- ⑤ Return to the manual operation selection screen with the [MODE]  key.

IMPORTANT	<ul style="list-style-type: none"> ● In continuous operation, the hydraulic unit stops the pump and turns OFF the solenoid valve immediately before the motor overload warning or controller overload warning is activated. If the pump stops in the middle of the cylinder stroke, this hydraulic unit is overloaded. In such a case, re-execute continuous operation after elapse of a certain period. ● In continuous operation, the “operation completion” digital output signal remains OFF. ● In continuous operation, the surge suppressing function is disabled.
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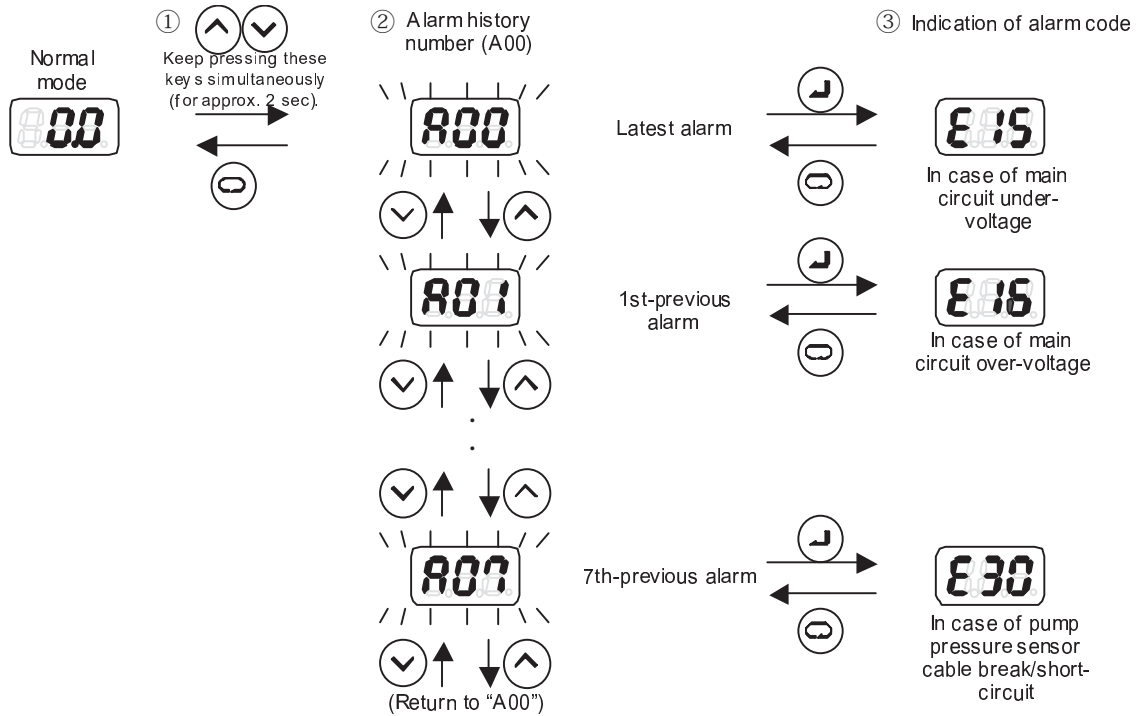
The pressure setting for continuous operation can be specified with the parameter.
 Specify the pressure depending on the load condition of the hydraulic circuit.






No.	Code	Name	Setting range	Factory-setting
G17	P04	AV_P Pressure setting for continuous operation	1.5 - 7.0 [MPa]	1.5

9.7 Alarm mode

The alarm mode allows you to check up to eight alarm conditions that occurred in the past.

9.7.1 Operations of the alarm mode



- ① Press the [UP]  and [DOWN]  keys simultaneously (for approx. 2 seconds). The display shifts to the alarm mode.
- ② Select an alarm history number with the [UP]  or [DOWN]  key. During selection of an alarm selection number, the display blinks. "A00" indicates the latest alarm, and then older alarms are displayed in sequence (A01, A02, ...).
- ③ Press the [ENT]  key to register the alarm history number to be displayed. The corresponding alarm code is displayed.

MEMO

If there is no alarm history,  is displayed.

Chapter 10 Description on Parameters

10.1 Configuration of parameters

10.1.1 Group configuration

As shown in the table below, parameters are classified by function.

Group number	Type of parameters	Outline																																				
G00 to G15	Control setting for each axis	<p>Specify pressure, flow rate and acceleration/deceleration time for each axis. These parameters can be individually specified for the SOL-a and SOL-b solenoid valves of each axis. (Example) G00: Axis 1a → Specify how the cylinder operates when the Axis 1 SOL-a solenoid valve is energized.</p> <table border="1"> <thead> <tr> <th>Group number</th> <th>Target axis</th> <th>Group number</th> <th>Target axis</th> </tr> </thead> <tbody> <tr> <td>G00</td> <td>Axis 1a</td> <td>G08</td> <td>Axis 5a</td> </tr> <tr> <td>G01</td> <td>Axis 1b</td> <td>G09</td> <td>Axis 5b</td> </tr> <tr> <td>G02</td> <td>Axis 2a</td> <td>G10</td> <td>Axis 6a</td> </tr> <tr> <td>G03</td> <td>Axis 2b</td> <td>G11</td> <td>Axis 6b</td> </tr> <tr> <td>G04</td> <td>Axis 3a</td> <td>G12</td> <td>Axis 7a</td> </tr> <tr> <td>G05</td> <td>Axis 3b</td> <td>G13</td> <td>Axis 7b</td> </tr> <tr> <td>G06</td> <td>Axis 4a</td> <td>G14</td> <td>Axis 8a</td> </tr> <tr> <td>G07</td> <td>Axis 4b</td> <td>G15</td> <td>Axis 8b</td> </tr> </tbody> </table>	Group number	Target axis	Group number	Target axis	G00	Axis 1a	G08	Axis 5a	G01	Axis 1b	G09	Axis 5b	G02	Axis 2a	G10	Axis 6a	G03	Axis 2b	G11	Axis 6b	G04	Axis 3a	G12	Axis 7a	G05	Axis 3b	G13	Axis 7b	G06	Axis 4a	G14	Axis 8a	G07	Axis 4b	G15	Axis 8b
Group number	Target axis	Group number	Target axis																																			
G00	Axis 1a	G08	Axis 5a																																			
G01	Axis 1b	G09	Axis 5b																																			
G02	Axis 2a	G10	Axis 6a																																			
G03	Axis 2b	G11	Axis 6b																																			
G04	Axis 3a	G12	Axis 7a																																			
G05	Axis 3b	G13	Axis 7b																																			
G06	Axis 4a	G14	Axis 8a																																			
G07	Axis 4b	G15	Axis 8b																																			
G16	Control axis setting	Specify whether each axis is to be used or not, and whether to enable or disable pressure correction.																																				
G17	Control setting	Specify the control parameters such as control axis priority and continuous operation pressure setting.																																				
G18	System setting	Specify the system parameters such as digital input/output functions.																																				
G19	Communication setting	Specify the user serial communication setting.																																				
G20	(Reserved)	Reserved group																																				
G21	Pressure sensor filter setting	Specify the filter type and filter time constant for the pressure sensor.																																				
G22	(Reserved)	Reserved group																																				

10.1.2 Parameter list

Each group is comprised of the parameters listed in the table below.

IMPORTANT	<ul style="list-style-type: none"> ● In the following table, the parameters indicated with asterisk (*) become active when the power supply is turned ON after a setting change. ● “G16: control axis setting” may be different from the following table, depending on the number of axes and combination of valves. The following table shows the standard settings for the eight-axis type.
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Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
G00 Axis setting 1a	P00	P_1A	Pressure setting	1.5 – 7.0 [MPa]	Specify the hold pressure for the relevant axis. Refer to “10.4.2 Pressure and flow rate settings”.	1.5
	P01	Q_1A	Flow rate setting	3.5 – 28.5 [L/min]	Specify the flow rate for the relevant axis. “10.4.2 Pressure and flow rate settings”.	3.5
	P02	QU1A	Acceleration time	0.01 – 2.50 [sec]	Specify the rising and falling time constants for ramp	0.01
	P03	QD1A	Deceleration time	0.01 – 2.50 [sec]	processing under the flow rate command. Specify the time to reach the maximum flow rate. Refer to “10.4.3 Acceleration and deceleration time settings”.	0.01
	P04	CG1A	Speed-change flow rate	3.5 – 28.5 [L/min]	Specify the flow rate when the speed change command is turned ON with the digital input signal. Refer to “10.7.2 Change flow rate by speed change command”.	3.5
	P05	PV1A	Initial operation pressure setting	1.5 – 7.0 [MPa]	Specify the pressure command value for cylinder operation. Refer to “10.4.4 Initial operation pressure”.	7.0
	P06	DT_1	Operation completion wait time	0 – 250 The unit of time can be specified with the G17 – P05 parameter.	Specify the wait time before the pump stops and the solenoid valve turns OFF after a pump pressure rise is detected (for example, when a single cylinder is returned by spring force). Refer to “10.5.5 Operation completion wait time”.	0
	P07	DF1D	Pressure drop detection tolerance	0.1 – 2.5 [MPa]	Specify a pressure deviation from “P00: Pressure setting”, to define the pre-charge pressure drop detection tolerance for pressure correction. Refer to “10.6 Correcting pre-charge pressure drop”.	0.5

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P08 (*)	SL1A	Surge suppressing function	0: Disable 1: Enable	Specify whether to enable or disable the surge suppressing function. Refer to “10.7.1 Surge suppressing function”.	1
G01 Axis setting 1b			Specify the control parameters for the 1b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G02 Axis setting 2a			Specify the control parameters for the 2a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G03 Axis setting 2b			Specify the control parameters for the 2b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G04 Axis setting 3a			Specify the control parameters for the 3a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G05 Axis setting 3b			Specify the control parameters for the 3b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G06 Axis setting 4a			Specify the control parameters for the 4a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G07 Axis setting 4b			Specify the control parameters for the 4b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G08 Axis setting 5a			Specify the control parameters for the 5a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G09 Axis setting 5b			Specify the control parameters for the 5b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G10 Axis setting 6a			Specify the control parameters for the 6a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G11 Axis setting 6b			Specify the control parameters for the 6b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
G12 Axis setting 7a			Specify the control parameters for the 7a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G13 Axis setting 7b			Specify the control parameters for the 7b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G14 Axis setting 8a			Specify the control parameters for the 8a axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G15 Axis setting 8b			Specify the control parameters for the 8b axis. Descriptions of the parameters are the same as those for “G00: Axis setting 1a”.			
G16 Control axis setting	P00 (*)	VS_1	Control axis enable – Axis 1	0: Disable 1: Enable	Specify whether to enable or disable the control axis. Refer to “10.3.2 Control enable/disable setting”.	1
	P01 (*)	PC1A	Pressure correcting function – Axis 1a	0: Disable 1: Enable	Specify whether to enable or disable the pressure correcting function that autonomously re-charges pressure by detecting a pre-charge pressure drop. Refer to “10.3.3 Pressure correction enable/disable setting”.	1
	P02 (*)	PS1A	Monitor pressure sensor connector – Axis 1a	0: No connection 1 – 8: Connector No. of monitor pressure sensor	Specify the connector No. of the monitor pressure sensor connected to the unit. Refer to “10.3.4 Monitor pressure sensor connector setting”.	1
	P03 (*)	PC1B	Pressure connecting function – Axis 1b	Description of this parameter is the same as that for G16 – P01. Specify the parameter for the SOL-b solenoid valve of the 1st axis.		0
	P04 (*)	PS1B	Monitor pressure sensor connector – Axis 1b	Description of this parameter is the same as that for G16 – P02. Specify the parameter for the SOL-b solenoid valve of the 1st axis.		0
	P05~ P09	Reserve numbers. (These parameters are not displayed.)				
	P10 (*)	VS_2	Control axis enable – Axis 2	Specify these parameters for Axis 2. Descriptions on these parameters are the same as those for G16 – P00 to P04.		1
	P11 (*)	PC2A	Pressure correcting function – Axis			1
	P12 (*)	PS2A	Monitor pressure sensor connector – Axis 2a			2

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P13 (*)	PC2B	Pressure connecting function - Axis 2b			0
	P14 (*)	PS2B	Monitor pressure sensor connector - Axis 2b			0
	P15~P19	Reserve numbers. (These parameters are not displayed.)				
	P20 (*)	VS_3	Control axis enable - Axis 3	Specify these parameters for Axis 3. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P21 (*)	PC3A	Pressure correcting function - Axis 3a			1
	P22 (*)	PS3A	Monitor pressure sensor connector - Axis 3a			3
	P23 (*)	PC3B	Pressure connecting function - Axis 3b			0
	P24 (*)	PS3B	Monitor pressure sensor connector - Axis 3b			0
	P25~P29	Reserve numbers. (These parameters are not displayed.)				
	P30 (*)	VS_4	Control axis enable - Axis 4	Specify these parameters for Axis 4. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P31 (*)	PC4A	Pressure correcting function - Axis 4a			1
	P32 (*)	PS4A	Monitor pressure sensor connector - Axis 4a			4
	P33 (*)	PC4B	Pressure connecting function - Axis 4b			0
	P34 (*)	PS4B	Monitor pressure sensor connector - Axis 4b			0
	P35~P39	Reserve numbers. (These parameters are not displayed.)				
	P40 (*)	VS_5	Control axis enable - Axis 5	Specify these parameters for Axis 5. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P41 (*)	PC5A	Pressure correcting function - Axis 5a			1
	P42 (*)	PS5A	Monitor pressure sensor connector - Axis 5a			5
	P43 (*)	PC5B	Pressure connecting function - Axis 5b			0
	P44 (*)	PS5B	Monitor pressure sensor connector - Axis 5b			0
	P45~P49	Reserve numbers. (These parameters are not displayed.)				
	P50 (*)	VS_6	Control axis enable - Axis 6	Specify these parameters for Axis 6. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P51 (*)	PC6A	Pressure correcting function - Axis 6a			1
	P52 (*)	PS6A	Monitor pressure sensor connector - Axis 6a			6
	P53 (*)	PC6B	Pressure connecting function - Axis 6b			0

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P54 (*)	PS6B	Monitor pressure sensor connector - Axis 6b			0
	P55~P59	Reserve numbers. (These parameters are not displayed.)				
	P60 (*)	VS_7	Control axis enable - Axis 7	Specify these parameters for Axis 7. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P61 (*)	PC7A	Pressure correcting function - Axis 7a			1
	P62 (*)	PS7A	Monitor pressure sensor connector - Axis 7a			7
	P63 (*)	PC7B	Pressure connecting function - Axis 7b			0
	P64 (*)	PS7B	Monitor pressure sensor connector - Axis 7b			0
	P65~P69	Reserve numbers. (These parameters are not displayed.)				
	P70 (*)	VS_8	Control axis enable - Axis 8	Specify these parameters for Axis 8. Descriptions on these parameters are the same as those for G16 - P00 to P04.		1
	P71 (*)	PC8A	Pressure correcting function - Axis 8a			1
	P72 (*)	PS8A	Monitor pressure sensor connector - Axis 8a			8
	P73 (*)	PC8B	Pressure connecting function - Axis 8b			0
	P74 (*)	PS8B	Monitor pressure sensor connector - Axis 8b			0
	P75~P79	Reserve numbers. (These parameters are not displayed.)				
G17 Control setting	P00 (*)	PL_1	1st priority axis setting	0: As per factory setting 1A to 8b: Priority control axis	If operation priority must be given to any control axis over others, you can change the order of priority. Refer to "10.8 Priority setting during axis selection".	0
	P01 (*)	PL_2	2nd priority axis setting			0
	P02 (*)	PL_3	3rd priority axis setting			0
	P03 (*)	PL_4	4th priority axis setting			0
	P04	AV_P	Continuous operation pressure setting	1.5 - 7.0 [MPa]	Specify the pressure used for "continuous operation" when the manual mode is selected (for air bleeding, etc). Refer to "9.6.7 Continuous operation".	1.5
	P05	DT_U	Unit of operation completion wait time	0:10msec 1:100msec	Specify the unit of the operation completion wait time for each axis. Refer to "10.5.5 Operation completion wait time".	0
G18 System setting	P00 (*)	SO_E	Operation command enable	0: Disable 1: Enable	Specify whether to enable or disable the "DIN17: Operation command" digital input. Refer to "10.2.1 Operation command enable".	0

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P01 (*)	WN_O	Warning output logic	0, 1	You can change the output logic of “DOU3: Warning output”. 0: Output is ON in warning condition. 1: Output is OFF in warning condition. Refer to “10.2.2 Change warning output logic”.	0
	P02 (*)	INIP	Parameter initialization	0, 1	You can reset the parameters to the factory-set values. 0: No initialization 1: Reset parameters to factory-set values at next power-ON.	0
G19 Communication setting	P00 (*)	BT_S	Baud rate	0 - 3	Specify a baud rate for user serial communication. 0: 4800bps 1: 9600bps 2: 14400bps 3: 19200bps	3
	P01 (*)	PRTY	Telegram character	0 - 11	Specify telegram characters for user serial communication. 0: Bit=8, StpBit=1, Pari=Non 1: Bit=8, StpBit=1, Pari=Even 2: Bit=8, StpBit=1, Pari=Odd 3: Bit=8, StpBit=2, Pari=Non 4: Bit=8, StpBit=2, Pari=Even 5: Bit=8, StpBit=2, Pari=Odd 6: Bit=7, StpBit=1, Pari=Non 7: Bit=7, StpBit=1, Pari=Even 8: Bit=7, StpBit=1, Pari=Odd 9: Bit=7, StpBit=2, Pari=Non 10: Bit=7, StpBit=2, Pari=Even 11: Bit=7, StpBit=2, Pari=Odd	0
G20 (Reserve)	Reserved group. Parameter number is not displayed.					
G21 Pressure sensor filter setting	P00	PFFT	Pump pressure filter type	0: Primary delay 1: 3-Median 2: 4-Median 3: 6-Median 4: 10-Median	Specify the type of filter processing relative to pump pressure sensor feedback value. This function is effective in noise suppression.	0
	P01	PFLT	Pump pressure filter time constant	0 - 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. If the time constant is too long, control performance becomes unstable.	0
	P02	FTM1	Axis 1 monitor pressure filter type	0 - 4	Specify the type of filter for the Axis 1 monitor pressure sensor. Description on this parameter is the same as that for G21 - P00.	0

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P03	LTM1	Axis 1 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P04	FTM2	Axis 2 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 2 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P05	LTM2	Axis 2 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P06	FTM3	Axis 3 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 3 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P07	LTM3	Axis 3 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 0 ms.	0
	P08	FTM4	Axis 4 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 4 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P09	LTM4	Axis 4 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P10	FTM5	Axis 5 monitor pressure filter type	0~4	Specify the type of filter for the Axis 5 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P11	LTM5	Axis 5 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P12	FTM6	Axis 6 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 6 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P13	LTM6	Axis 6 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P14	FTM7	Axis 7 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 7 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0

Group number	Parameter No.	Symbol	Name	Range / Unit	Description	Factory-setting
	P15	LTM7	Axis 7 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
	P16	FTM8	Axis 8 monitor pressure filter type	0 – 4	Specify the type of filter for the Axis 8 monitor pressure sensor. Description on this parameter is the same as that for G21 – P00.	0
	P17	LTM8	Axis 8 monitor pressure filter time constant	0 – 250 [msec]	When the filter type is “0: Primary delay filter”, specify the time constant of the filter. Specify a time constant by 10 ms.	0
G22 (Reserve)	Reserved group. Parameter number is not displayed.					

10.2 Digital I/O signal settings

10.2.1 Operation command enable

You can specify whether to enable or disable the “DIN17: Operation command” digital input signal. Unless “DIN17: Operation command” is ON, the axis selection signals (DIN1 to DIN16) are not active, disabling cylinder operations.

No.		Name	Setting range	Factory-setting
G18	P00	Operation command enable	0: Disable 1: Enabl	0

Set value		Description
0	Disable	“DIN17: Operation command” is always regarded as ON status. Therefore, the unit executes pump startup preparation upon power-ON, and waits for the axis selection signal to turn ON.
1	Enabl	To operate the cylinder, “DIN17: Operation command” must be turned ON. The unit executes pump startup preparation when the operation command turns ON first after power-ON.

IMPORTANT	The parameter setting becomes active when the power supply is turned ON again.
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10.2.2 Change warning output logic

You can change the output logic of the “DOUT3: Warning output” digital output signal.

No.		Name	Setting range	Factory-setting
G18	P01	Warning output logic	0: Output is ON in warning condition. 1: output is OFF in warning condition.	0

Set value		Description
0	Output is ON in warning condition.	In the normal condition, the output is OFF. When a warning condition occurs, the output turns ON.
1	Output is OFF in warning condition.	In the normal condition, the output is ON. When a warning condition occurs, the output turns OFF.

IMPORTANT	The parameter setting becomes active when the power supply is turned ON again.
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10.3 Parameter settings depending on hydraulic circuit

For wiring of the solenoid valve and the pressure sensor at the user, the parameter settings described in this section are required.


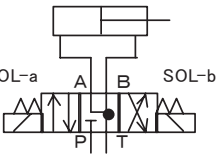
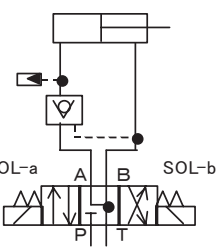
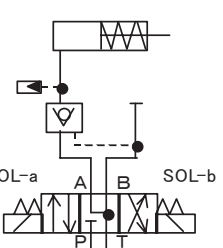
For the “valve block mounted type”, or the hydraulic unit that is equipped with a valve block, the parameters settings described in this section are not required, because the parameters have been set up depending on the hydraulic circuit before shipment.

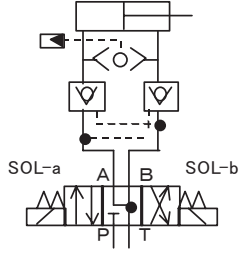
10.3.1 Example of connection settings and outline of functions

The following three types of parameters must be set up depending on the hydraulic circuit.

Parameter name	Outline of parameter
① Control axis enable setting	Specify whether the axis is to be controlled or not. Refer to “10.3.2 Control enable/disable setting”.
② Pressure correcting function	Specify whether to re-charge pressure autonomously by detecting a pre-charge pressure drop. This function is enabled only for the circuit that can hold pre-charge pressure with a non-leak valve and monitor the pressure with a pressure sensor. Refer to “10.3.3 Pressure correction enable/disable setting”.
③ Monitor pressure sensor connector	Specify the connector of the pressure sensor that monitors pre-charge pressure. If the hardware connection and parameter setting are incorrect, the sensor does not normally work. Refer to “10.3.4 Monitor pressure sensor connector setting”.

Examples of hydraulic circuits, functions of each port (when energizing SOL-a / SOL-b), and the corresponding parameter settings are listed below.

Example of hydraulic circuit	Energized solenoid	Function	Control axis enable setting	Pressure correction setting	Monitor pressure sensor connector
	SOL-a	This port is blocked by the blocking block. This axis is not controlled.	0: Disable	0: Disable	0: No connection
	SOL-b			0: Disable	0: No connection
	SOL-a	Holding and monitoring of pre-charge pressure are not required.	1: Enable	0: Disable	0: No connection
	SOL-b	Holding and monitoring of pre-charge pressure are not required.		0: Disable	0: No connection
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor. When a pressure drop is detected, pressure is re-charged.	1: Enable	1: Enable	#: Connector No.
	SOL-b	Holding of pre-charge pressure, and monitoring of pre-charge pressure with the pressure sensor are not required.		0: Disable	0: No connection
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor. When a pressure drop is detected, pressure is re-charged.	1: Enable	1: Enable	#: Connector No.
	SOL-b	Holding of pre-charge pressure, and monitoring of pre-charge pressure with the pressure sensor are not required.		0: Disable	0: No connection

Example of hydraulic circuit	Energized solenoid	Function	Control axis enable setting	Pressure correction setting	Monitor pressure sensor connector
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor. When a pressure drop is detected, pressure is re-charged.	1: Enable	1: Enable	#: Connector No.
	SOL-b	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor. When a pressure drop is detected, pressure is re-charged.		1: Enable	

The pump stop condition at completion of cylinder operation varies depending on the configuration of the hydraulic circuit. For the operation completing conditions, refer to “10.5 Pump stop at completion of cylinder operation”.

10.3.2 Control enable/disable setting

“Valve block mounted type” provides two types of manifold blocks (4-axis and 6-axis types).

An unused axis is equipped with a blocking block. The following parameters specify whether the relevant axis is connected with the cylinder or not (to be controlled or not).

No.	Name	Setting range	Factory-setting
G16	P00	Control axis enable – Axis 1	1
	P10	Control axis enable – Axis 2	1
	P20	Control axis enable – Axis 3	1
	P30	Control axis enable – Axis 4	1
	P40	Control axis enable – Axis 5	1
	P50	Control axis enable – Axis 6	1
	P60	Control axis enable – Axis 7	1
	P70	Control axis enable – Axis 8	1
		0: Disable 1: Enable	Setting for 8-axis type

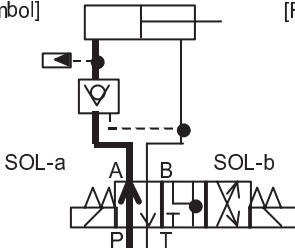
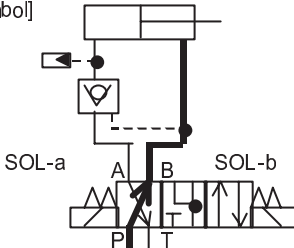
Set value	Description
0 Disable	For an unused axis (equipped with the blocking block), select “0: Disable”. <div style="border: 1px solid black; padding: 5px; width: fit-content;"> <p>MEMO Even if the axis selection signal is turned ON for the axis specified as “0: Disable”, pump startup and solenoid valve operation are disabled.</p> </div>
1 Enable	For an axis equipped with a solenoid valve, select “1: Enable”. The “axis selection” digital input signal controls the selected solenoid. Turning ON the axis selection signal “a” → Controls the SOL-a solenoid valve. Turning ON the axis selection signal “b” → Controls the SOL-b solenoid valve.

IMPORTANT	The parameter setting becomes active when the power supply is turned ON again.
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10.3.3 Pressure correction enable/disable setting

Specify whether to enable or disable the pressure correcting function that monitors the pre-charge pressure of the operating cylinder and autonomously re-charges pressure when a pressure drop is detected.

The following parameters can be individually specified for the SOL-a and SOL-b solenoid valves of each axis.

IMPORTANT	<ul style="list-style-type: none"> ● The parameter settings become active when the power supply is turned ON again. ● The “Pressure correcting function – Axis 1a” parameter is intended for the Axis 1 SOL-a solenoid setting, not for Port A. <p>[Normal symbol] </p> <p>[Reverse symbol] </p>
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No.	Name	Setting range	Factory-setting
G16	P01	Pressure correcting function – Axis 1a	1
	P03	Pressure correcting function – Axis 1b	0
	P11	Pressure correcting function – Axis 2a	1
	P13	Pressure correcting function – Axis 2b	0
	P21	Pressure correcting function – Axis 3a	1
	P23	Pressure correcting function – Axis 3b	0
	P31	Pressure correcting function – Axis 4a	1
	P33	Pressure correcting function – Axis 4b	0
	P41	Pressure correcting function – Axis 5a	1
	P43	Pressure correcting function – Axis 5b	0
	P51	Pressure correcting function – Axis 6a	1
	P53	Pressure correcting function – Axis 6b	0
	P61	Pressure correcting function – Axis 7a	1
	P63	Pressure correcting function – Axis 7b	0
P71	Pressure correcting function – Axis 8a	1	
P73	Pressure correcting function – Axis 8b	0	

0: Disable
1: Enable

Setting for 8-axis type

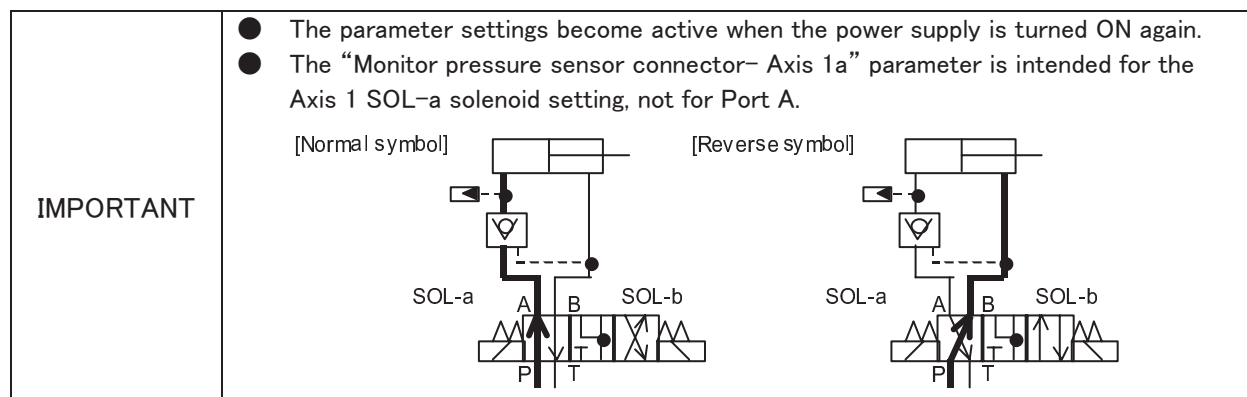
Set value	Description	Reference hydraulic circuit
0 Disable	<p>The hydraulic unit does not monitor pre-charge pressure of the operating cylinder, disabling the pressure correcting function when a pressure drop is detected.</p> <p>If a non-leak valve and pressure sensor are not provided in the hydraulic circuit as shown on the right (see “Port B”, which is controlled by the SOL-b solenoid), select “0: Disable”.</p>	
1 Enable	<p>The hydraulic unit monitors pre-charge pressure of the operating cylinder, and autonomously re-charges pressure when a pressure drop is detected.</p> <p>If a non-leak valve and pressure sensor are provided in the hydraulic circuit as shown on the right (see “Port A”, which is controlled by the SOL-a solenoid), select “1: Enable” to execute pressure correction.</p>	

IMPORTANT	<ul style="list-style-type: none"> ● If a non-leak valve is not provided for the control axis on which “pressure correcting function” is set to “1: Enable”, the pre-charge pressure cannot be held. In this case, the overload alarm may be activated by executing pressure correction repeatedly. ● If the “Monitor pressure sensor connector setting” parameter (see Section 10.3.4) is set to “0: No connection” for the control axis on which “pressure correcting function” is set to “1: Enable”, “E69: Parameter setting error” occurs.
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10.3.4 Monitor pressure sensor connector setting

To monitor pre-charge pressure, specify the connector of the monitor pressure sensor provided for each axis. After cylinder operation, pre-charge pressure is monitored with the monitor pressure sensor connected to the connector specified with this parameter.

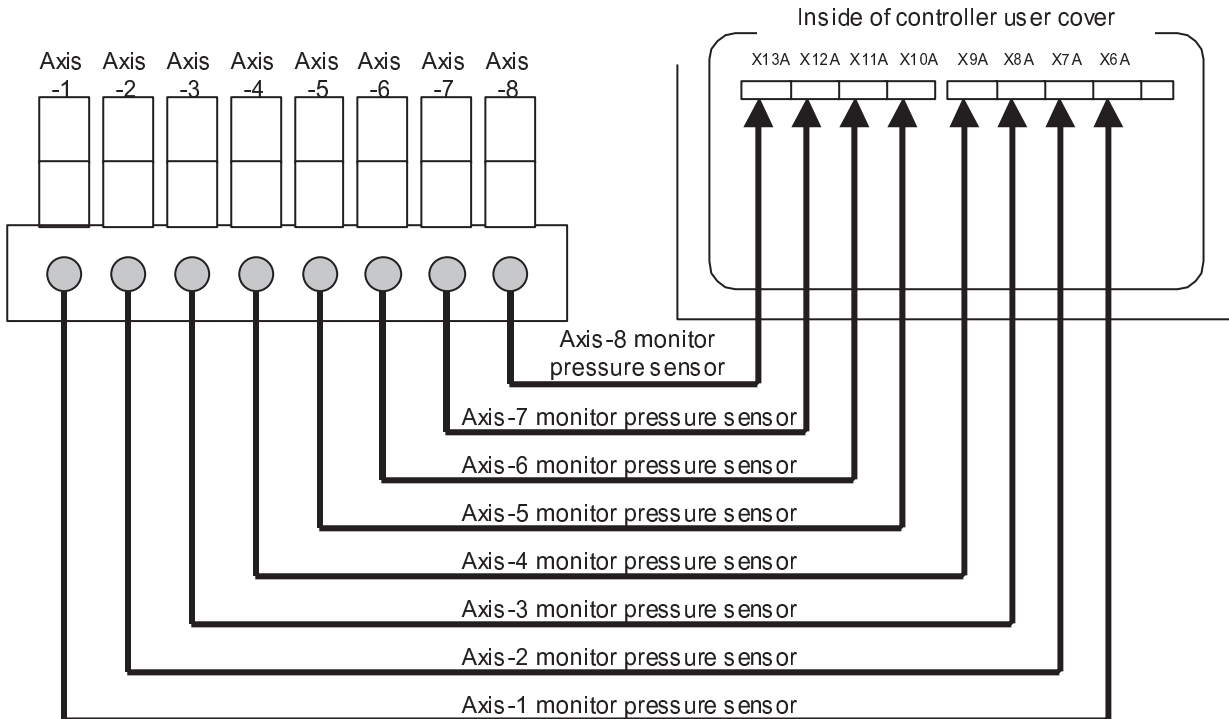
The following parameters can be individually specified for the SOL-a and SOL-b solenoid valves of each axis.



No.	Name	Setting range	Factory-setting	
G16	P02	Monitor pressure sensor connector- Axis 1a	1	
	P04	Monitor pressure sensor connector- Axis 1b	0	
	P12	Monitor pressure sensor connector- Axis 2a	2	
	P14	Monitor pressure sensor connector- Axis 2b	0	
	P22	Monitor pressure sensor connector- Axis 3a	3	
	P24	Monitor pressure sensor connector- Axis 3b	0	
	P32	Monitor pressure sensor connector- Axis 4a	0: No connection 1 to 8: Connector	4
	P34	Monitor pressure sensor connector- Axis 4b	No. of monitor pressure sensor	0
	P42	Monitor pressure sensor connector- Axis 5a		5
	P44	Monitor pressure sensor connector- Axis 5b		0
	P52	Monitor pressure sensor connector- Axis 6a		6
	P54	Monitor pressure sensor connector- Axis 6b		0
	P62	Monitor pressure sensor connector- Axis 7a		7
	P64	Monitor pressure sensor connector- Axis 7b		0
	P72	Monitor pressure sensor connector- Axis 8a		8
	P74	Monitor pressure sensor connector- Axis 8b		0

Setting for 8-axis type

Set value	Description	
	Pressure sensor connector No.	Remarks
0	No connection	If no pressure sensor is connected, select “0: No connection”.
1	X6A connector	X6A connector
2	X7A connector	X7A connector
3	X8A connector	X8A connector
4	X9A connector	X9A connector
5	X10A connector	X10A connector
6	X11A connector	X11A connector
7	X12A connector	X12A connector
8	X13A connector	X13A connector

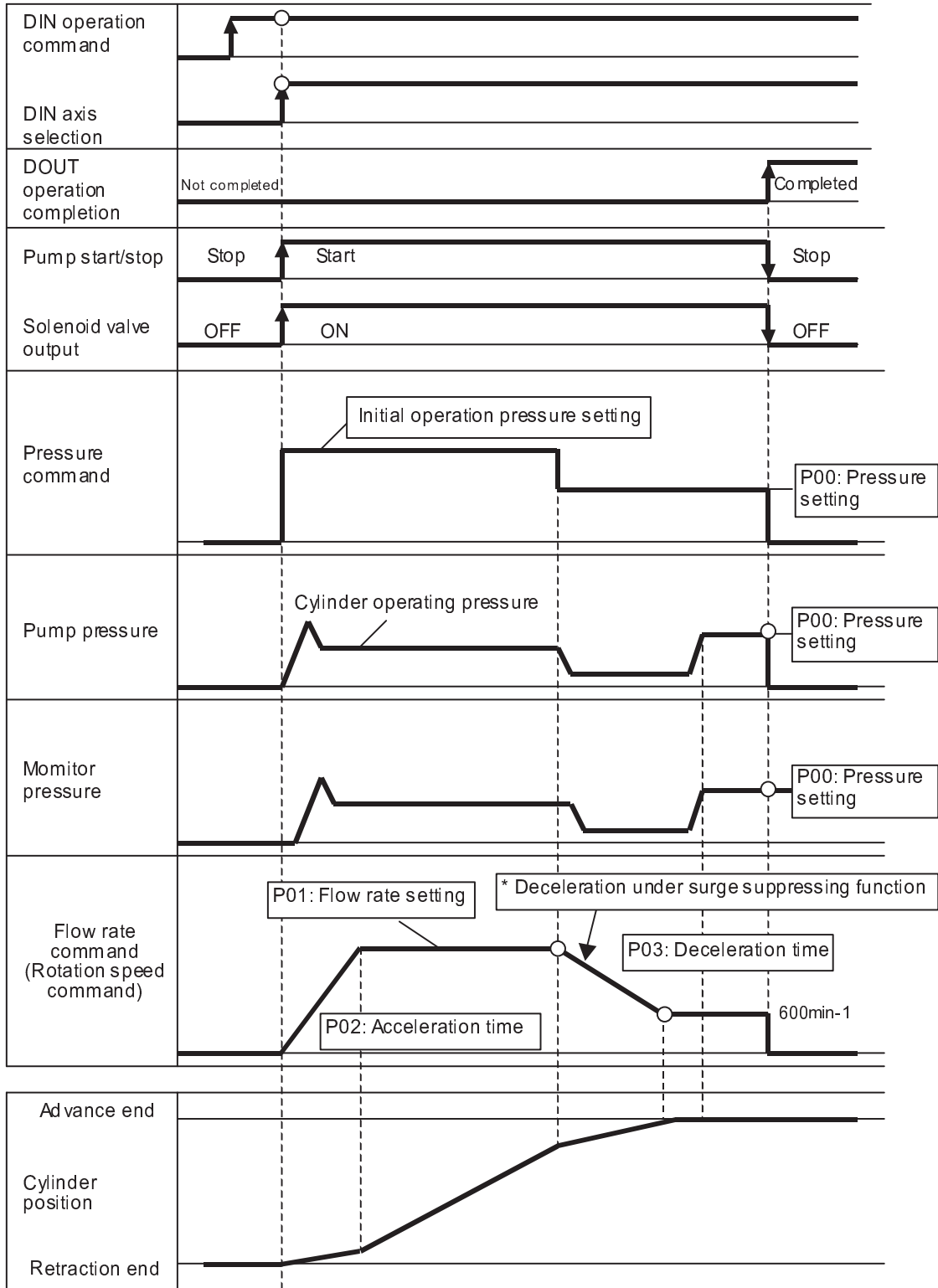


Reference hydraulic circuit	Energized solenoid	Example of setting
<p>Axis-1 monitor pressure sensor Connect the sensor to the X6A connector.</p>	SOL-a	In the single-axis hydraulic circuit as shown on the left, the Axis-1 monitor pressure sensor provided for SOL-a is connected with the X6A connector. In this case, select "1: X6A".
	SOL-b	Since no monitor pressure sensor is provided for SOL-b, select "0: No connection".
<p>Axis-3 monitor pressure sensor Connect the sensor to the X8A connector.</p>	SOL-a	In the three-axis hydraulic circuit as shown on the left, the Axis-3 monitor pressure sensor monitors the pressure for SOL-a via the shuttle valve. Since the Axis-3 monitor pressure sensor is connected with the X8A connector, select "3: X8A".
	SOL-b	The pressure for SOL-b is monitored with the Axis-3 monitor pressure sensor via the shuttle valve. As with the case for SOL-a, since the Axis-3 monitor pressure sensor is connected with the X8A connector, select "3: X8A".

IMPORTANT	<ul style="list-style-type: none"> ● If the actual monitor pressure sensor connector is different from the setting of the above parameter, the sensor does not normally work. Be sure to confirm the actual connector to ensure correct parameter setting. ● If the "Pressure correction enable/disable setting" parameter (see Section 10.3.3) is set to "1: Enable" for the control axis on which the "Monitor pressure sensor connector setting" parameter (see Section 10.3.4) is set to "0: No connection", "E69: Parameter setting error" occurs.
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10.4 Cylinder operation setting

10.4.1 Cylinder operation timing chart



10.4.2 Pressure and flow rate settings

Specify the hold pressure and flow rate for cylinder operation.

These parameters can be individually specified for SOL-a and SOL-b of each axis. Therefore, pressure and flow rate can be individually specified for clamping and unclamping, even with the same axis.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis8b)	P00	Pressure setting	1.5 - 7.0 [MPa]
	P01	Flow rate setting	3.5 - 28.5 [L/min]

10.4.3 Acceleration and deceleration time settings

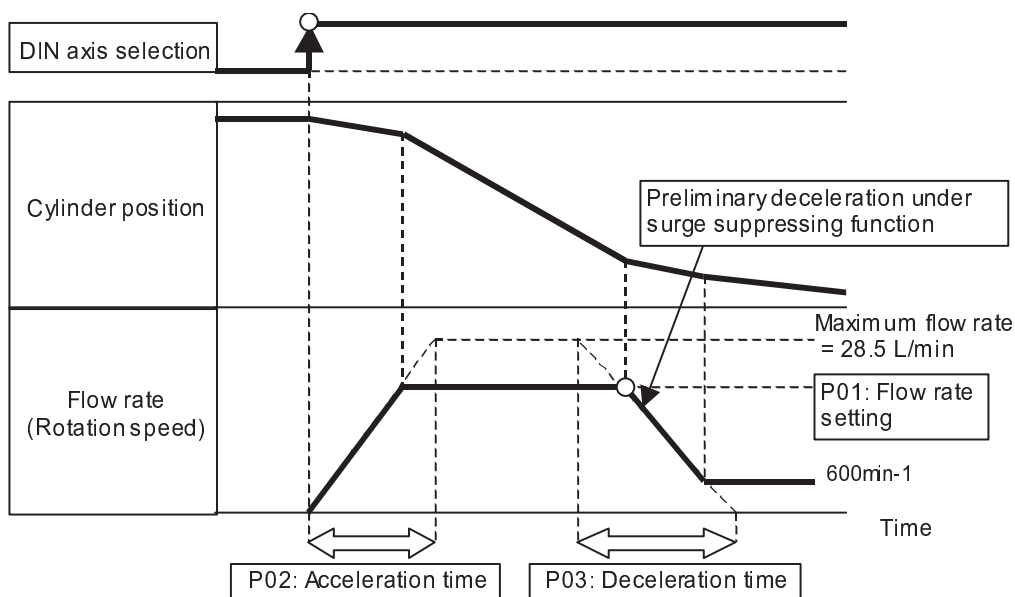
With acceleration/deceleration time settings, the hydraulic unit can reduce impact during cylinder acceleration and stop.

For acceleration time, specify the time to increase the flow rate from the stop condition to the maximum. For deceleration time, specify the time to reduce the flow rate from the maximum to the stop condition.

Acceleration/deceleration time can be individually specified for SOL-a and SOL-b of each axis.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis8b)	P02	Acceleration time	0.01 - 2.50 [sec]
	P03	Deceleration time	

IMPORTANT	<ul style="list-style-type: none"> ● When the cylinder stops with the axis selection signal OFF status, deceleration is disabled. When the pump stops and the solenoid valve turns OFF, the cylinder abruptly stops. In this case, the motor runs free. Refer to “12.3 Cylinder stop”. ● The deceleration time setting becomes active during deceleration under the “speed change” digital input signal, and during deceleration under the surge suppressing function. Refer to “10.7.2 Change flow rate by speed change command” and “10.7.1 Surge suppressing function”, respectively.
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10.4.4 Initial operation pressure

Specify the pressure command value for cylinder operation.

When this parameter is larger than “P00: Pressure setting”, the cylinder operates at the specified flow rate.

The initial operation pressure can be individually specified for SOL-a and SOL-b of each axis.

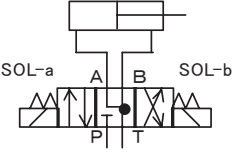
No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis8b)	P05 Initial operation pressure setting	1.5 – 7.0 [MPa]	7.0

IMPORTANT	<ul style="list-style-type: none"> ● If the cylinder operating load pressure exceeds “P05: Initial operation pressure setting”, the pump discharge rate may not conform to the flow rate setting, causing unstable operation. In this case, set “P05: Initial operation pressure setting” larger than the cylinder operating load pressure. ● If the cylinder operating load pressure is close to 7.0 MPa, reduce the load pressure by reducing the circuit pressure loss, or by reviewing the hydraulic circuit configuration (e.g. by increasing the cylinder size).
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10.5 Pump stop at completion of cylinder operation

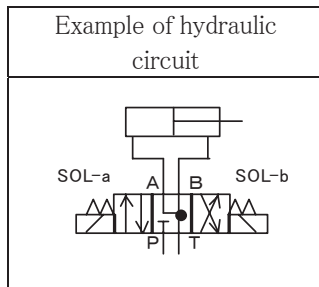
10.5.1 Configuration of hydraulic circuit and operation completing conditions

This hydraulic unit provides the idle stop function that checks each control axis for a pressure rise after cylinder operation, and autonomously stops the pump and turns OFF the solenoid valve when it recognizes completion of operation. The control axis operation completion detecting method varies depending on configuration of the hydraulic circuit and the corresponding parameter settings. The configuration of hydraulic circuit and operation completing conditions are as listed below.

Reference hydraulic circuit	Energized solenoid	Function	Operation completing condition	Reference section
	SOL-a	Holding and monitoring of pre-charge pressure are not required.	When a pump pressure rise is detected, operation completion is recognized.	10.5.2 Operation completing condition 1
	SOL-b	Holding and monitoring of pre-charge pressure are not required.		

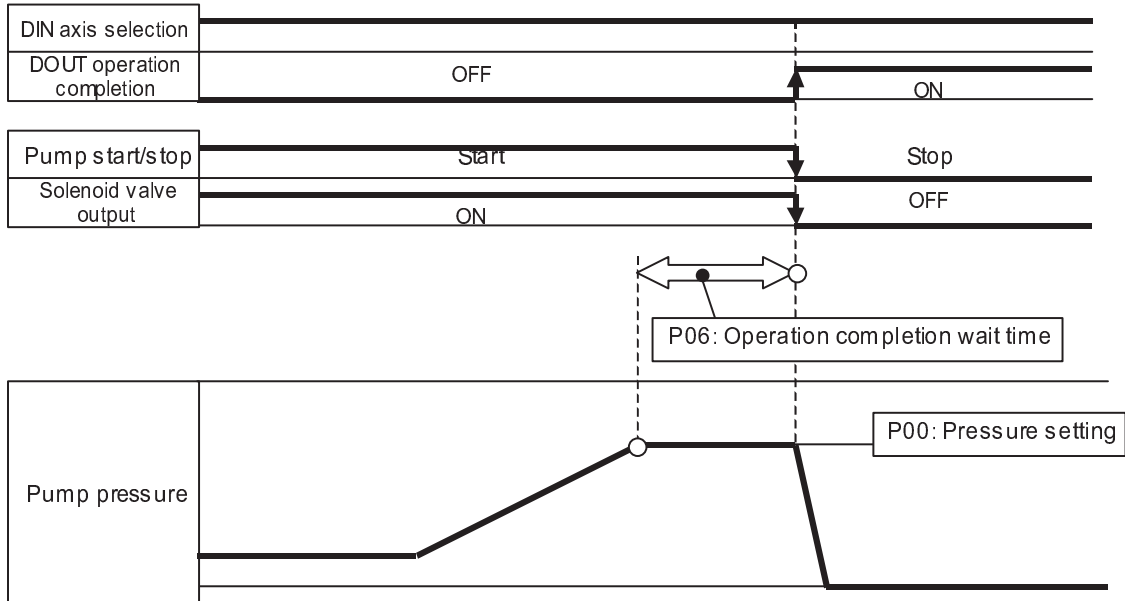
Reference hydraulic circuit	Energized solenoid	Function	Operation completing condition	Reference section
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor.	When the conditions given in both ① and ② are satisfied, operation completion is recognized. ① Pump pressure rise ② Monitor pressure rise	10.5.3 Operation completing condition 2
	SOL-b	Holding of pre-charge pressure, and monitoring of pre-charge pressure with the pressure sensor are not required.	When both ① and ② conditions are satisfied, operation completion is recognized. ① Pump pressure rise ② Monitor pressure drop in the opposite port	10.5.4 Operation completing condition 3
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor.	When both ① and ② conditions are satisfied, operation completion is recognized. ① Pump pressure rise ② Monitor pressure rise	10.5.3 Operation completing condition 2
	SOL-b	Since the hydraulic circuit uses a single cylinder, holding of pre-charge pressure, and monitoring of pre-charge pressure with the pressure sensor are not required.	When both ① and ② conditions are satisfied, operation completion is recognized. ① Pump pressure rise ② Monitor pressure drop in the opposite port	10.5.4 Operation completing condition 3
	SOL-a	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor.	When the conditions given in both ① and ② are satisfied, operation completion is recognized. ① Pump pressure rise ② Monitor pressure rise	10.5.3 Operation completing condition 2
	SOL-b	Holds pressure with the non-leak valve, and monitors the pre-charge pressure with the pressure sensor.		

10.5.2 Operation completing condition 1



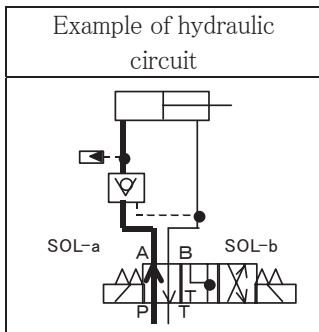
To operate a cylinder in the circuit where both Port A and Port B have no monitor pressure sensor as shown on the left, operation completion is recognized when a pump pressure rise is detected.

MEMO After a pump pressure rise is detected, the pump starting time can be changed with the “P06: Operation completion wait time” parameter. For the operation completion wait time setting, refer to “10.5.5 Operation completion wait time”.



- ① When the pump pressure becomes larger than “P00: Pressure setting”, the pressure rise condition is judged normal.
- ② Wait for elapse of “P06: Operation completion wait time”.
- ③ After elapse of “P06: Operation completion wait time”, the pump stops, and the solenoid valve turns OFF. At the same time, the “operation completion” digital output signal turns ON.

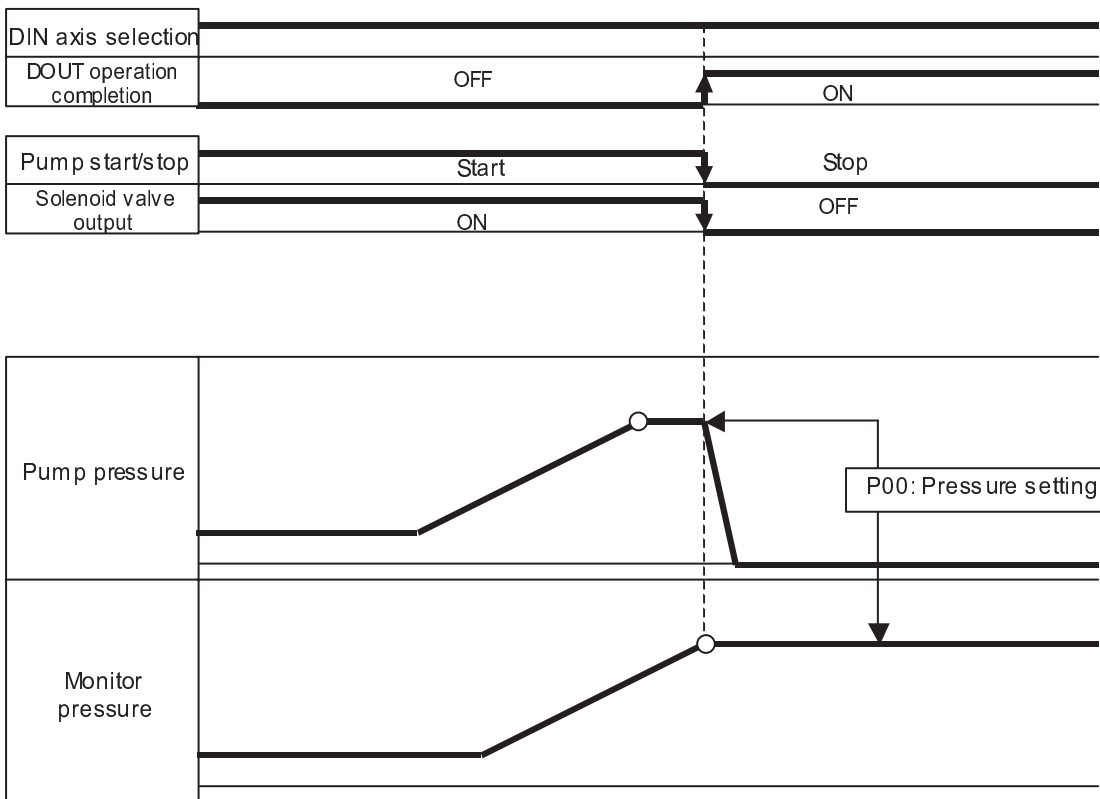
10.5.3 Operation completing condition 2



To operate a cylinder in the port equipped with a monitor pressure sensor (see “SOL-a” in the hydraulic circuit shown on the left), operation completion is recognized when both the following ① and ② conditions are satisfied:

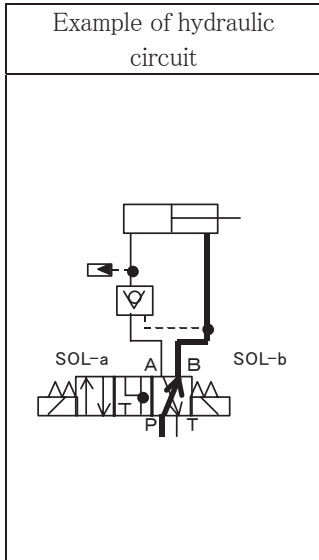
- ① Pump pressure rise
- ② Monitor pressure rise

MEMO For operation completing condition 2, setting of the “P06: Operation completion wait time” parameter is invalid.



- ① When the pump pressure becomes larger than “P00: Pressure setting”, the pressure rise condition is judged normal.
- ② Also, when the monitor pressure becomes larger than “P00: Pressure setting”, the pressure rise condition is judged normal.
- ③ After the pump pressure and monitor pressure rise, the pump stops, and the solenoid valve turns OFF. At the same time, the “operation completion” digital output signal turns ON.

10.5.4 Operation completing condition 3

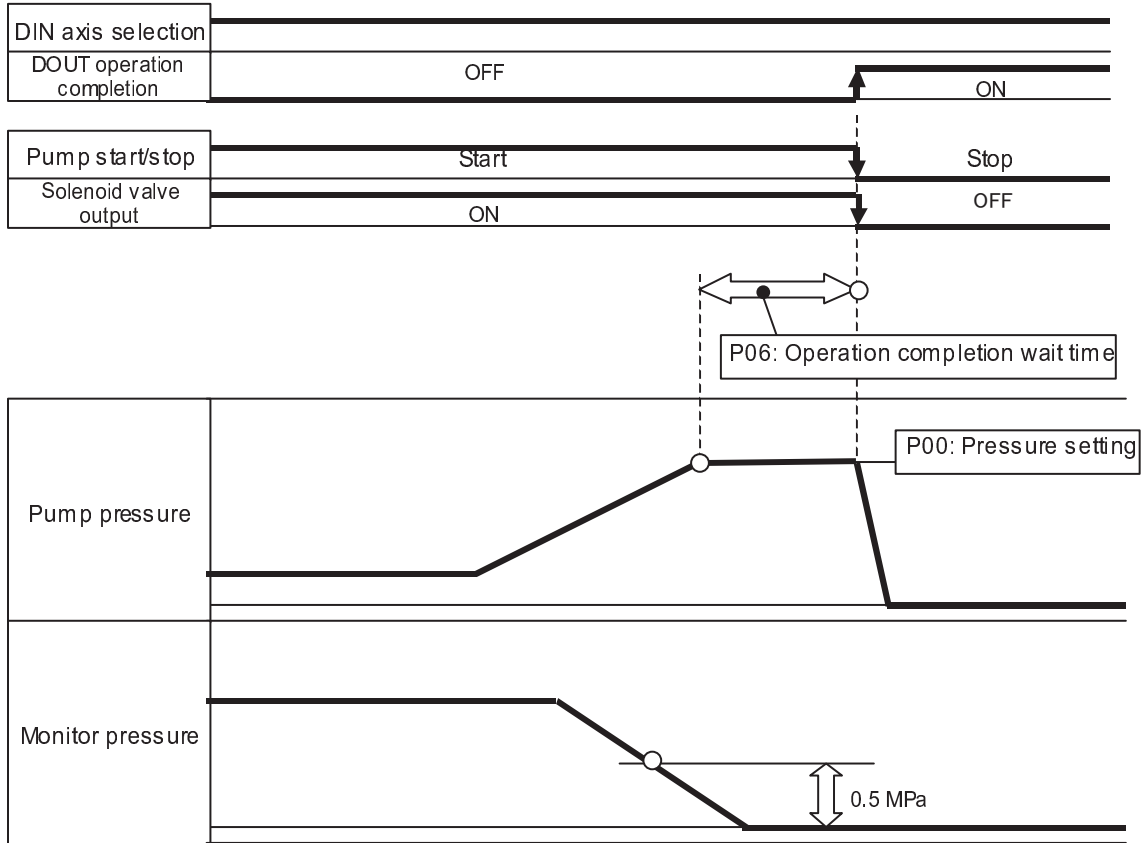


If a monitor pressure sensor is not provided for the operating port but provided for the opposite port (see “SOL-b” in the hydraulic circuit on the left), operation completion is recognized when both the following ① and ② conditions are satisfied:

- ① Pump pressure rise
- ② Monitor pressure drop in the opposite port

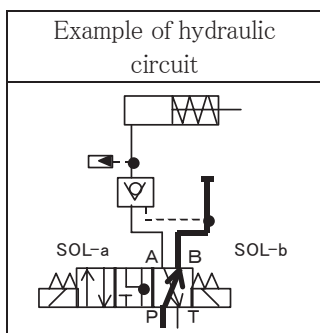
In this example, the pressure is detected with the monitor pressure sensor provided for Port A.

MEMO After pump pressure rise and monitor pressure drop are detected, the pump starting time can be changed with the “P06: Operation completion wait time” parameter. Specify a wait time for an application where the cylinder takes a long time to return to the stroke end (for example, when a single cylinder is returned by spring force). For the operation completion wait time setting, refer to “10.5.5 Operation completion wait time”.



- ① When the pump pressure becomes larger than “P00: Pressure setting”, the pressure rise condition is judged normal.
- ② When the monitor pressure in the opposite port falls below 0.5 MPa, a pressure drop is detected.
- ③ After the pump pressure rises and the monitor pressure drops, wait for elapse of “P06: Operation completion wait time”.
- ④ After elapse of “P06: Operation completion wait time”, the pump stops, and the solenoid valve turns OFF. At the same time, the “operation completion” digital output signal turns ON.

10.5.5 Operation completion wait time



This hydraulic unit autonomously stops the pump and turns OFF the solenoid valve when it recognizes completion of operation after cylinder operation. Therefore, to return a single cylinder (see “SOL-b” in the hydraulic circuit as shown on the left), the pump stops and the solenoid valve turns OFF based on the operation completing condition 3 (see Section “10.5.4 Operation completing condition 3”).

In such a case, you can specify the wait time setting parameter so that the hydraulic unit can continue to supply pilot pressure for the non-leak valve.

The pump stop timing at completion of cylinder operation varies depending on configuration of the hydraulic circuit. Refer to “10.5.1 Configuration of hydraulic circuit and operation completing conditions”.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis8b)	P06 Operation completion wait time	0 - 250 The unit of time can be specified with the G17- P05 parameter.	0

IMPORTANT	<ul style="list-style-type: none"> ● The “P06: Operation completion wait time” parameter cannot be individually specified for SOL-a and SOL-b. Once the wait time for SOL-a is changed, the setting for SOL-b will be also changed. ● The “operation completion wait time” parameter becomes active under “operation completing condition 1” and “operation completing condition 3”. As for “operation completing condition 2”, the “operation completion wait time” setting is invalid.
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Unit of the wait time can be changed.

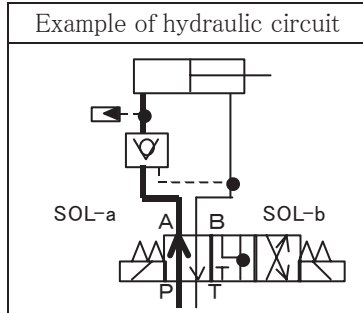
If a single cylinder takes a long time to reach the stroke end due to small spring force, change the unit of the wait time.

No.	Name	Setting range	Factory-setting
G17	P05 Unit of operation completion wait time	0: 10 ms 1: 100 ms	0

IMPORTANT	If pressure hold operation is executed for a long period with a high pressure setting, the unit becomes overloaded. In such a case, lower the pressure setting, or shorten the wait time.
------------------	---

10.6 Correcting pre-charge pressure drop

This hydraulic unit provides the pressure correcting function that autonomously re-charges pressure when the pre-charge pressure lowers. Pressure drop is detected with the pressure sensor mounted to each axis.



To execute pressure correction, holding the pressure with a non-leak valve and monitoring the pre-charge pressure with a pressure sensor are required (see “SOL-a” in the hydraulic circuit on the left).

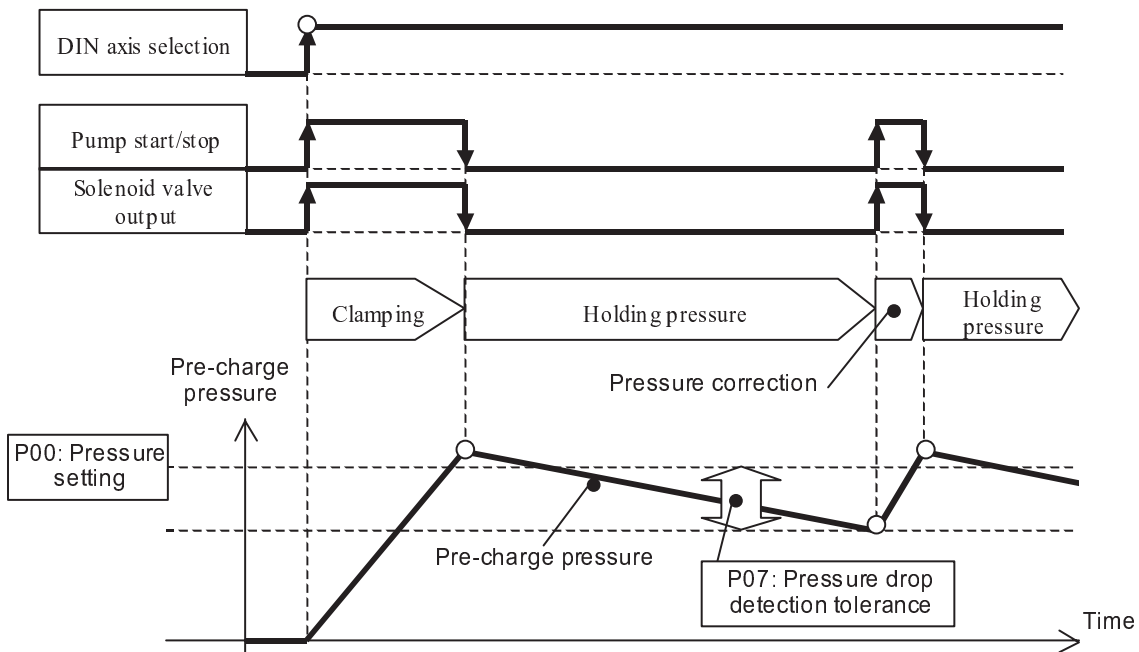
Furthermore, you must set the parameter to enable the pressure correcting function.

For the parameter setting, refer to “10.3.3 Pressure correction enable/disable setting”.

You can specify the pressure to start re-charging pressure with the pressure correcting function by setting a pressure drop tolerance relative to the preset pre-charge pressure.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis8b)	P07	Pressure drop detection tolerance	0.1 - 2.5 [MPa]

IMPORTANT “P07: Pressure drop detection tolerance” cannot be individually specified for SOL-a and SOL-b. Once the setting for SOL-a is changed, the setting for SOL-b will be also changed.





Pressure correction is applied only to the axis on which the axis selection signal is ON. For an application where the pressure must be held at a certain level or higher (for clamping, etc.), be sure to keep the axis selection signal ON even after the clamp operation is completed.

IMPORTANT	Pre-charge pressure is held with the non-leak type pilot check valve. However, if the pressure drop detection tolerance setting is small, pressure correction is frequently repeated, causing the unit to be overloaded. In this case, specify the “07: Pressure drop detection tolerance” parameter so that pressure correction is not frequently executed.
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10.7 Reducing pressure surge during clamping

To reduce pressure surge, this hydraulic unit provides the following two methods:

Function	Outline	Remarks
Surge suppressing function	The hydraulic unit autonomously decelerates the cylinder before it reaches the stroke end, thus reducing pressure surge. It is not required to specify a deceleration position from a host device. Refer to “10.7.1 Surge suppressing function”.	<ul style="list-style-type: none"> This function is suitable for an application with constant cylinder stroke (e.g. for clamping workpieces of the same size.) Cylinder stroke teaching operation is required.
Changing between high-speed and low-speed with “DIN19: Speed change command” digital input signal	With the “DIN19: Speed change command” digital input signal, the flow rate can be changed. Refer to “10.7.2 Change flow rate by speed change command”.	<ul style="list-style-type: none"> This function is suitable for an application with variable cylinder stroke.

10.7.1 Surge suppressing function

The hydraulic unit autonomously decelerates the cylinder before it reaches the stroke end, thus reducing pressure surge. It is not required to specify a deceleration position from a host device.

To enable the surge suppressing function, perform the following two operation steps:

Operation	Reference section
① Enables the surge suppressing function by setting the parameter.	Refer to “Surge suppressing function enable/disable setting” described below.
② Execute teaching operation.	Refer to “9.6.6 Teaching operation”.

■ Surge suppressing function enable/disable setting

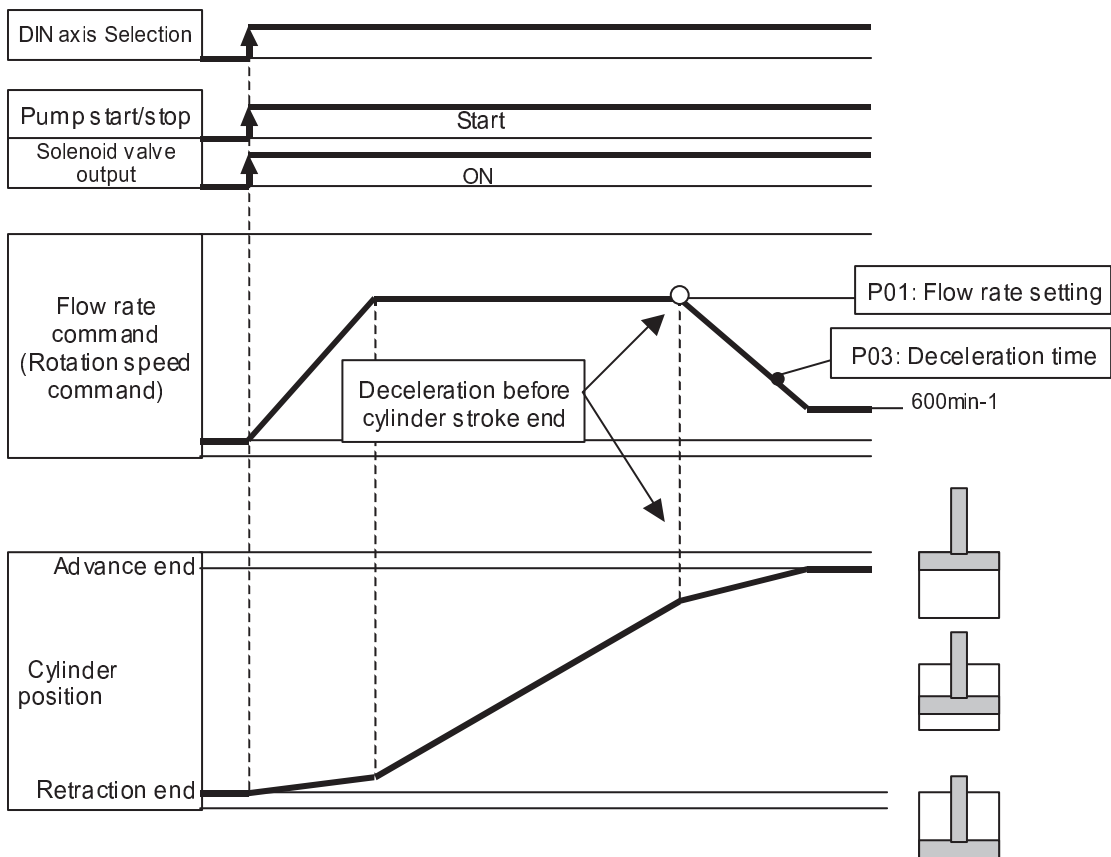
You can specify whether to enable or disable the surge suppressing function individually for SOL-a and SOL-b of each axis. However, the surge suppressing function cannot be enabled simply with this parameter setting. In addition to this parameter setting, you must execute teaching operation. For details on the teaching operation, refer to “9.6.6 Teaching operation”.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis 8b)	P08 Surge suppressing function	0: Disable 1: Enable	1

Set value	Description
0 Disable	Disables the surge suppressing function. The cylinder head reaches the stroke end without deceleration at the flow rate specified with the “P01: Flow rate setting” parameter.
1 Enable	Enables the surge suppressing function. Since the cylinder head reaches the stroke end at a low speed, pressure surge can be reduced. Deceleration under the surge suppressing function is executed according to the “P03: Deceleration time” parameter.

IMPORTANT The parameter setting becomes active when the power supply is turned ON again.

■ Cylinder operation when surge suppressing function is enabled

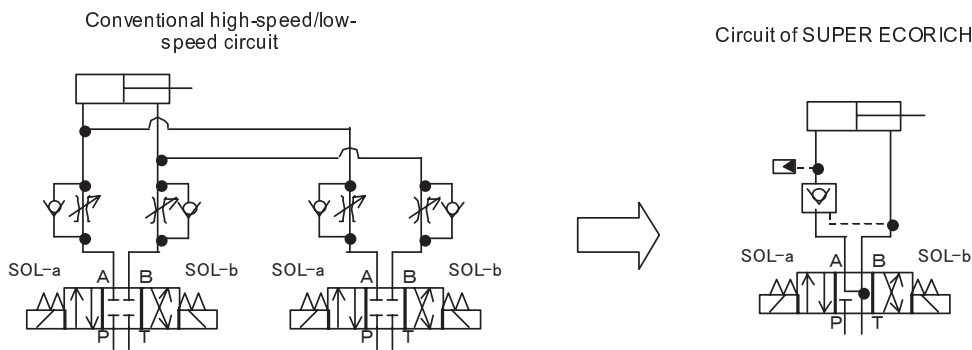


IMPORTANT	<ul style="list-style-type: none"> ● The surge suppressing function is suitable for an application with constant cylinder stroke (e.g. for clamping.) ● For applications with variable cylinder stroke (e.g. when using workpieces of different sizes), the surge suppressing function does not effectively work. For such applications, take any of the following countermeasures: <ul style="list-style-type: none"> • Execute teaching operation at every workpiece changeover. • Decelerate the cylinder before it reaches the stroke end by using the “speed change command” digital input signal. ● To decelerate the cylinder before its stroke end with the surge suppressing function, teaching operation is required. For the teaching operation, refer to “9.6.6 Teaching operation”. If you operate the cylinder without executing the teaching operation, the motor runs at a rotation speed of approx. 600 rpm, regardless of the flow rate setting.
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10.7.2 Change flow rate by speed change command

The hydraulic unit can change the flow rate by using the “DIN19: Speed change command” digital input signal. This function can change the cylinder speed in two steps, without necessity of high-speed and low-speed circuits with solenoid valves.

To reduce pressure surge for an application with variable cylinder stroke (e.g. when using workpieces of different sizes), it is effective to decelerate the cylinder before its stroke end by using the speed change command.



IMPORTANT	<ul style="list-style-type: none"> ● This hydraulic unit uses a meter-in control system to change the flow rate through pump rpm control. Therefore, it is recommended to provide a load compensation circuit with a counterbalance valve, in order to prevent the cylinder from running out of control when driving large load of inertia. ● Adjust the speed change command ON timing on the main machinery to turn ON the speed change command signal before the workpiece touch position so that the cylinder touches the workpiece after deceleration. ● To decelerate the cylinder before its stroke end with the speed change command, set the “P08: Surge suppressing function” parameter to “0: Disable”.
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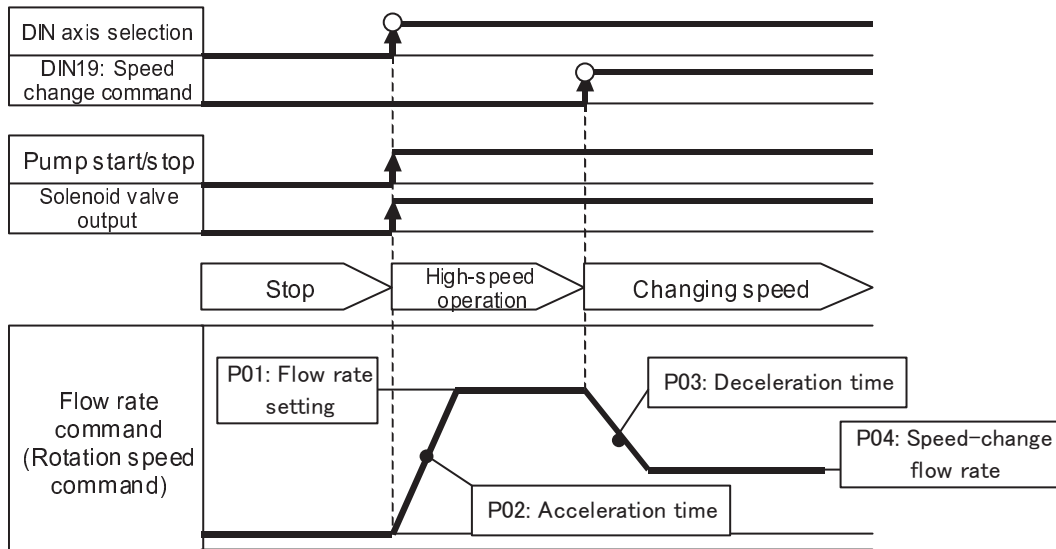
■ Speed-change flow rate setting

The speed-change flow rate can be individually specified for SOL-a and SOL-b of each axis.

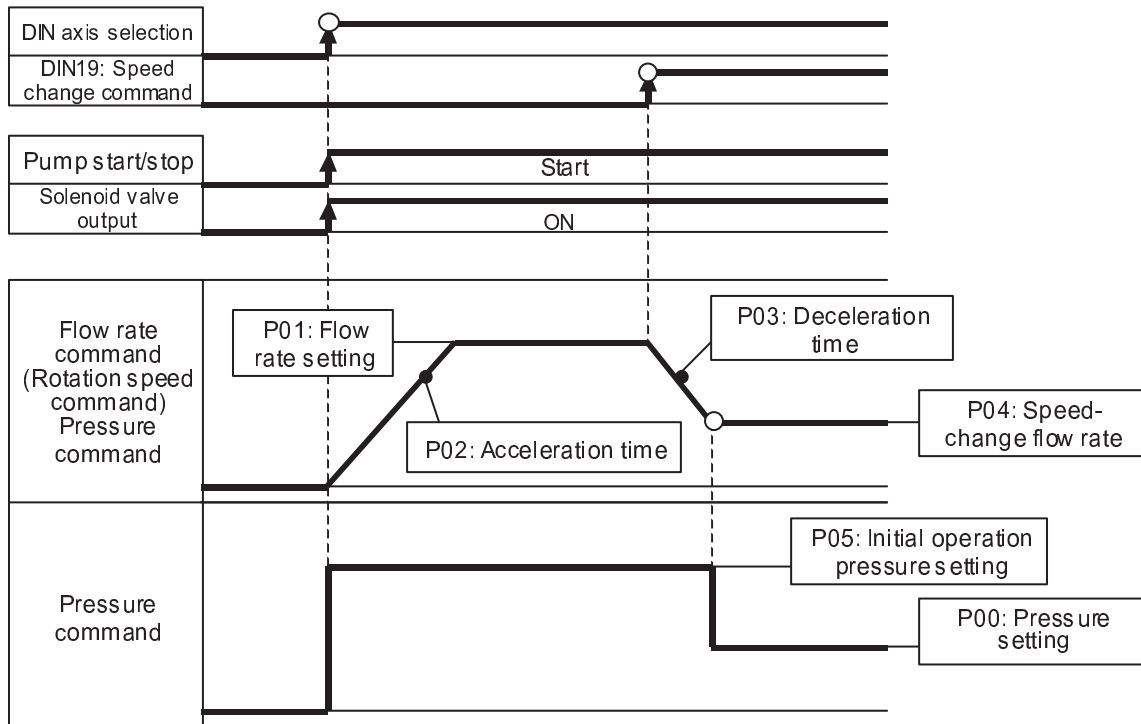
When the flow rate is changed with the speed change command, the cylinder accelerates or decelerates according to the “P02: Acceleration time” and “P03: Deceleration time” parameters.

No.	Name	Setting range	Factory-setting
G00 (Axis 1a) to G15 (Axis 8b)	P04 Speed-change flow rate	3.5 ~28.5 [L/min]	3.5

While the “DIN19: Speed change command” digital input signal is ON, the unit operates at the speed-change flow rate specified by the parameter.



■ Operation sequence under speed change command



- ① When the axis selection signal turns ON, the pump starts, and the solenoid valve turns ON. The flow rate command value increases to the value of “P01: Flow rate setting” according to “P02: Acceleration time”. The pressure command value is set at “P05: Initial operation pressure setting”.
- ② When “DIN: Speed change command” turns ON, the flow rate decreases to the value of “P04: Speed-change flow rate” according to “P03: Deceleration time”.
- ③ When the deceleration is completed, the pressure command value shifts to “P00: Pressure setting”, to touch a workpiece.

IMPORTANT

- To operate the cylinder at a low speed until the stroke end, keep the speed change command signal ON. While the speed change command signal is ON, the flow rate is changed.

- The acceleration time (A) and deceleration time (B) depending on speed change command ON/OFF status can be changed with the “P02: Acceleration time” and “P03: Deceleration time” parameters. Refer to “10.4.3 Acceleration and deceleration time settings”.

MEMO

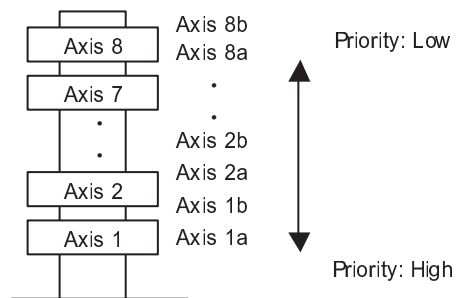
If the speed change command has already turned ON when the axis selection signal turns ON, the hydraulic unit starts operation at the flow rate for the changed speed.

10.8 Priority setting during axis selection

This hydraulic unit cannot operate several cylinders simultaneously. Therefore, if several axis selection signals turn ON at completion of cylinder operation, these axes will be operated according to the specified order of priority.

With the factory setting, the order of priority is specified as shown on the right.

When “Axis 1a” and “Axis 2a” are simultaneously selected, “Axis 1a” is controlled first, and then “Axis 2a” is controlled.



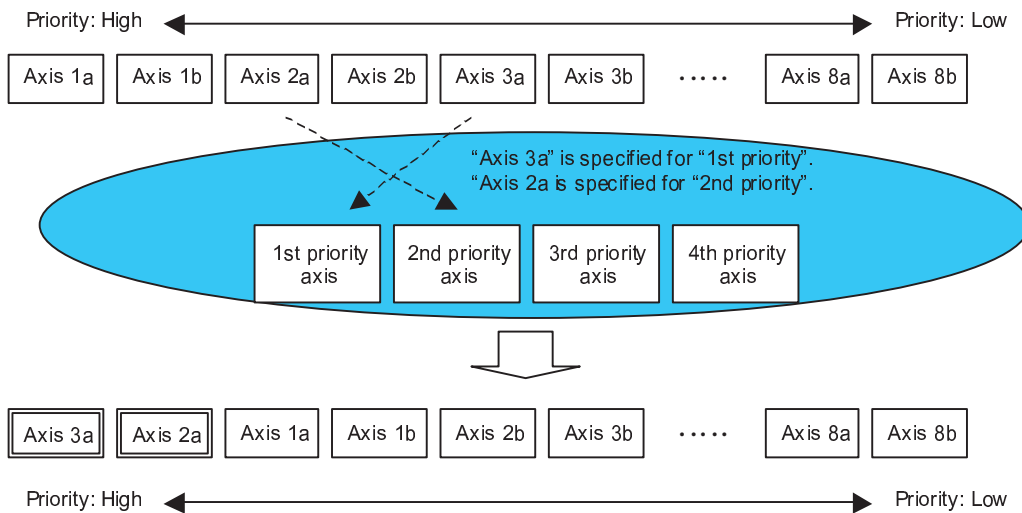
Because of the characteristic of the main machinery, you can individually specify the order of priority for each axis, if you intend to operate several axes in arbitrary order different from the above.

Axis numbers are assigned to individual axes (“1st priority”, “2nd priority”, ...) according to the order of priority.

With the axis numbers, specify whether it is indicated for “SOL-a” or “SOL-b” of each control axis.

No.	Name	Setting range	Factory-setting
G17	P00	1st priority axis setting	0: As per factory setting
	P01	2nd priority axis setting	1A to 8b: Control axis subject to priority setting
	P02	3rd priority axis setting	
	P03	4th priority axis setting	

When “Axis 3a” and “Axis 2a” are specified as “1st priority” and “2nd priority” axes, the operating sequence is as follows:



IMPORTANT	<ul style="list-style-type: none"> ● If all settings of 1st priority to 4th priority axes are “0”, the operating sequence conforms to the factory setting. ● If at least one of the 1st priority to 4th priority axes has been specified, priority is given to the control axis specified as 1st – 4th priority axis. ● The order to priority defines the order to start processing for each axis when several axis selection command signals turn ON, or when pressure correction is executed for several axes due to pre-charge pressure drop. It does not mean that the unit stops the currently controlled axis in the middle of operation, to give priority to the specified axis over others. ● The parameter setting becomes active when the power supply is turned ON again.
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Chapter 11 Operation

**CAUTION**

- Conduct wiring so that the power supplies can be immediately turned OFF in case of emergency.
- If the unit operates in an unexpected manner, ensure safety before starting operation.
- During operation, wear protective gear and gloves.

11.1 Turning power ON

Before turning ON the power supplies, be sure to check the following items:

- Check if the hydraulic unit is properly installed. (See “7.1 Installation”)
- Check if the piping is properly connected. (See “7.2 Piping”)
- Check if the hydraulic oil is filled. (See “7.3 Filling hydraulic oil”)
- Check if the cables are properly connected. (See “Chapter 8 Wiring”)
- Check if the digital input signal is OFF.
- Check if the power supply voltage is proper.

Control power supply		1 ϕ 200 VAC (50 Hz/60 Hz), 220 VAC (60 Hz)
Main circuit power supply		1 ϕ 200 VAC (50 Hz/60 Hz) 220 VAC (60 Hz)
Solenoid valve power supply	Model code:A	100 VAC (50 Hz/60 Hz), 110 VAC (60 Hz)
	Model code:B	200 VAC (50 Hz/60 Hz), 220 VAC (60 Hz)
	Model code:P	24 VDC

Turn on the power supplies according to the following procedure:

Procedure		LED display	
①	Turning ON the control power supply	When the control power supply is turned ON	
		Initialization is completed.	
②	Turning ON the main circuit power supply	When the main circuit power supply is turned ON	
		Charging the capacitor is completed.	
		Pump startup preparation (*1)	
		Operation ready (*1)	 Pressure indication
③	Turning ON the solenoid valve power supply	No change	

IMPORTANT	If the “G18-P00: Operation command enable” parameter is set to “1: Enable”, the pump startup preparation and operation ready processing (*1) will be executed when the operation command signal turns ON first after power-ON.
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MEMO	<ul style="list-style-type: none"> • For details on the power-ON sequence, refer to “12.1 When power supply is turned ON”. • The control power supply, main circuit power supply and solenoid valve power supply can be simultaneously turned ON.
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11.2 Test run

Step	Operating procedure	Reference section	
①	Parameter settings depending on hydraulic circuit For all axes, specify the following parameters: <ul style="list-style-type: none"> • Control axis enable/disable setting • Pressure correction enable/disable setting • Pressure sensor connector setting For the “valve block mounted type” hydraulic unit that is equipped with a valve block, these parameters settings are not required.	“10.3 Parameter settings depending on hydraulic circuit”	
②	Cylinder operation parameter setting	For all axes, specify the parameters required for cylinder operation (pressure, flow rate, etc.).	“10.4 Cylinder operation setting”
③	Preparation of host device sequence program	Prepare a cylinder operation program for the host device.	“Chapter 12 Host Sequence”
④	Flushing operation	Connect all pipes (except for the actuator piping) in a loop, and flush the unit through the filter. The hydraulic unit can be operated by executing continuous operation in the manual operation mode. Check each piping for loose connection or oil leak.	“9.6.7 Continuous operation”
⑤	Actuator piping	Connect the loop piping connected in flushing operation to the actuator.	
⑥	Oil replacement	After flushing operation, replace the hydraulic oil with new oil.	“13.5.1 Hydraulic oil replacement procedure”
⑦	Air bleeding	Bleed air from the hydraulic circuit thoroughly. The hydraulic unit can be operated by executing continuous operation in the manual operation mode. Incomplete air bleeding may result in unstable operation.	“9.6.7 Continuous operation”
⑧	Teaching operation	Execute teaching operation by moving the cylinder. For all axes, execute teaching operation in the manual operation mode.	“9.6.6 Teaching operation”

IMPORTANT	<ul style="list-style-type: none"> ● Some parameters become active when the power supply is turned ON again. Once a parameter setting is changed, be sure to turn ON the power supply before starting the hydraulic unit. ● In addition to the above, the hydraulic unit provides various functions for adjustment specific to your system. Refer to “Chapter 10 Description on Parameters”.
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11.3 Operation check

11.3.1 When “DIN17: Operation command” is set to “Disable”

Step	Operating procedure	Reference section
⑨	Operation start	“Chapter 12 Host Sequence”
	After confirming that the “DOUT1: Operation ready” signal is ON, turn ON the “axis selection” digital input signal. Then, the pump starts, and the selected solenoid valve turns ON. When the cylinder moves to the stroke end, the hydraulic unit autonomously stops the pump, and turns OFF the solenoid valve.	
	Check the operating axis and operating direction are matched with the axis selection.	
	Check each piping for loose pipe and oil leak.	
⑩	Operation end	“Chapter 12 Host Sequence”
	Turn OFF the “axis selection” digital input signal.	

11.3.2 When “DIN17: Operation command” is set to “Enable”

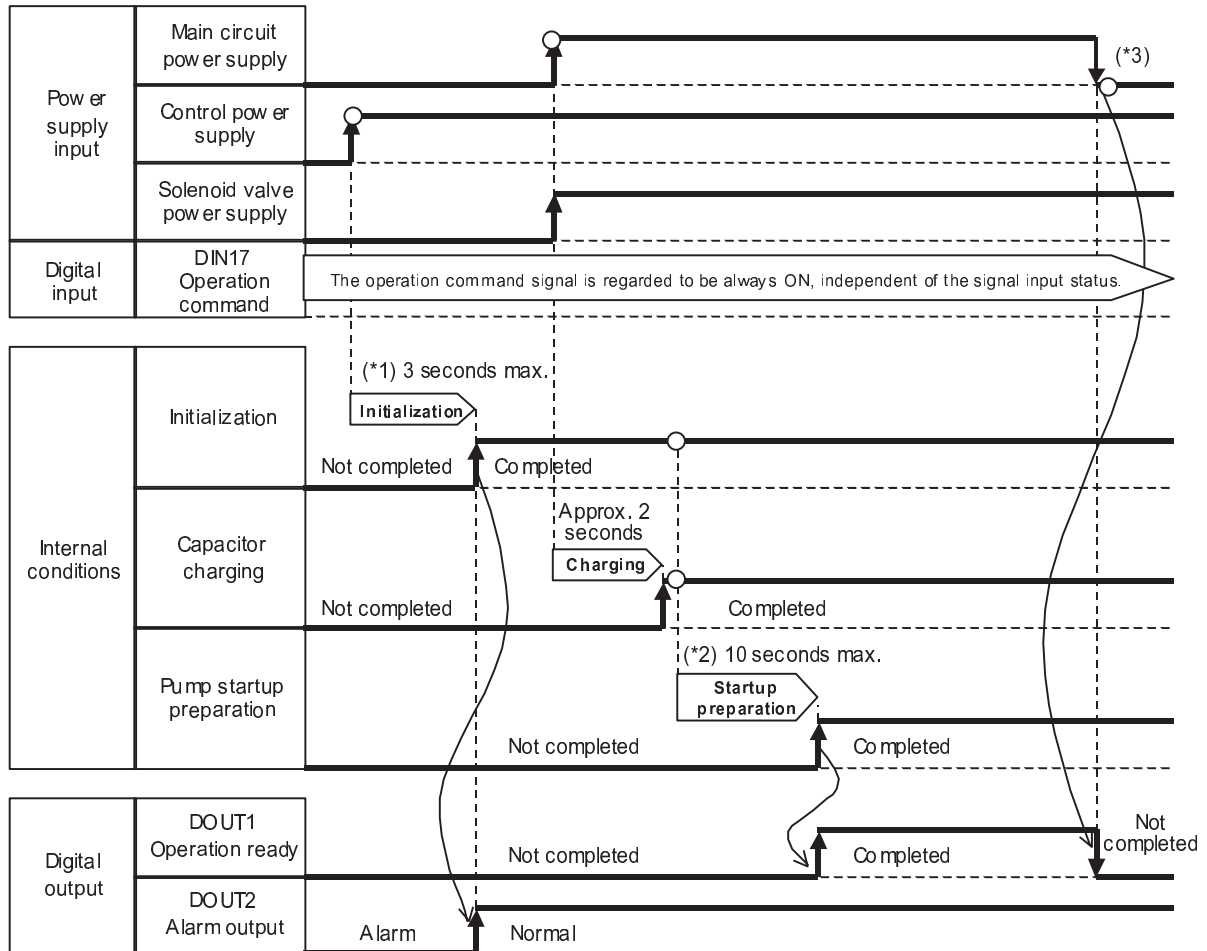
Step	Operating procedure	Reference section
⑨	Operation start	“Chapter 12 Host Sequence”
	Turn ON the “DIN17: Operation command” signal. The pump startup preparation is executed, when the “DIN17: Operation command” signal is turned ON first after power-ON.	
	After confirming that the “DOUT1: Operation ready” signal is ON, turn ON the “axis selection” digital input signal. Then, the pump starts, and the selected solenoid valve turns ON. When the cylinder moves to the stroke end, the hydraulic unit autonomously stops the pump, and turns OFF the solenoid valve.	
	Check the operating axis and operating direction are matched with the axis selection.	
	Check each piping for loose pipe and oil leak.	
⑩	Operation end	“Chapter 12 Host Sequence”
	Turn OFF the “axis selection” digital input signal.	
	Turn OFF the “DIN17: Operation command” signal.	

Chapter 12 Host Sequence

12.1 When power supply is turned ON

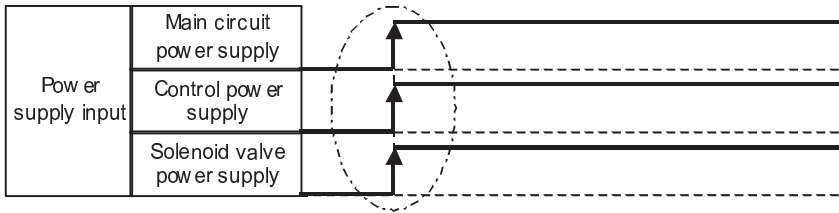
12.1.1 When “DIN17: Operation command” digital input is set to “Disable”

When the “DIN17: Operation command” digital input is disabled, the operation command signal is regarded to be always ON. The operation sequence at power-ON is as follows:



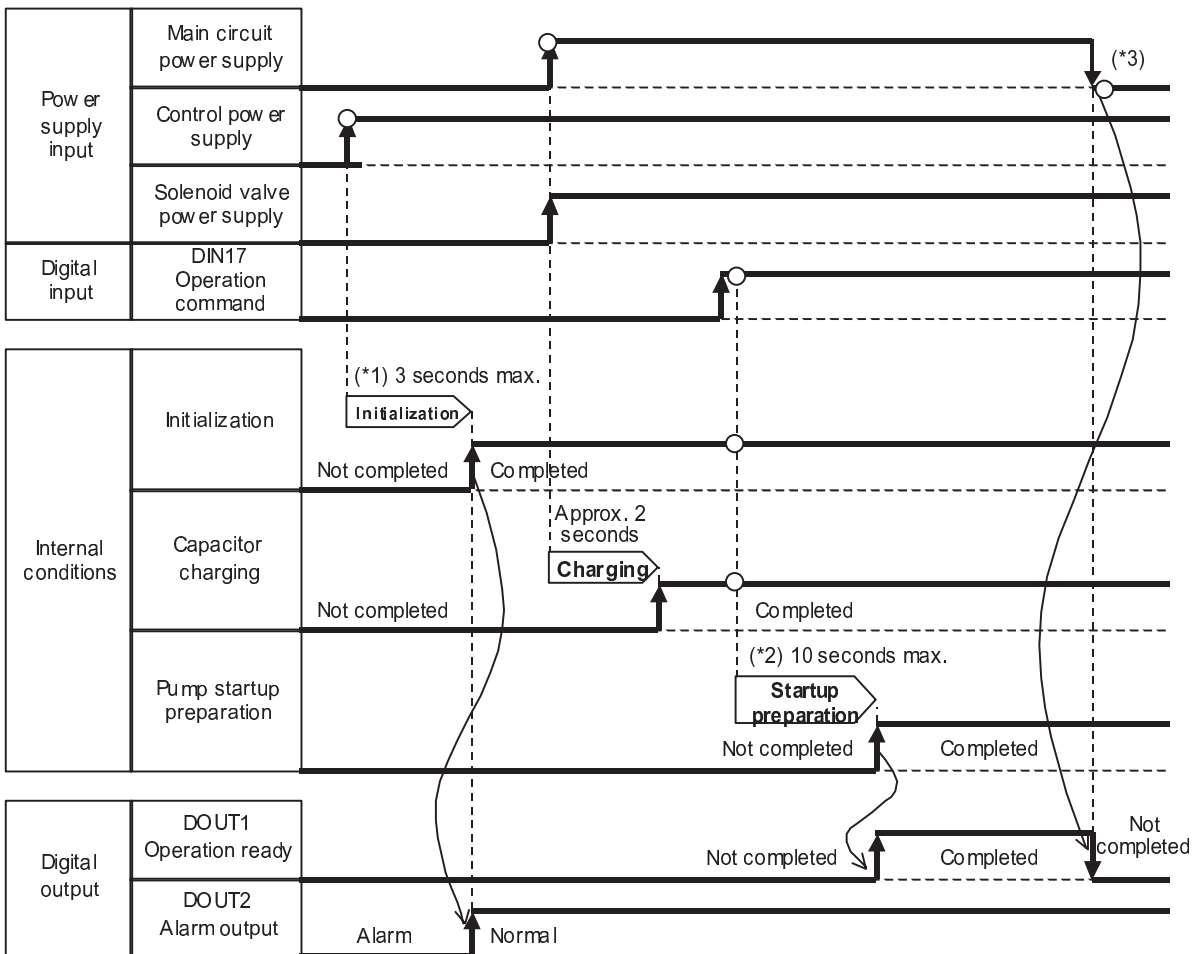
- *1. The time required for controller initialization is 3 seconds max. after the control power supply is turned ON. Until initialization is completed, the “DOUT2: Alarm output” signal remains OFF. Ensure that the host device does not detect an alarm.
- *2. After the main circuit power supply is turned ON, the pump startup preparation starts at completion of capacitor charging. When the pump startup preparation is completed, the “DOUT1: Operation ready” signal turns ON.
- *3. When the main circuit power supply is turned OFF, the “DOUT1: Operation ready” signal also turns OFF.

The control power supply, main circuit power supply and solenoid valve power supply can be simultaneously turned ON.



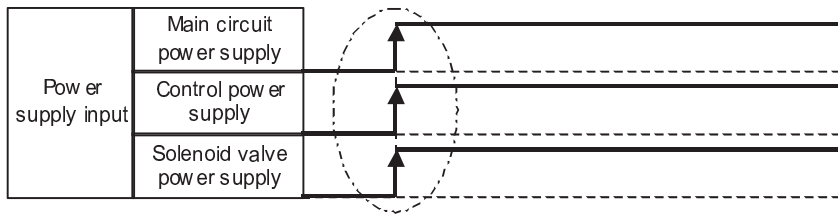
12.1.2 When “DIN17: Operation command” digital input is set to “Enable”

When the “DIN17: Operation command” digital input is enabled, the operation sequence at power-ON is as follows:

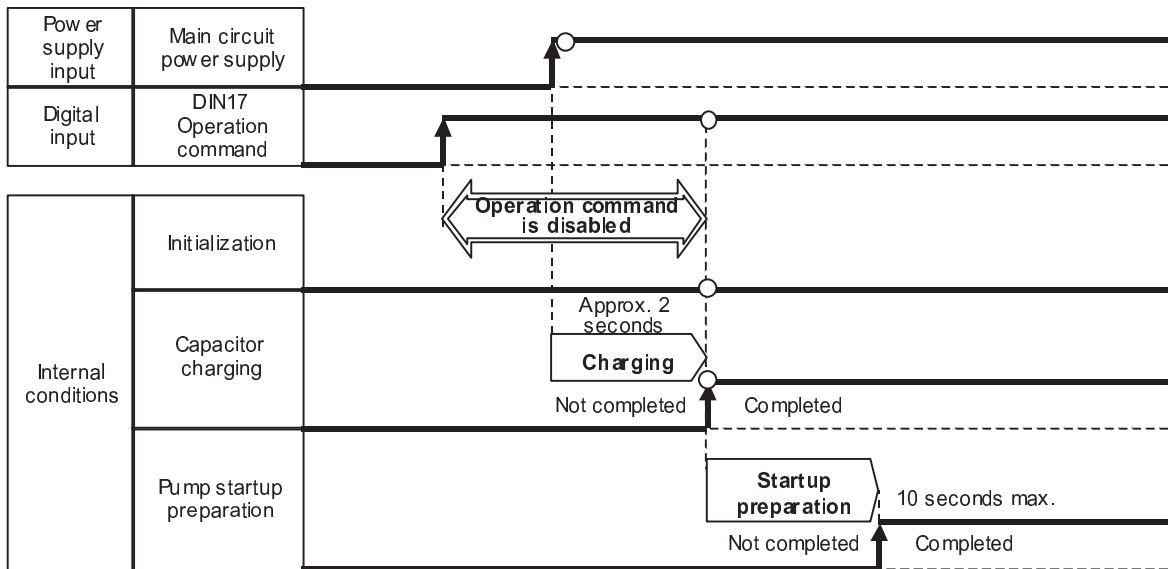


- *1. The time required for controller initialization is 3 seconds max. after the control power supply is turned ON. Until initialization is completed, the “DOUT2: Alarm output” signal remains OFF. Ensure that the host device does not detect an alarm.
- *2. The pump startup preparation starts when the “DIN17: Operation command” signal turns ON first after the power supply is turned ON. When the pump startup preparation is completed, the “DOUT1: Operation ready” signal turns ON.
- *3. When the main circuit power supply is turned OFF, the “DOUT1: Operation ready” signal also turns OFF.

The control power supply, main circuit power supply and solenoid valve power supply can be simultaneously turned ON.



The “DIN17: Operation command” digital input is disabled until capacitor charging is completed after the main circuit power supply is turned ON. If the operation command signal has turned ON before the main circuit power supply is turned ON, the pump startup preparation starts after completion of capacitor charging.



12.1.3 Pump startup preparation

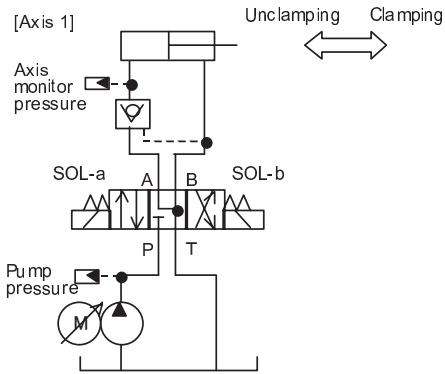
Pump startup preparation takes ten seconds at the maximum. The conditions to enable pump startup preparation are as listed below.

G18 – P00 : “Operation command enable” parameter setting	Condition
0 : Disable	<ul style="list-style-type: none"> • When capacitor charging is completed after power-ON • When capacitor charging is completed after alarm reset
1 : Enable	<ul style="list-style-type: none"> • When operation command turns ON first after power-ON • When operation command turns ON first after alarm reset <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>MEMO After completion of pump startup preparation, pump startup preparation is not executed even if “DIN17: Operation command” is turned OFF once and then turned ON again.</p> </div>

If any of the following conditions occurs during pump startup preparation, the pump startup preparation is canceled.

- When the main circuit power supply is turned OFF
- When the operation command signal is turned OFF
- When an alarm condition occurs

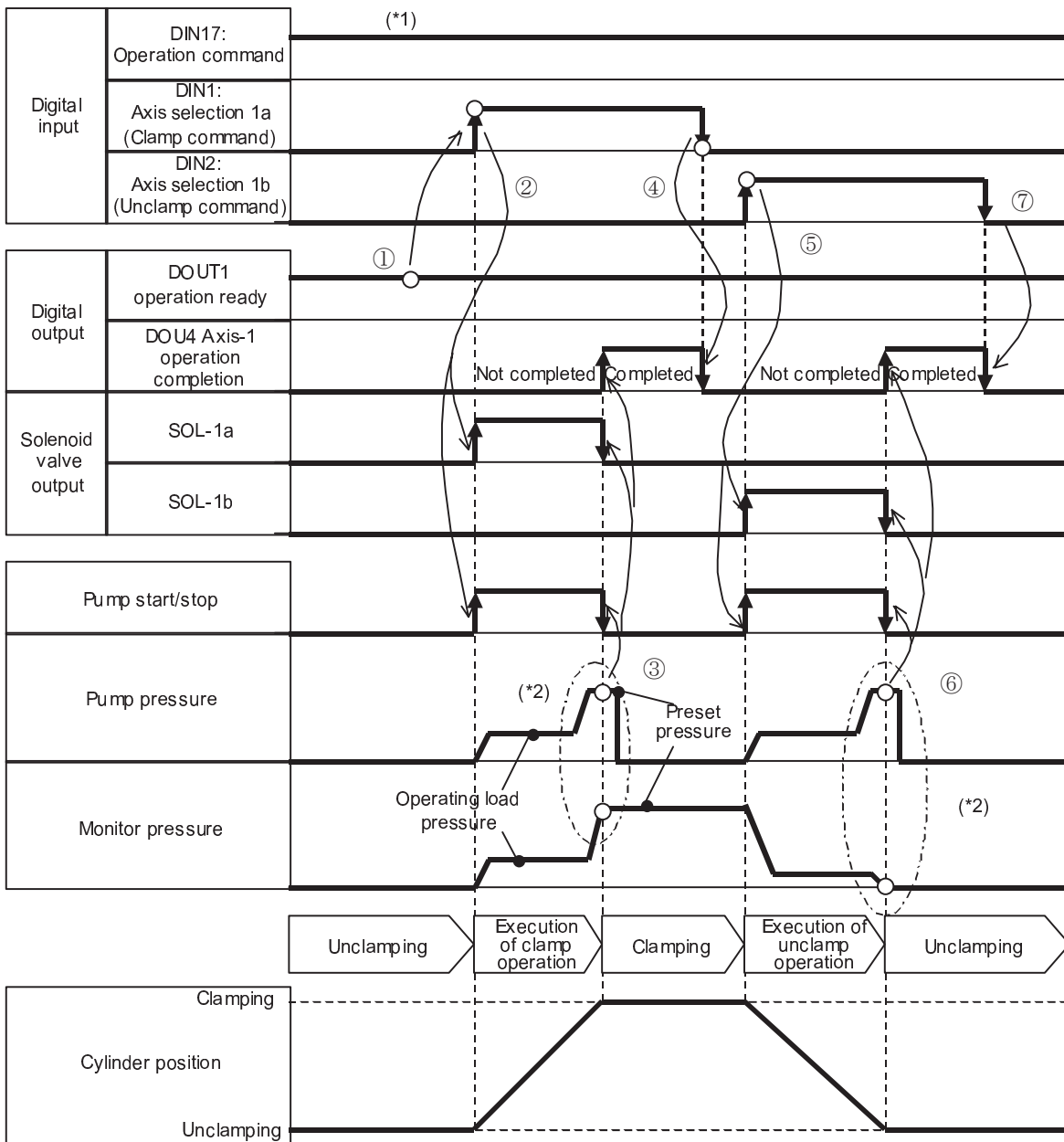
12.2 Clamping and unclamping operations



For example, to execute clamping operation by energizing SOL-a, and to execute unclamping operation by energizing SOL-b for [Axis 1] in the hydraulic circuit shown on the left, the hydraulic unit operates according to the following timing chart.

The following timing chart shows the operations after completion of pump startup preparation (after the unit becomes ready for operation).

For the operation sequence before completion of preparation, refer to “12.1 When power supply is turned ON”.

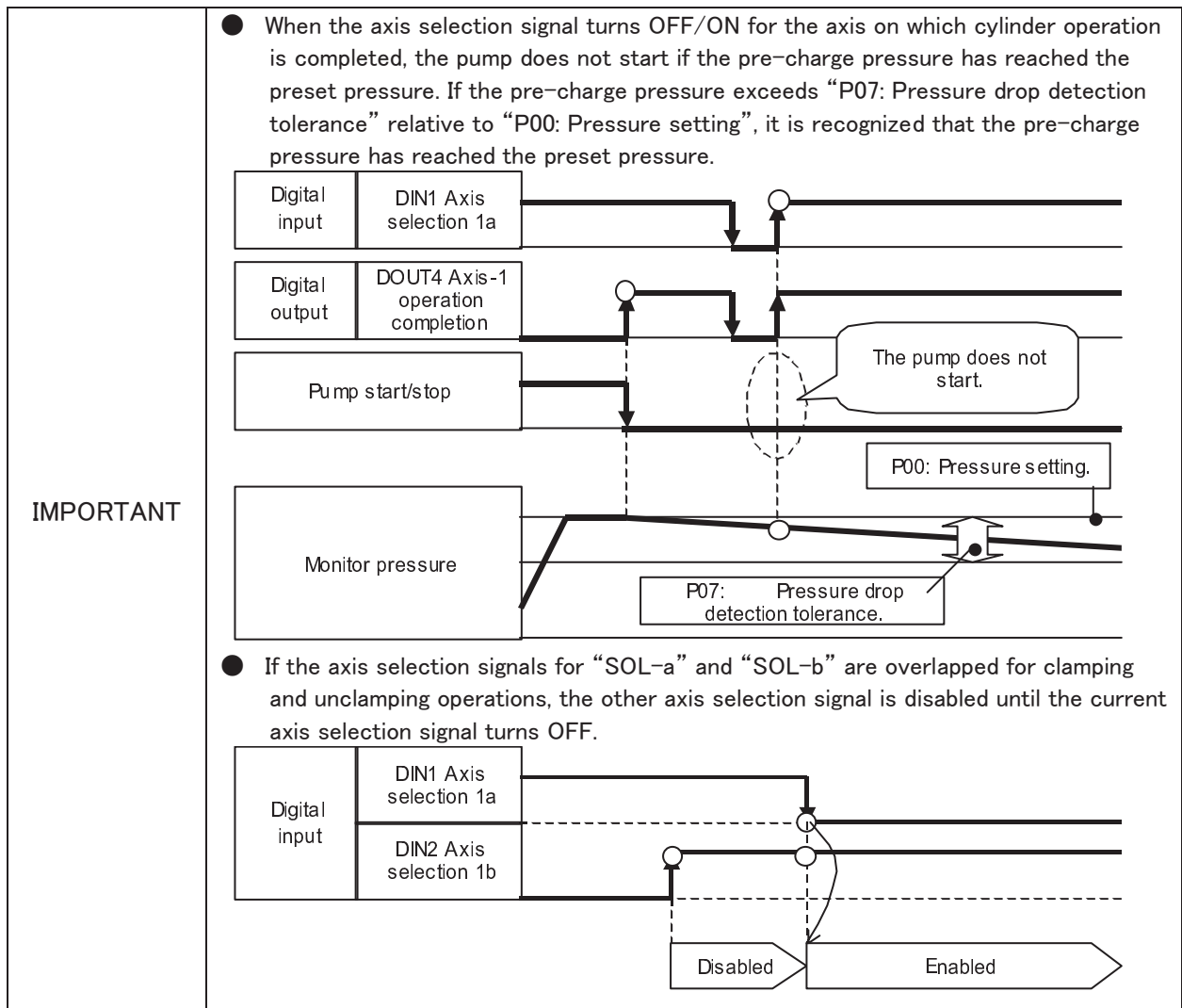


■ Clamping operation

- ① After confirming that the “DOUT1: Operation ready” signal is ON, turn ON the “DIN1: Axis selection 1a (Clamp command)” signal.
- ② The pump starts, and the “SOL-a” solenoid valve turns ON to execute clamping operation.
- ③ When pump pressure rise and monitor pressure rise are detected after completion of clamping operation, the pump stops, and the solenoid valve turns OFF. At the same time, the “DOUT4: Axis-1 operation completion” digital output turns ON.
- ④ When the “DIN1: Axis selection 1a (Clamp command)” signal turns OFF, the “DOUT4: Axis-1 operation completion” signal also turns OFF.

■ Unclamping operation

- ⑤ When the “DIN2: Axis selection 1b (Unclamp command)” signal turns ON, the pump starts, and the “SOL-b” solenoid valve turns ON.
- ⑥ When pump pressure rise and monitor pressure drop are detected after completion of unclamping operation, the pump stops, and the solenoid valve turns OFF. At the same time, the “DOUT4: Axis-1 operation completion” digital output turns ON.
- ⑦ When the “DIN2: Axis selection 1b (Unclamp command)” signal turns OFF, the “DOUT4: Axis-1 operation completion” signal also turns OFF.



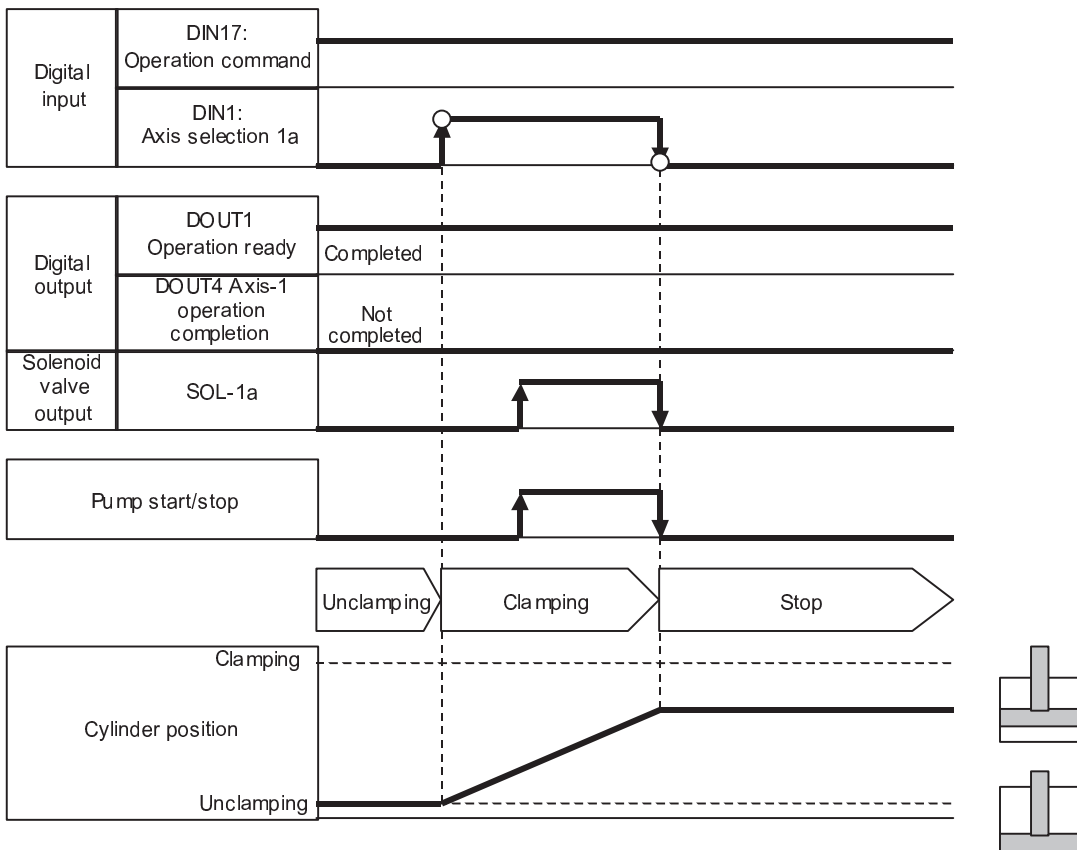
MEMO	<p>*1. When the operation command is disabled, it is not necessary to turn ON the “Operation command” digital input signal. This signal is regarded to be always ON. When the operation command is enabled, be sure to turn ON the “Operation command” digital input signal to operate the cylinder.</p> <p>*2. The operation completing condition varies depending on configuration of the hydraulic circuit. Refer to “10.5.1 Configuration of hydraulic circuit and operation completing conditions”.</p>
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12.3 Cylinder stop

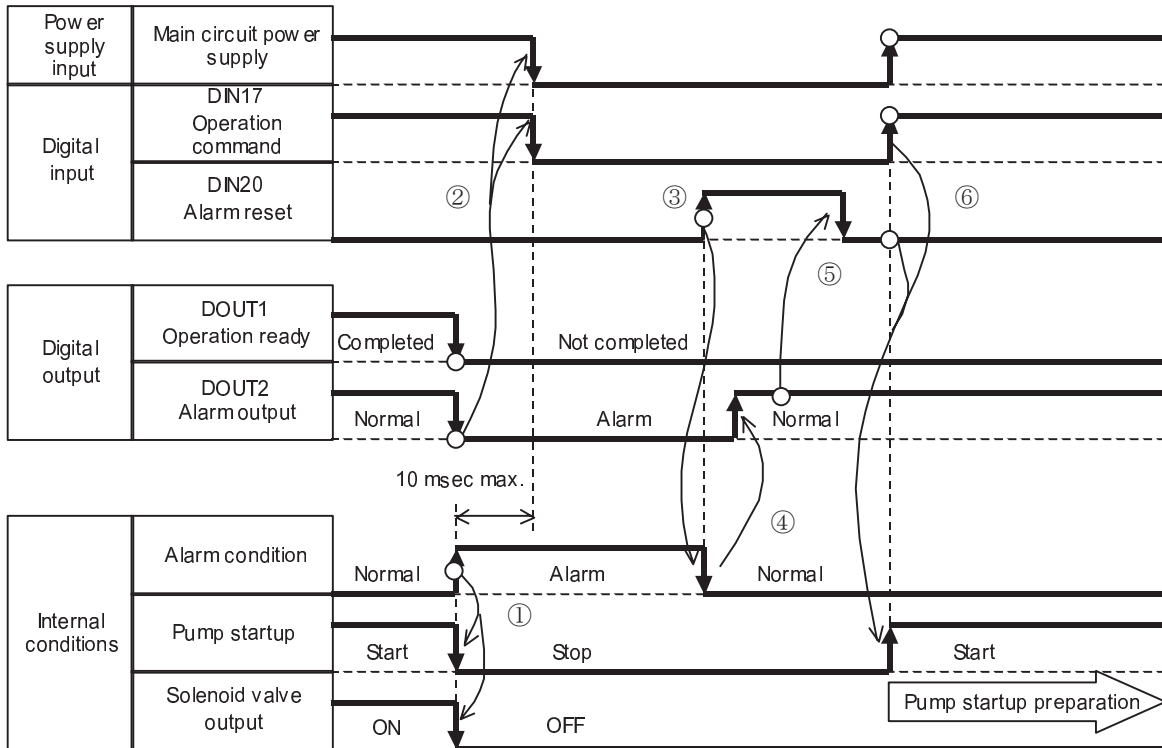
In any of the following conditions, the cylinder operation stops. The pump stops, and the solenoid valve turns OFF to stop the unit immediately.

- When the axis selection signal is turned OFF
- When “DIN17: Operation command” is turned OFF
- When an alarm condition occurs
- When the unit is not ready due to any reason other than the above (e.g. the main circuit power supply is turned OFF).

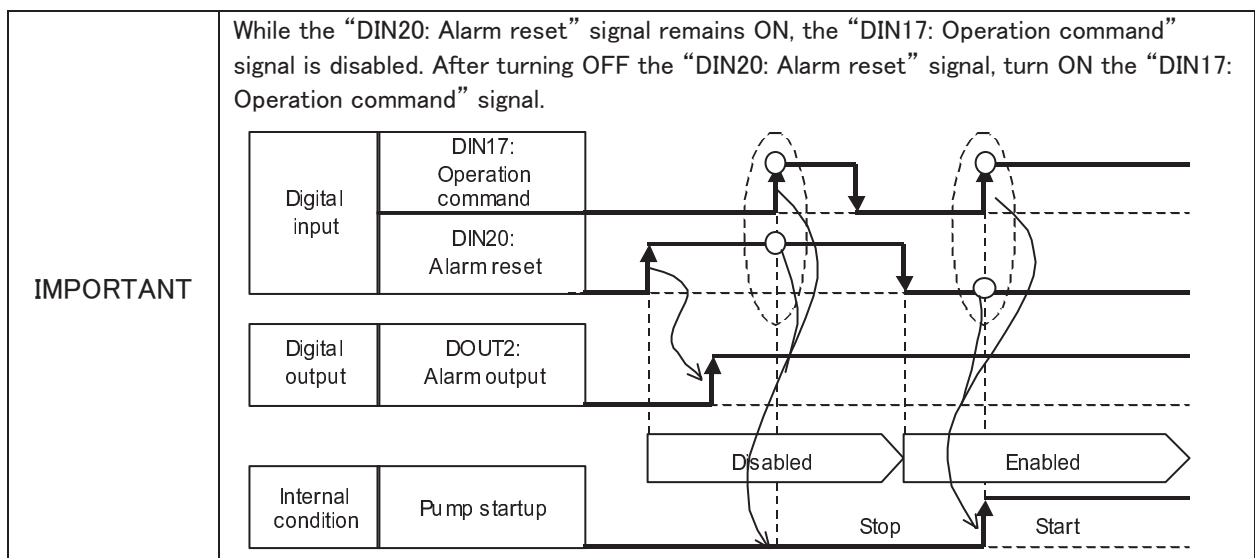
When the axis selection signal is turned OFF during cylinder operation, the unit immediately stops as shown in the following chart:



12.4 Activation of alarm and alarm reset

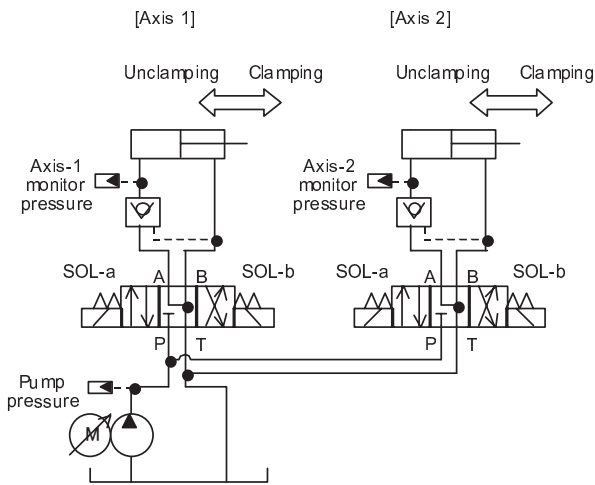


- ① At occurrence of an alarm condition, the pump stops, and the solenoid valve turns OFF. The “DOUT1: Operation ready” and “DOUT2: Alarm output” signals turn OFF.
- ② After confirming that the “DOUT2: Alarm output” signal is OFF, turn OFF the main circuit power supply for the hydraulic unit and the operation command. Turn OFF the power supply for the solenoid valve, if necessary.
- ③ After removing the cause of alarm, the alarm can be reset by turning ON the “DIN20: Alarm reset” signal.
- ④ When the alarm condition is reset, the “DOUT: Alarm output” signal turns ON.
- ⑤ After confirming that the “DOUT2: Alarm output” signal is ON, turn OFF the “DIN20: Alarm reset” signal.
- ⑥ After turning OFF the “DIN20: Alarm reset” signal, turn ON the main circuit power supply, and turn ON the “DIN17: Operation command” signal. Then, the pump starts. When the operation command signal is turned ON first after alarm reset, the pump startup preparation is executed.



12.5 Operating several axes

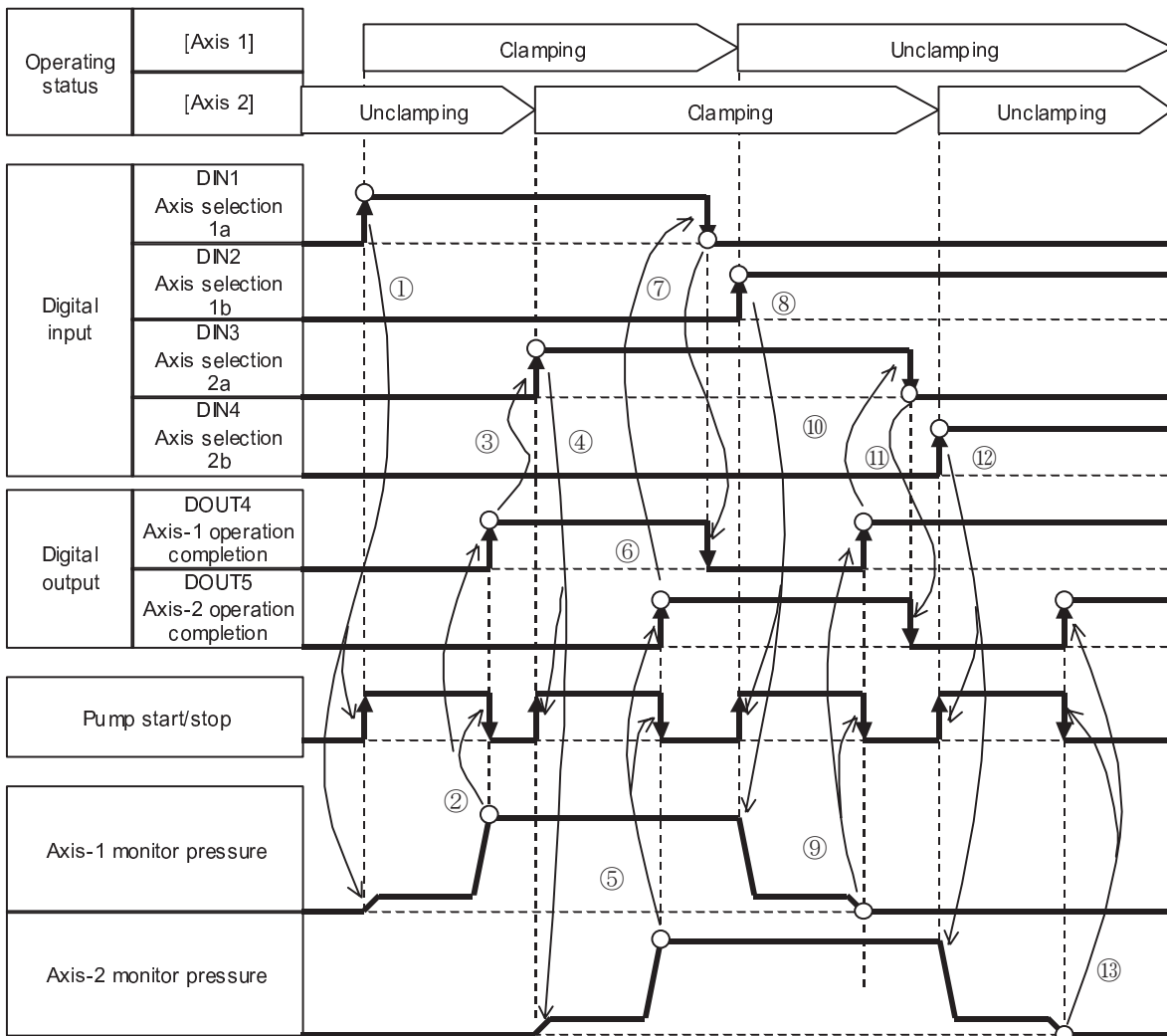
12.5.1 Operating several axes in sequence



For example, if you intend to clamp Axis 1 and Axis 2, and then unclamp Axis 1 and Axis 2 in this sequence in the hydraulic circuit shown on the left, the hydraulic unit operates according to the following timing chart.

The following timing chart shows the operations after completion of pump startup preparation (after the unit becomes ready for operation).

For the operation sequence before completion of preparation, refer to “12.1 When power supply is turned ON”.



■ **Axis 1 and Axis 2 clamping operations**

- ① When the “DIN1: Axis selection 1a” signal turns ON, the pump starts, and the Axis-1 clamping operation starts.
- ② After completion of the Axis-1 clamping operation, the pump stops, and the “DOOUT4: Axis-1 operation completion” signal turns ON.
- ③ After confirming that the “DOOUT4: Axis-1 operation completion” signal is ON, turn ON the “DIN3: Axis selection 2a” signal.
- ④ When the “DIN3: Axis selection 2a” signal turns ON, the pump starts, and the Axis-2 clamping operation starts.
- ⑤ After completion of the Axis-2 clamping operation, the pump stops, and the “DOOUT5: Axis-2 operation completion” signal turns ON.

■ **Axis 1 and Axis 2 unclamping operations**

- ⑥ After confirming that the Axis-2 clamping operation is completed (the “DOOUT5: Axis-2 operation completion” signal is ON), execute the Axis-1 unclamping operation. Turn OFF the “DIN1: Axis selection 1a” signal for the clamp command.

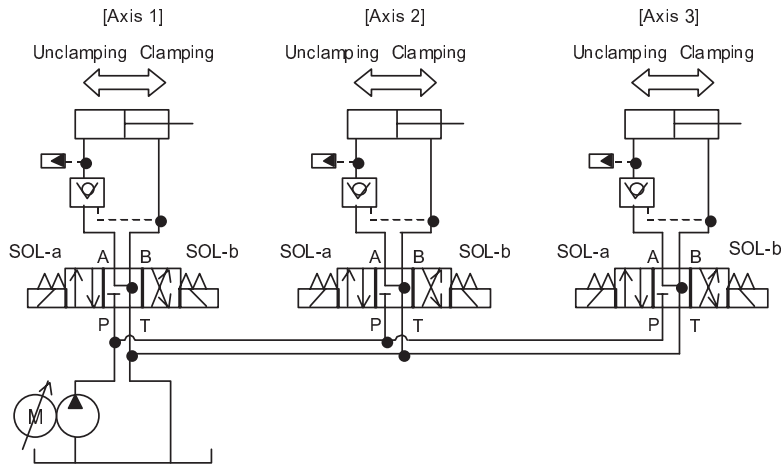
MEMO	Turn OFF the clamp command before turning ON the unclamp command, so that the clamp and unclamp commands are not simultaneously ON.
-------------	---

- ⑦ When “DIN1: Axis selection 1a” signal turns OFF, the “DOOUT4: Axis-1 operation completion” signal turns ON.
- ⑧ When the “DIN2: Axis selection 1b” signal turns ON, the pump starts, and the Axis-1 unclamping operation starts.
- ⑨ After completion of the unclamping operation, the pump stops, and the “DOOUT4: Axis-1 operation completion” signal turns ON.
- ⑩ After confirming that the “DOOUT4: Axis-1 operation completion” signal is ON, execute the Axis-2 unclamping operation. Turn OFF the “DIN3: Axis selection 2a” signal for the unclamp command.
- ⑪ When the “DIN3: Axis selection 2a” turns off, “DOOUT5: Axis-2 operation completion” signal turns OFF.
- ⑫ When the “DIN4: Axis selection 2b” signal turns ON, the pump starts, and the Axis-2 unclamping operation starts.
- ⑬ After completion of the unclamping operation, the pump stops, and the “DOOUT5: Axis-2 operation completion” signal turns ON.

12.5.2 If several axis selection signals are simultaneously turned ON

This hydraulic unit cannot simultaneously operate several axes.

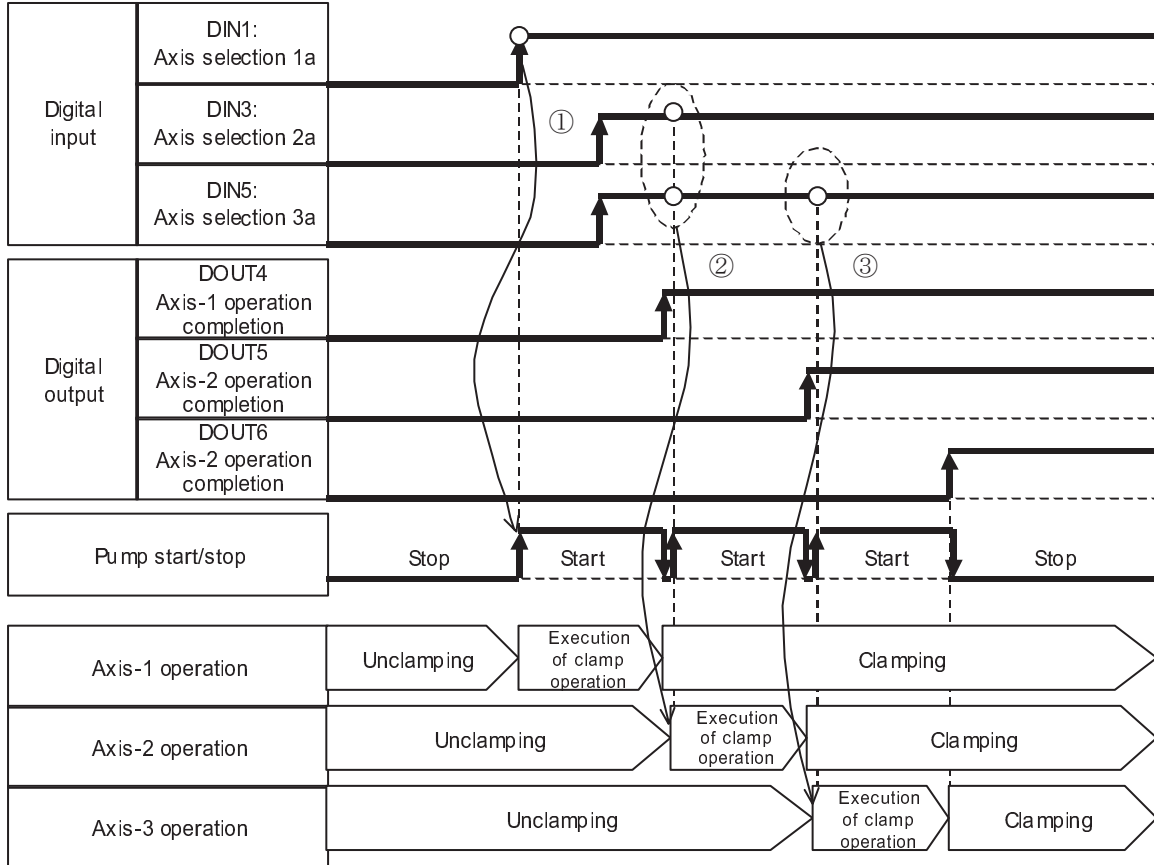
If several axis selection signals are simultaneously turned ON during cylinder operation, the unit operates one axis with the highest priority, among the axes on which axis selection signals have turned ON. For details on the order of priority, refer to “10.8 Priority setting during axis selection”.



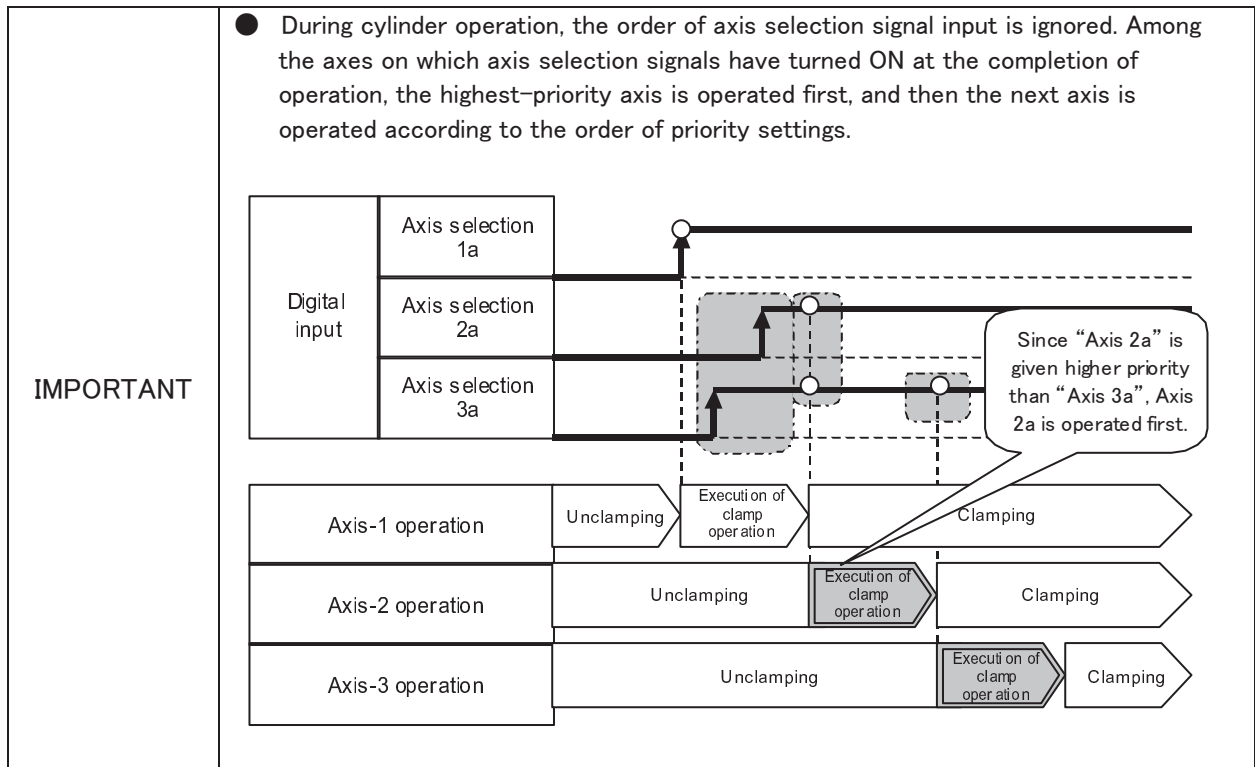
For your reference, the following timing chart shows an example that Axis 2 and Axis 3 clamp commands are simultaneously turned ON during operation of Axis 1 in the hydraulic circuit shown on the left.

The following is a reference timing chart based on the factory-set priority. With the factory setting, the order of priority for the control axes is as follows:

Axis 1a > Axis 1b > Axis 2a > Axis 2b > Axis 3a > Axis 3b



- ① When the “DIN1: Axis selection 1a” signal turns ON, Axis 1 starts operation.
- ② After completion of the Axis-1 operation, the “DIN3: Axis selection 2a” and “DIN5: Axis selection 3a” signals are ON. Therefore, “Axis 2a” with higher priority is selected, and then Axis 2 starts operation.
- ③ After completion of the Axis-2 operation, Axis 3 starts operation.



Chapter 13 Maintenance and Inspection

13.1 About alarms

Once the protective function is activated, the alarm turns ON, and the corresponding alarm code is indicated on the LED display of the operation panel.

When an alarm turns ON, the pump stops, and the solenoid valve turns OFF to stop the unit immediately. In this status, the “DOUT2: Alarm output” digital output signal turns OFF.

When the protective function is activated, check the relevant parts and take corrective actions according to the table below, to remove the cause of alarm.

Alarm reset methods are as follows:

- Turn ON the “Alarm reset” digital input signal.
- Reset the alarm by operating the panel.
- Turn OFF the power supply once, and then turn it ON again.

IMPORTANT	In the following table, the alarms indicated with asterisk (*) cannot be reset with the alarm reset signal. To reset the alarm, turn OFF the power supply, remove the cause of the alarm, and then turn ON the power supply again.
------------------	--

Alarm code	Name	Cause	Corrective action
E10	Output device error The output device over-current protective function is activated.	The motor rotation speed is unstable due to contamination.	<ul style="list-style-type: none"> • Replace the motor pump assembly and hydraulic oil.
		The pump is started in the reverse direction due to returned load.	<ul style="list-style-type: none"> • Reduce the load volume. • Review the startup timing.
		The pump is out of control under vacuum due to large load of inertia.	<ul style="list-style-type: none"> • Review the hydraulic circuit. • Reduce the load of inertia.
		The pump or motor has seized up or locked.	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Short-circuit or ground fault of the motor	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the encoder	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the controller	<ul style="list-style-type: none"> • Replace the controller.
		Malfunction due to large noise	<ul style="list-style-type: none"> • Reduce the ambient noise. • Review the wiring system. • Insert a ferrite core.
E11	Motor over-current The motor output current exceeded the specified value.	The motor rotation speed is unstable due to contamination.	<ul style="list-style-type: none"> • Replace the motor pump assembly and hydraulic oil.
		The pump is started in the reverse direction due to returned load.	<ul style="list-style-type: none"> • Reduce the load volume. • Review the startup timing.
		The pump is out of control under vacuum due to large load of inertia.	<ul style="list-style-type: none"> • Review the hydraulic circuit. • Reduce the load of inertia.
		The pump or motor has seized up or locked.	<ul style="list-style-type: none"> • Replace the motor pump assembly.

Alarm code	Name	Cause	Corrective action
		Short-circuit or ground fault of the motor	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the encoder	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the controller	<ul style="list-style-type: none"> • Replace the controller.
		Malfunction due to large noise	<ul style="list-style-type: none"> • Reduce the ambient noise. • Review the wiring system. • Insert a ferrite core.
E12	Motor over-speed The motor rotation speed exceeded 120% of the maximum rated rotation speed.	The pump is operated at high speed in the reverse direction due to returned load.	<ul style="list-style-type: none"> • Reduce the load volume.
		The pump is operated at high speed under vacuum due to large load of inertia.	<ul style="list-style-type: none"> • Review the hydraulic circuit. • Reduce the load of inertia.
		Fault of the encoder	<ul style="list-style-type: none"> • Replace the motor pump assembly.
E15	Main circuit under-voltage The main circuit DC voltage dropped below the specified value (170 VDC).	The power supply voltage is low.	<ul style="list-style-type: none"> • Set the power supply voltage at the specified value.
		Fault of the controller	<ul style="list-style-type: none"> • Replace the controller.
E16	Main circuit over-voltage The main circuit DC voltage exceeded the specified value (400 VDC).	The power supply voltage is high.	<ul style="list-style-type: none"> • Set the power supply voltage at the specified value.
		Increase in regenerative power due to rapid deceleration	<ul style="list-style-type: none"> • Prolong the deceleration time. • Reduce the load of inertia.
E17	Motor overload The motor overload protective function is activated by electronic thermal trip.	The pressure correcting function is set to “Enable” for the circuit without a non-leak valve.	<ul style="list-style-type: none"> • Set the pressure correcting function correctly according to “10.3.3 Pressure correction enable/disable setting”.
		The operation completion wait time setting is long.	<ul style="list-style-type: none"> • Reduce the pressure setting. • Shorten the operation completion wait time. • “10.5.5 Operation completion wait time”
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
		The pre-charge pressure holding time is shortened due to contamination, and the pressure correction frequency is increased.	<ul style="list-style-type: none"> • Conduct flushing. • Replace the hydraulic oil. • Replace the non-leak valve.
		Increased leak in the hydraulic circuit	<ul style="list-style-type: none"> • Check the hydraulic piping for external leak. • Conduct cylinder maintenance (packing replacement, etc.). • Replace the cylinder. • Replace the non-leak valve.

Alarm code	Name	Cause	Corrective action
E18	Pump startup preparation error The pump startup preparation was not completed within the specified time.	Fault of the encoder.	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Abnormal load due to pump seizure, etc.	
		Fault of the motor	
E20 (*)	Encoder cable break The encoder cable has broken.	Encoder cable break	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the encoder	
		The pump has locked, disabling operation.	
		Fault of the motor	<ul style="list-style-type: none"> • Replace the controller.
Fault of the controller			
E21 (*)	Motor cable break The motor cable has broken.	Motor cable break	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the output device	<ul style="list-style-type: none"> • Replace the controller.
E26	Main circuit voltage error An error occurred with the main circuit voltage detector.	Fault of the controller	<ul style="list-style-type: none"> • Replace the controller.
E27	Controller overload The controller overload protective function is activated by electronic thermal trip.	The pressure correcting function is set to “Enable” for the circuit without a non-leak valve.	<ul style="list-style-type: none"> • Set the pressure correcting function correctly according to “10.3.3 Pressure correction enable/disable setting”.
		The operation completion wait time setting is long.	<ul style="list-style-type: none"> • Reduce the pressure setting. • Shorten the operation completion wait time. “10.5.5 Operation completion wait time”
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
		The pre-charge pressure holding time is shortened due to contamination, and the pressure correction frequency is increased.	<ul style="list-style-type: none"> • Conduct flushing. • Replace the hydraulic oil. • Replace the non-leak valve.
		Increased leak in the hydraulic circuit	<ul style="list-style-type: none"> • Check the hydraulic piping for external leak. • Conduct cylinder maintenance (packing replacement, etc.). • Replace the cylinder. • Replace the non-leak valve.
E29	Motor synchronization error The motor is out of synchronization.	The pump or motor has seized up or locked.	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the encoder	

Alarm code	Name	Cause	Corrective action																
E30	Pump pressure sensor cable break/short-circuit The pump pressure sensor cable has broken or short-circuited, or the sensor detected an abnormal pressure.	Detection of abnormal pressure	• Review the hydraulic circuit.																
		The pressure sensor is not connected.	• Check the pressure sensor harness.																
		Pressure sensor harness break, short-circuit or contact failure	• Replace the pressure sensor harness.																
		Fault of the pressure sensor	• Replace the pressure sensor.																
E32 to E39	Monitor pressure sensor cable break/short-circuit The monitor pressure sensor cable has broken or short-circuited, or the sensor detected an abnormal pressure.	Detection of abnormal pressure	• Review the hydraulic circuit.																
		Incorrect parameter setting, or incorrect connector setting	• Set the parameter or connector properly according to “10.3.4 Monitor pressure sensor connector setting”. • Check the connector of the sensor connected.																
		The pressure sensor is not connected.	• Check the pressure sensor harness.																
		Pressure sensor harness break, short-circuit or contact failure	• Replace the pressure sensor harness.																
		Fault of the pressure sensor	• Replace the pressure sensor.																
		<table border="1"> <tr> <td>E32</td> <td>Axis 1</td> <td>E36</td> <td>Axis 5</td> </tr> <tr> <td>E33</td> <td>Axis 2</td> <td>E37</td> <td>Axis 6</td> </tr> <tr> <td>E34</td> <td>Axis 3</td> <td>E38</td> <td>Axis 7</td> </tr> <tr> <td>E35</td> <td>Axis 4</td> <td>E39</td> <td>Axis 8</td> </tr> </table>	E32	Axis 1	E36	Axis 5	E33	Axis 2	E37	Axis 6	E34	Axis 3	E38	Axis 7	E35	Axis 4	E39	Axis 8	
		E32	Axis 1	E36	Axis 5														
E33	Axis 2	E37	Axis 6																
E34	Axis 3	E38	Axis 7																
E35	Axis 4	E39	Axis 8																
E40 (*)	Motor thermistor cable break/short-circuit The motor thermistor cable has broken or short-circuited.	The motor thermistor cable has broken or short-circuited.	• Replace the controller. • Replace the motor pump assembly.																
		The motor thermistor cable has a contact failure.																	
E41	Motor overheat The motor temperature exceeded the specified value for 30 seconds or longer.	The ambient temperature is high.	• Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a well-ventilated place.																
		The duty ratio is high.	• Prolong the stop time. • Review the duty ratio.																
		The load pressure is high.	• Review the hydraulic circuit.																
E42 (*)	Radiator fin thermistor cable break/short-circuit The radiator fin thermistor cable has broken or short-circuited.	The radiator fin thermistor cable has broken or short-circuited.	• Replace the controller.																
		The radiator fin thermistor cable has a contact failure.																	
E43	Radiator fin overheat The radiator fin temperature exceeded the specified value for 30 seconds or longer.	The ambient temperature is high.	• Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a well-ventilated place.																
		The duty ratio is high.	• Prolong the stop time. • Review the duty ratio.																
		The load pressure is high.	• Review the hydraulic circuit.																

Alarm code	Name	Cause	Corrective action
E46 (*)	Controller thermistor cable break/short-circuit The controller thermistor cable has broken or short-circuited.	The controller thermistor cable has broken or short-circuited.	<ul style="list-style-type: none"> • Replace the controller.
		The controller thermistor cable has a contact failure.	
E47	Controller overheat The controller internal temperature exceeded the specified value for 30 seconds or longer.	The ambient temperature is high.	<ul style="list-style-type: none"> • Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a place where the ambient temperature is within the specified range.
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
E48	Solenoid valve short-circuit error The short-circuit protective function for the solenoid valve output circuit is activated.	Incorrect wiring of the solenoid valve (DC type)	<ul style="list-style-type: none"> • Correct the solenoid valve wiring.
		Solenoid valve spool lock (AC type)	<ul style="list-style-type: none"> • Replace the solenoid valve.
E64	Dry run error The pump is started with the oil level reduced.	The oil level is low.	<ul style="list-style-type: none"> • Refill the hydraulic oil.
		Air bleeding has not been conducted.	<ul style="list-style-type: none"> • Conduct air bleeding.
E66	Speed deviation error The motor speed deviation exceeded the specified value.	The pump is operated at high speed in the reverse direction due to returned load.	<ul style="list-style-type: none"> • Conduct air bleeding.
		The pump is operated at high speed under vacuum due to large load of inertia.	<ul style="list-style-type: none"> • Review the hydraulic circuit. • Reduce the load of inertia.
		The pump or motor has locked.	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Fault of the encoder	
E69	Parameter setting error Control axis parameter setting is incorrect.	The setting of the “pressure sensor connector setting” parameter is inconsistent with the “pressure correcting function” setting.	Correct the parameter setting. “10.3.3 Pressure correction enable/disable setting” “10.3.4 Monitor pressure sensor connector setting”
E70	Pump pressure rise error The pump pressure has not increased.	Increased leak due to pump wear	<ul style="list-style-type: none"> • Replace the motor pump assembly.
		Increased leak in the hydraulic circuit	<ul style="list-style-type: none"> • Check the hydraulic piping for external leak. • Conduct cylinder maintenance (packing replacement, etc.). • Replace the cylinder.
		Incorrect user-setting of relief valve pressure in hydraulic circuit	<ul style="list-style-type: none"> • Set the relief valve pressure higher than the specified pressure

Alarm code	Name	Cause	Corrective action																	
		The oil level is low.	• Refill the hydraulic oil.																	
		Air bleeding has not been conducted.	• Conduct air bleeding.																	
		Pump pressure sensor harness signal cable break	• Replace the pressure sensor harness.																	
E71 to E78	Axis pressure rise error The pump pressure has increased, but the axis monitor pressure has not increased.	Solenoid valve switching failure	• Replace the solenoid valve.																	
		Incorrect connection of the monitor pressure sensor harness	• Check the pressure sensor connection.																	
		Incorrect setting of the “pressure sensor connector setting” parameter	• Correct the parameter setting. “10.3.4 Monitor pressure sensor connector setting”																	
		<table border="1"> <tr> <td>E71</td> <td>Axis 1</td> <td>E75</td> <td>Axis 5</td> </tr> <tr> <td>E72</td> <td>Axis 2</td> <td>E76</td> <td>Axis 6</td> </tr> <tr> <td>E73</td> <td>Axis 3</td> <td>E77</td> <td>Axis 7</td> </tr> <tr> <td>E74</td> <td>Axis 4</td> <td>E78</td> <td>Axis 8</td> </tr> </table>	E71	Axis 1	E75	Axis 5	E72	Axis 2	E76	Axis 6	E73	Axis 3	E77	Axis 7	E74	Axis 4	E78	Axis 8	The oil level is low.	• Refill the hydraulic oil.
		E71	Axis 1	E75	Axis 5															
		E72	Axis 2	E76	Axis 6															
		E73	Axis 3	E77	Axis 7															
		E74	Axis 4	E78	Axis 8															
	Air bleeding has not been conducted.	• Conduct air bleeding.																		
	Solenoid valve harness cable break	• Replace the solenoid valve harness.																		
	Monitor pressure sensor harness signal cable break	• Replace the pressure sensor harness.																		
	Fuse blown-out on the controller solenoid valve board	• Replace the controller fuse.																		
E90 (*)	Inverter initialization error An error has occurred due to the controller initialization.	Fault of the controller	• Replace the controller.																	
E91 (*)	CPU error The watchdog timer detected an error.	CPU processing time error	• Turn ON the power supply again • Replace the controller.																	
E93 (*)	Parameter error	Fault of the storage element	• Replace the controller.																	

13.2 About warnings

When a warning condition occurs, the following warning code is indicated on the LED display of the operation panel. At the same time, the “DOUT3: Warning output” digital output signal turns ON. Monitor this signal with the host device to check the warning condition immediately when the warning signal is activated, and remove the cause of the warning.

IMPORTANT	If the unit continues operation regardless of the warning condition, the protective function is activated, causing an alarm.
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MEMO	The output logic of the “DOUT3: Warning output” digital output signal can be specified with the parameter. Refer to “10.2.2 Change warning output logic”.
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Warning code	Name	Cause	Corrective action
L44	Motor overheat warning The motor temperature exceeded the specified temperature (motor overheat protection activating temperature – 10°C).	The ambient temperature is high.	<ul style="list-style-type: none"> • Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a well-ventilated place.
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
L45	Radiator fin overheat warning The radiator fin temperature exceeded the specified temperature (radiator fin overheat protection activating temperature – 10°C).	The ambient temperature is high.	<ul style="list-style-type: none"> • Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a well-ventilated place.
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
L49	Controller overheat warning The controller temperature exceeded the specified temperature (controller overheat protection activating temperature – 10°C).	The ambient temperature is high.	<ul style="list-style-type: none"> • Install the hydraulic unit in a place where the ambient temperature is within the specified range. • Install the hydraulic unit in a well-ventilated place.
		The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
L67	Motor overload warning The motor load value exceeded 80% of the specified value for motor overload protection thermal trip.	The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
		The pre-charge pressure holding time is shortened due to contamination, and the pressure correction frequency is increased.	<ul style="list-style-type: none"> • Conduct flushing. • Replace the hydraulic oil. • Replace the non-leak valve.
		Increased leak in the hydraulic circuit	<ul style="list-style-type: none"> • Check the hydraulic piping for external leak. • Conduct cylinder maintenance (packing replacement, etc.). • Replace the cylinder. • Replace the non-leak valve.
L68	Controller overload warning The controller load value exceeded 80% of the specified value for controller overload protection thermal trip.	The duty ratio is high.	<ul style="list-style-type: none"> • Prolong the stop time. • Review the duty ratio.
		The load pressure is high.	<ul style="list-style-type: none"> • Review the hydraulic circuit.
		The pre-charge pressure holding time is shortened due to contamination, and the pressure correction frequency is increased.	<ul style="list-style-type: none"> • Conduct flushing. • Replace the hydraulic oil. • Replace the non-leak valve.

Warning code	Name	Cause	Corrective action
		Increased leak in the hydraulic circuit	<ul style="list-style-type: none"> • Check the hydraulic piping for external leak. • Conduct cylinder maintenance (packing replacement, etc.). • Replace the cylinder. • Replace the non-leak valve.
L84	Waiting for pump startup Pump startup preparation was executed when the pump is running.	While the pump is running with external force (returned load, etc.), the operation command was turned ON to execute pump startup preparation.	<ul style="list-style-type: none"> • Start pump startup preparation after the pump has stopped.

13.3 Troubleshooting

If any of the following phenomena occurs, examine the cause of the trouble, and take corrective actions.

Phenomenon	Possible cause	Corrective action
No indication on the display	The control power supply is OFF.	<ul style="list-style-type: none"> • Check the control power supply.
	The control power supply voltage is abnormal.	
During execution of the manual mode, “Loc” is indicated, and operation is disabled.	Any digital input signal other than “DIN17: Operation command” is ON.	<ul style="list-style-type: none"> • Turn OFF all digital input signals other than “DIN17: Operation command”. Refer to “9.6.2 Manual operation lock”
The actuator does not operate in the continuous operation mode.	The pressure is insufficient. With the factory setting, the continuous operation pressure is 1.5 MPa.	<ul style="list-style-type: none"> • Increase the pressure setting with the “G17-P04: Continuous operation pressure” parameter. Refer to “9.6.7 Continuous operation”.
Operation stops in the middle of the continuous operation mode.	The unit is overloaded during operation. If the unit is overloaded during continuous operation, the operation stops.	<ul style="list-style-type: none"> • If the continuous operation is executed again, the operation is restarted. For long-term continuous operation, stop the unit for a long time before restart. Refer to “9.6.7 Continuous operation”.
Pump startup preparation is not executed even if “DIN17: Operation command” is turned ON.	The main circuit power supply is OFF.	<ul style="list-style-type: none"> • Check the main circuit power supply.
	The main circuit power supply voltage is abnormal.	
	Alarm is activated.	<ul style="list-style-type: none"> • Remove the cause of alarm, and reset the alarm.

Phenomenon	Possible cause	Corrective action
	Digital input signal cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring. Refer to “8.6 Connecting I/O signals”. Input status can be checked on the operation panel. Refer to “9.4.3 Indication of digital I/O status”.
	The pump startup preparation has already been executed.	<ul style="list-style-type: none"> The pump startup preparation is executed when the operation command is turned ON first after power-ON. Once the pump startup preparation is completed, it will not be executed again even if the operation command is turned ON/OFF. Refer to “12.1.3 Pump startup preparation”.
Even if the “Axis selection” digital input signal is turned ON, the relevant axis does not operate.	The main circuit power supply is OFF.	<ul style="list-style-type: none"> Supply power to the main circuit.
	The main circuit power supply voltage is abnormal.	
	Alarm is activated.	<ul style="list-style-type: none"> Remove the cause of alarm, and reset the alarm.
	Digital input signal cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring. Refer to “8.6 Connecting I/O signals”. Input status can be checked on the operation panel. Refer to “9.4.3 Indication of digital I/O status”.
	The operation command has not turned ON. If the “G18-P00: Operation command enable” parameter is set to “1”, you must turn ON “DIN17: Operation command”.	<ul style="list-style-type: none"> After turning ON “DIN17: Operation command”, turn ON the axis selection signal in the operation ready status. Refer to “12.2 Clamping and unclamping operations”.
Operation of the axis on which axis selection signal has turned ON is completed, and the pre-charge pressure has not decreased.	<p>When the axis operation is completed and the preset pressure has been reached, the pump does not start. Refer to “12.2 Clamping and unclamping operations”.</p>	
The pump starts, but the cylinder does not operate.	The solenoid valve power supply is OFF.	<ul style="list-style-type: none"> Supply power to the solenoid valve according to the solenoid valve voltage type.
	Solenoid valve cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring of the solenoid valve. Refer to “8.5 Connecting power supplies”.
	Fault of the solenoid valve	<ul style="list-style-type: none"> Replace the solenoid valve.

Phenomenon	Possible cause	Corrective action
The cylinder operation speed is low.	Teaching operation has not been conducted. Before teaching operation, the motor runs at approx. 600 rpm rotation speed.	<ul style="list-style-type: none"> • Execute teaching operation. Refer to “9.6.6 Teaching operation”.
	The hydraulic circuit pressure increases during cylinder operation. Possible causes are: <ul style="list-style-type: none"> • The cylinder does not smoothly move. • The hydraulic pipe is thin. 	<ul style="list-style-type: none"> • Check the cylinder mounting condition. • Enlarge the pipe diameter.
	The setting of the “P05: Initial operation pressure setting” parameter is equal to, or lower than the pressure of the hydraulic circuit during cylinder operation.	<ul style="list-style-type: none"> • Set the “P05: Initial operation pressure setting” parameter higher than the load pressure. • Review the hydraulic circuit, and reduce the load pressure.
The flow rate does not change even if the “DIN19: Speed change” digital signal is turned ON.	Digital input signal cable break or incorrect wiring.	<ul style="list-style-type: none"> • Check the wiring. Refer to “8.6 Connecting I/O signals”. • Input status can be checked on the operation panel. Refer to “9.4.3 Indication of digital I/O status”.
	The speed-change flow rate is equal to the preset flow rate.	<ul style="list-style-type: none"> • Specify the speed-change flow rate correctly. Refer to “10.7.2 Change flow rate by speed change command”.
	Because of large load of inertia, the cylinder excessively moves. This hydraulic unit uses a meter-in speed-change control system through pump rpm control.	<ul style="list-style-type: none"> • Provide a load compensation circuit with a counterbalance valve.
Alarm cannot be reset even if the “DIN20: Alarm reset” digital signal is turned ON.	Digital input signal cable break or incorrect wiring	<ul style="list-style-type: none"> • Check the wiring. Refer to “8.6 Connecting I/O signals”. • Input status can be checked on the operation panel. Refer to “9.4.3 Indication of digital I/O status”.
	The cause of alarm has not been removed.	<ul style="list-style-type: none"> • Remove the cause of alarm. Refer to “13.1 About alarms”.
	The activated alarm cannot be reset. Some alarms cannot be reset depending on the alarm type.	<ul style="list-style-type: none"> • Examine the alarm condition, and remove the cause of alarm. Refer to “13.1 About alarms”.

Phenomenon	Possible cause	Corrective action
The axis operation completion output signal did not turn ON.	Digital output signal cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring. Refer to “8.6 Connecting I/O signals”. Digital output terminals can be operated on the operation panel. Refer to “9.6.3 Digital output operation”.
	<p>The axis selection signal is OFF.</p> <p>When the axis selection signal is OFF, the axis operation completion signal is OFF.</p>	<ul style="list-style-type: none"> Check the sequence program of the host device. Refer to “12.2 Clamping and unclamping operations”
“DOUT1: Operation ready” signal did not turn ON.	Digital input signal cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring. Refer to “8.6 Connecting I/O signals”. Input status can be checked on the operation panel. Refer to “8.6.3 Specifications of digital output signal connector”.
	An alarm has been activated.	<ul style="list-style-type: none"> Remove the cause of alarm, and reset the alarm.
	The main circuit power supply is OFF.	<ul style="list-style-type: none"> Supply power to the main circuit.
	<p>The operation command is OFF.</p> <p>When the “G18-P00: Operation command enable” parameter is set to “1”, you must turn ON the “DIN17: Operation command” signal.</p>	<ul style="list-style-type: none"> Turn ON “DIN17: Operation command” to complete pump startup preparation. Refer to “12.1.2 When “DIN17: Operation command” digital input is set to “Enable””.
“DOUT2: Alarm output” cannot be recognized.	Digital output signal cable break or incorrect wiring	<ul style="list-style-type: none"> Check the wiring. Refer to “8.6 Connecting I/O signals”. Digital output terminals can be operated on the operation panel. Refer to “9.6.3 Digital output operation”.
	<p>The alarm output logic is incorrect.</p> <p>The alarm output is ON in normal conditions, In an alarm condition, the alarm output is OFF.</p>	<ul style="list-style-type: none"> Check the program of the host device.

Phenomenon	Possible cause	Corrective action
<p>“DOUT3: Warning output” cannot be recognized.</p>	<p>Digital output signal cable break or incorrect wiring</p>	<ul style="list-style-type: none"> • Check the wiring. Refer to “8.6 Connecting I/O signals”. • Digital output terminals can be operated on the operation panel. Refer to “9.6.3 Digital output operation”.
	<p>The warning output logic is incorrect.</p> <p>With the factory setting, the alarm output is ON in normal conditions, and in an alarm condition, the alarm output is OFF.</p> <p>With the “G18-P01: Warning output logic” parameter, you can invert the output logic.</p>	<ul style="list-style-type: none"> • Check the program of the host device. • Change the output logic according to the program of the host device. Refer to “10.2.2 Change warning output logic”.
<p>The motor frequently repeats start/stop operations.</p>	<p>Incomplete air bleeding in the hydraulic unit</p>	<ul style="list-style-type: none"> • Conduct air bleeding. Refer to “9.6.7 Continuous operation”.
	<p>Due to a leak in the hydraulic circuit, the pre-charge pressure cannot be retained.</p> <ul style="list-style-type: none"> • External leak (from piping, etc.) • Internal leak in the cylinder 	<ul style="list-style-type: none"> • Repair the leak in the hydraulic circuit. • Conduct cylinder maintenance, or replace the cylinder.
	<p>Leak from the non-leak valve due to contamination</p>	<ul style="list-style-type: none"> • Replace the hydraulic oil. • Replace the non-leak valve.
<p>The cylinder stops in the middle of operation.</p>	<p>The axis selection signal is OFF.</p>	<ul style="list-style-type: none"> • Check the program of the host device.
	<p>Because the cylinder operation load pressure is high (equal to the preset pressure), the cylinder operation is regarded as completed.</p>	<ul style="list-style-type: none"> • Review the hydraulic circuit, and reduce the load pressure. • Increase the preset pressure.
<p>Even if the pre-charge pressure decreases, pressure correction is not executed.</p>	<p>The axis selection command is OFF.</p> <p>To re-charge pressure at detection of a pressure drop, the axis selection command must be kept ON even after operation is completed.</p>	<ul style="list-style-type: none"> • Check the program of the host device. Refer to “10.6 Correcting pre-charge pressure drop”.
	<p>The “pressure correcting function” parameter is set to “Disable”.</p>	<ul style="list-style-type: none"> • Set the “pressure correcting function” parameter to “1: Enable”. Refer to “10.3.3 Pressure correction enable/disable setting”.
<p>The pre-charge pressure is unstable.</p>	<p>Incomplete air bleeding in the hydraulic unit</p>	<ul style="list-style-type: none"> • Conduct air bleeding. Refer to “9.6.7 Continuous operation”. • After air bleeding, conduct teaching operation again. Refer to “9.6.6 Teaching operation”.

Phenomenon	Possible cause	Corrective action
	<p>Cylinder deterioration</p> <p>Because the leak volume in the cylinder is unstable, the deceleration position for the surge suppressing function fluctuates, resulting in unstable pre-charge pressure.</p>	<ul style="list-style-type: none"> Conduct cylinder maintenance, or replace the cylinder.
	<p>Pump deterioration</p> <p>Because of pump deterioration, pulsation increases, resulting in unstable pressure.</p>	<ul style="list-style-type: none"> Replace the motor pump assembly.
Abnormal sound from the pump or motor	Operation sound during high-speed rotation	<ul style="list-style-type: none"> This sound is specific to the variable speed motor. It is normal.
	Flow sound (whish) in pressure holding status	<ul style="list-style-type: none"> A little flow sound is normal.
	Sound from the fixed restrictor in the relief valve block.	
	Damage to the pump sliding part or motor bearing	<ul style="list-style-type: none"> Replace the motor pump assembly.
	Periodic sound (rumble) in synchronization with rotation	
	<p>The motor runs in the reverse direction.</p> <p>Because the motor runs in the reverse direction due to a fault of the motor, the pump does not suck up oil.</p>	<ul style="list-style-type: none"> Replace the motor pump assembly. The rotation speed can be checked with the “d02-n01: Motor rotation speed” monitor. Refer to “9.4 Monitor mode”.
The pump or motor becomes hot.	The duty ratio is high.	<ul style="list-style-type: none"> Review the duty ratio.
	The ambient temperature is high.	<ul style="list-style-type: none"> Use the hydraulic unit in the specified environmental conditions. Refer to “7.1.2 Installation place”.
	Pump deterioration, or increased wear in sliding parts due to entry of foreign object	<ul style="list-style-type: none"> Replace the motor pump assembly.
	Damage to the motor bearing	
The hydraulic unit shakes.	The hydraulic unit is not properly fastened.	<ul style="list-style-type: none"> Fasten the hydraulic unit securely to a rigid level base. Refer to “7.1.2 Installation place”.

13.4 Details of inspection

13.4.1 Daily inspection

Inspect following conditions while running.

- ① The cylinder moves according to preset conditions.
- ② Abnormal sound or vibration.
- ③ Discoloration due to abnormal smell, heating.
- ④ Correct LED display.
- ⑤ Installation environment is as specification (Abnormal high or low temperature, condensation, dust, etc.)
- ⑥ Tool and hazardous substance are left in surrounding.
- ⑦ Float locates between red line and yellow line of oil gauge. Confirm hydraulic oil becoming muddy and bubble getting mixed.
- ⑧ Abnormal high or low oil temperature. (Less than 60°C)
- ⑨ Loosen part of piping, oil leakage.

13.4.2 Periodic inspection



- Before conducting wiring work, turn OFF the input power supply. Failure to observe this instruction may result in electric shock.
- To restart wiring work after the power supply is turned ON once, make sure that the motor has stopped, and wait for at least five minutes after the power supply is turned OFF. Failure to observe this instruction may result in electric shock.
- Do not attempt to disassemble or repair the system by the user. Failure to observe this instruction may result in electric shock.

It is recommended to perform the following inspections periodically when the system is at a standstill.

- ① Damage of coating of the cables, abnormal tension, deformation by external force, discoloration due to heating.
- ② Damage of deformation of covers, display.
- ③ Deformation, damage of discoloration of terminal block and connector.
- ④ Adhesion of contamination, dust, foreign matters.
- ⑤ Looseness in controller's sheet metal cover, screw and fall-out.
- ⑥ Deterioration of hydraulic oil. Recognize oil color changing to dark-brown (ASTM level 4: bright yellow).
- ⑦ Damage of hose, exposure of the reinforcement layer, deformation by external force, leak from a coupling part.

Change quickly new hose when discovered an above symptom, because it is danger. In addition, recommendation of hose exchange is less than 2 years.

13.5 Maintenance procedure



DANGER

- Maintenance and inspection must be conducted by qualified technical experts. Failure to observe this instruction may result in electric shock or fire.
- Before wiring work, make sure that the input power supply is OFF. Failure to observe this instruction may result in electric shock.
- To restart wiring work after the power supply is turned ON, make sure that the motor has stopped, and wait for at least five minutes after the power supply is turned OFF. Failure to observe this instruction may result in electric shock.
- Do not change the wiring, or connect/disconnect the terminals in live conditions. Failure to observe this instruction may result in electric shock, accident or injury.
- Do not disassemble or repair this product at user. Failure to observe this instruction may result in electric shock.



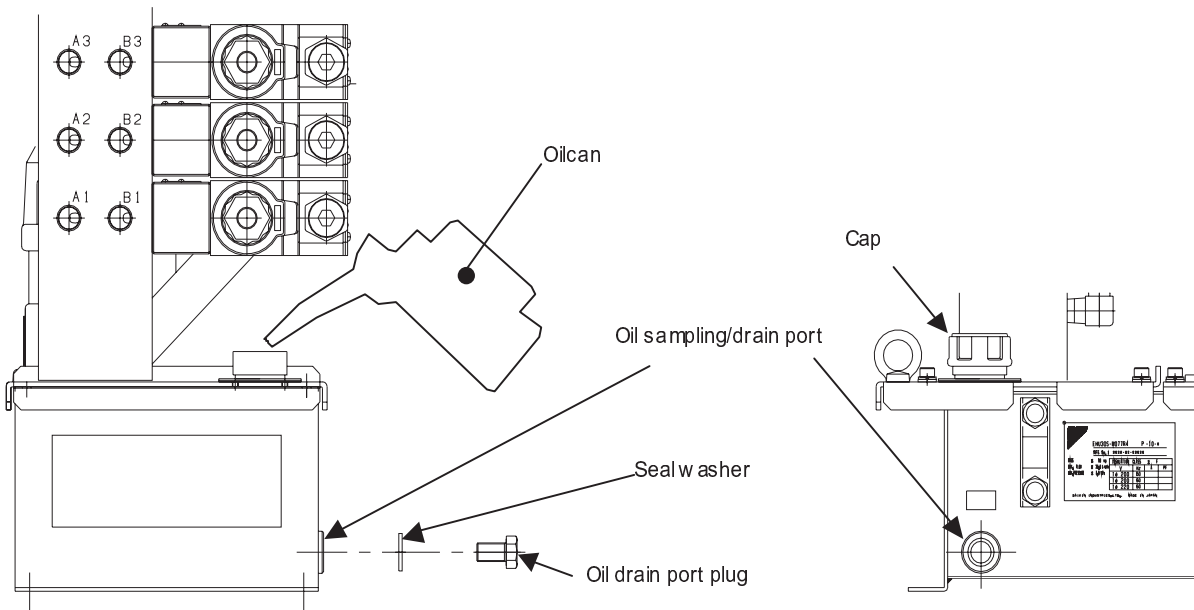
CAUTION

- During maintenance, wear protective goggles and gloves.
- During air blowing, be careful not to allow foreign objects to touch the eyes.
- Note that oil flows out of the piping during disassembly of the hydraulic unit. Before maintenance, check for residual pressure in the piping.
- If hydraulic oil returns from the cylinder and piping into the tank, the oil may overflow from the tank. Collect hydraulic oil returned from the cylinder into an oil pan, instead of the tank.

13.5.1 Hydraulic oil replacement procedure

To replace the hydraulic oil, perform the following procedure:

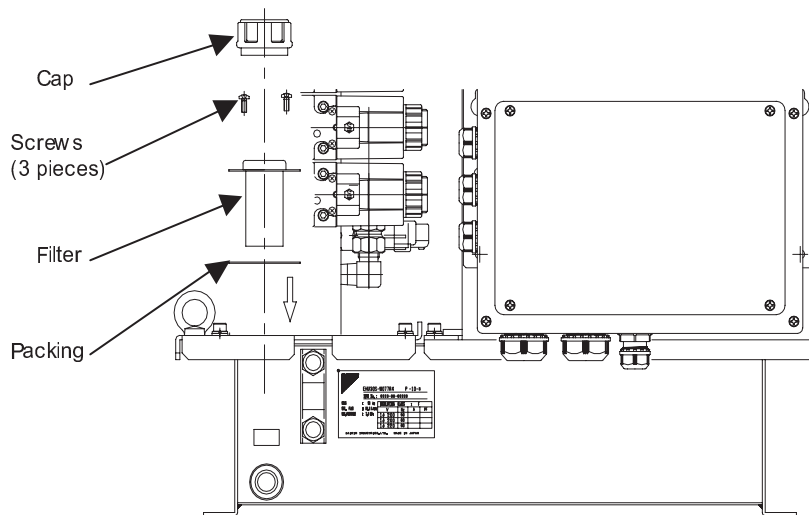
- ① Turn OFF the power supplies.
- ② Put a waste oil pan below the oil sampling/drain port at the bottom of the tank.
- ③ Remove the plug from the oil sampling/drain port by using a spanner. The width across flats of the plug is 26 mm.
- ④ After confirming that the hydraulic oil is completely drained from the tank, mount the plug to the oil sampling/drain port. The tightening torque should be 39.2 ± 3.9 [N·m].
- ⑤ Remove the cap from the oil filling port/air breather by turning the cap counterclockwise.
- ⑥ Pour new hydraulic oil through the oil filling port by using an oilcan. Make sure that the oil level is between the red and yellow marks of the oil level gauge.
- ⑦ After pouring hydraulic oil, mount the cap to the oil filling port/air breather by turning the cap clockwise.



13.5.2 Oil filling port/air breather maintenance procedure

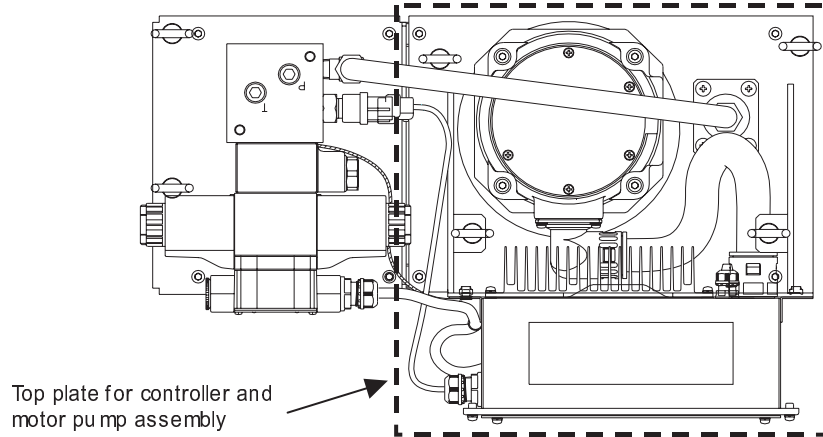
To disassemble or clean the oil filling port/air breather, perform the following procedure:

- 1) Turn OFF the power supplies.
- 2) Remove the cap by turning it counterclockwise manually.
- 3) Remove the screws (M4, at three places) that fasten the filter, and remove the filter. The screw tightening torque should be 1.5 ± 0.15 [N·m]. The cap (with a chain) cannot be separated from the filter.
- 4) Blow air onto the filter to remove accumulated or adhering foreign objects.
- 5) After cleaning, re-mount the filter by following the above disassembling procedure in the reverse sequence.



13.5.3 Suction strainer maintenance procedure

The tank top plate of the hydraulic unit can be separated. During maintenance of the suction strainer, remove the top plate for the controller and the motor pump assembly.

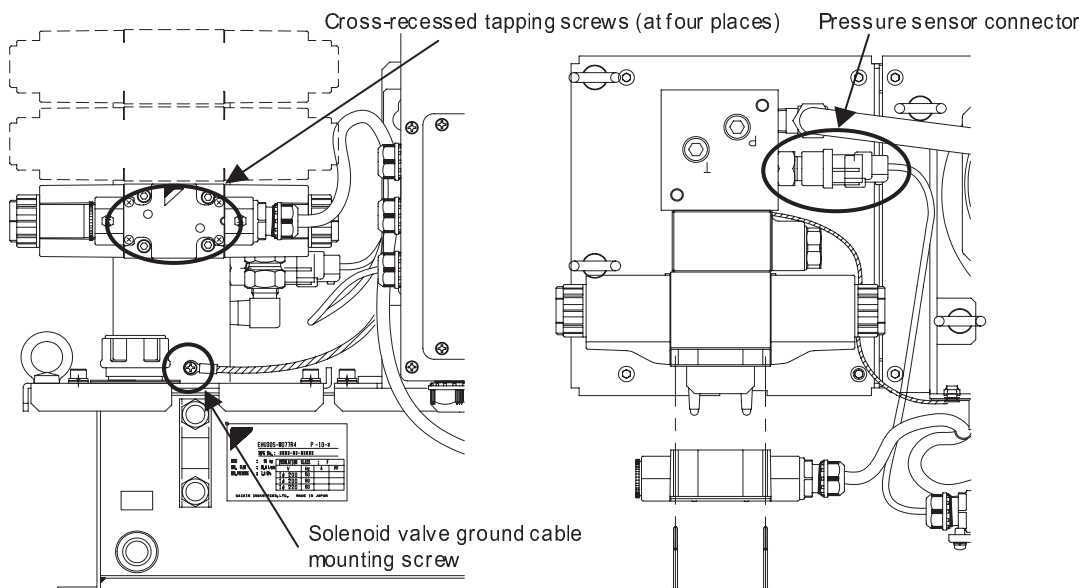


To disassemble or clean the suction strainer, perform the following procedure:

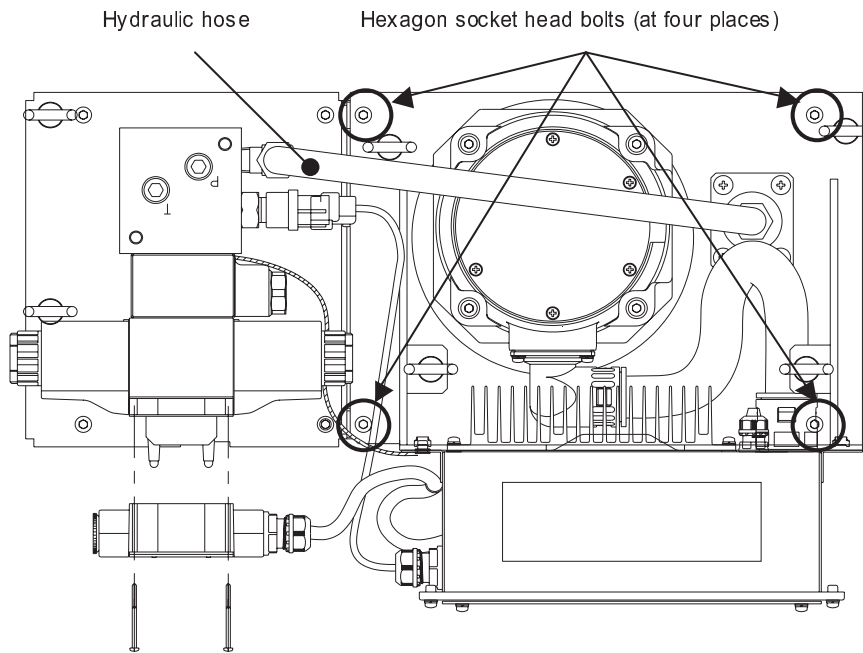
- 1) Turn OFF the power supplies.
- 2) Remove the following cables. Before removing the cables, apply marking to the mounted positions, so that the cables can be re-mounted to the original positions.

Put the removed cables into a bag to prevent entanglement or damage to the cables.

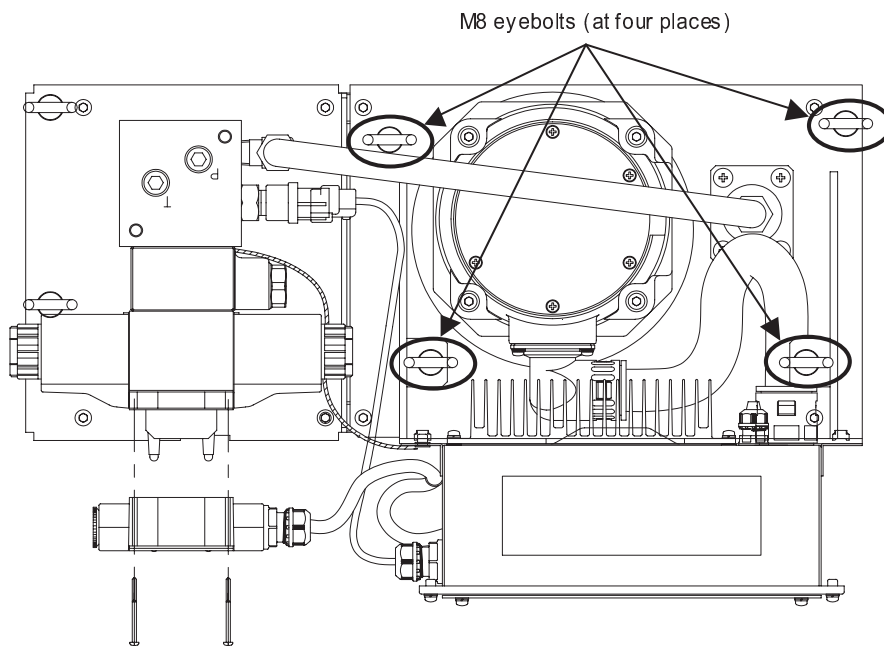
Power supply cable, Solenoid valve power supply cable	Remove the cables according to the procedure described in “8.5 Connecting power supplies” in the reverse sequence.
I/O signal cable	Remove the cables according to the procedure described in “8.6 Connecting I/O signals” in the reverse sequence.
Solenoid valve output harness	The solenoid valve output harness can be removed together with the solenoid valve terminal box, by loosening the cross-recessed tapping screws (M3, at four places) of the terminal box. The tightening torque should be 0.5 to 0.7 [N·m].
Solenoid valve ground cable	The solenoid valve ground cable is connected to the manifold block. The cable can be removed by loosening the screw. The tightening torque should be 1.0 [N·m].
Monitor pressure sensor harness, Pump pressure sensor harness	Each pressure sensor harness is connected to the pressure sensor with the connector. Remove the connector.



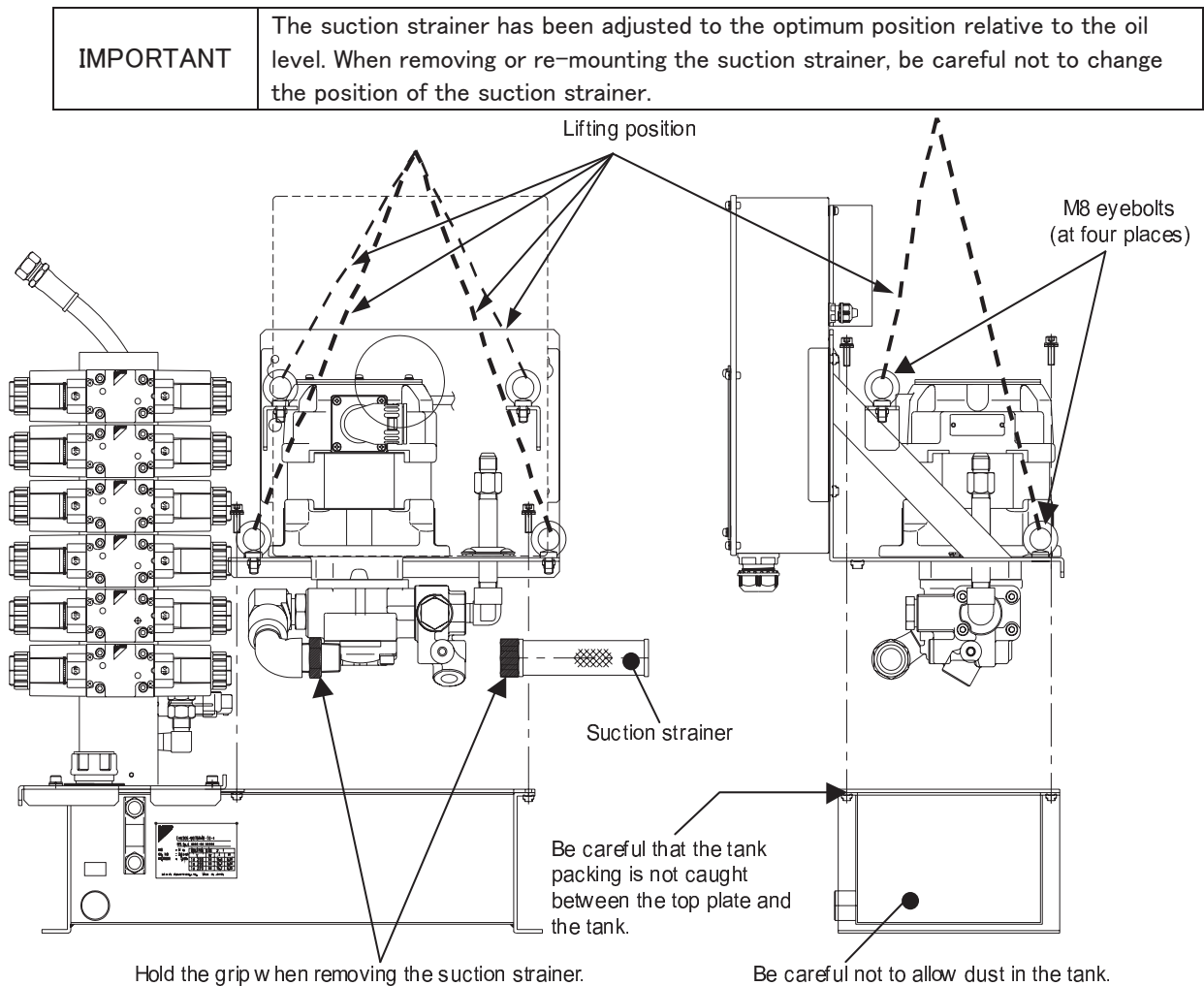
- 3) Remove the hydraulic hoses.
- 4) Remove the hexagon socket head bolts (M6, at four places) that fasten the top plate.



- 5) Mount the M8 eyebolts to the stays at four places of the top plate, and lift the top plate.



- 6) When the top plate is lifted, you can see the suction strainer. Remove the suction strainer by holding the grip of the suction strainer with a spanner.



- 7) Blow air onto the filter to remove accumulated or adhering foreign objects.
 8) After cleaning is completed, mount the suction strainer. The tightening torque should be 39.2 [N·m].
 9) Mount the removed top plate to the original position. After lowering the top plate onto the tank, fasten the top plate with the hexagon socket head bolts (M6, at four places). The tightening torque should be 5.9 [N·m].

IMPORTANT	When lowering the top plate, be careful that the top plate will not hit against the solenoid valve, pressure sensor or other parts to prevent damage to the equipment. Furthermore, be careful not to allow the tank packing or harness to be caught between the top plate and the tank.
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- 10) Re-mount the hydraulic hoses and cables securely to the original positions.

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