Hybrid Hydraulic System

# Super Unit for Molding Machine

# SUT00S5021/SUT00S8018
# SUT00S13018/SUT00S13021
# SUT00S20018

# Operation Manual

## [ORIGINAL INSTRUCTIONS]

**Oil Hydraulics Division**

# Introduction

Thank you for selecting the SUPER UNIT of DAIKIN Hydraulic System.
This operation manual describes how to operate this SUPER UNIT, 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 Precausions |
| --- |
| ● Improper operation or handling of this product causes an accident, reduced service life or performance deterioration of the equipment.<br>● 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.<br>● The contents of this manual are subject to change for the purpose of a change in product specifications or improvement of users' convenience.<br>● Keep this manual carefully in a place where users can refer to it whenever required.<br>● 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: “CAUTION” and “WARNING”.

| | |
|---|---|
| **WARNING** | 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 “WARNING” or “CAUTION”.
“NOTE” provides information necessary for using this product.

### 1.1.1 Application of this product

**WARNING**

- This product is a hydraulic unit to drive a molding machine installed inside a factory. Do not use this product for any other purpose.

### 1.1.2 Precautions for using this product

**WARNING**

- Transportation, installation, piping, wiring, operation, manipulation, maintenance and inspection of this product must be conducted by qualified personnel. To conduct such work, wear protective gear required to ensure safe work (work clothes, safety band, helmet, safety shoes, gloves, etc.).
- 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.
- 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.
- 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.
- Use this product within the specification range given in this manual. Failure to observe this instruction may result in an accident or injury.

### 1.1.3 Precautions for transportation

**WARNING**

- Before transporting this product, check the weight and the center of gravity of this product. Failure to observe this instruction may result in injury.
- For transportation of the motor pump, use the eyebolts. If this product is slung by any part other than the eyebolts, it may fall or overturn.
- When this product is in the packed condition, transport it with appropriate transportation tools. Otherwise, injury may occur.
- Before operating this product, check if the safety devices can normally work to avoid a hazardous condition in case of malfunction of peripheral sensors and equipment due to electromagnetic noise. Failure to observe this instruction may result in an accident.
- Install this product in a place that can withstand the product weight. Failure to observe this instruction may result in an accident.

**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.

### 1.1.4 Precautions for installation and wiring

**WARNING**

- Wiring work must be conducted by qualified technical experts. 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 hydraulic unit according to laws and ordinances of the country where this product is used. 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.
- Do no 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 power supply input voltage conforms to the specified voltage rating. Failure to observe this instruction may result in fire or other accidents.
- Be sure to observe the specified mounting environment. Failure to observe this instruction may result in fire or other accidents

**CAUTION**

- To ensure correct wiring, check the terminal assignment and terminal symbols.
- Conduct withstand voltage test at 2120 VDC or lower voltage. Otherwise, the hydraulic unit may be damaged.
- Conduct megger test according to laws and ordinances of the country where this product is used.
- Do not apply strong impact to this product. Failure to observe this instruction may result in a fault of the product.
- 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.
- For the hydraulic unit of 400 V type, ground the neutral point of the power supply. Otherwise, the hydraulic unit may be damaged.
- Use a commercial power supply. If other power supply (inverter power supply etc.) is used, the hydraulic unit may be damaged.

### 1.1.5 Precautions for operation

**WARNING**

- 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.

**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.
- If a power failure occurs, set up the equipment so that the hydraulic unit will not abruptly restart after power recovery. Failure to observe this instruction may result in injury.
- During operation, and immediately after operation, do not touch the radiator fins and electronic equipment because these parts are hot. Failure to observe this instruction may result in burns.
- Do not turn ON/OFF the power supply frequently. Failure to observe this instruction may result in a fault of the equipment.

### 1.1.6 Precautions for maintenance and inspection

**WARNING**

- 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.

### 1.1.7 Precaution for product disposal

**CAUTION**

- Dispose of this product according to laws and ordinances of the country where this product is used.

## 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

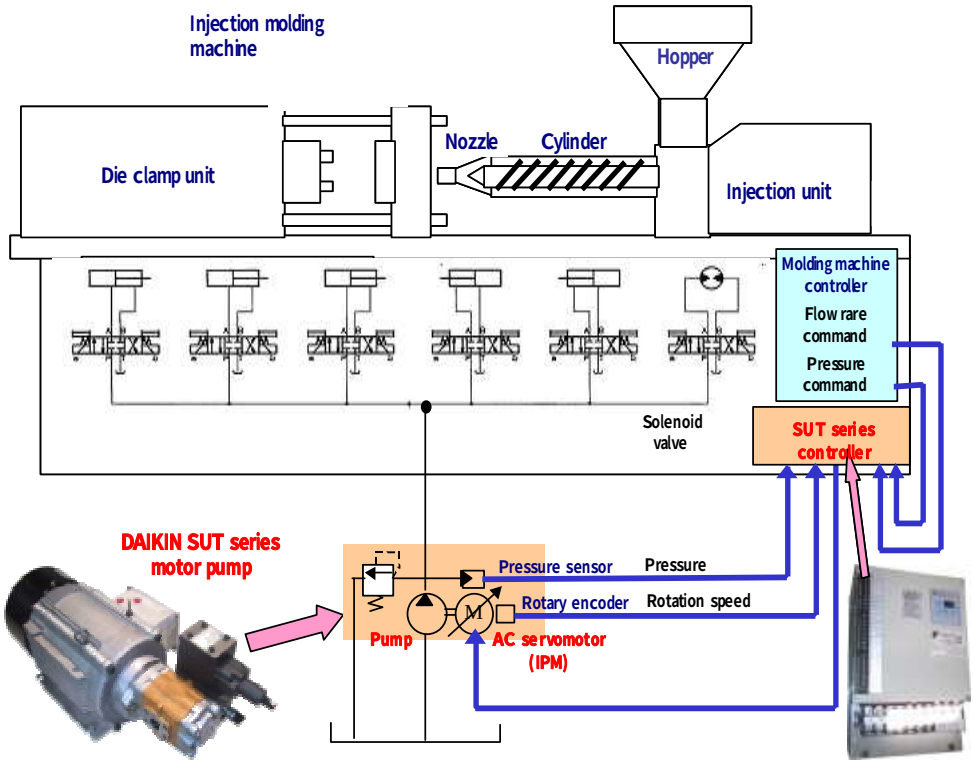
## 2.1 Outline of this System

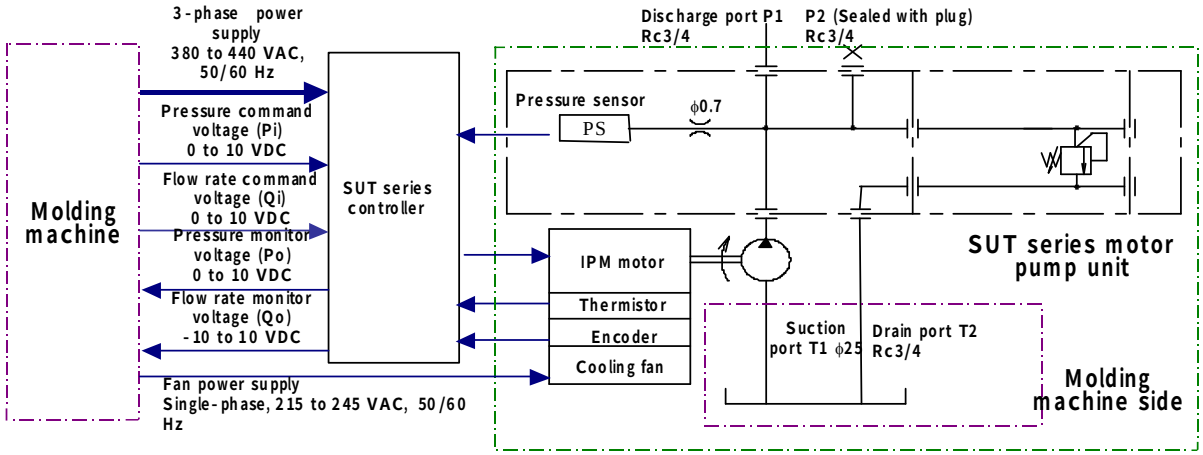
This product is a hydraulic unit intended for molding machine manufacturers to drive a molding machine installed inside a factory. This hydraulic unit mainly consists of an IPM motor, gear pump, pressure sensors and digital controller. It incorporates pressure and flow rate control functions through motor rotation speed control.

When this hydraulic unit is mounted to a molding machine in combination with a directional selector valve, operation speed and hold pressure can be easily controlled in die clamping, weighing and injection steps. Pressure and flow rate control commands are input as analog voltages from the molding machine. During cylinder operation, the hydraulic unit executes flow rate control. After the cylinder load pressure exceeds a command pressure, the hydraulic unit executes pressure control by reducing the motor rotation speed so that a target pressure is not exceeded.

During flow rate control, a pump motor rotation speed is detected with an encoder. During pressure control, pump discharge pressure is detected with a pressure sensor for feedback control. The IPM motor is always controlled so as to provide a rotation speed and torque just required for the molding machine. This hydraulic unit ensures overwhelmingly higher energy-saving effect and higher control performance, in comparison with conventional hydraulic control systems using flow rate control valves and pressure control valves.

## 2.2 System Configuration

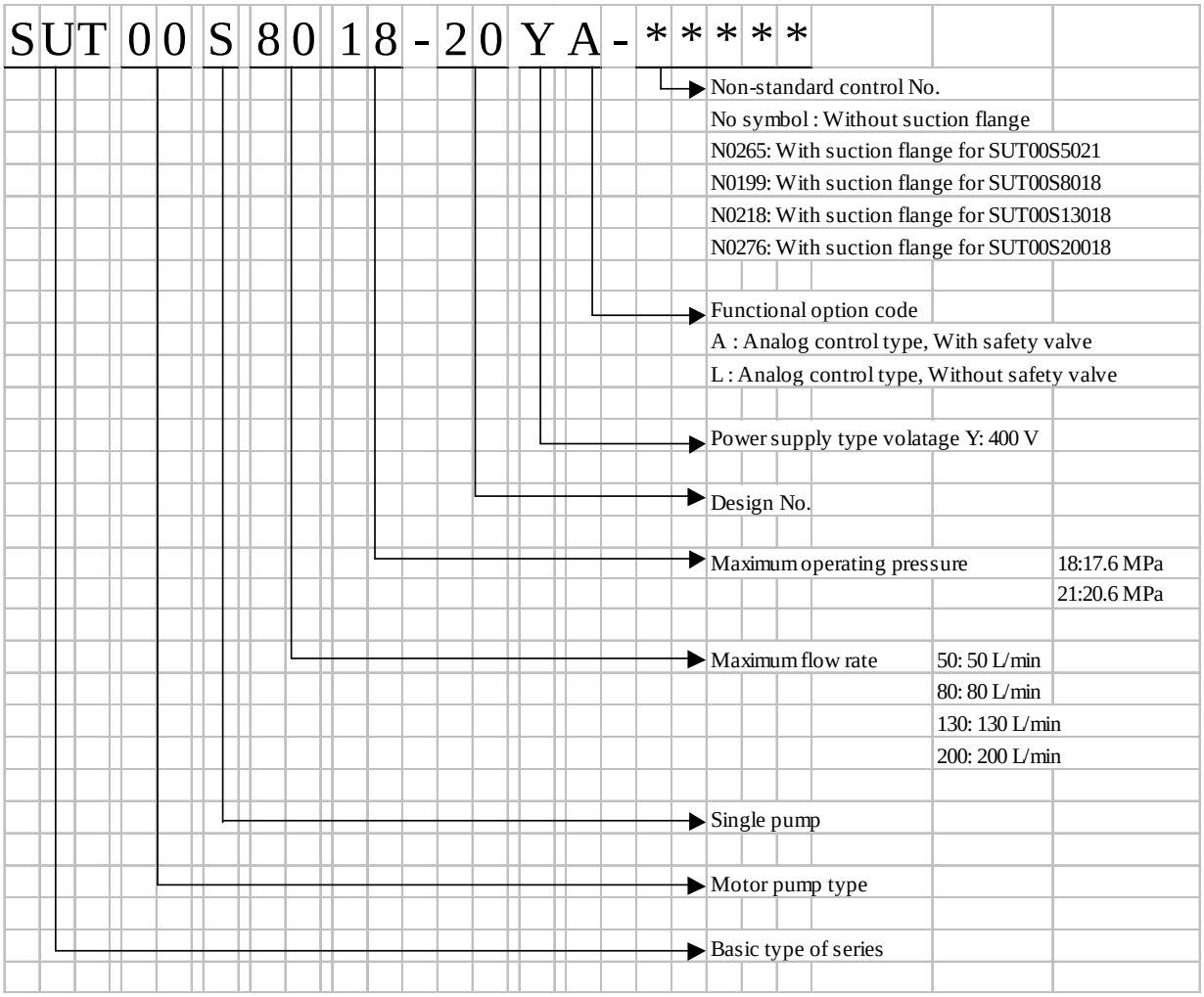


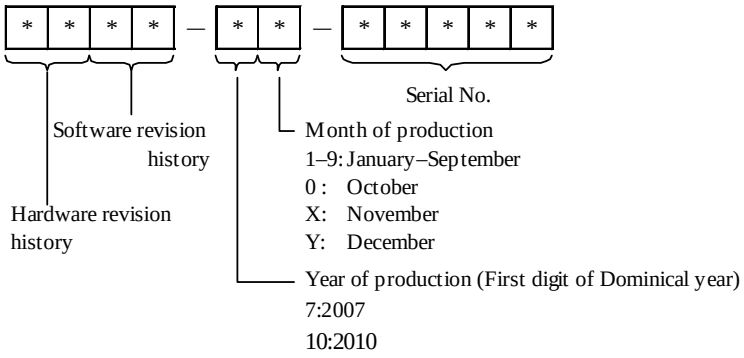
# Chapter 3 Specifications

## 3.1 Model Identification Code

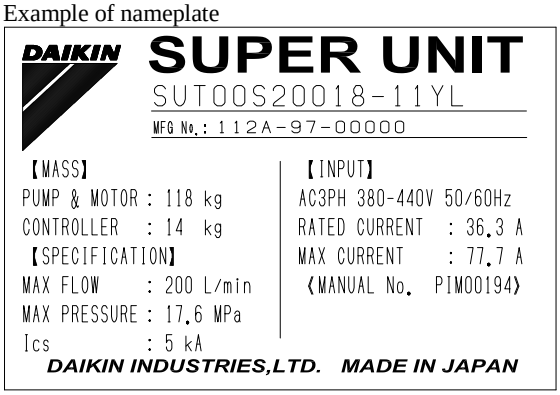
### 3.1.1 Types of motor pump and controller



## 3.1.2 Manufacturing No.

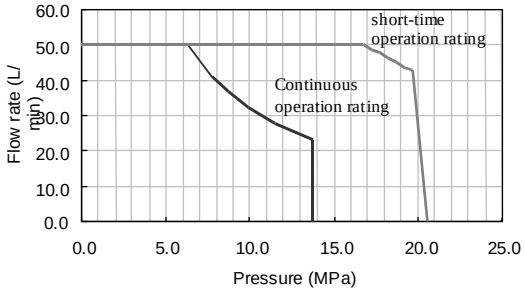



• Example of nameplate




[RATED CURRENT]
Average operating current at specified maximum output

[MAX CURRENT]
Maximum static current of short-time operation rating




| NOTE |
|---|
| Before shipment, a pair of motor pump and controller has undergone inspection. Use the pair of motor pump and controller of the same serial No. The serial No. is indicated on the nameplate of each product. |

## 3.2 Specifications

### 3.2.1 Principal specifications

| Item | | | Specification | | | | |
|---|---|---|---|---|---|---|---|
| Model Identification Code | | | SUT00S | | | | |
| | | | 5021 | 8018 | 13018 | 13021 | 20018 |
| Maximum operating pressure | | | 20.6 | 17.6 | 17.6 | 20.6 | 17.6 |
| Maximum flow rate | | | 50 | 80 | 130 | | 200 |
| Operating pressure adjusting range (*1) | | | 0.21–20.6 | 0.18–17.6 | 0.18–17.6 | 0.21–20.6 | 0.18–17.6 |
| Operating flow rate adjusting range (*1) | | | 0.5–50.0 | 0.8–80.0 | 1.3–130.0 | | 2.0–200.0 |
| Pump | Pump type | | Single gear pump | | | | |
| | Pump capacity ($cm^3$/rev) | | 20.7 | #20:32.4<br>#21:31.2 | 44.0 | | 73.0 |
| Power supply | Power supply for controller input | | 3ϕ 380–440 VAC (50 Hz/60 Hz)<br>Allowable power supply voltage fluctuation range –20% to +10% (*2) | | | | |
| | | Required power supply capacity (kVA) | 20.1 | | 34.8 | | 52.0 |
| | Power supply for motor cooling fan | | AC 1ϕ 215–245 V (50 Hz/60 Hz) | | | | |
| Rated point | | | 1800 $min^{-1}$<br>58.4 N•m | | 1800 $min^{-1}$ 79.6 N•m | | 1800 $min^{-1}$<br>117 N•m |
| Rated current for controller input (A) (*4) | | | 19 | | 26 | | 40 |
| Rated current for motor input (A) (*4) | | | 21 | | 29 | | 45 |
| Leak current (mA) (*4) | | | 2.1 | | 3.9 | | 2.8 |
| Weight | Motor pump (kg) | | 69 | 70 | 103 | | 118 |
| | Controller (kg) | | 11 | | | | 14 |
| Applied standards (*4) | EMC Directive | | IEC/EN55011, IEC/EN61000-6-2, IEC/EN61800-3 | | | | |
| | Low Voltage Directive | | IEC/EN61800-5-1 | | | | |
| | Machinery Directive | | IEC/EN60204-1 | | | | |

*1. Although a command input exceeding the above adjusting range is allowable, it may result in unstable operation. Therefore, use the command pressure and flow rate within the specified adjusting ranges. The above adjusting ranges include the short-time operation ratings. For continuous operation ratings, refer to “3.3 P-Q Characteristics
*2. Even if the power supply voltage is within the allowable fluctuation range, the output may be reduced by power supply voltage fluctuations in the negative direction.
If there is possibility of power supply voltage fluctuations, select an appropriate P-Q area by referring to the typical characteristics shown in “3.3 P-Q Characteristics”.
*3. Typical value during operation with our recommended noise filter
*4. DAIKIN-recommended noise suppressing measures may be required depending on the operating environment of your unit.

## 3.2.2 Common specifications of products

| Item | | | Specification |
|---|---|---|---|
| Analog input | (2ch) | | Command resolution 0.1% of F.S. |
| | Pressure command Pi | | 0–+10V/0–PMAX (*1) |
| | Flow rate command Qi | | 0–+10V/0–QMAX (*1) |
| Analog output | (2ch) | | |
| | Pressure monitor Po | | 0–+10–/0–PMAX (*1) |
| | Flow rate monitor Qo | | –10–+10–/–QMAX–+QMAX (*1) |
| Digital input signal (*2) | (8ch) | | Insulated via photo-coupler, +24 VDC (27 V max.), 5 mA/ch<br>Positive common/Negative common |
| | | DI1 | Start/stop signal |
| | | DIN2–8 | (Unused) |
| Digital output signal (*3) | (7ch) | | Insulated via photo-coupler, +24 VDC, 30 mA max.<br>Negative common |
| | | DO1 | Ready signal |
| | | DO2–3 | (Unused) |
| | | DO4 | Warning output (Normal: OFF, Warning: ON) |
| | | DO5–7 | (Unused) |
| Contact output | (1ch) | | Dry contact, 30 VDC, 1c contact, 500 mA max. |
| Drive motor | | | 3-phase IPM motor |
| Paint color | Motor pump | | No painting, Fan cover: Black |
| | Controller | | Ivory white (Munsell 5Y7.5/1) |
| Hydraulic oil (*4) | Oil type | | Dedicated mineral hydraulic oil, Wear-resistant hydraulic oil |
| | Oil temperature | | 0–60°C (Recommended temperature range: 15–50°C) |
| | Viscosity grade | | ISO VG32–68 |
| | Viscosity range | | 15–400 $mm^2/s$ |
| | Pollution degree | | NAS Class 9 or lower degree |
| Operating environment (*5) | Atmosphere | | Indoor (Not exposed to direct sunlight)<br>Free from corrosive gas, inflammable gas, oil mist and dust |
| | Altitude | | 1000 m max. |
| | Ambient humidity | | 85%RH or less (No condensation) |
| | Ambient temperature | | |
| | | Motor pump | 0–40°C |
| | | Controller | 0–55°C |
| | Installation direction | | |
| | | Motor pump | To be fastened to molding machine base. Horizontal installation |
| | | Controller | To be mounted in control panel (IP54). Vertical installation (with the main power supply terminal block facing down) |
| Protective structure | Controller | | IP00 |
| | Motor (*6) | | IP44 |
| Storing environment | Storing temperature | | |
| | | Motor pump | –20 to 70°C (No freezing) |
| | | Controller | –20 to 60°C (No freezing) |
| | Storing humidity | | |
| | | Motor pump | 85%RH max. (No condensation) |
| | | Controller | |
| Startup time | | | 5 seconds max. (at 15°C ambient temperature) |
| Power supply ground type (*7) | | | TN |
| Others | | | • Be sure to connect a no-fuse breaker to the controller power supply. For the no-fuse breaker, refer to “9.1.1 Breaker”.<br>• Be sure to connect the ground terminals of the controller and the motor pump<br>• If the controller power supply is frequently turned ON/OFF, the controller service life will be remarkably shortened. It is recommended that the motor should be started and stopped with digital input (DI1..., terminals M3-43). |

*1. For details of PMAX and QMAX, refer to “11.2.2 [P06:PMAX], [P07:QMAX] Pressure/flow rate command scaling”. Input/output voltage can be changed with the “VMAX” parameter. For the “VMAX” parameter, refer to “11.2.1 [P05:VMAX] Input command voltage scaling value”.
*2. To use a semiconductor relay, select a relay whose leak current is 1 mA or less.
*3. To use a relay, provide surge-suppressing measures, or select a surge-protective type.
*4. A hydraulic oil other than mineral hydraulic oil (water-containing oil or synthetic oil: e.g. water-glycol) cannot be used. When the hydraulic oil is used at a temperature out of the recommended operating temperature range, the pressure pulsation may increase, or the flow rate may decrease. However, it is not an abnormal condition. For recommended brands of hydraulic oil, refer to DAIKIN “Hydraulic Unit General Catalog” (Reference No. HK196).”
*5. Except for the shaft through hole, encoder connector, motor cooling fan and terminal box.
*6. TN-C: TN type grounding that uses both neutral line and protective conductor. TN-S: TN type grounding that separates neutral line from protective conductor. The TN type power distribution system provides a protective ground conductor together with a power line, so that the power supply system is grounded via one point, to which point a ground terminal of equipment is to be connected.

### 3.2.3 Specifications of performance

The following data indicate typical performance, not guaranteed values.

| Item | | Specification | | | | |
|---|---|---|---|---|---|---|
| Model Identification Code | | SUT00S | | | | |
| | | 5021 | 8018 | 13018 | 13021 | 20018 |
| Flow rate characteristics | Linearity | F.S. 1% | | | | |
| | Hysteresis | F.S. 1% | | | | |
| | Maximum flow rate response (*1) | 0.1 sec | | | | |
| | Repeatability | F.S. 1 % | | | | |
| | Sound level (dB(A)) (*3) | 74 (50 L/min14MPa) | 75 (80 L/min1MPa) | 78 (130 L/min6MPa) | | 85 (200 L/min4MPa) |
| Pressure characteristics | Linearity | F.S. 1% | | | | |
| | Hysteresis | F.S. 1% | | | | |
| | Maximum pressure response(*2) | 0.1 sec | | | | |
| | Repeatability | F.S. 1% | | | | |
| | Sound level (dB(A)) (*3) | 64 | 62 | 61 | | 61 |

*1 Response time required to reach 95% (under no load condition) of flow rate command value during flow rate change between “0” and maximum flow rate
*2 Response time required to reach 95% of pressure command value during pressure change between “0” and maximum pressure
For a controller other than SUT00S20018, use of 3/4B high-pressure hose (length: 2 m) is assumed for the load volume condition. For the SUT00S20018 controller, use of 1B high-pressure hose (length: 2 m) is assumed.
*3 Typical sound level measured in five directions on average, at 1 m distance from the motor pump end face

**WARNING**

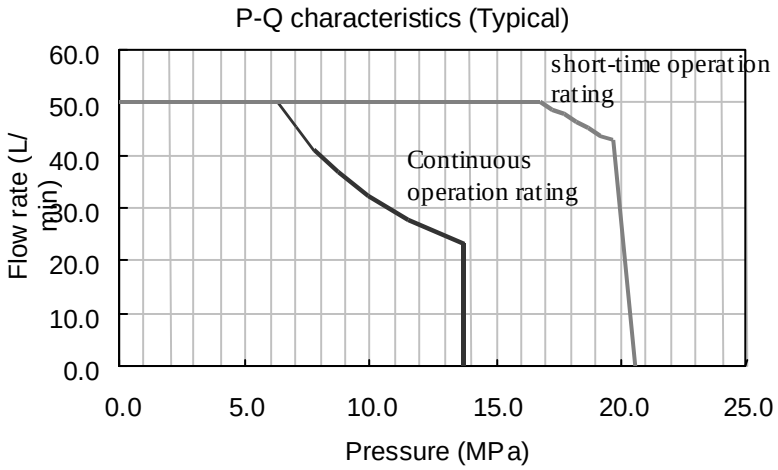
- When a large flow rate command is issued, the motor pump generates 80 dB-A or larger sound. It is recommended that operators should wear earplugs, or that a cover is mounted around the motor pump of this hydraulic unit. Failure to observe this instruction may result in injury.

## 3.3 P-Q Characteristics

### 3.3.1 Typical characteristics

If a square mean value of average hydraulic output and load pressure is within the range of continuous operation rating for an operation cycle of the molding machine to which this hydraulic unit is mounted, continuous operation is enabled.
During an operation cycle, the short-time output enables operation for 20 seconds. The short-time output can be used during an operation cycle of 20% or less duty time ratio. If operation load exceeds this range, the hydraulic unit outputs an overload alarm ("E27" or "E17") to stop the pump.
Therefore, you should thoroughly consider the load condition and operation cycle of the molding machine to which this hydraulic unit is mounted.

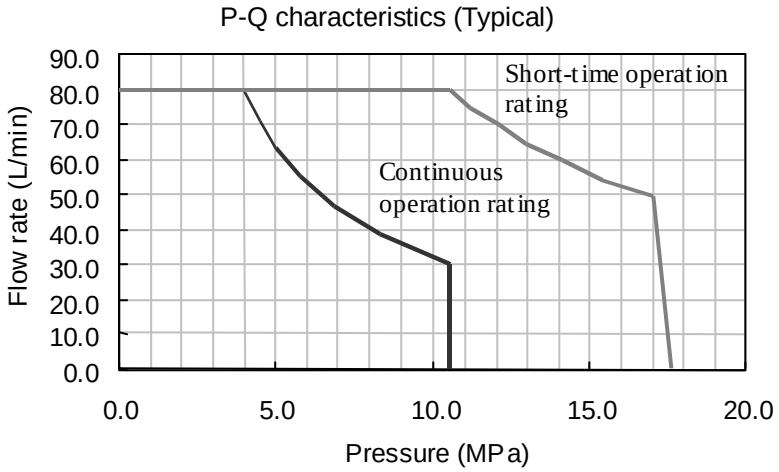
● SUT00S5021




Continuous operation rating: 5.3 kW
Short-time operation rating: 14.0 kW

* The above data indicate typical characteristics at 40°C oil temperature, with 400 V, 50 Hz power supply.

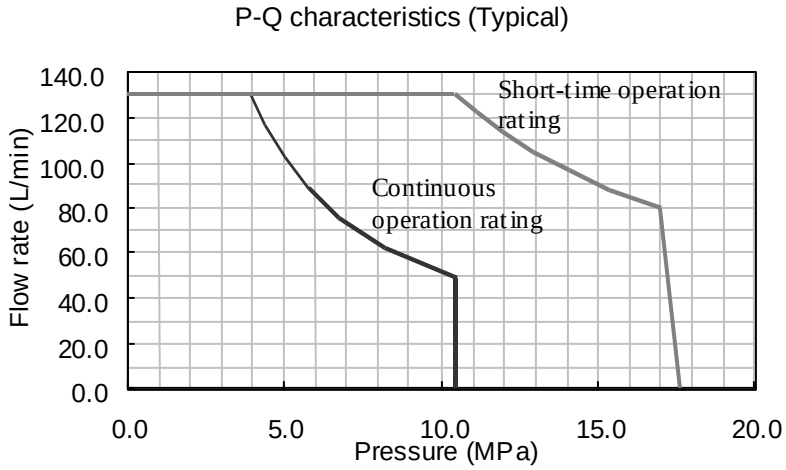
● SUT00S8018




Continuous operation rating: 5.3 kW
Short-time operation rating: 14.0 kW

* The above data indicate typical characteristics at 40°C oil temperature, with 400 V, 50 Hz power supply.

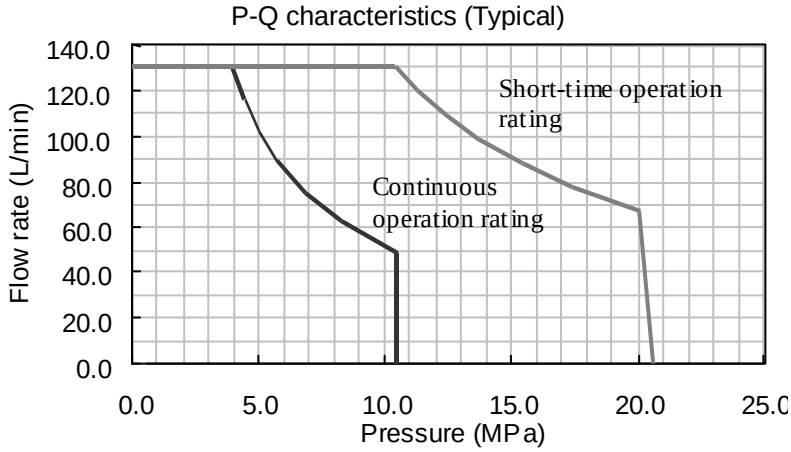
● SUT00S13018




Continuous operation rating: 8.5 kW
Short-time operation rating: 22.5 kW

* The above data indicate typical characteristics at 40°C oil temperature, with 400 V, 50 Hz power supply.

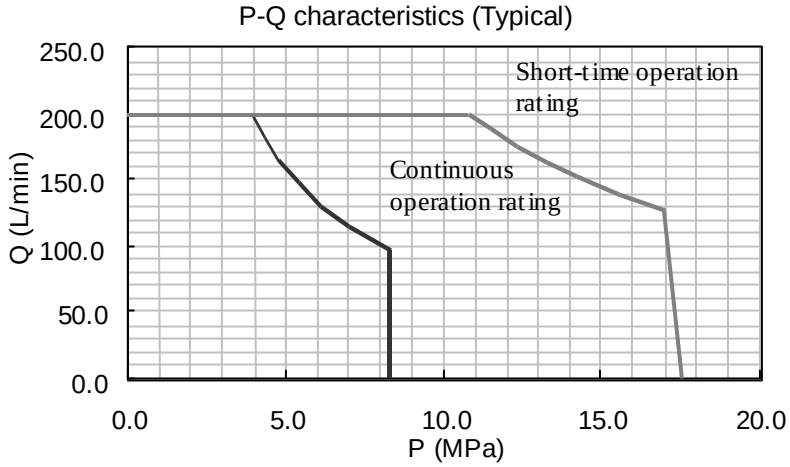
● SUT00S13021




Continuous operation rating: 8.5 kW
Short-time operation rating: 22.5 kW

* The above data indicate typical characteristics at 40°C oil temperature, with 400 V, 50 Hz power supply.

● SUT00S20018



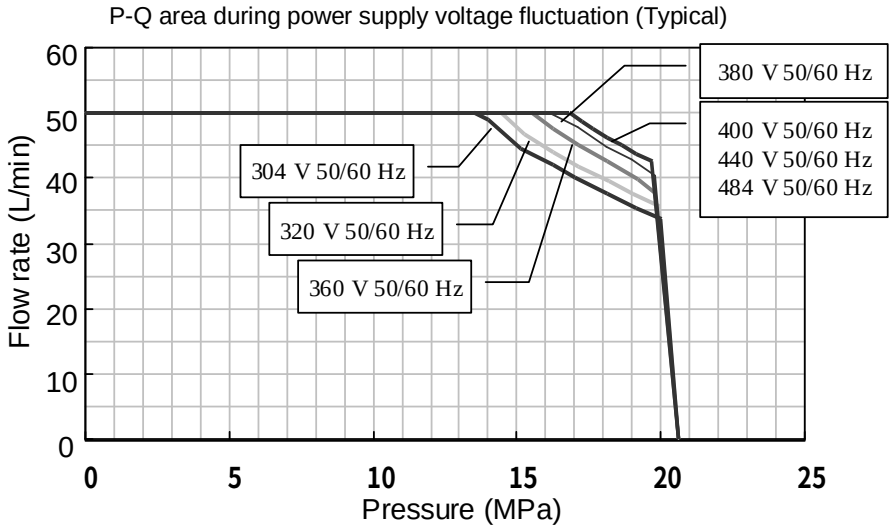

Continuous operation rating: 13.3 kW
Short-time operation rating: 36 kW

* The above data indicate typical characteristics at 40°C oil temperature, with 400 V, 50 Hz power supply.

### 3.3.2 Power supply voltage fluctuations

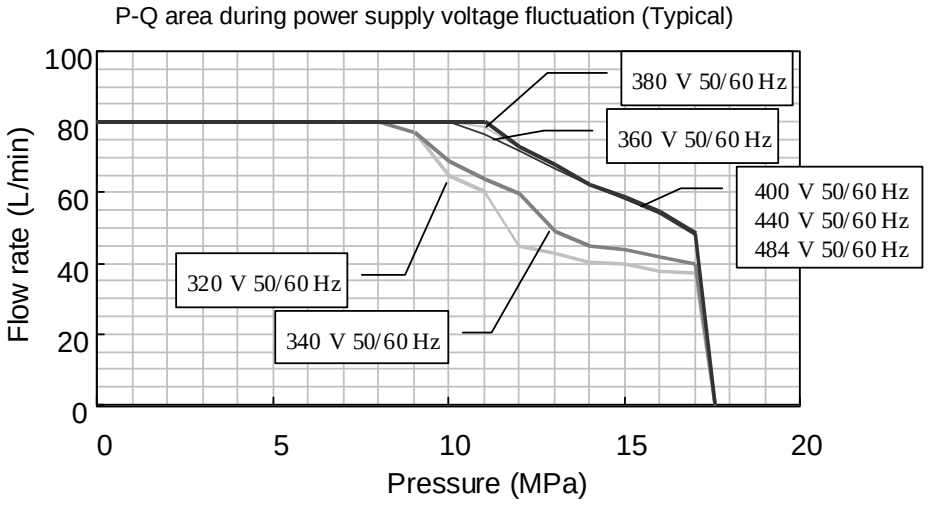
Even if the power supply voltage is within the allowable fluctuation range, the output may be reduced by power supply voltage fluctuations in the negative direction.
If there is possibility that the power supply voltage decreases to 380 VAC or lower, select an appropriate P-Q area by referring to the typical characteristics shown as follows.

- SUT00S5021



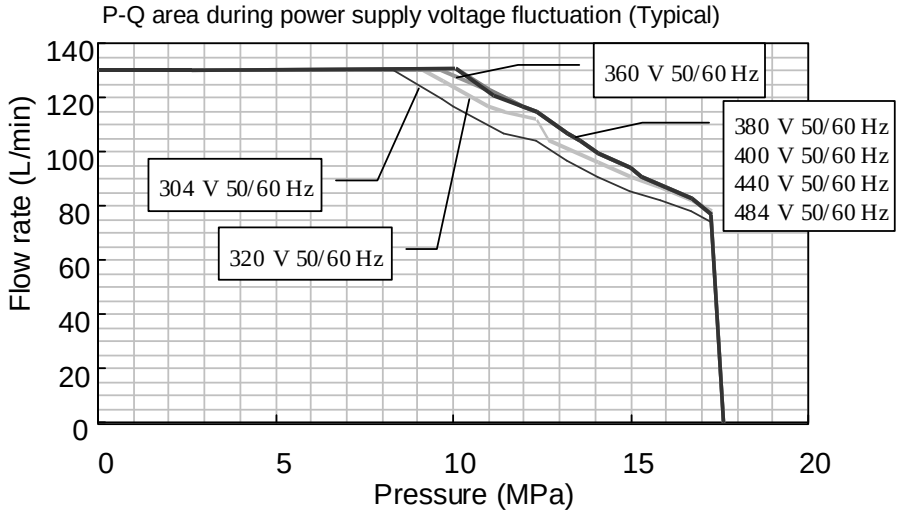

* Typical characteristics at 40°C oil temperature

- SUT00S8018



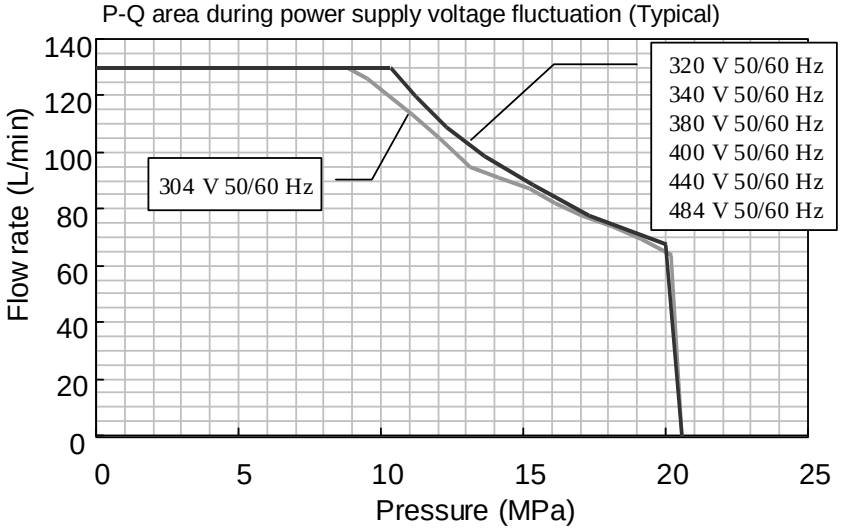

* Typical characteristics at 40°C oil temperature

● SUT00S13018



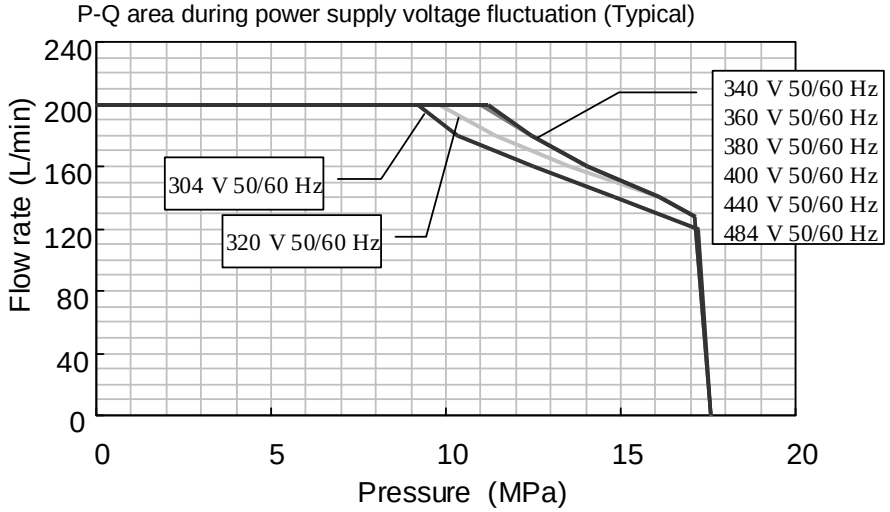

* Typical characteristics at 40°C oil temperature

● SUT00S13021




* Typical characteristics at 40°C oil temperature

● SUT00S20018




* Typical characteristics at 40°C oil temperature

## 3.4 Precautions for Use

- This hydraulic unit is equipped with a safety valve.
  This safety valve has been set to a specified pressure before shipment. However, the set pressure of the safety valve may decrease while the machine is repeatedly used for a long period, or due to contaminants in the hydraulic oil. If this unit is continuously used with the safety valve activated, it may output an alarm due to a temperature rise and so on. In this case, re-adjust the safety valve pressure setting by referring to "13.5 Safety Valve Adjustment".
  When SUT00S20018 is used, adjust the pressure setting with the safety valve provided in the main machine.

- The allowable fluctuation range of the controller power supply voltage is –20 to +10%. Even if the power supply voltage is within the allowable range, a power supply voltage fluctuation in the positive direction may result in an alarm output (regenerative overload etc.) during response, depending on the operating condition and load condition of the molding machine, causing the pump to stop.

- If the load voltage is large (exceeding the volume given in the table below), excessive regenerative power is generated when the controller power supply is turned OFF in high-pressure holding status, which may result in damage to the controller. Do not turn OFF the power supply in high-pressure holding status.

| Model Identification Code | SUT00S5021 | SUT00S8018<br>SUT00S13021 | SUT00S13018 | SUT00S20018 |
|---|---|---|---|---|
| Load volume | 10 L | 15 L | 20 L | 30 L |

- If this hydraulic unit is operated with a circuit where an inline check valve is provided for the pump discharge port, load pressure reduction control is disabled. Do not provide an inline check valve for the discharge port.
  To operate this unit with a circuit including an accumulator, protect the pump with a check valve to prevent reverse flow of hydraulic oil from the accumulator to the pump. When the power supply is turned OFF, the motor serves as a generator due to reverse flow of hydraulic oil, causing damage to the controller.
  If load is applied to the pump when the power supply is turned ON, the motor may not normally start up. Keep the pump under no load for 5 seconds after power-ON.

- The regenerative breaking resistor surface temperature becomes high depending on operating conditions. Mount the regenerative resistor to a metal surface in a well-ventilated place that ensures easy heat radiation. Be careful not to touch the regenerative breaking resistor when it becomes hot.

- Install the controller in a control panel that provides IP54 enclosure rating, with at least 100 mm space above and under the controller. To access the controller during wiring, it is recommended that at least 30 mm space is provided on the left side of the controller. Also, ensure at least 100 mm space around the motor pump.

- To protect the hydraulic unit, provide a surge protector near the controller power supply.

- To start and stop the hydraulic unit, use the start and stop signals of the unit, without using an electromagnetic contactor. To turn ON/OFF the electromagnetic contactor, make sure that the hydraulic unit has completed stopped. Otherwise, the power supply circuit devices may be damaged.

- Be sure to connect the neutral point of the power supply to a ground line. If the insulation distance is too short, it may cause a failure of the hydraulic unit.

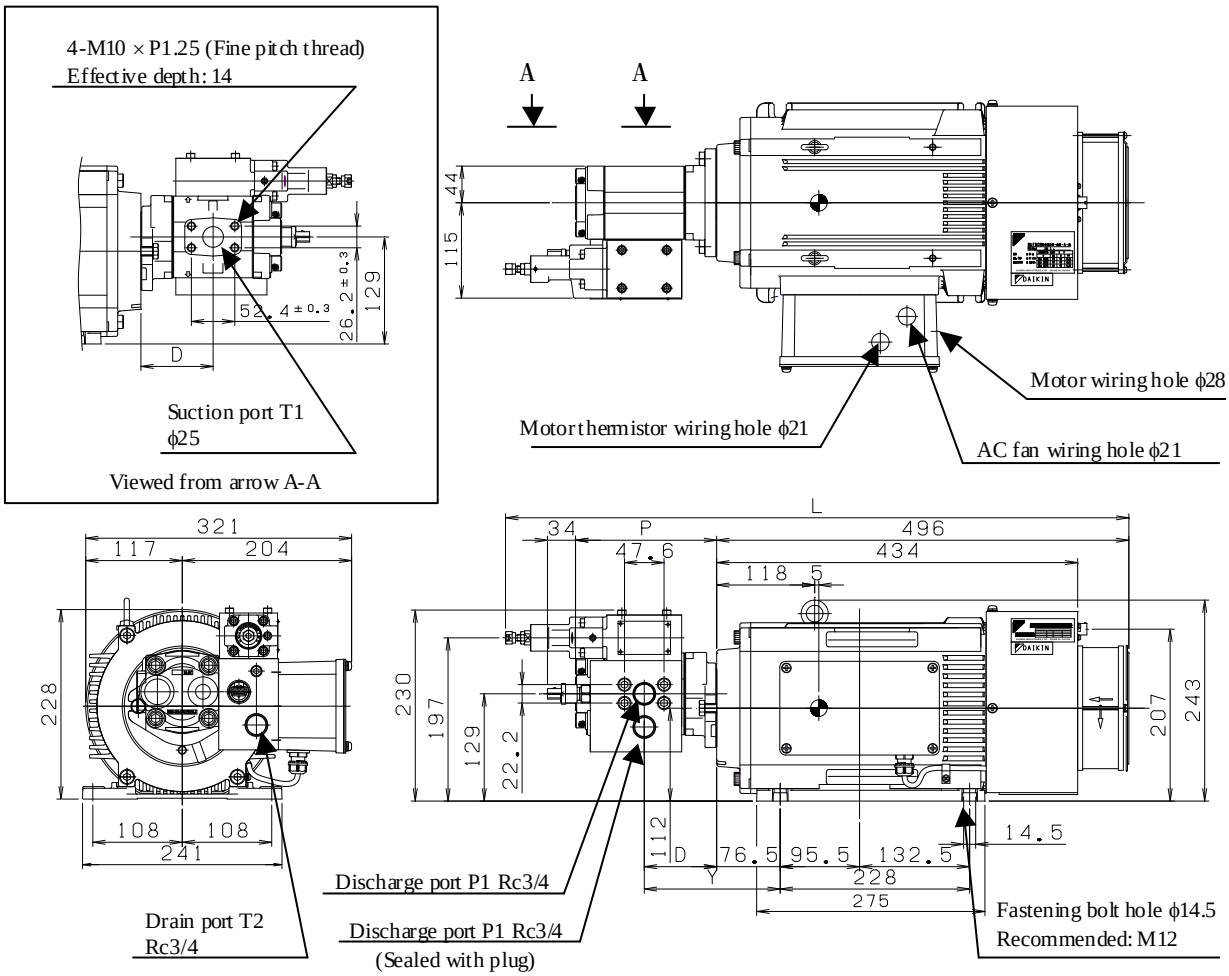
- Use a commercial power supply. If other power supply (inverter power supply etc.) is used, the hydraulic unit may be damaged.

## 3.5 Outer Dimensions

### 3.5.1 Motor pump outer dimensions

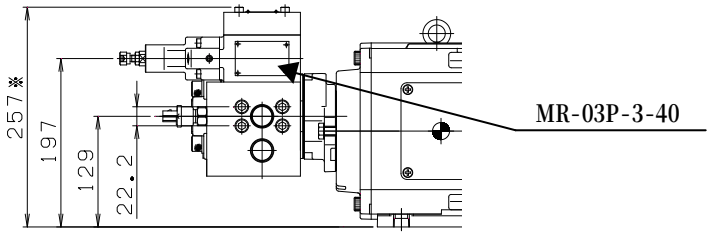
Secure an installation space in consideration of the surrounding space as shown in “7.2 Installation of Motor Pump”.

- SUT00S8018/ SUT00S5021

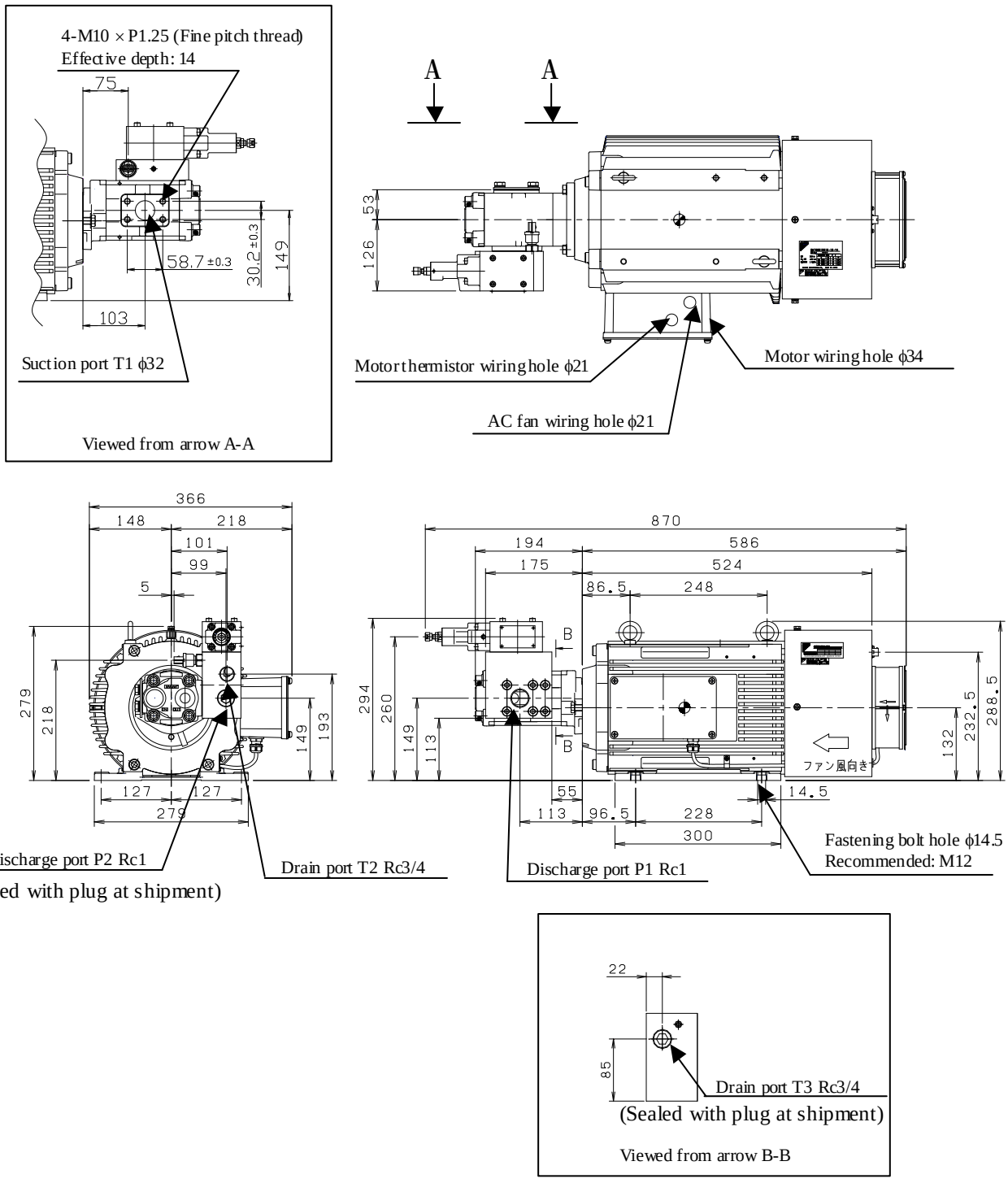



| Model Identification Code | D | L | P | Y |
|---|---|---|---|---|
| SUT00S5021 | 80 | 736 | 156 | 156.5 |
| SUT00S8018 | 87 | 750 | 170 | 163.5 |

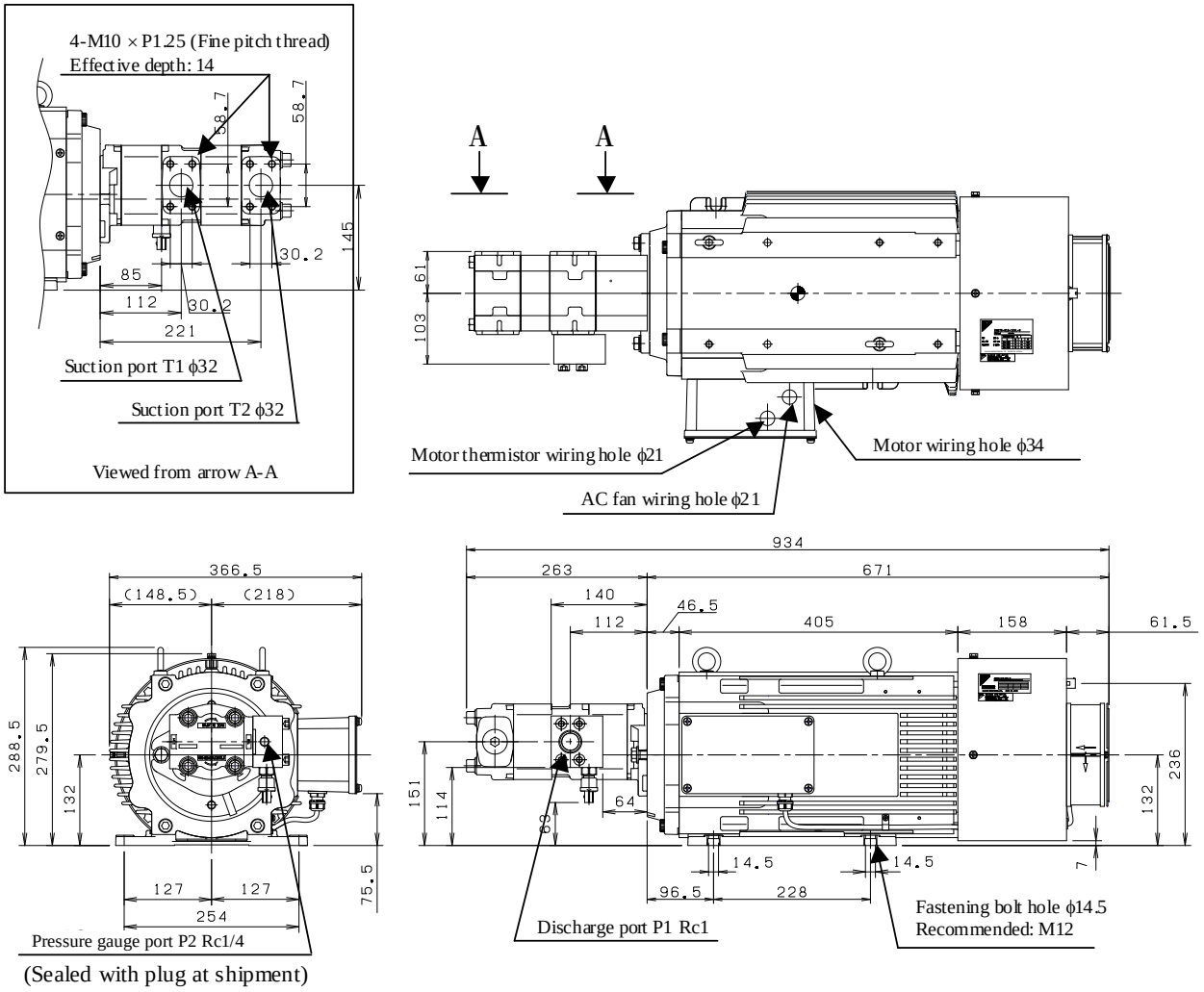
* With the models of January 2009 or later production, the relief value has been changed from “MR-03P-3-40” to “MR-03P-3-40-56”. Accordingly, the outer dimension of the unit has been changed from “257” to “230”.



● SUT00S13018/SUT00S13021



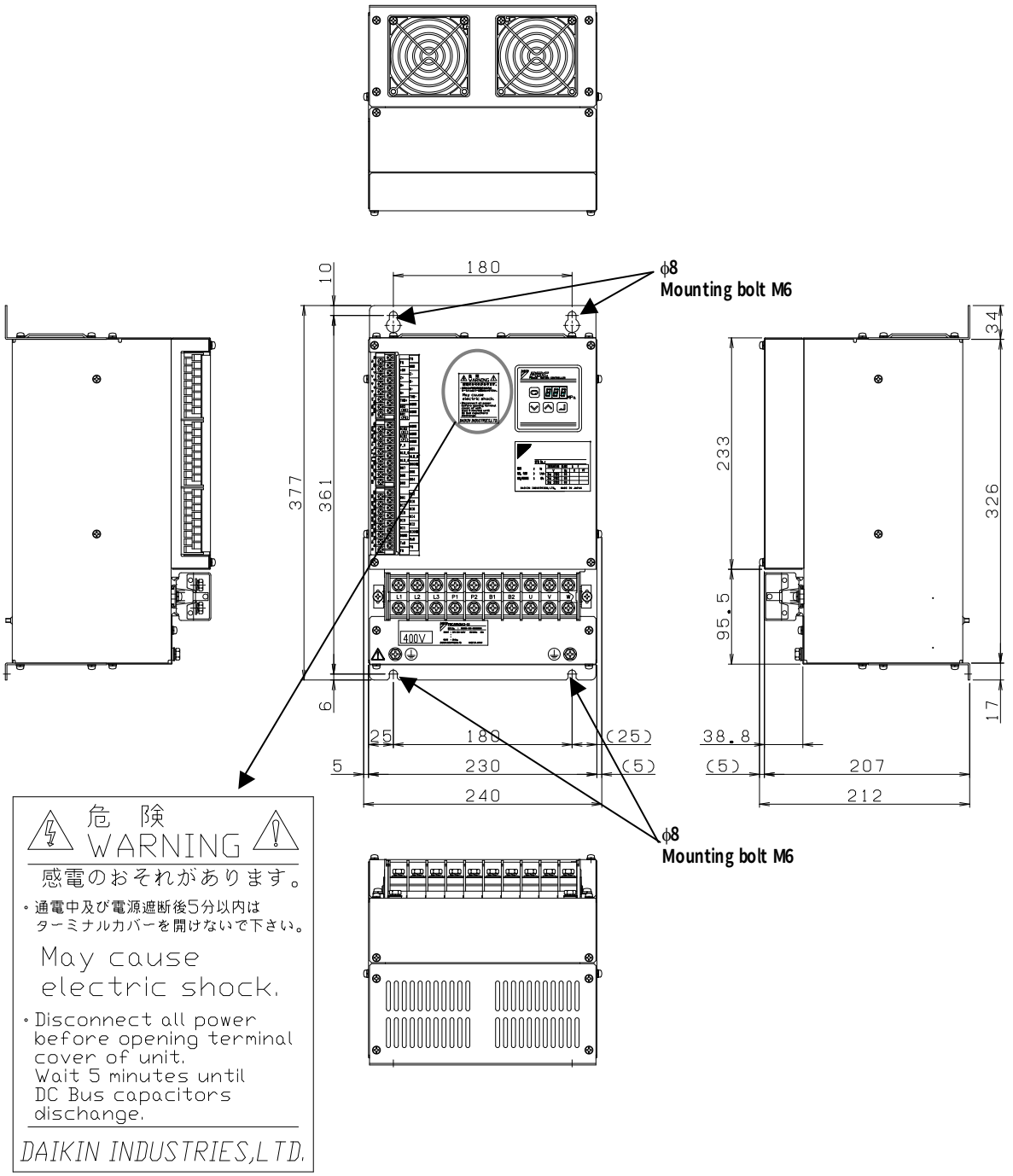
● SUT00S20018



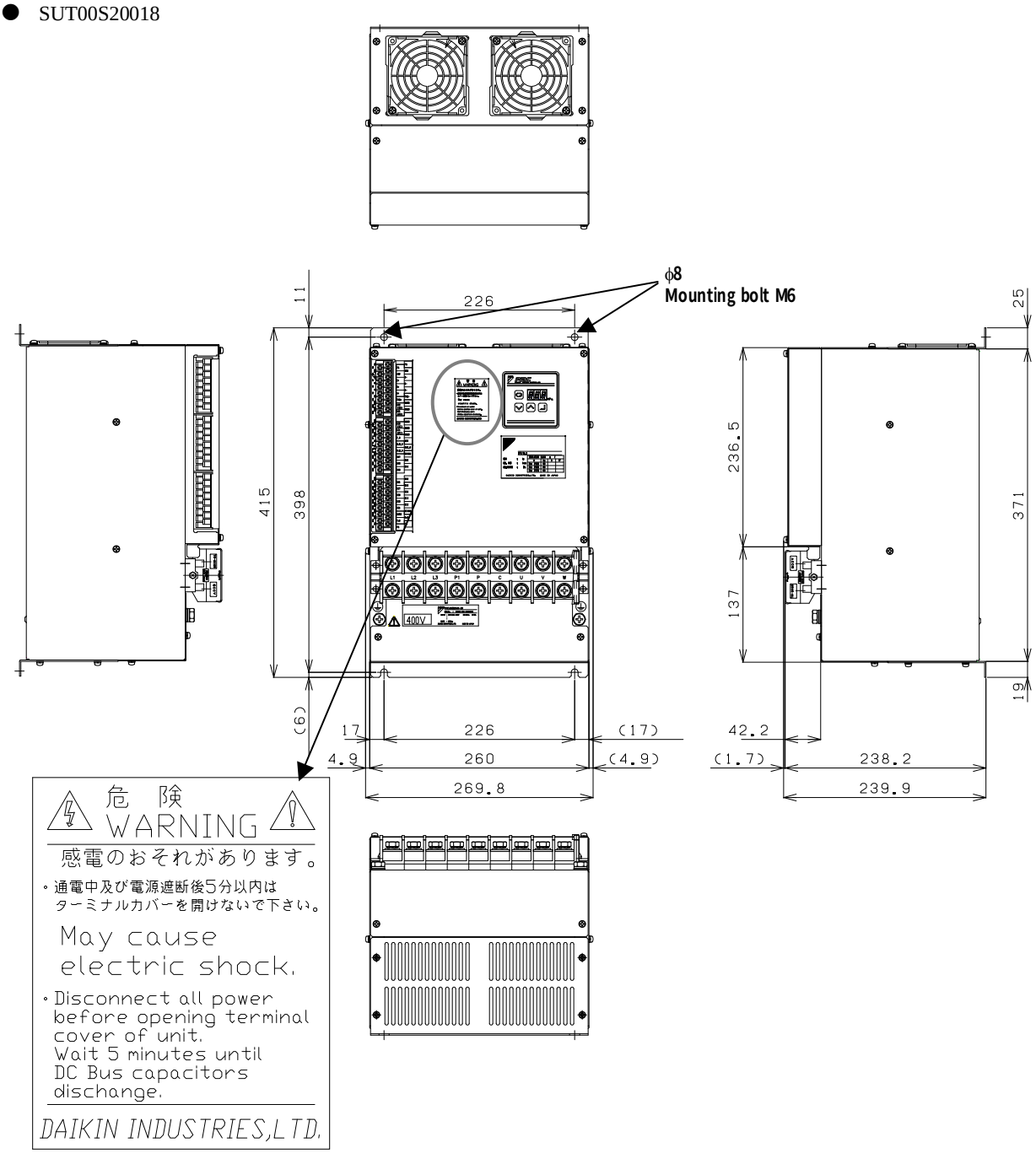
## 3.5.2 Controller outer dimensions

Secure an installation space in consideration of the surrounding space as shown in “7.3 Installation of the controller”.

- SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021



● SUT00S20018

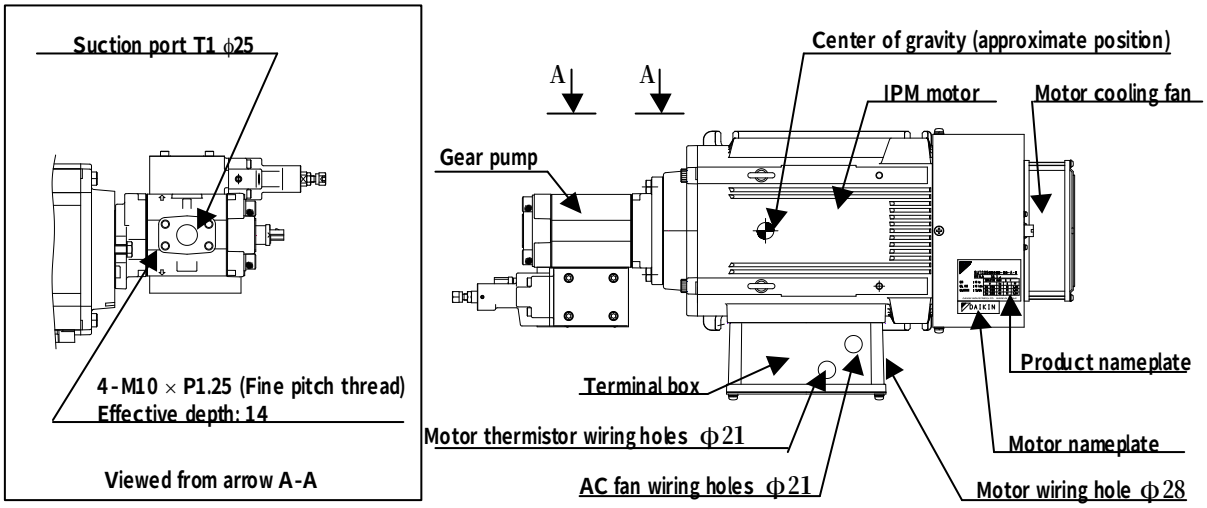


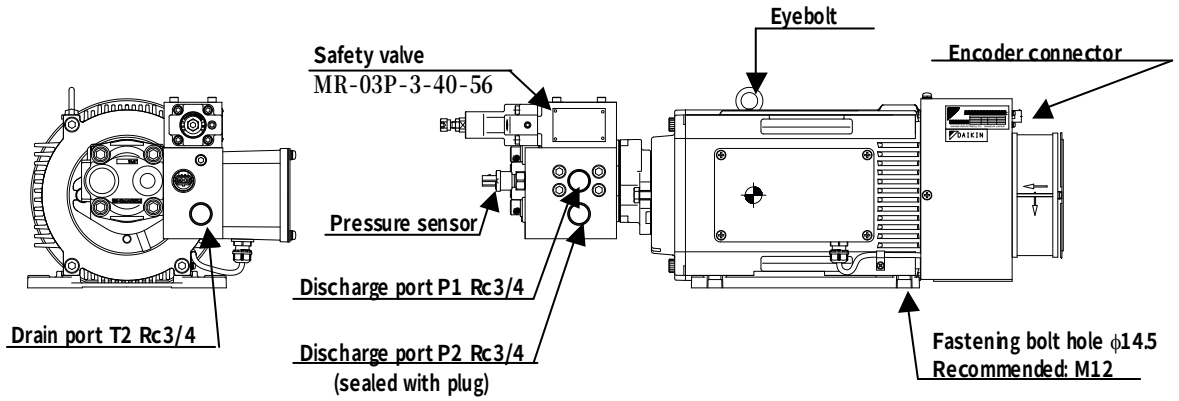
# Chapter 4 Part Names

## 4.1 Part Names of Each Unit

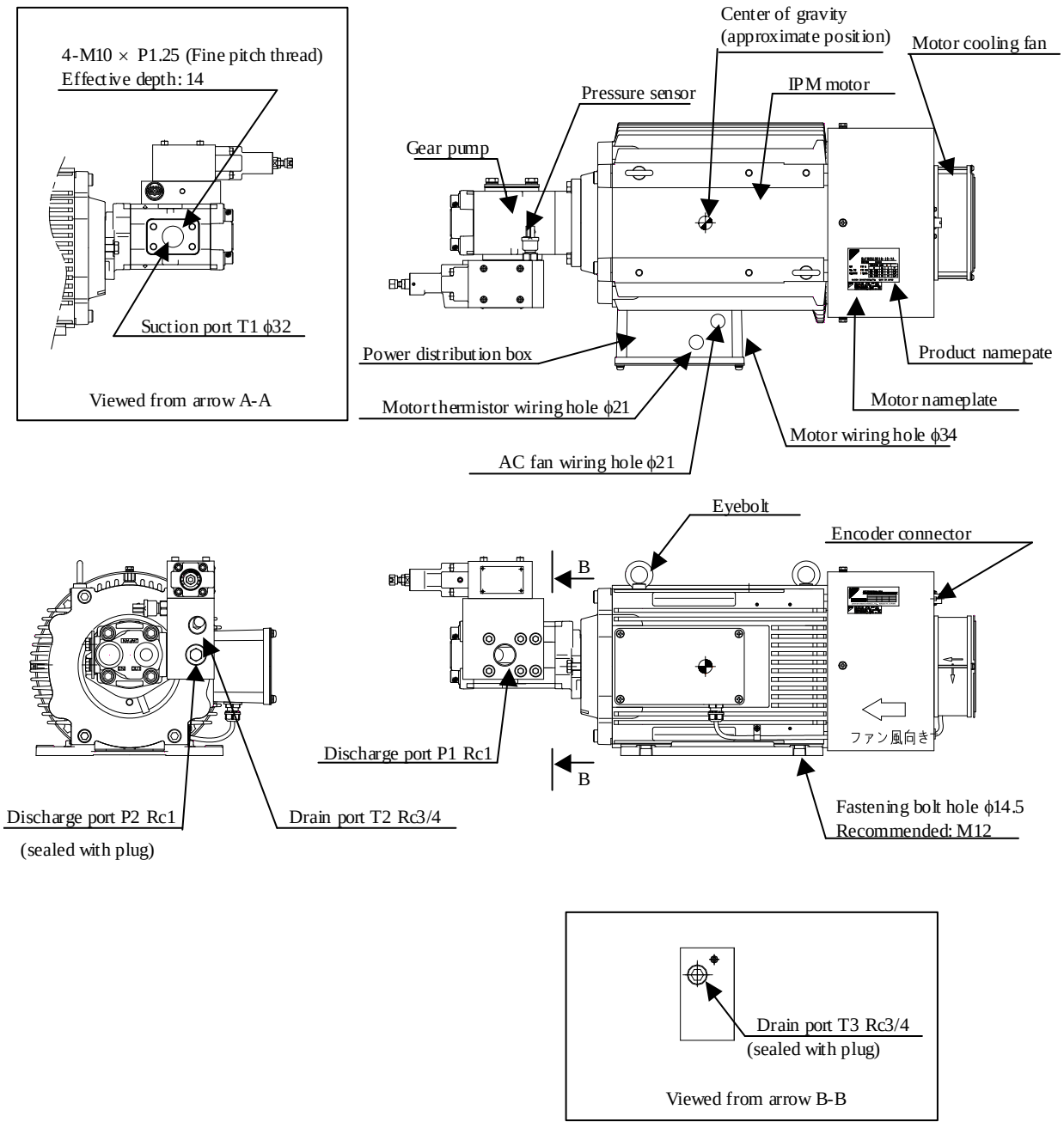
### 4.1.1 Motor pump

- SUT00S5021-20YA/SUT00S8018-20YA/SUT00S8018-21YA

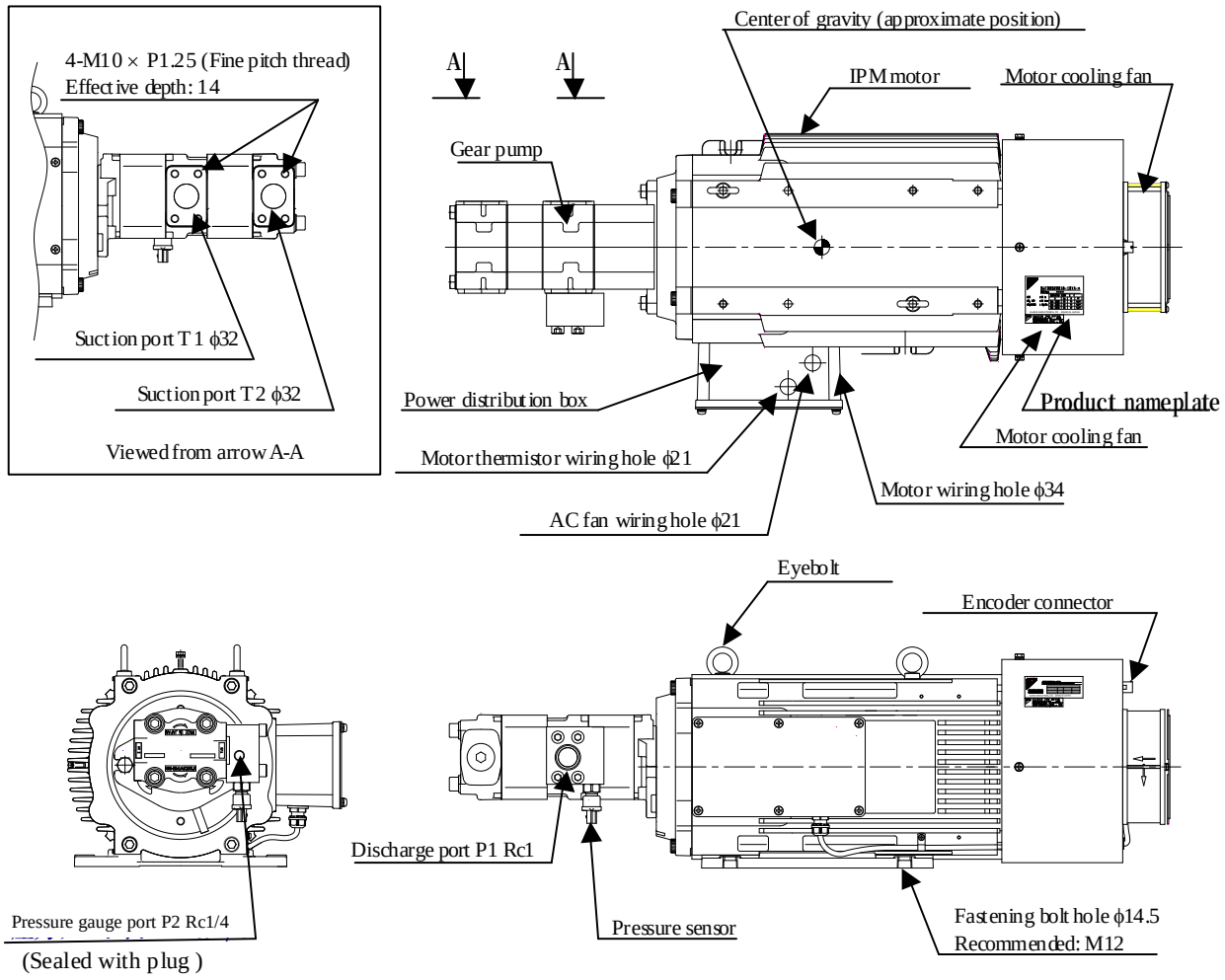


● SUT00S13018-10YA/ SUT00S13021-10YA

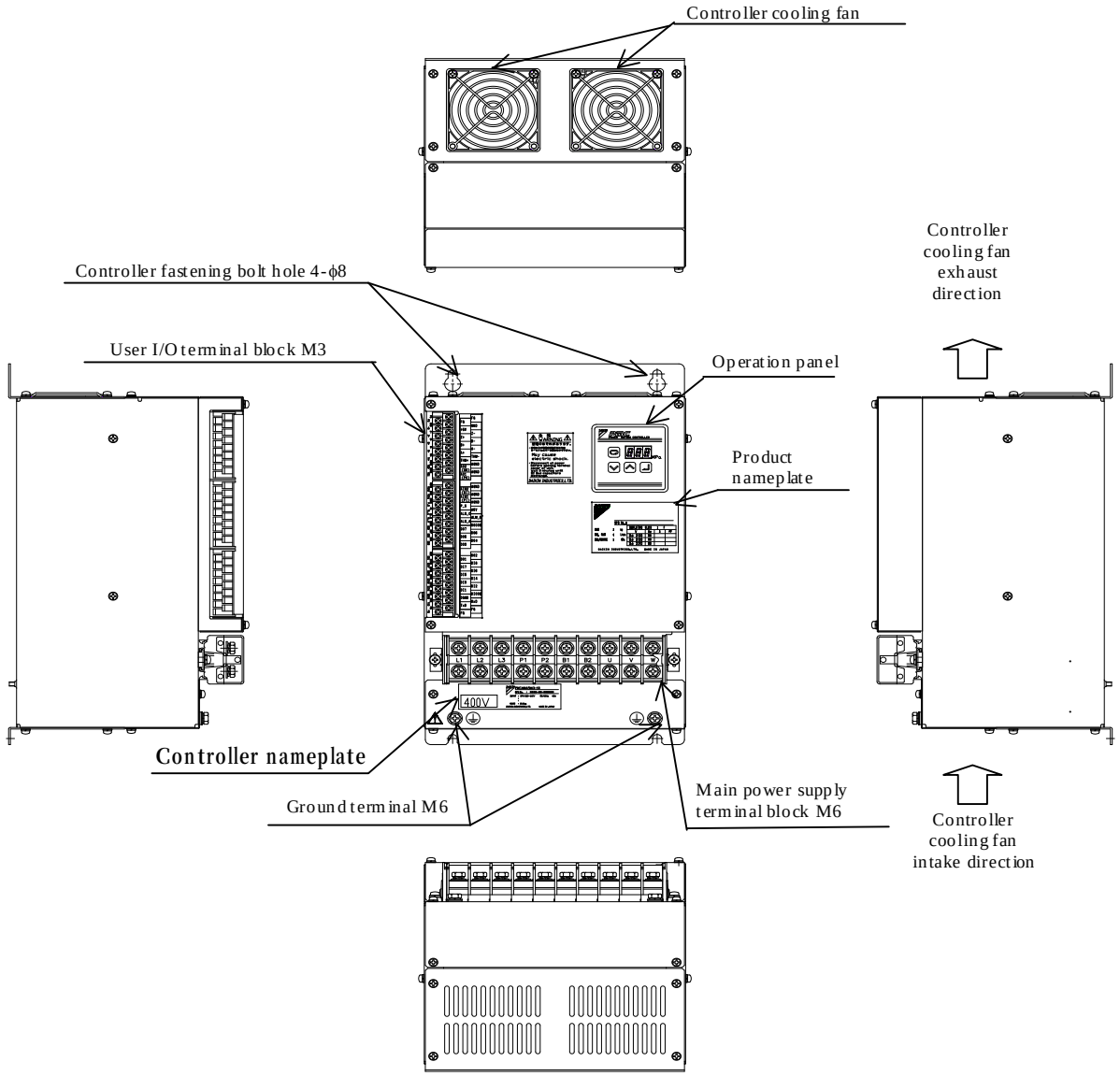


● SUT00S20018-10YL

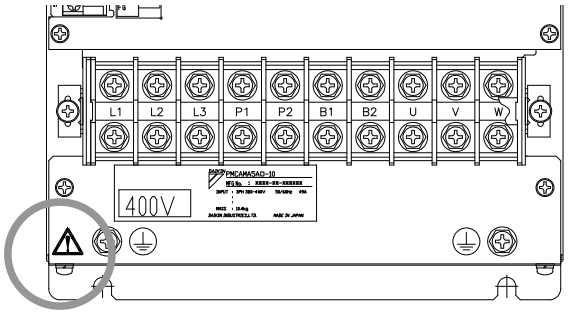


## 4.1.2 Controller

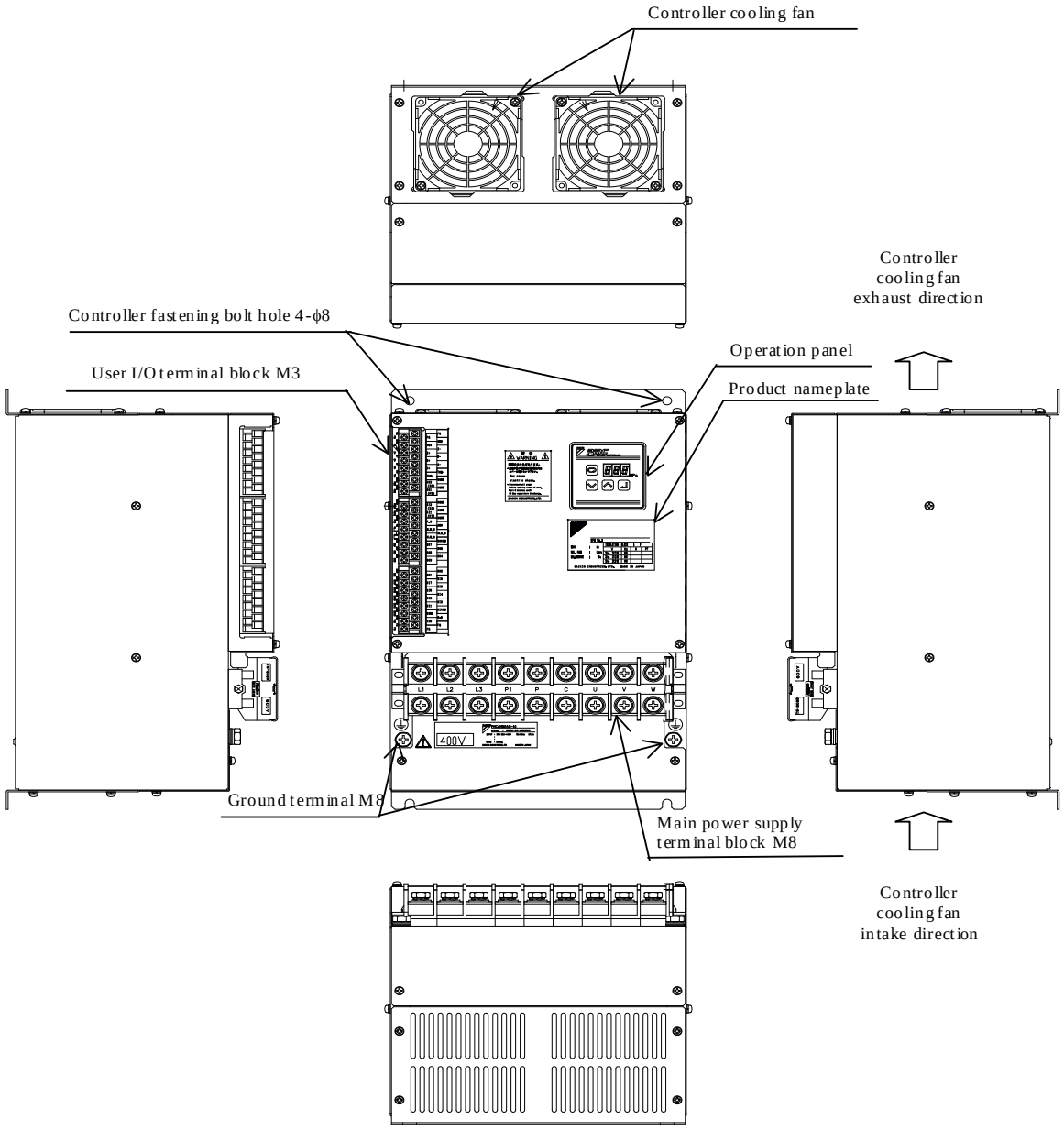
● SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021



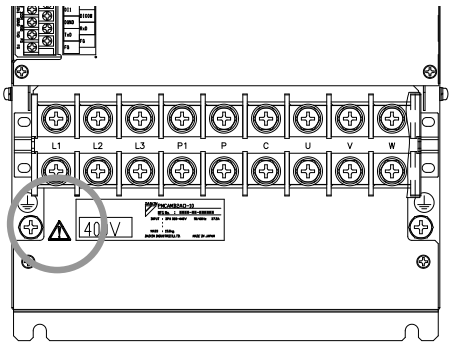

* Since a leak current of 3.5 mA or more is expected, use a wire with 10 $mm^2$ or larger cross-section area, or two wires to ground the controller.



● SUT00S20018




* Since a leak current of 3.5 mA or more is expected, use a wire with 10 $mm^2$ or larger cross-section area, or two wires or more to ground the controller.



# 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

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

### 3. Piping

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

After installation is competed, conduct piping work.

### 4. Wiring

Refer to “Chapter 9 Electric 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 “11.2 Description of Parameters”.

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 “11.2 Description of Parameters”.

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

### 8. Flushing

Refer to “11.4 Pump Operation/Air ”.

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 “11.4 Pump Operation/Air ”.

After flushing is completed, replace the hydraulic oil.

### 10. Air Purge

Refer to “11.4 Pump Operation/Air ”.

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

### 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. Otherwise, the product may fall or overturn.

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

| | |
|---|---|
| Pump & Motor | 1 unit |
| Controller | 1 unit |

## 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.

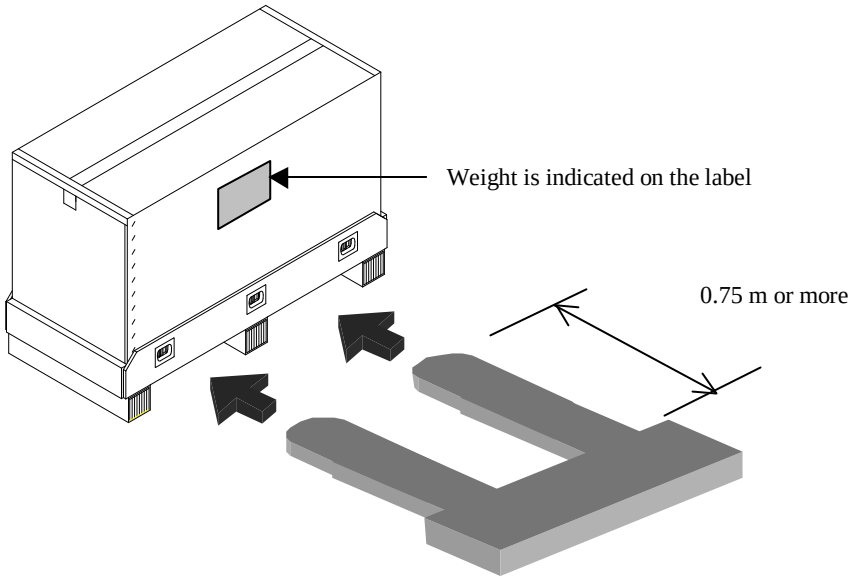
Check the product nameplate to confirm that the delivered product conforms to your ordered model. For product models, refer to "3.1 Model Identification Code".

# Chapter 7 Transportation and Installation

## 7.1 Transportation

### 7.1.1 Transportation of the product in package

To transport this product in package, sling the product package with a lift and so on. For sling points, see the figure below. The weight of the product in package is indicated on the label affixed to the side of the package.




**WARNING**

- To transport this product in package, use an appropriate transportation apparatus. Otherwise, the product may fall or overturn.
- Before lifting the product, check the weight and center of gravity of the product. Otherwise, the product may fall or overturn.

### 7.1.2 Transportation of the motor pump

The motor pump weight is as follows: Sling the motor pump within the sling gear's rated load capacity.

| Unit model | Motor pump weight |
|---|---|
| SUT00S5021-20YA | 69 [kg] |
| SUT00S8018-20YA<br>SUT00S8018-21YA | 70 [kg] |
| SUT00S13018-10YA<br>SUT00S13021-10YA | 103 [kg] |

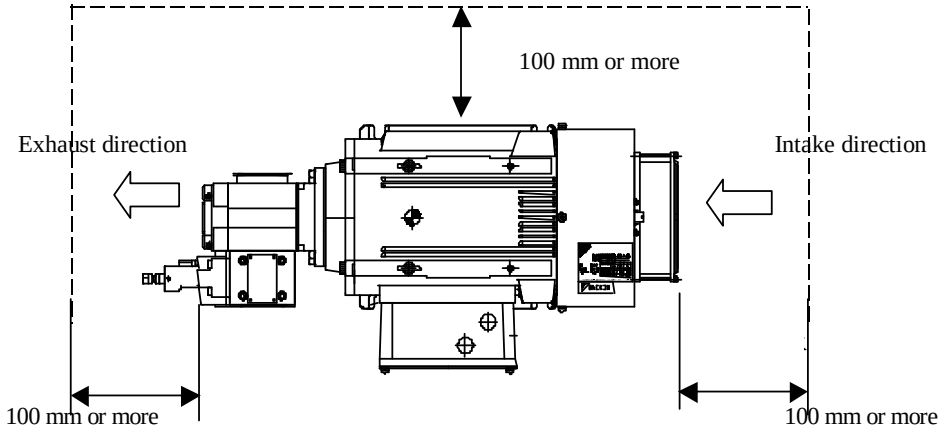
**WARNING**

- For transportation of this product, use the eyebolts attached to the product. If the product is slung by any other parts, the product may fall or overturn.
- Use a transportation apparatus appropriate for this product. Otherwise, the product may fall or overturn.
- Before slinging the product, check the weight and the center of gravity of this product. Otherwise, the product may fall or overturn. For the center of gravity of the single unit of the motor pump, refer to "3.5.1 Motor pump outer dimensions".

## 7.2 Installation of Motor Pump

### 7.2.1 Precautions for installation of the motor pump

The motor cooling fan sucks up air from outside, and exhausts air toward the motor.
During installation of the motor pump, ensure at least 100 mm space from the motor pump end surface, so that air intake and exhaust of the motor cooling fan will not be blocked. Also, install the motor pump in a well-ventilated place, so that hot air will not stay around the motor pump.




### 7.2.2 Fastening the motor pump

Since the motor pump may slide due to reaction force of the hydraulic oil in the piping, or due to a shock during startup, fasten the motor pump horizontally to a molding machine base. The recommended mounting bolt is M12.
When the motor pump is installed as shown above, ensure ventilation around the exhaust port. (For example. use a cover with ventilation holes.)
If the motor pump and installation base are mounted with shock-absorbing rubber, the motor pump may shake during motor startup, and when reaction force of hydraulic oil is applied to the pump. Ensure an enough space with a margin in consideration of vibration of the piping.

**⚠ CAUTION**

- Do not drop this product, or do not apply strong impact to this product. Failure to observe this instruction may result in an accident or damage to the product.
- Do not step on this product, or do not put a heavy object on the product. Failure to observe this instruction may result in an accident or damage to the product.
- Fasten this product securely. Tighten the mounting bolts securely so that they will not be loosened by vibration. Failure to observe this instruction may result in an accident or damage to the product.
- Do not allow any foreign object to enter the fan in this product. Failure to observe this instruction may result in an accident or damage to the product.

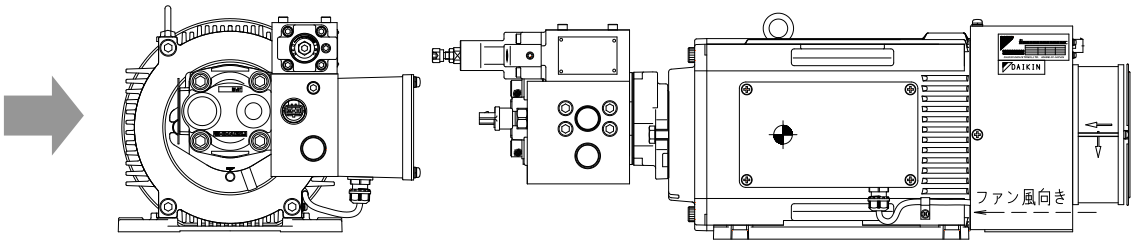
## 7.2.3 Changing direction of the pump suction port

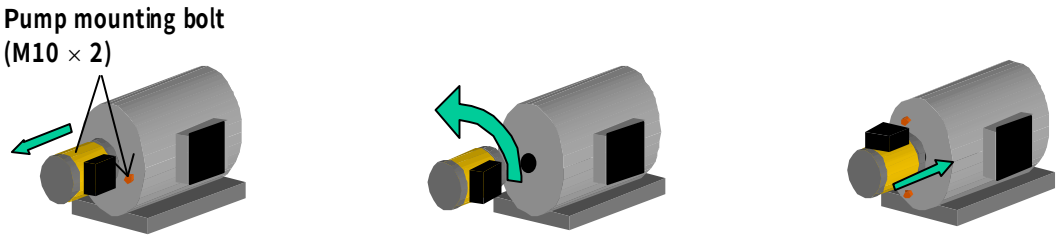
With the factory setting, the pump suction port faces the left (when viewed from the pump side). If you change the direction of the pump suction port downward, turn the pump mounting angle counterclockwise by 90°, as shown in the figure below.

1) Remove two pump mounting bolts, and pull the pump shaft slightly from the motor in the axial direction.
2) Turn the pump unit counterclockwise by 90°, so that the suction port is located at the bottom.
3) Insert the pump, and fasten it with the mounting bolts. (Tightening torque: 30.0 N·m)

The pump shaft is a spline shaft, which can be removed from the motor by pulling it axially. The pump shaft need not be entirely pulled out.

• Direction of suction port at shipment



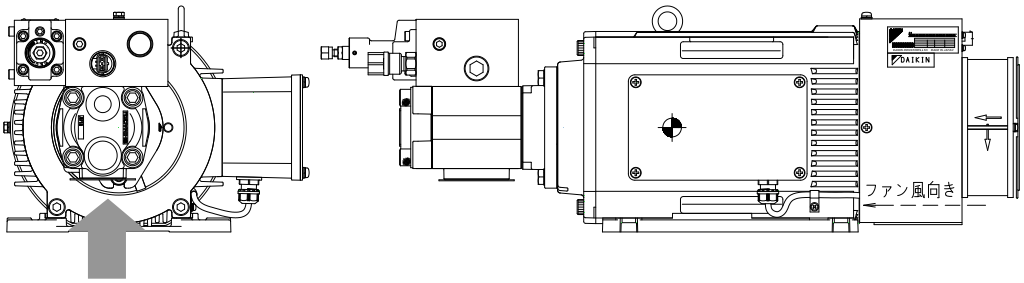




1) Remove the mounting bolts, and pull the pump shaft slightly.

2) Turn the pump by 90°.

3) Insert the pump, and fasten it with the mounting bolts. (Tightening torque: 30.0 ± 3.0 N·m)

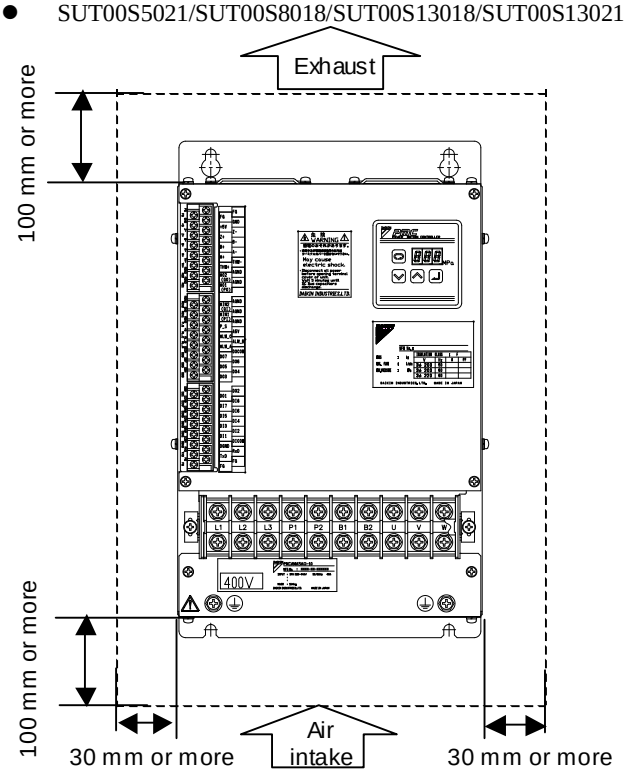
• Suction port after change



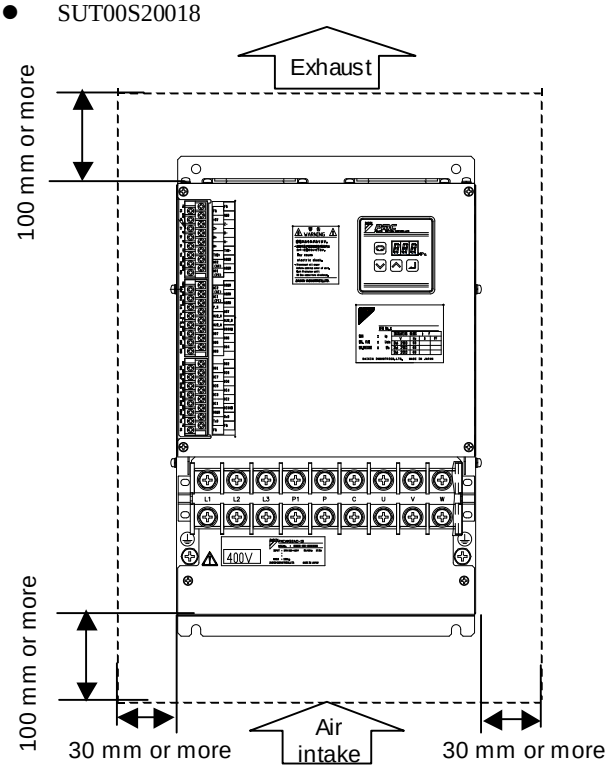
## 7.3 Installation of the controller

- Install the controller vertically. Ensure at least 100 mm space above and under the controller. To access the controller during wiring, it is recommended that at least 30 mm space is provided on the left side of the controller.
- Be sure to install the controller in a control panel that provides IP54 enclosure rating.

● SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021




● SUT00S20018




### ⚠ CAUTION

- Be sure not to harm yourself when installing the controller. It may cause an injury
- Mount the controller to an incombustible material, such as metal.
- Avoid installing the controller in a place where oil mist or airborne dust is present. Install the controller in a fully-enclosed panel (IP54) that does not allow entry of airborne substances.
- Install the controller in a place free from harmful gas or liquid, radioactive substances, or combustible substances.
- Install the controller in a place with little vibration.
- Install the controller in a place with little salt.
- Install the controller in a place where it is not exposed to direct sunlight.
- When a drill is used for installation work, take appropriate measures to prevent metal chips from entering inside of the controller. (For example, mount a protective cover to the controller.) After installation work, do not forget to remove the protective cover. If the controller is operated with the protective cover mounted, ventilation deteriorates, causing overheating of the controller, which may result in a fault of the controller.
- For an inductive load connected around the controller (electromagnetic contactor, electromagnetic relay, electromagnetic valve, solenoid, electromagnetic brake, etc.), be sure to provide a surge absorber.
- Particularly when several controllers are installed in a panel, the panel internal temperature will easily increase. Keep the controller's air intake temperature at 55°C or lower by using a cooling fan, etc.

# Chapter 8 Hydraulic Piping

Connect piping to all of the following ports:

| Unit model | Discharge piping | Suction piping | Drain piping |
|---|---|---|---|
| SUT00S5021-20YA | P1 or P2 | T1 | T2 |
| SUT00S8018-20YA<br>SUT00S8018-21YA | | | |
| SUT00S13018-10YA<br>SUT00S13021-10YA | P1 | T1 | T2 or T3 |
| SUT00S20018-10YL | P1 | T1 and T2 | – |

## 8.1 Discharge piping

Recommended specifications of the discharge piping are listed below:

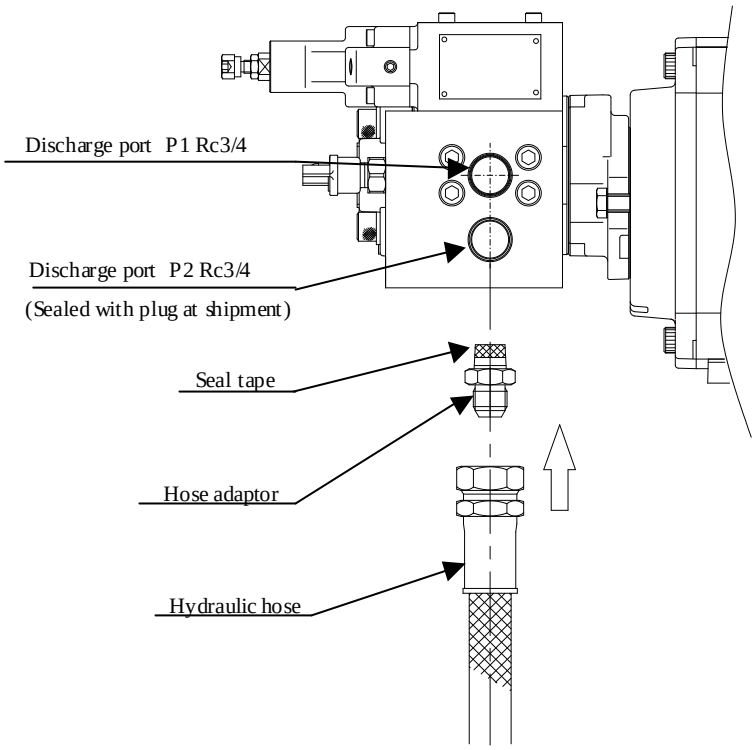
| Unit model | Withstand pressure |
|---|---|
| SUT00S5021-20YA | 34.5 MPa |
| SUT00S13021-10YA | |
| SUT00S8018-20YA<br>SUT00S8018-21YA | 27.5 MPa |
| SUT00S13018-10YA | |
| SUT00S20018-10YL | |

● SUT00S5021-20YA /SUT00S8018-20YA /SUT00S8018-21YA

The hydraulic unit provides two P ports (P1 and P2).

| Port No. | Name | Size |
|---|---|---|
| P1 | Discharge port | Rc3/4 |
| P2 | Discharge port<br>(Sealed with plug at shipment) | Rc3/4 |

Connect the discharge piping to the P1 or P2 port. The port size is Rc3/4.
Connect the piping as shown below.




Before shipment, the P1 port has been sealed with a resin plug with O-ring. The P2 port is sealed with a hexagon socket head plug.
Remove the resin plug with O-ring, and connect a hydraulic hose. Then, tighten the hose by winding seal tape.

**CAUTION**

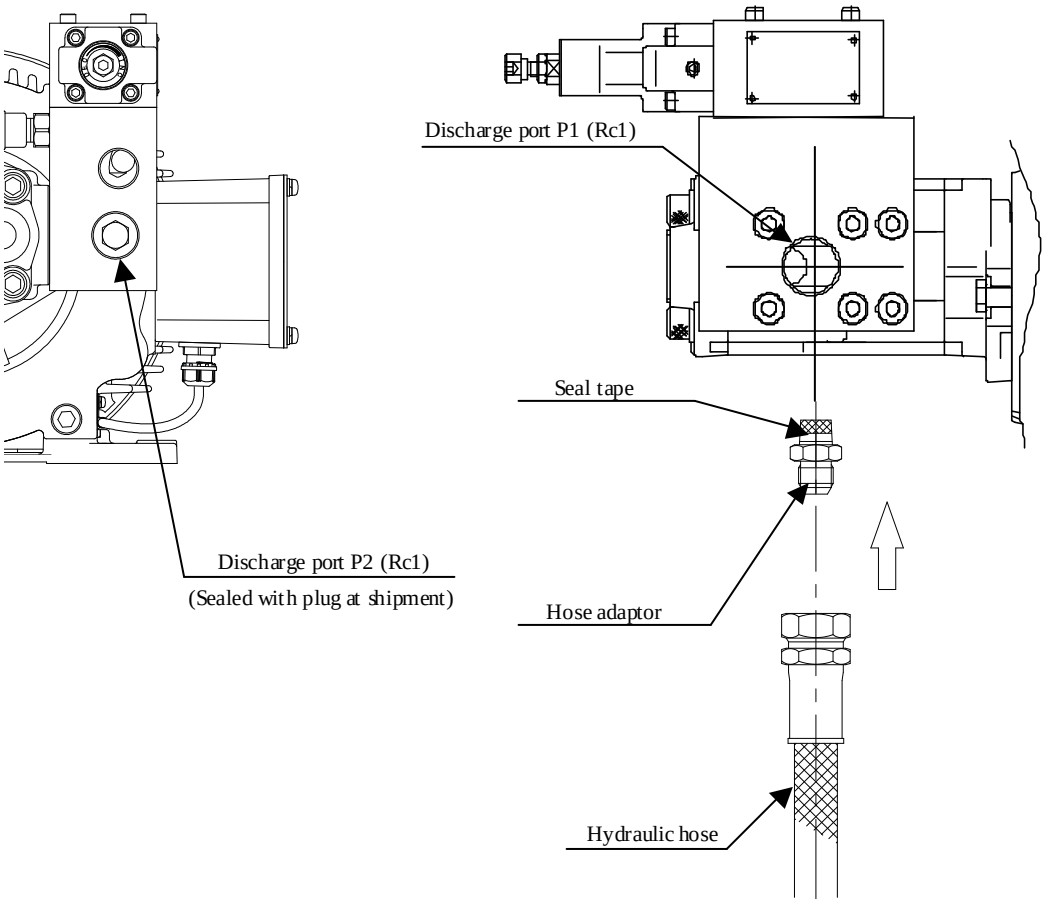
- For piping to this unit, use a hose.
- Select an appropriate hose length. If the connected hose is too long, it will shake during load fluctuations, causing interference with the main machine.
- During hose connection, make sure that the hose bend radius is larger than the allowable minimum bend radius given in the specifications, and that the hose will not twist.
- If excessive strain may be applied due to the hose weight, support the hose.
- For an unused port, attach a hexagon socket plug to block it. Otherwise, oil leak may occur.

● SUT00S13018-10YA/SUT00S13021-10YA

The hydraulic unit provides the P1 and P2 discharge ports.

| Port No. | Name | Size |
|---|---|---|
| P1 | Discharge port | Rc1 |
| P2 | Discharge port<br>(Sealed with plug at shipment) | Rc1 |

Connect the discharge piping to the P1 or P2 port. The port size is Rc1.




Before shipment, the P1 port has been sealed with a resin plug with O-ring. The P2 port is sealed with a hexagon socket head plug.
Remove the resin plug with O-ring, and connect a hydraulic hose. Then, tighten the hose by winding seal tape.
When the discharge piping is connected to the P2 port, attach a high-pressure plug to the P1 port by winding seal tape.

## ⚠ CAUTION

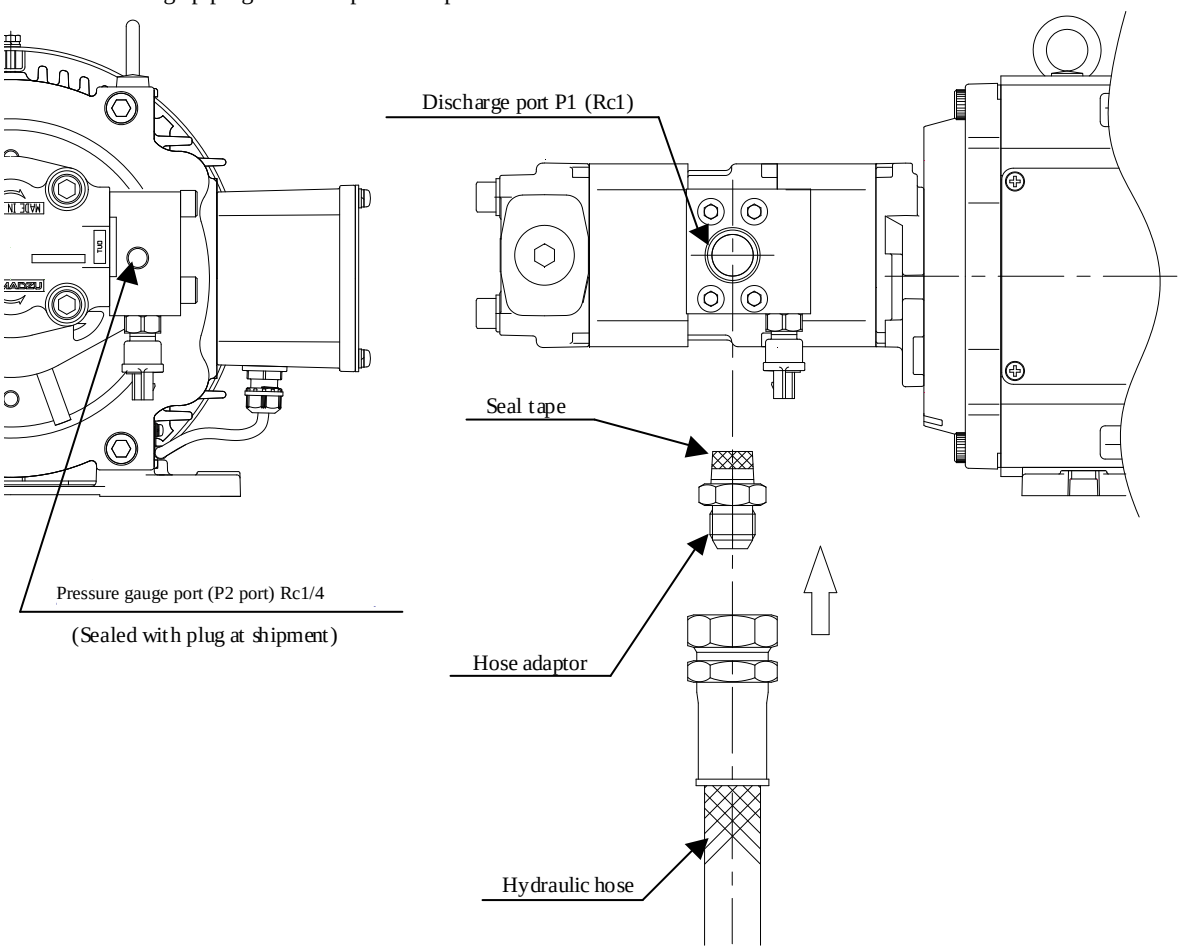
- For piping to this unit, use a hose.
- Select an appropriate hose length. If the connected hose is too long, it will shake during load fluctuations, causing interference with the main machine.
- During hose connection, make sure that the hose bend radius is larger than the allowable minimum bend radius given in the specifications, and that the hose will not twist.
- If excessive strain may be applied due to the hose weight, support the hose.
- For an unused port, attach a hexagon socket plug to block it. Otherwise, oil leak may occur.

● SUT00S20018-10YL

A discharge port (P1) and a pressure gauge port (P2) are provided.

| Port No. | Name | Size |
|---|---|---|
| P1 | Discharge port | Rc1 |
| P2 | Pressure gauge port<br>(Sealed with plug at shipment) | Rc1/4 |

Connect the discharge piping to the P1 port. The port size is Rc1.




Before shipment, the P1 port has been sealed with a resin plug with O-ring. The P2 port is sealed with a hexagon socket head plug.
Remove the resin plug with O-ring, and connect a hydraulic hose. Then, tighten the hose by winding seal tape.
When the discharge piping is connected to the P2 port, attach a high-pressure plug to the P1 port by winding seal tape. The P2 port is used to attach a pressure gauge. Attach a pressure gauge, as required.

**⚠ CAUTION**

- For piping to this unit, use a hose.
- Select an appropriate hose length. If the connected hose is too long, it will shake during load fluctuations, causing interference with the main machine.
- During hose connection, make sure that the hose bend radius is larger than the allowable minimum bend radius given in the specifications, and that the hose will not twist.
- If excessive strain may be applied due to the hose weight, support the hose.
- For an unused port, attach a hexagon socket plug to block it. Otherwise, oil leak may occur.

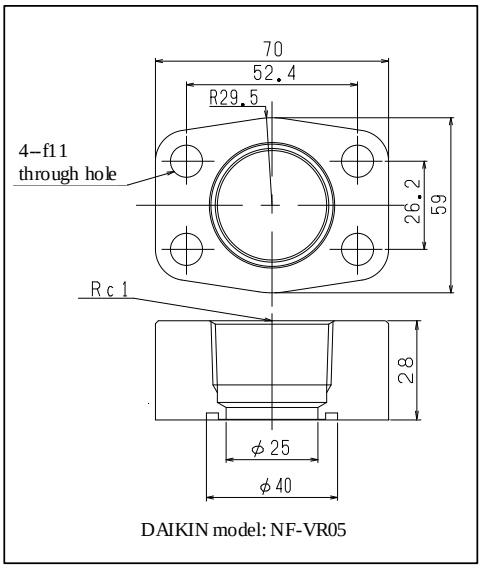
## 8.2 Suction piping

Recommended specifications of the suction piping are listed below:

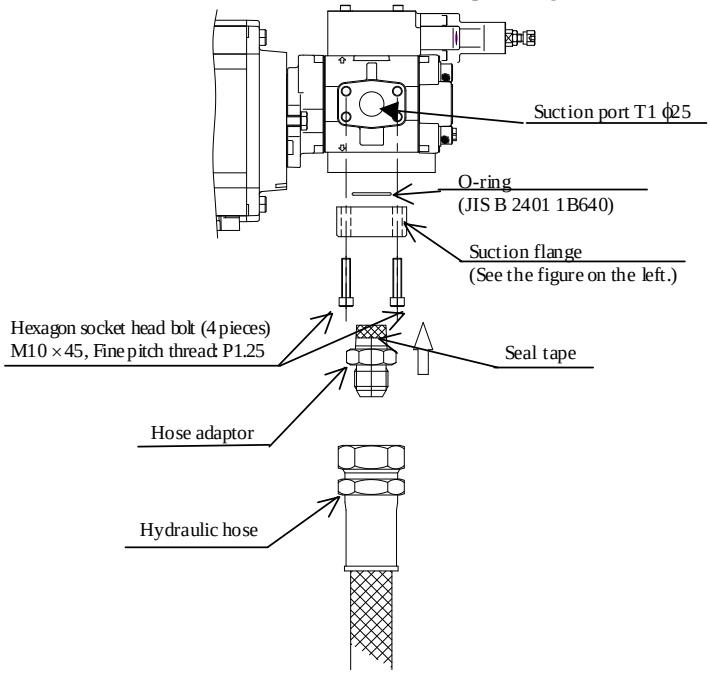
| Unit model | Withstand pressure | Size | Length |
|---|---|---|---|
| SUT00S5021 | 1.5 MPa | Rc 1-1/4 | 1.5 m or less |
| SUT00S8018 | | Rc 1-1/2 | |
| SUT00S13018 | | Rc 2 | |
| SUT00S13021 | | Rc 2 | |
| SUT00S20018 | | Rc 2 (2 port) | |

● SUT00S5021-20YA/SUT00S8018-20YA /SUT00S8018-21YA

Connect a hose to the suction port via a suction flange. The suction flange should be prepared by the user. Order our optional parts, if required.
The suction port flange size conforms to the SAE J518 “STANDARD PRESSURE SERIES” 1-1/4 split flange boss standard.



DAIKIN model: NF-VR05



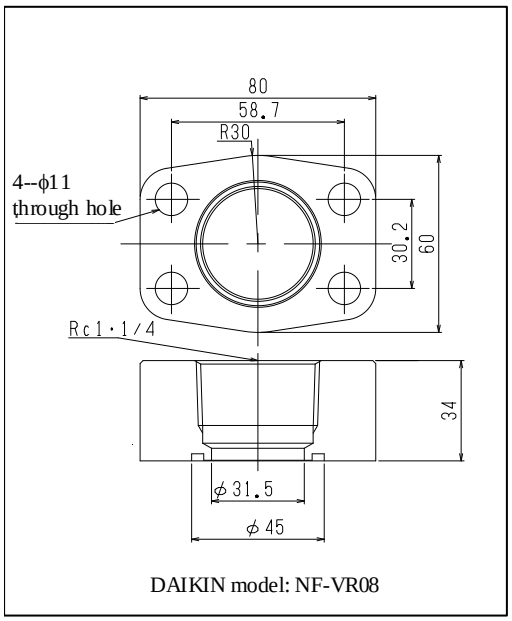

Before shipment, the suction port has been equipped with a cover port.
Remove the cover port, and connect the hydraulic hose. Tighten the hose by winding seal tape.
For piping to the suction port, provide an approx. 150-mesh suction filter.

### ⚠ CAUTION

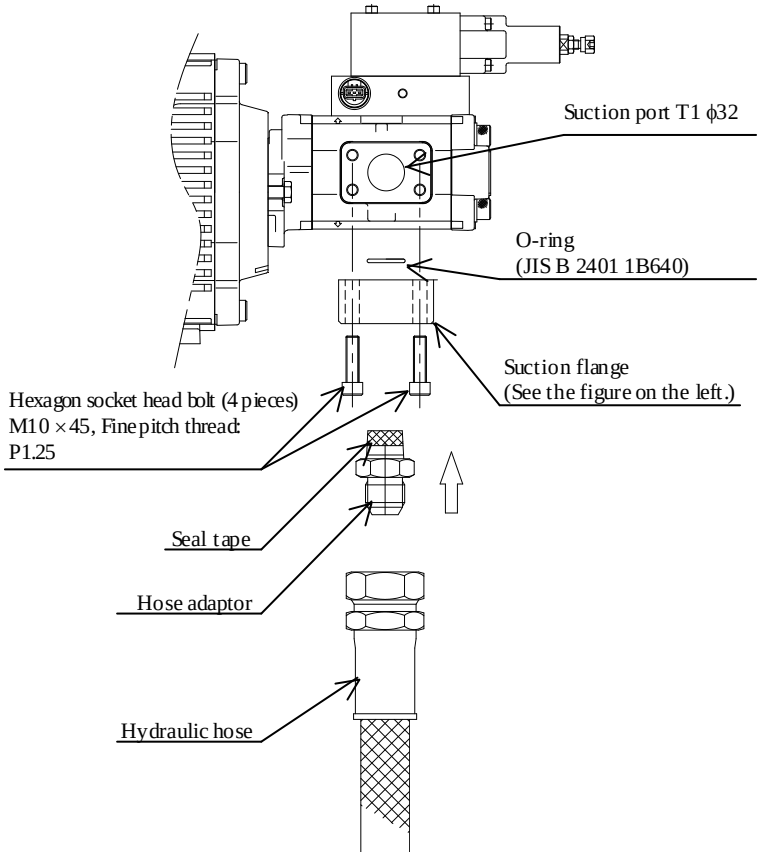
- For piping to this unit, use a hose.
- When connecting a hose, make sure that the hose bend radius is larger than that defined in the hose specifications.
- When connecting a hose, do not twist the hose.
- If the hose may develop excessive strain due to the hose weight, support the hose.
- Make sure that the suction pressure is in a range of –0.02 to 0.2 MPa. If the suction pressure is lower than –0.02 MPa, cavitation occurs, which may result in abnormal sound, flow rate reduction, and abnormal wear of the pump internal components. On the contrary, if the suction pressure exceeds 0.2 MPa, the pump seal parts may be damaged. Conform to the standard suction piping conditions given below.
  SUT00S5021: The pipe diameter should be 1-1/4B or more, and the pipe length should be 1.5 m or less.
  SUT00S8021: The pipe diameter should be 1-1/2B or more, and the pipe length should be 1.5 m or less.

● SUT00S13018-10YA

Connect a hose to the suction port via a suction flange. The suction flange should be prepared by the user. Order our optional parts, if required.
The suction port flange size conforms to the SAE J518 “STANDARD PRESSURE SERIES” 1-1/4 split flange boss standard.




DAIKIN model: NF-VR08




Before shipment, the suction port has been equipped with a cover port.
Remove the cover port, and connect the hydraulic hose. Tighten the hose by winding seal tape.
For piping to the suction port, provide an approx. 150-mesh suction filter.

## ⚠ CAUTION

- For piping to this unit, use a hose.
- When connecting a hose, make sure that the hose bend radius is larger than that defined in the hose specifications.
- When connecting a hose, do not twist the hose.
- If the hose may develop excessive strain due to the hose weight, support the hose.
- Make sure that the suction pressure is in a range of –0.02 to 0.2 MPa. If the suction pressure is lower than –0.02 MPa, cavitation occurs, which may result in abnormal sound, flow rate reduction, and abnormal wear of the pump internal components. On the contrary, if the suction pressure exceeds 0.2 MPa, the pump seal parts may be damaged. Conform to the standard suction piping conditions given below.

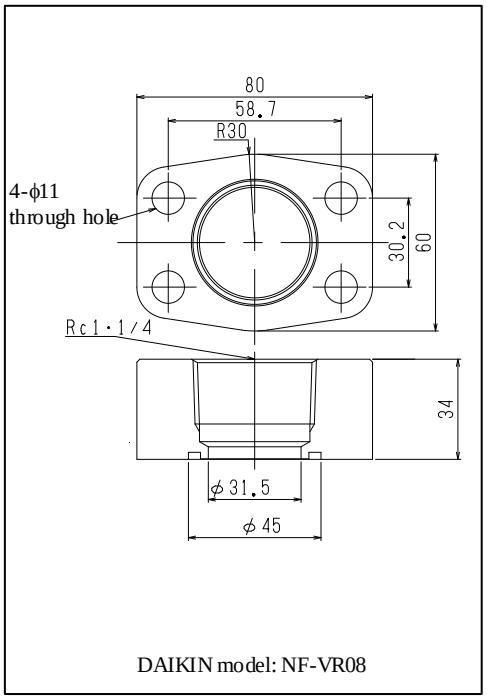
  SUT00S13018: The pipe diameter should be 2B or more, and the pipe length should be 1.5 m or less.

● SUT00S20018-10YL

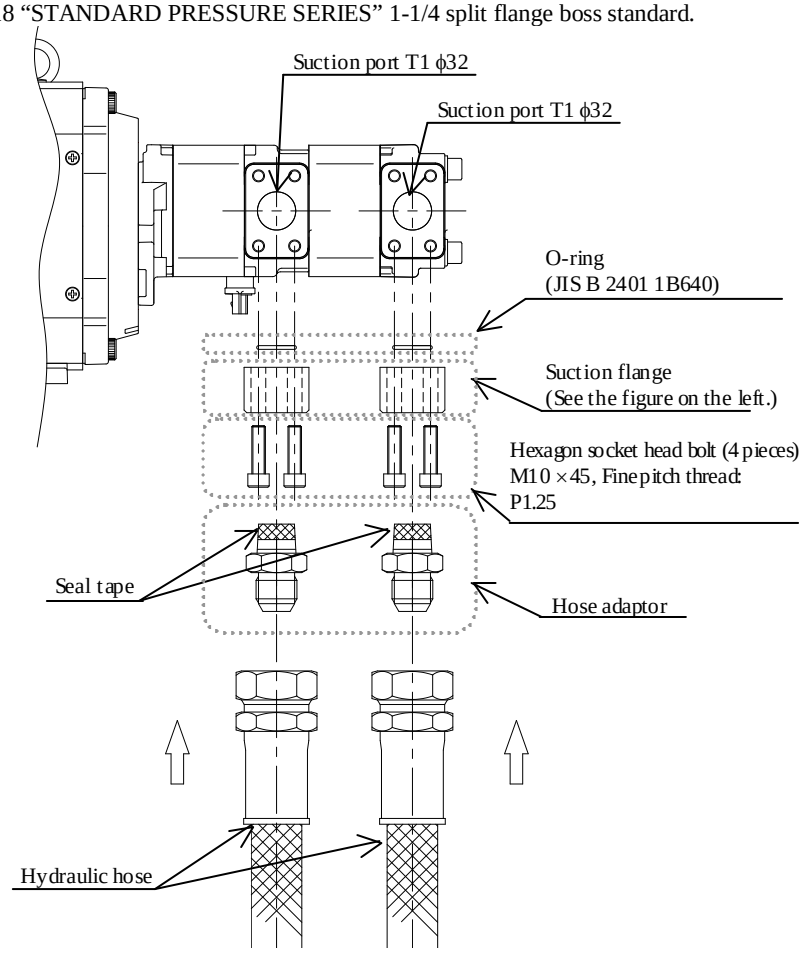
Connect the suction piping to both T1 and T2 ports.

Connect a hose to the suction port via a suction flange. The suction flange should be prepared by the user. Order our optional parts, if required.

The suction port flange size conforms to the SAE J518 “STANDARD PRESSURE SERIES” 1-1/4 split flange boss standard.




DAIKIN model: NF-VR08




Before shipment, the suction port has been equipped with a cover port.

Remove the cover port, and connect the hydraulic hose. Tighten the hose by winding seal tape.

For piping to the suction port, provide an approx. 150-mesh suction filter.

## ⚠ CAUTION

- For piping to this unit, use a hose.
- When connecting a hose, make sure that the hose bend radius is larger than that defined in the hose specifications.
- When connecting a hose, do not twist the hose.
- If the hose may develop excessive strain due to the hose weight, support the hose.
- Make sure that the suction pressure is in a range of –0.02 to 0.2 MPa. If the suction pressure is lower than –0.02 MPa, cavitation occurs, which may result in abnormal sound, flow rate reduction, and abnormal wear of the pump internal components. On the contrary, if the suction pressure exceeds 0.2 MPa, the pump seal parts may be damaged. Conform to the standard suction piping conditions given below.

  SUT00S20018: For each piping to two ports, the pipe diameter should be 2B or more, and the pipe length should be 1.5 m or less.

## 8.3 Drain piping

Recommended specifications of the suction piping are listed below:

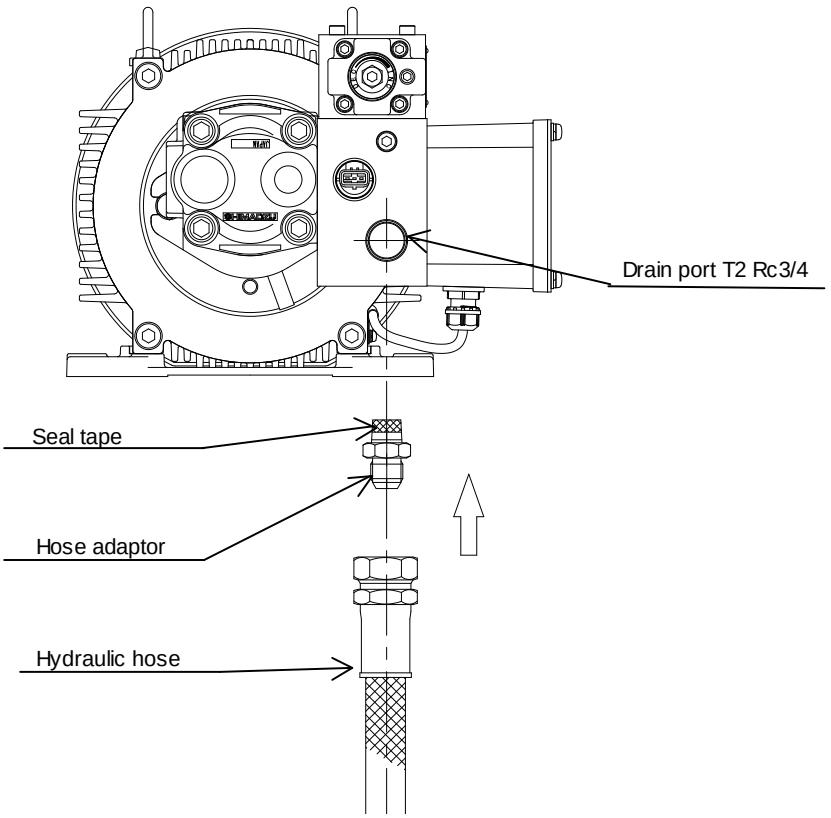
| Unit model | Withstand pressure |
|---|---|
| SUT00S5021-20YA | 1.5 MPa |
| SUT00S8018-20YA | |
| SUT00S13018-10YA | |
| SUT00S13021-10YA | |

● SUT00S5021-20YA/SUT00S8018-20YA /SUT00S8018-21YA

The hydraulic unit provides one drain port.

| Port No. | Name | Size |
|---|---|---|
| T2 | Drain port | Rc3/4 |

Connect the drain piping to the T2 port. The port size is Rc3/4.
Connect the piping as shown below.




Before shipment, the T2 port has been sealed with a resin plug with O-ring.
Remove the resin plug with O-ring, and connect a hydraulic hose. Then, tighten the hose by winding seal tape.

**CAUTION**

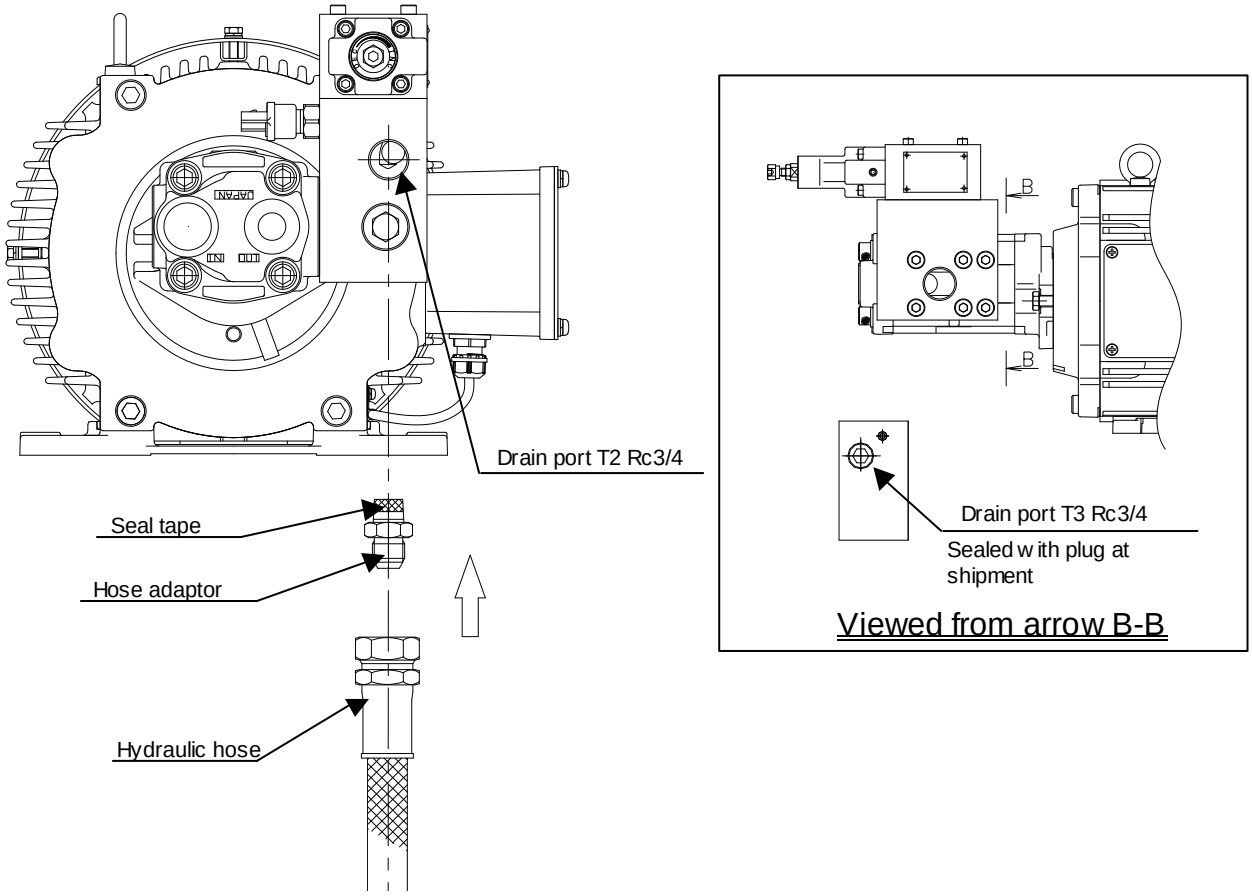
- For piping to this unit, use a hose.
- During hose connection, make sure that the hose bend radius is larger than the allowable minimum bend radius given in the specifications, and that the hose will not twist.
- If the hose may develop excessive strain due to the hose weight, support the hose.

● SUT00S13018-10YA/SUT00S13021-10YA

The hydraulic unit provides two drain ports.

| Port No. | Name | Size |
|---|---|---|
| T2 | Drain port | Rc3/4 |
| T3 | Drain port<br>(Sealed with plug at shipment) | Rc3/4 |

Connect the drain piping to the T2 port. The port size is Rc3/4.
Connect the piping as shown below.




Before shipment, the T2 port has been sealed with a resin plug with O-ring.
Remove the resin plug with O-ring, and connect a hydraulic hose. Then, tighten the hose by winding seal tape.

**CAUTION**

- For piping to this unit, use a hose.
- During hose connection, make sure that the hose bend radius is larger than the allowable minimum bend radius given in the specifications, and that the hose will not twist.
- If the hose may develop excessive strain due to the hose weight, support the hose.

# Chapter 9 Electric Wiring

- This hydraulic unit needs electric wiring of the main power supply, motor cable, motor cooling fan power supply, motor thermistor, encoder, pressure sensor, DC reactor, regenerative breaking register and I/O signals, as required.
  For recommended cables and specifications, refer to detailed description on each connection.
- The controller does not include a set of sensor connectors. The harnesses are optionally available.
  For details, refer to "9.2.3 Pressure sensor harness" and "9.2.4 Encoder harness".
- Connect the motor, motor cooling fan power supply and motor thermistor cables through the specified wiring holes.
- To protect the electric circuits against short-circuit and overcurrent, and to prevent an electric shock, provide a no-fuse breaker conforming to the EU standard EN60947-2 for the main power supply of the hydraulic unit.
  For details, refer to "9.1.1 Breaker".
- As the power supply connection device, use a switch whose contact pitch is 3 mm or longer (on three poles) when the switch is OFF.

## ⚠ WARNING

- Be sure to connect the ground terminal according to laws and ordinances of the country where this product is used. Connect the ground terminal directly without using a circuit breaker.
- Be sure to install the hydraulic unit first, before connecting the ground terminal.
- Before wiring work, be sure to turn OFF the main power supply breaker, and wait for at least 5 minutes.
- Connect the cable with the terminals so that they are not short-circuited and do not cause a ground fault. Otherwise, you may get an electric shock, or a fire may occur.

## ⚠ CAUTION

- Do not connect the motor cable and the power supply cable to the I/O signal terminals. Otherwise, the controller will be damaged.
- Do not apply a power supply voltage higher than the hydraulic unit power supply rating. Otherwise, the controller will be damaged.
- Do not use a thermal relay, because the hydraulic unit incorporates an overcurrent protective function and does not need a thermal relay for overcurrent protection. If a thermal relay is used, the unit may malfunction due to inverter switching operation.
- To protect this product, provide a surge protector in the pre-stage of the controller power supply.
- To start and stop the hydraulic unit, use the start and stop signals of this product, without using an electromagnetic contactor. Otherwise, the power supply circuit devices will be damaged, causing damage to the controller.
- Be sure to connect the neutral point of the power supply to a ground line. If the insulation distance is too short, it may cause a failure of the controller.
- Do not share the controller's ground cable with a welding machine or power equipment. Otherwise, the power supply balance will deteriorate, causing a fault of the controller.
- Make the ground cable length short. If the controller is placed at a long distance from the ground point, the electric potential on the controller's ground terminal becomes unstable, because of a leak current flowing through the controller.
- When several controllers are used, make sure that the ground cable is not looped.
- Make sure that the motor cable, DCL cable and regenerative resistor cable do touch the controller housing.
- After completion of wiring, be sure to check the wiring for the following points before turning ON the power supply.
  - Check for incorrect wiring.
  - Check for a waste wire or residual screw.
  - Check for loose connection of a screw.
  - Make sure that an unsheathed wire on a terminal does not touch other terminals.

# 9.1 Selection of Peripheral Equipment

## 9.1.1 Breaker

To prevent an accident with the power supply, be sure to use a no-fuse breaker conforming to the EU standard EN60947-2 for the power supply connection line.
Since the controller's output is switched at a high speed, the controller generates a high-frequency leak current. Therefore, for the controller's primary circuit, use an earth leakage breaker with high-frequency current countermeasures applicable to inverter equipment. Provide an earth leakage breaker with rated current sensitivity of 30 mA or more for one controller unit.

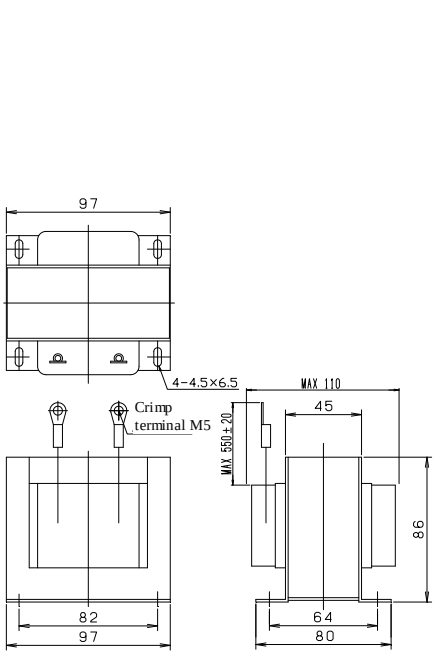
| Unit model | Capacity of breaker |
|---|---|
| SUT00S5021<br>SUT00S8018 | 30 A |
| SUT00S13018<br>SUT00S13021 | 40 A |
| SUT00S20018 | 50 A |

# 9.2 Optional Electrical Equipment

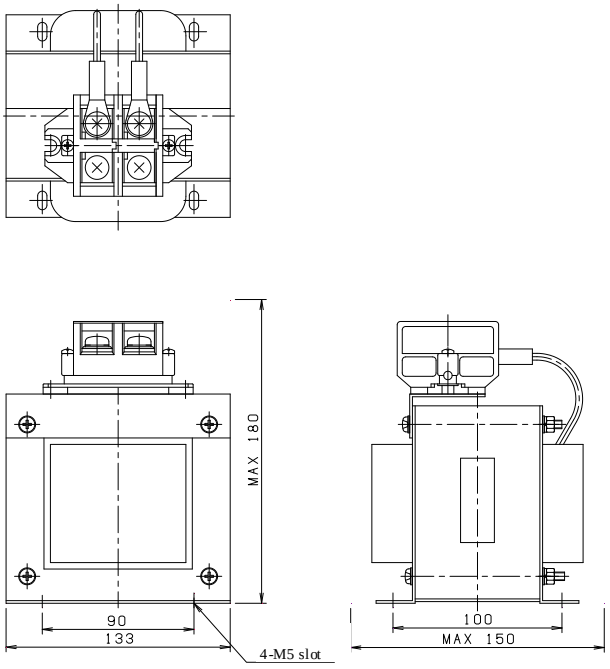
## 9.2.1 DC reactor

To improve a power factor, use a DC reactor. Connect a DC reactor between the P1 and P2 terminals on the main power supply terminal block. For the wiring procedure, refer to "9.11.1 Connecting the DC reactor".
The type of the DC reactor is as follows:

| Unit model | Type of option | Manufacturer |
|---|---|---|
| SUT00S5021<br>SUT00S8018 | PM-SDL04 | Daikin Industries, Ltd. |
| SUT00S13018<br>SUT00S13021 | | |
| SUT00S20018 | PM-SDL05 | |




PM-SDL04




PM-SDL05

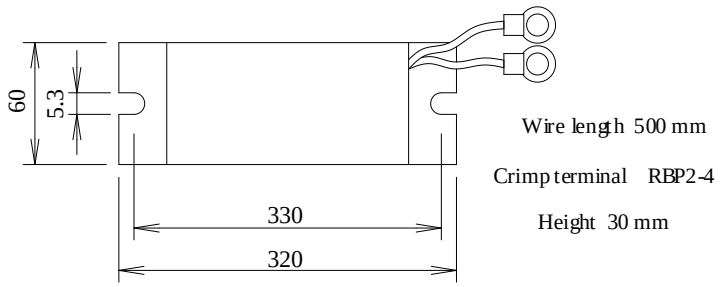
## 9.2.2 Regenerative breaking resistor

When the motor is running in the following conditions, the motor serves as a generator. For the wiring procedure, refer to “9.11.2 Connecting the regenerative breaking resistor”.
The regenerative breaking resistor consumes power generated by the motor in this status.

- Deceleration time in motor acceleration/deceleration step
- When the motor is under load
- When the motor rotates in the reverse direction under load

As an optional accessory, DAIKIN supplies the following regenerative breaking resistor:

| Type | Manufacturer | Capacity | Resistance | Lead length |
|---|---|---|---|---|
| PM-RB06 | Daikin Industries, Ltd. | 500 W | 68 Ω | 500 mm |




To use the above regenerative breaking resistor, connect the specified number of resistors in parallel.

| Unit model | Quantity |
|---|---|
| SUT00S5021<br>SUT00S8018 | 2 |
| SUT00S13018<br>SUT00S13021 | 4 |
| SUT00S20018 | 6 |

## 9.2.3 Pressure sensor harness

For wiring of the pressure sensor, the following pressure sensor harness is optionally available. For the wiring procedure, refer to “9.10 Connecting the Pressure Sensor Harness”.

| Unit model | Type of option | Cable length | Manufacturer |
|---|---|---|---|
| SUT00S5021<br>SUT00S8018 | PM-SPH05-003 | 5 m | Daikin Industries, Ltd. |
| SUT00S13018<br>SUT00S13021<br>SUT00S20018 | PM-SPH10 | 10 m | |

Pressure sensor harness

### 9.2.4 Encoder harness

For wiring of the encoder, the following encoder harness is optionally available. For the wiring procedure, refer to “9.9 Connecting the Encoder”.

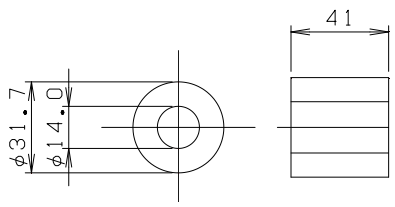
| Unit model | Type of option | Cable length | Manufacturer |
|---|---|---|---|
| SUT00S5021<br>SUT00S8018 | PM-SEH05-P22-A09R | 5 m | Daikin Industries, Ltd |
| SUT00S13018<br>SUT00S13021<br>SUT00S20018 | PM-SEH10-P22-A09R | 10 m | |

Encoder harness
PM-SEH05-P22-A09R

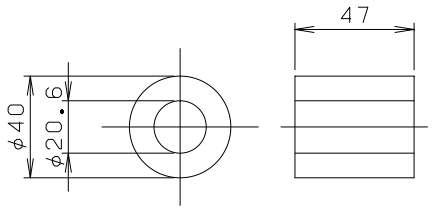
### 9.2.5 Ferrite core

If there is problem about noise emission from this hydraulic unit, wind a ferrite core on the power supply line to reduce noise interference.
The recommended ferrite cores are as follows:

| Unit model | Type of option | Manufacturer |
|---|---|---|
| SUT00S5021<br>SUT00S8018 | PM-FC01 | Kitagawa Industries Co., Ltd. (RFC-H13) |
| SUT00S13018<br>SUT00S13021<br>SUT00S20018 | PM-FC04 | Kitagawa Industries Co., Ltd. (RFC-20) |




PM-FC01

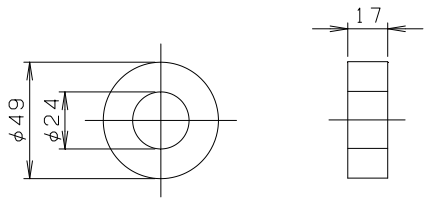



PM-FC04

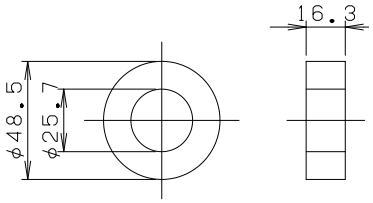
## 9.2.6 Ring core

If there is problem about noise emission from this hydraulic unit, wind a ring core on the power supply line to reduce noise interference.
The recommended ring cores are as follows:

| Unit model | Type of option | Manufacturer |
|---|---|---|
| SUT00S5021<br>SUT00S8018 | PM-SRC01 | JFE Steel Corporation R-47/27/15A |
| SUT00S13018<br>~~SUT00S13021~~ | PM-SRC01 | JFE Steel Corporation R-47/27/15A |
| | PM-SRC02 | Kitagawa Industries Co., Ltd. TRM-47-27-15E-WE |




PM-SRC01




PM-SRC02

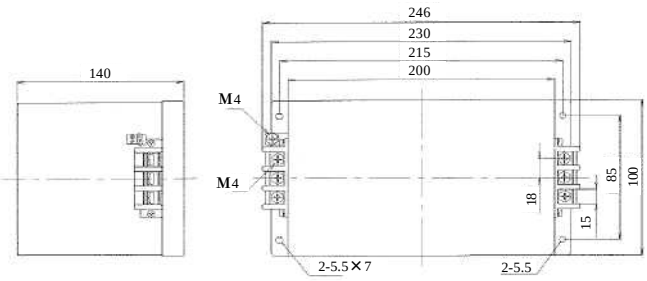
## 9.2.7 Noise filter

To prevent malfunction due to noise from the power supply line, or to prevent influence of noise from this hydraulic unit on external equipment, use a noise filter.
Followings are the recommended brands of noise filters for category C2/C3 in accordance with IEC68100-3. Select suitable ones according to your noise environment.

For the wiring procedure, refer to "Chapter 14 **Connection Diagram**".

| Unit model | Category | Type of option | Manufacturer |
|---|---|---|---|
| SUT00S5021<br>SUT00S8018 | C2 | PM-SNF03 | Okaya Electric Industries Co., Ltd |
| | C3 | - | Shaffner EMC Co., Ltd FN3025HL-30 |
| SUT00S13018<br>~~SUT00S13021~~ | C2 | PM-SNF03 | Okaya Electric Industries Co., Ltd |
| | C3 | - | Shaffner EMC Co., Ltd FN3025HP-30-71 |
| SUT00S20018 | C2 | PM-SNF07 | Shaffner EMC Co., Ltd FN3025HP-50-72 |
| | C3 | PM-SNF07 | Shaffner EMC Co., Ltd FN3025HP-50-72 |

*Shaffner noise filters are intended to be prepared by users




PN-SNF03

### 9.2.8 Optional accessory set

| Unit model | Type of option | Description | |
|---|---|---|---|
| | | Name | Type |
| SUT00S5021<br>SUT00S8018 | PM-SOP04 | DC reactor | PM-SDL04 |
| | | Regenerative resistor | PM-RB06 (2 pieces) |
| | | Encoder harness | PM-SEH05-P22-A09R |
| | | Pressure sensor harness | PM-SPH05-001 |
| SUT00S13018<br>SUT00S13021 | PM-SOP08 | DC reactor | PM-SDL04 |
| | | Regenerative resistor | PM-RB06 (4 pieces) |
| | | Encoder harness | PM-SEH05-P22-A09R |
| | | Pressure sensor harness | PM-SPH05-002 |
| SUT00S20018 | PM-SOP12 | DC reactor | PM-SDL05 |
| | | Regenerative resistor | PM-RB06 (6 pieces) |
| | | Encoder harness | PM-SEH05-P22-A09R |
| | | Pressure sensor harness | PM-SPH10 |

To ensure conformity to the EMC (Electro Magnetic Compatibility) standard, additional components (noise filter, ring core, ferrite core, etc.) are required. Prepare these components separately, as required. For details, refer to “Chapter 14 Connection Diagram”.

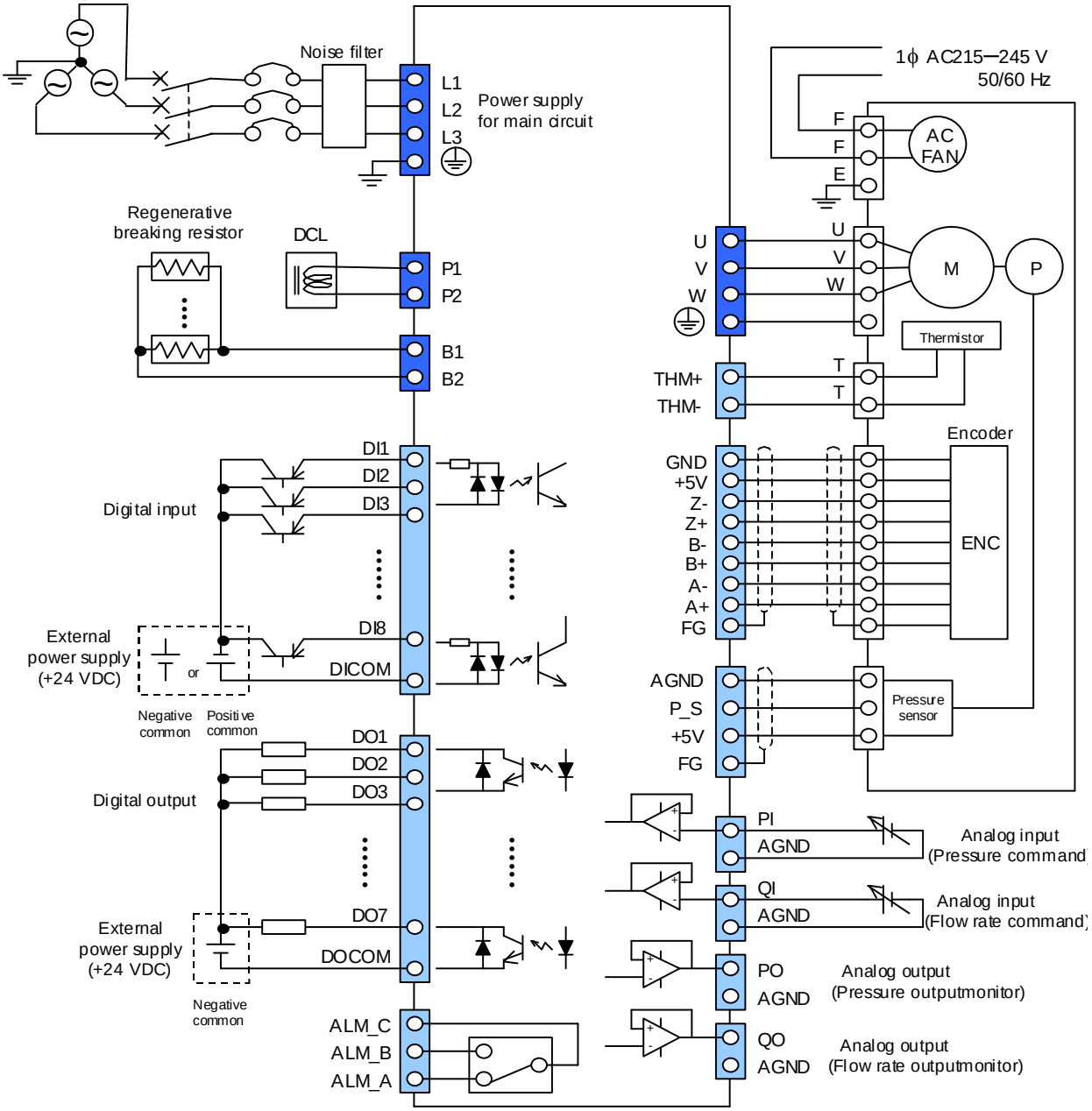
### 9.2.9 AC reactor

When the controller is connected to a power supply transformer with capacity of 10 times or larger than the controller’s capacity, when switching of a leading-phase capacitor is expected, or when a thyristor converter for DC drive, etc. is connected to the same power supply system, an excessive peak current flows through the input power supply circuit, causing a fault of the controller.
In such a case, connect an AC reactor to the controller input circuit.

| Unit model | Type of option | Manufacturer |
|---|---|---|
| SUT00S5021<br>SUT00S8018 | RWK 212-21-KL | SCHAFFNER |
| SUT00S13018<br>SUT00S13021 | RWK 212-29-KL | |
| SUT00S20018 | RWK 212-46-KL | |

## 9.3 Electrical Connection Diagram (Overall)

● SUT00S8018/SUT00S13018/SUT00S13021
3ϕAC380─440 V 50/60 Hz

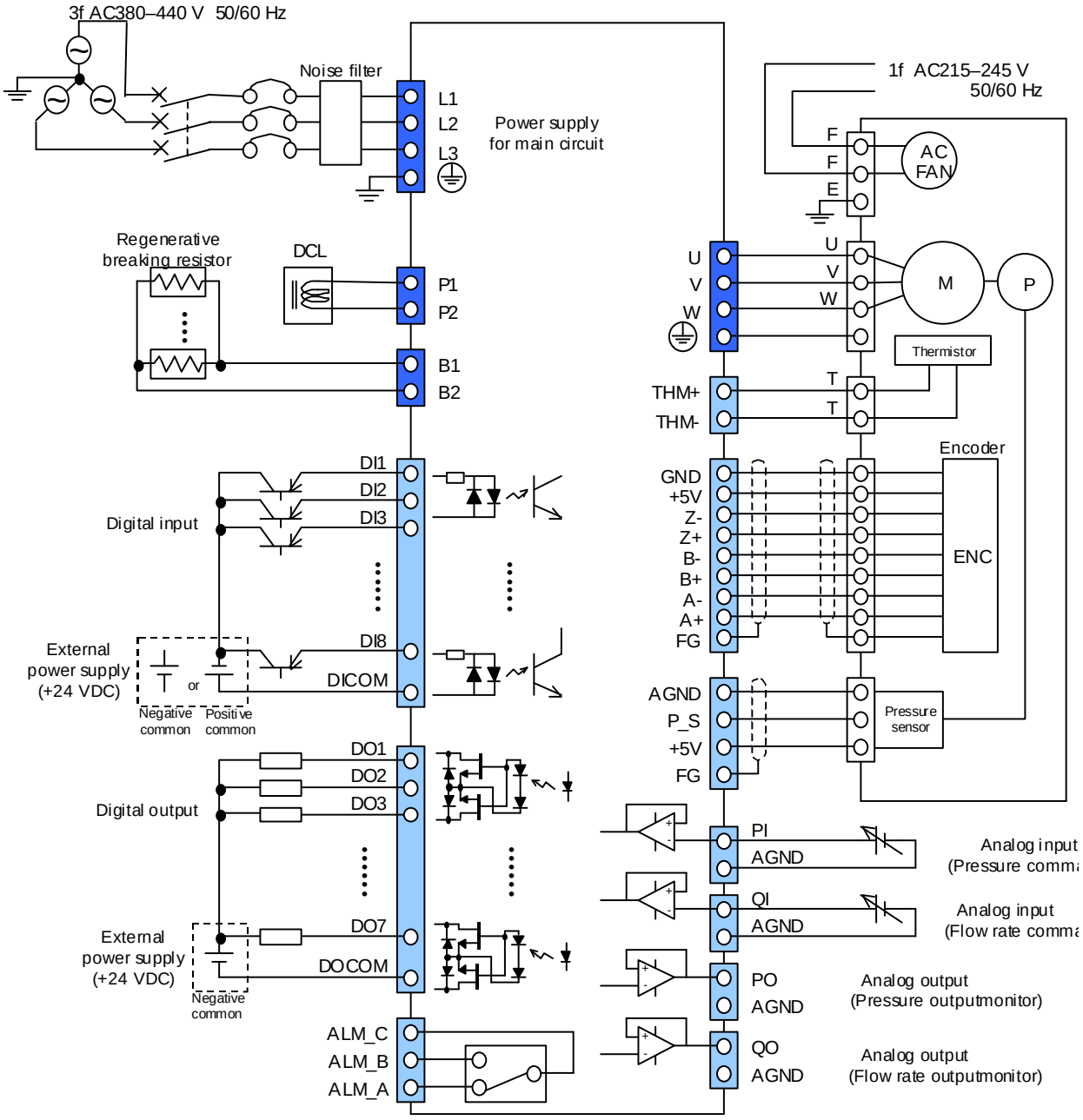



Located on the “main power supply terminal block” of the controller.

Located on the “user I/O terminal block” of the controller.

Located in the motor terminal box.

● SUT00S5021

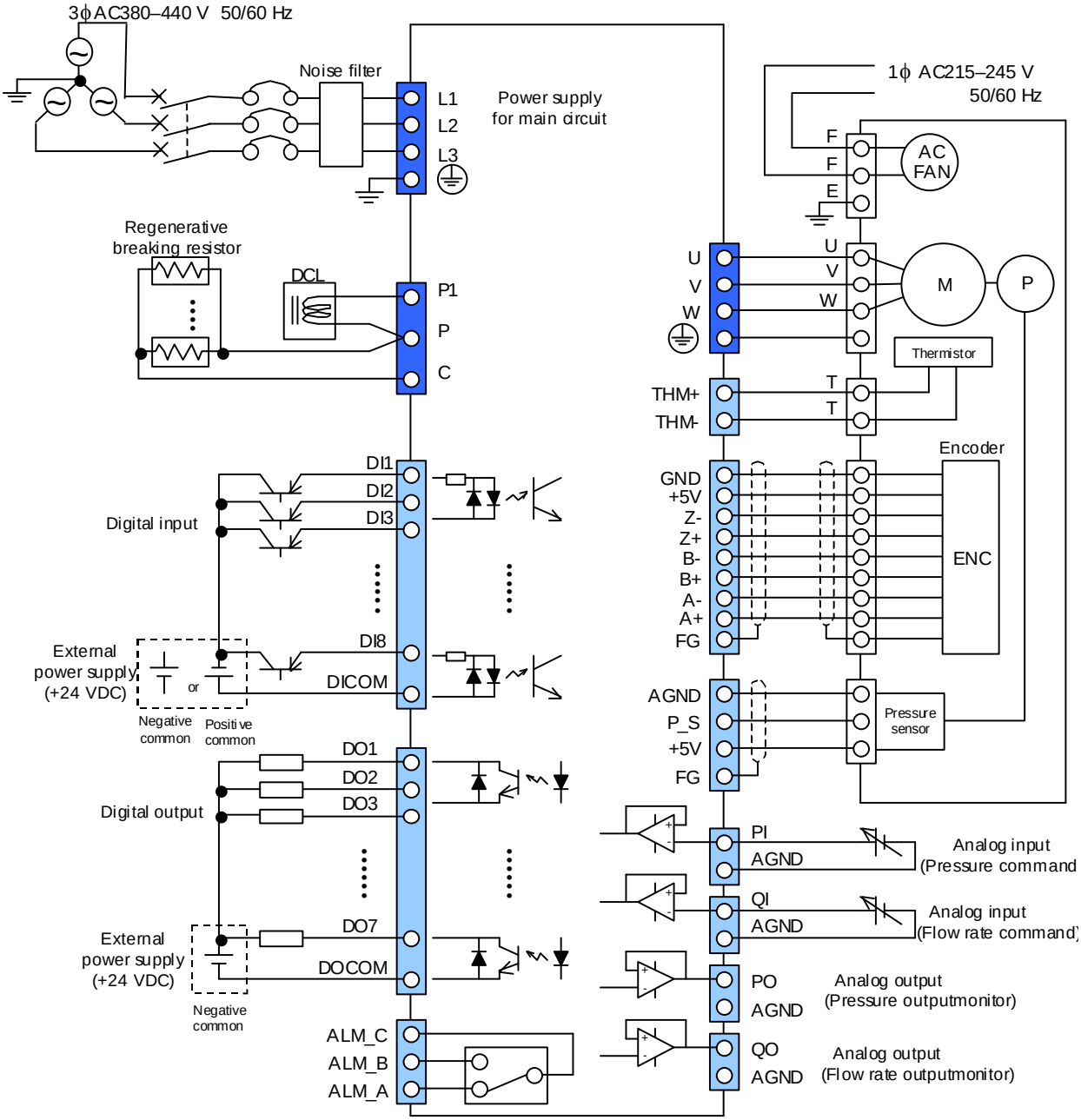



Located on the “main power supply terminal block” of the controller.

Located on the “user I/O terminal block” of the controller.

Located in the motor terminal box.

● SUT00S20018




Located on the “main power supply terminal block” of the controller.

Located on the “user I/O terminal block” of the controller.

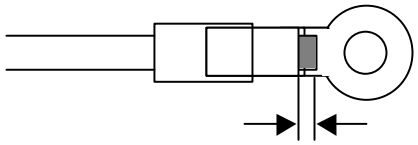
Located in the motor terminal box.

## 9.4 Terminal Connections

### 9.4.1 Crimp terminal

Prepare crimp terminals as shown below.

- Use crimp terminals. For specification of each terminal, refer to detailed description on each connection.
- Crimp each terminal with the cable conductors protruding from the terminal by approx. 1 mm.



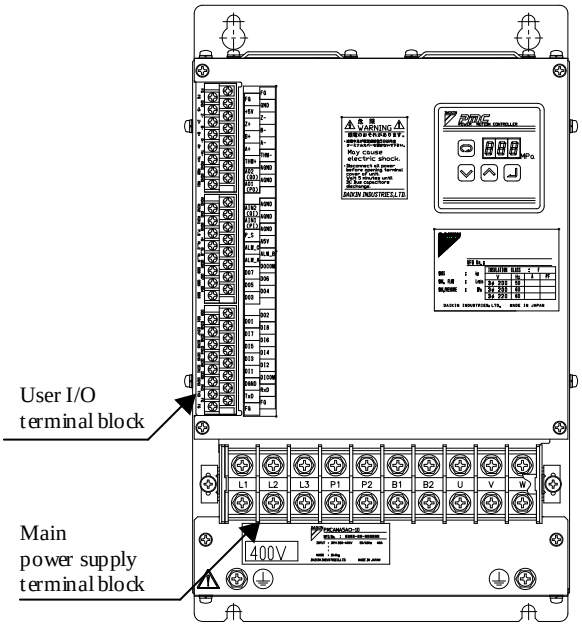

**CAUTION**

- Do not conduct crimp work with live wires or around live wires. Otherwise, you may get an electric shock.
- Use an appropriate crimp terminal conforming to the cable size. Otherwise, you may get an electric shock, or a fire may occur.
- To crimp a terminal, use an appropriate tool for the crimp terminal. Otherwise, you may get an electric shock, or a fire may occur.

## 9.4.2 Connections to the controller

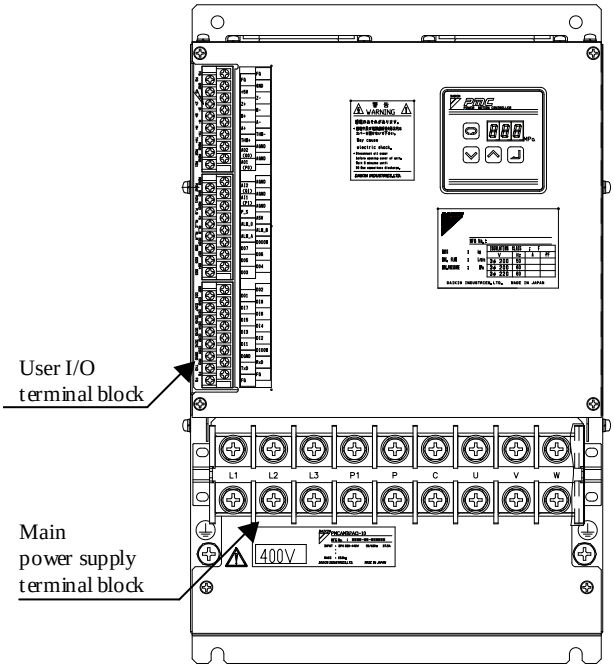
Connections to the controller are shown below. For details, refer to description on each connection. Components to be connected to each terminal are shown in the table below.

- SUT00S5021/SUT00S8018/ SUT00S13018/SUT00S13021




| terminal block | Terminal code | Cable to connect |
|---|---|---|
| Main power supply terminal block | L1/L2/L3 | Main power supply |
| | P1/P2 | DC reactor |
| | B1/B2 | Regenerative breaking resistor |
| | U/V/W | Motor output |
| User I/O terminal block | See the terminal assignment of the I/O terminal block. | Encoder |
| | | Motor thermistor |
| | | Pressure sensor |
| | | I/O signals |

- SUT00S20018

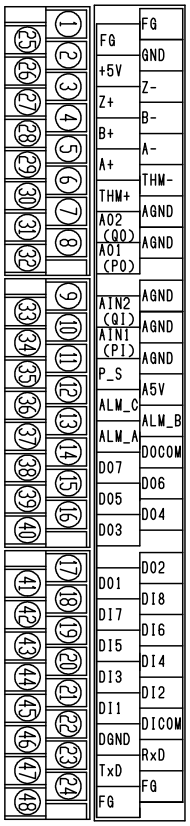



| terminal block | Terminal code | Cable to connect |
|---|---|---|
| Main power supply terminal block | L1/L2/L3 | Main power supply |
| | P1/P | DC reactor |
| | P/C | Regenerative breaking resistor |
| | U/V/W | Motor output |
| User I/O terminal block | See the terminal assignment of the I/O terminal block. | Encoder |
| | | Motor thermistor |
| | | Pressure sensor |
| | | I/O signals |

**CAUTION**

- Do not use the terminals indicated as “Unused”. Using these terminals for any other purpose results in damage to the controller.

Terminal assignment of the I/O terminal block is as follows:

| I/O terminal block | Terminal No. | Terminal code | Name | Terminal No. | Terminal code | Name |
|---|---|---|---|---|---|---|
|  | 25 | FG | Frame ground | 1 | FG | Frame ground |
| | 26 | +5V | +5 V power supply | 2 | GND | Ground |
| | 27 | Z+ | Encoder Z phase + | 3 | Z– | Encoder Z phase – |
| | 28 | B+ | Encoder B phase + | 4 | B– | Encoder B phase – |
| | 29 | A+ | Encoder A phase + | 5 | A– | Encoder A phase – |
| | 30 | THM+ | Thermistor + | 6 | THM– | Thermistor – |
| | 31 | AO2 (QO) | Analog output 2 | 7 | AGND | Analog ground |
| | 32 | AO1 (PO) | Analog output 1 | 8 | AGND | Analog ground |
| | 33 | AI2 (QI) | Analog input 2 | 9 | AGND | Analog ground |
| | 34 | AI1 (PI) | Analog input 1 | 10 | AGND | Analog ground |
| | 35 | P_S | Pressure sensor signal | 11 | AGND | Analog ground |
| | 36 | ALM_C | Contact output common | 12 | A5V | Pressure sensor power supply |
| | 37 | ALM_A | Contact output a | 13 | ALM_B | Contact output b |
| | 38 | DO7 | (Unused) | 14 | DOCOM | Digital output common |
| | 39 | DO5 | (Unused) | 15 | DO6 | (Unused) |
| | 40 | DO3 | (Unused) | 16 | DO4 | Digital output 4 |
| | 41 | DO1 | Digital output 1 | 17 | DO2 | (Unused) |
| | 42 | DI7 | (Unused) | 18 | DI8 | (Unused) |
| | 43 | DI5 | (Unused) | 19 | DI6 | (Unused) |
| | 44 | DI3 | (Unused) | 20 | DI4 | (Unused) |
| | 45 | DI1 | Digital input 1 | 21 | DI2 | (Unused) |
| | 46 | DGND | (Unused) | 22 | DICOM | Digital input common |
| | 47 | TxD | (Unused) | 23 | RxD | (Unused) |
| | 48 | FG | Frame ground | 24 | FG | Frame ground |

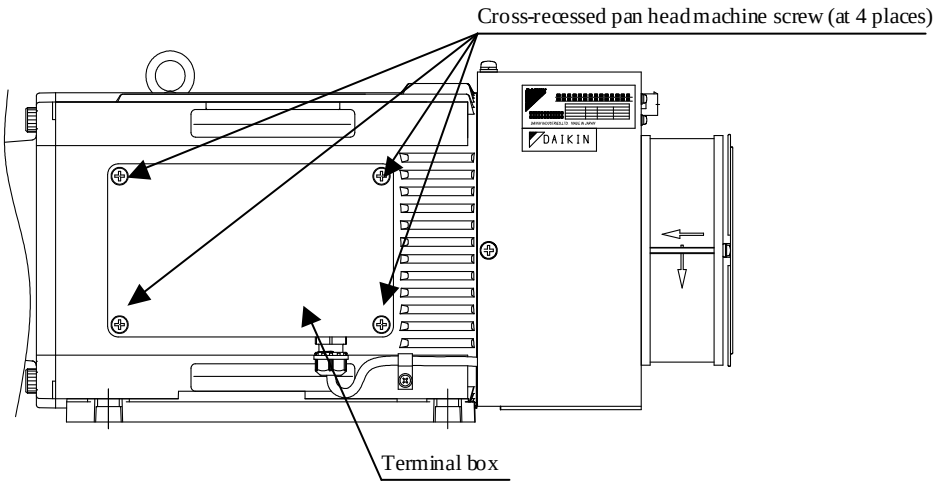
**CAUTION**

- Do not use the terminals indicated as “Unused”. Using these terminals for any other purpose results in damage to the controller.

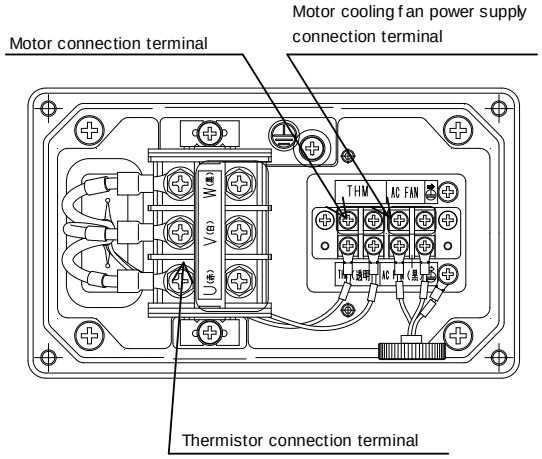
### 9.4.3 Connections to the motor

Connections to the motor terminals, thermistor terminals, and motor cooling fan terminals are provided in the terminal box. You can remove the terminal box cover by loosening the screws (at four places).

- Screw size: M6
- Recommended tightening torque: 2.6 [N•m]




Connections to the motor are shown below. For details, refer to each connecting procedure.

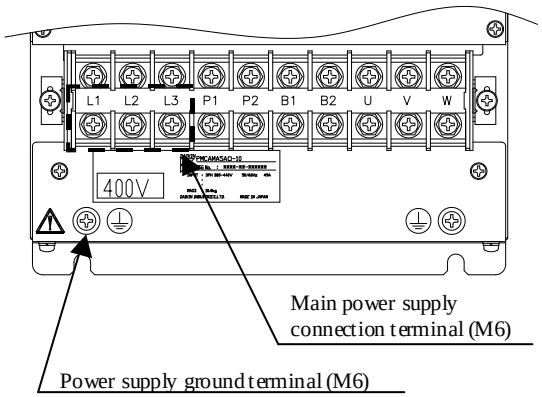



Components to be connected with each terminal are listed in the table below.

| Terminal | Cable to connect |
|---|---|
| Motor connection terminal | Motor cable |
| Motor cooling fan power supply connection terminal | Motor cooling fan power supply cable |
| Thermistor connection terminal | Thermistor cable |

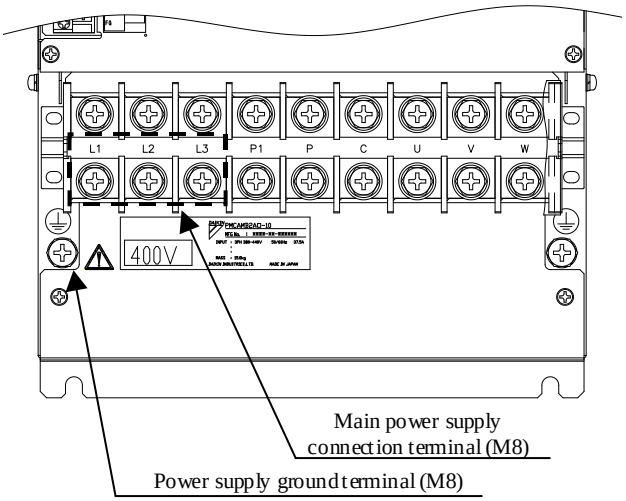
## 9.5 Connecting the Power Supply

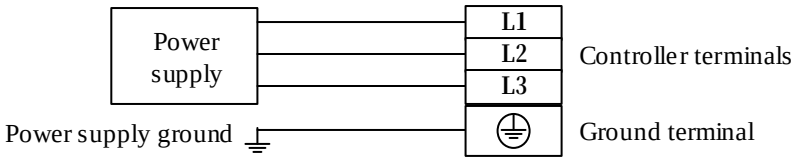
● SUT00S5021/SUT00S8018/
SUT00S13018/SUT00S13021




◆ Recommended tightening torque: 3.5 [N•m]

● SUT00S20018




◆ Recommended tightening torque: 8.0 [N•m]

1) Prepare the power supply cable and crimp terminals.

● **SUT00S5021/ SUT00S8018**

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 8 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 8 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R8-6 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 6 $mm^2$ or more , Rated voltage: 600 V<br>Recommended: CE362 6 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M6 screw<br>Recommended: RBP5.5-6 |

● **SUT00S13018/SUT00S13021**

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 14 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 14 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R14-6 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 6 $mm^2$ or more , Rated voltage: 600 V<br>Recommended: CE362 6 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M6 screw<br>Recommended: RBP5.5-6 |

● SUT00S20018

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 38 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 38 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M8 screw<br>Recommended: R38-8 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 16 $mm^2$ or more , Rated voltage: 600 V<br>Recommended: CE362 16 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M8 screw<br>Recommended: RBP14-8 |

2) Connect the ground cable to the power supply ground terminal. Recommended tightening torque is 3.5 [N·m].

3) Connect the power supply cable to the terminal block. Do not use the power supply ground terminal screw. The power supply ground terminal screw is identified by green color.
The phase order of the input power supply is not related to that of the terminal block. The input power supply can be also connected to L1, L2 and L3 terminals.

To prevent malfunction due to noise from a power line, and to suppress influence of noise from the controller on external equipment, use a noise filter.

**⚠ WARNING**

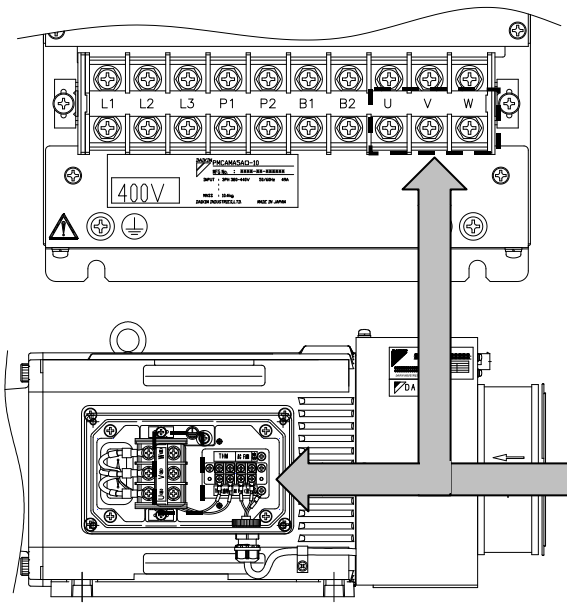
- Use an AC power supply conforming to the power supply specifications of the hydraulic unit.
- Use a power supply cable conforming to the power supply specifications.
- Do not connect a power supply cable to the ground terminal.
- Be sure to connect the ground terminal according to laws and ordinances of the country where this product is used.
- When you unsheathe the power supply cable, be careful not to damage the conductors.
- Make sure that the cable conductors are not protruding from the terminal block.
- Connect the cable with the terminals so that they are not short-circuited and do not cause a ground fault. Otherwise, you may get an electric shock, or a fire may occur.
- Do not confuse the power supply ground terminal screw with the main power supply connection terminal screw. If the main power supply connection terminal is tightened with the power supply ground terminal screw, the power supply cable may not be securely fastened. This causes the terminal block to heat up, resulting in a fire. To prevent confused use of the terminal screws, the power supply ground terminal screw is identified by green color.

**⚠ CAUTION**

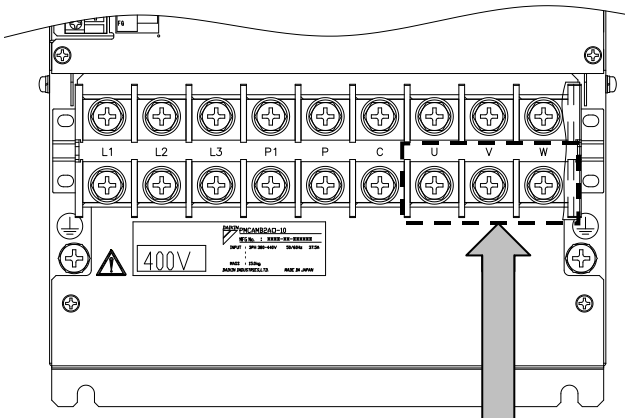
- To connect the end of each cable, use a crimp terminal.
- Place the noise filter ground cable away from output cables as far as possible.
- Separate the noise filter input and output lines. Use caution when you tie the cables or place the cables in the same conduit.
- To start and stop the hydraulic unit, use the start and stop signals of the unit, without using an electromagnetic contactor. To turn ON/OFF the electromagnetic contactor, make sure that the hydraulic unit has completed stopped. Otherwise, the power supply circuit devices may be damaged.

## 9.6 Connecting the Motor Cable

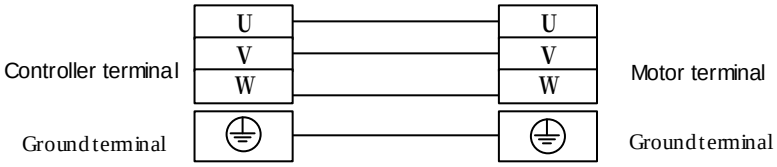
● SUT00S5021/SUT00S8018/
SUT00S13018/SUT00S13021




● SUT00S20018




Motor cable

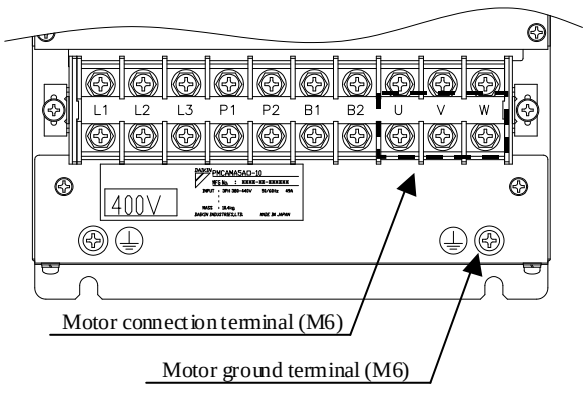



◆Recommended tightening torque: 3.5 [N•m]

Recommended tightening torque:
◆Motor : 3.5 [N•m]
◆Controller : 8.0 [N•m]

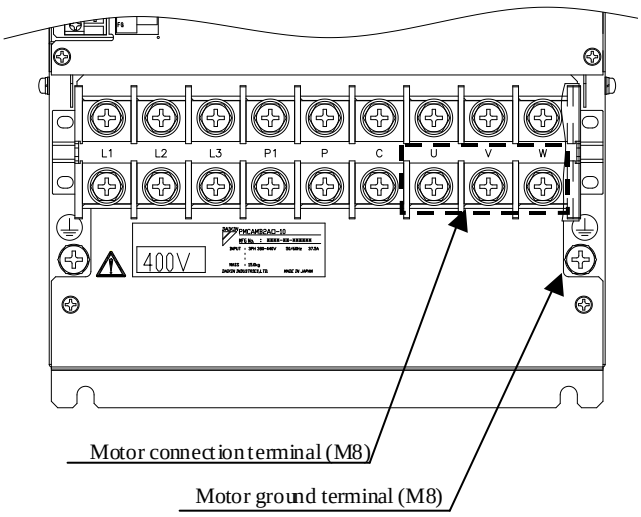
### 9.6.1 Connections to the controller

● SUT00S5021/SUT00S8018
/SUT00S13018/SUT00S13021




◆ Recommended tightening torque: 3.5 [N•m]

● SUT00S20018




◆ Recommended tightening torque: 8.0 [N•m]

1) Prepare the motor cable and crimp terminals. The motor cable length should be 5 m max. (except for SUT00S20018).For SUT00S20018, the motor cable length should be 10 m max.

● SUT00S5021/ SUT00S8018

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 8 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 8 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R8-6 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 6 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 6 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M6 screw<br>Recommended: RBP5.5-6 |

● SUT00S13018/SUT00S13021

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 14 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 14 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R14-6 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 10 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 10 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M6 screw<br>Recommended: RBP8-6 |

● SUT00S20018

| | | |
|---|---|---|
| When using 60°C cable | Power supply cable | Wire cross-section area: 14 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 14 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Bare crimp terminal (R type), Round terminal for M8 screw<br>Recommended: R14-8 |
| When using 70°C cable | Power supply cable | Wire cross-section area: 10 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 10 $mm^2$ × 4 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Crimp terminal with insulation sheath, Round terminal for M8 screw<br>Recommended: RBP8-8 |

2) Connect the ground cable to the motor ground terminal. The ground cable size should be equal to, or larger than that of the motor cable.

3) Connect the motor cable to the connection terminals with correct phases on the terminal block.
Do not use the motor ground terminal screw. The motor ground terminal screw is identified by green color.

**WARNING**

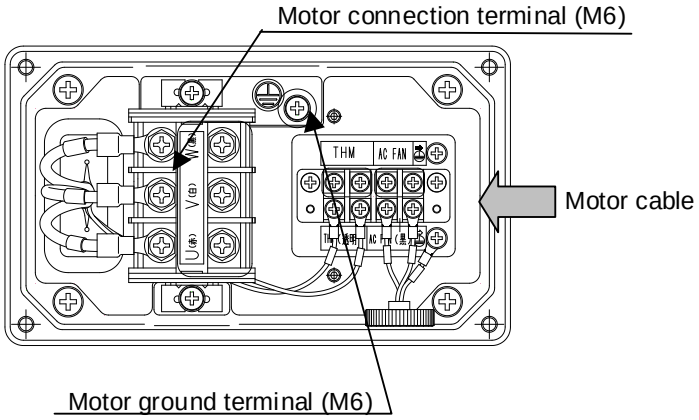
- Do not confuse the motor ground terminal screw with the motor connection terminal screw. If the motor connection terminal is tightened with the motor ground terminal screw, the motor cable may not be securely fastened. This causes the terminal block to heat up, resulting in a fire. To prevent confused use of the terminal screws, the motor ground terminal screw is identified by green color.

**CAUTION**

- Do not turn ON/OFF the contactor during operation, with the contactor connected between the motor cables. If the electromagnetic contactor is turned ON during operation, a large current flows through the circuit, causing damage to the controller.
- Do not connect a leading-phase capacitor or noise filter between the controller and the motor. Otherwise, the controller's higher harmonics cause overheating or damage of the capacitor or noise filter. Also, this may result in damage to the controller.
- If the motor cables are placed together in a grounded metal conduit, radiant noise can be reduced. Furthermore, if the signal cables are placed at 30 cm or longer distance from a power cable, noise interference can be reduced.

## 9.6.2 Connections to the motor

Connect the cable that has been prepared in the controller connection step to the motor.




| Terminal name | Terminal code |
|---|---|
| Motor cable U phase | U (Red) |
| Motor cable V phase | V (White) |
| Motor cable W phase | W (Black) |
| Ground | ⏚ |

◆ Recommended tightening torque

| | |
|---|---|
| Motor connection terminal (M6) | 4.3 [N•m] |
| Motor ground terminal (M6) | 2.6 [N•m] |

◆ Wiring port size

| | |
|---|---|
| SUT00S5021<br>SUT00S8018 | ϕ28 |
| SUT00S13018<br>SUT00S20018 | ϕ34 |

1) To protect the cable and prevent a foreign object from entering the terminal box during wiring, use a grommet suitable for the wiring hole. The cable clamp for wiring is not included in the product. It should be prepared by the user.

2) Connect the ground cable to the motor ground terminal. The ground cable size should be equal to, or larger than that of the motor cable.

3) Connect the motor cable to the connection terminals with correct phases.。

**⚠ WARNING**

- Do not connect the power supply cable to the motor connection terminals. Incorrect wiring may result in a fire or other accident.
- After completion of the wiring, be sure to re-mount the cover to the motor terminal box. Otherwise, you may get an electric shock.

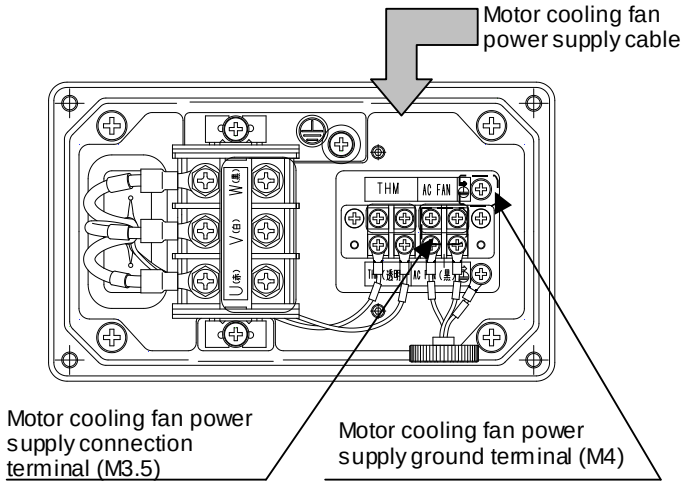
**⚠ CAUTION**

- When connecting the motor cable, use caution not to connect the cable with incorrect phases. Incorrect wiring may result in unintended operation of the motor (reverse rotation etc.).
- Do not connect a contactor to the motor cable.

## 9.7 Connecting the Motor Cooling Fan

The motor cooling fan power supply specifications are as follows: The main machine should be equipped with the motor cooling fan power supply.

| | |
|---|---|
| Power supply | Single-phase, 230 V ± 15 V |




| Terminal name | Indication |
|---|---|
| Motor cooling fan power supply connection terminal | AC FAN<br>AC FAN |
| Motor cooling fan power supply ground terminal | ⏚ |

* The motor cooling fan power supply has no polarity.

◆Recommended tightening torque

| | |
|---|---|
| Motor cooling fan power supply connection terminal (M3.5) | 0.8 [N•m] |
| Motor cooling fan power supply ground terminal (M4) | 0.8 [N•m] |

◆ Wiring port size: ϕ21

1) Prepare the power supply cable and crimp terminals. The length of the power supply cable should be 5 m max.

● SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021/SUT00S20018

| | | |
|---|---|---|
| Motor cooling fan power supply cable | When using 60°C cable | Wire cross-section area: 0.5 $mm^2$ or more, Rated voltage: 300 V<br>Recommended: VCTF36 0.5 $mm^2$ × 3 wires, Kuramo Electric Co., Ltd. |
| | When using 70°C cable | Wire cross-section area: 0.5 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 0.5 $mm^2$ × 3 wires, Kuramo Electric Co., Ltd. |
| Crimp terminal | | Crimp terminal with insulation sheath (R type), Round terminal for<br>Power supplya : M3.5 screw Recommended: RBP1.25-4<br>Ground terminal : M4 screw Recommended: RBP1.25-3.5 |

2) To protect the cable and prevent a foreign object from entering the terminal box during wiring, use a cable clamp suitable for the wiring hole. The cable clamp used for wiring is not included in the product. It should be prepared by the user.

3) Connect the ground cable to the motor cooling fan power supply ground terminal. The ground cable size should be equal to, or larger than that of the motor cooling fan power supply cable.

4) The motor cooling fan power supply connection terminals have no polarity.

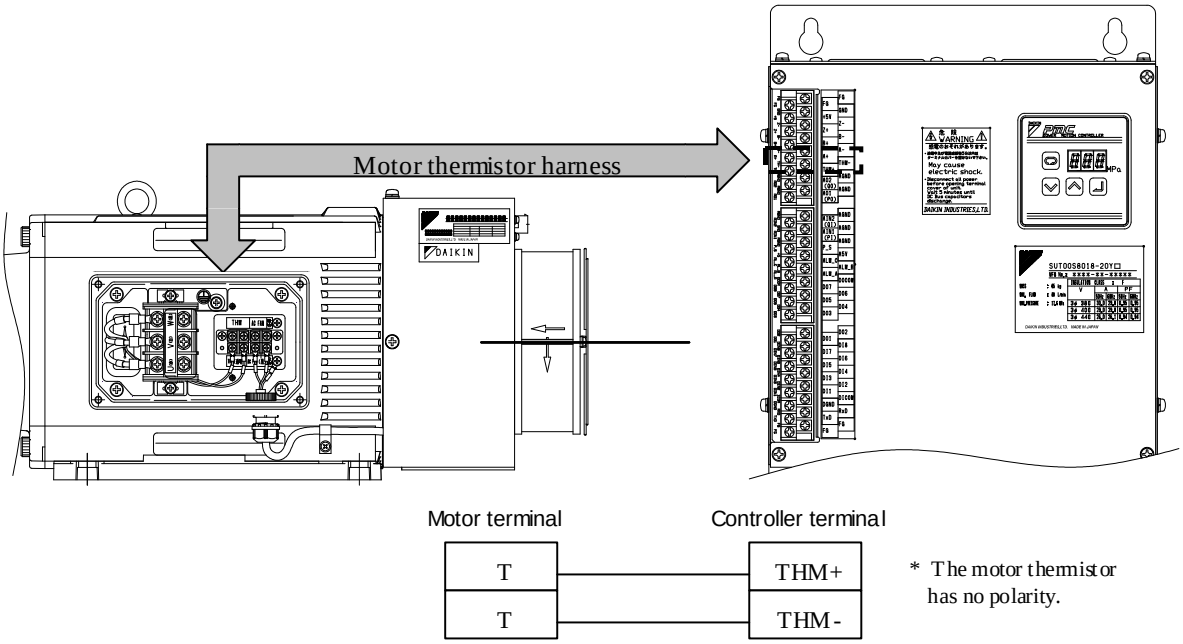
**⚠WARNING**

- After completion of the wiring, be sure to re-mount the cover to the motor terminal box. Otherwise, you may get an electric shock.

**CAUTION**

- Be careful not to connect the motor cooling fan power supply cable to the thermistor terminals. Incorrect wiring causes damage to the thermistor, resulting in a fire or other accident.

## 9.8 Connecting the Motor Thermistor Harness




### 9.8.1 Connections to the controller

1) Prepare the motor thermistor harness and crimp terminals.
   - SUT00S5021/ SUT00S8018/SUT00S13018/SUT00S13021/SUT00S20018

| | | |
|---|---|---|
| Motor thermistor harness | | Wire cross-section area: 0.3 $mm^2$ or more, Rated voltage: 300 V<br>Recommended: KVC-36 0.3 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd. |
| Crimp terminal | Controller side | Crimp terminal with insulation sheath (R type), Round terminal for M3 screw<br>Recommended: RBP1.25-3 |
| | Motor side | Crimp terminal with insulation sheath (R type), Round terminal for M3.5 screw<br>Recommended: RBP1.25-3.5 |

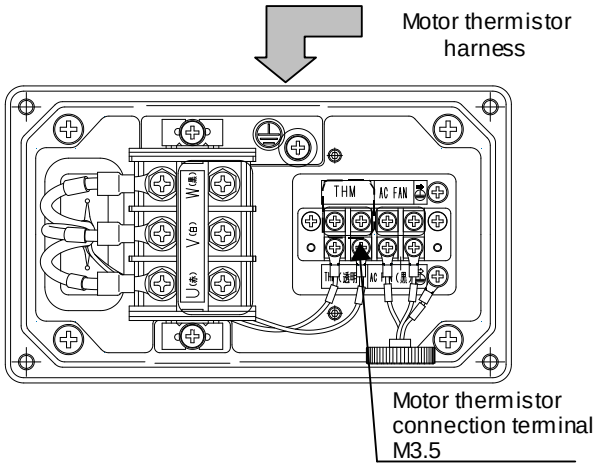
2) Verify specifications of the signal, and connect the signal cable between the [THM+] and [THM–] terminals on the I/O terminal block.
   Recommended tightening torque is 0.6 [N•m].
   If the motor is started with incorrect wiring of the motor thermistor harness, the motor may be damaged. Connect the motor thermistor harness to the specified terminals correctly.

**CAUTION**

- If the motor cooling fan power supply cable is incorrectly connected to the motor thermistor terminals, it causes damage to the motor.

## 9.8.2 Connections to the motor

Connect the motor thermistor harness to the motor.




| Terminal name | Indication |
|---|---|
| Motor thermistor connection terminal | THM |
| | THM |

* The thermistor connection terminals have no polarity.

◆ Recommended tightening torque: 0.8 [N•m]
◆ Wiring port size: ϕ21

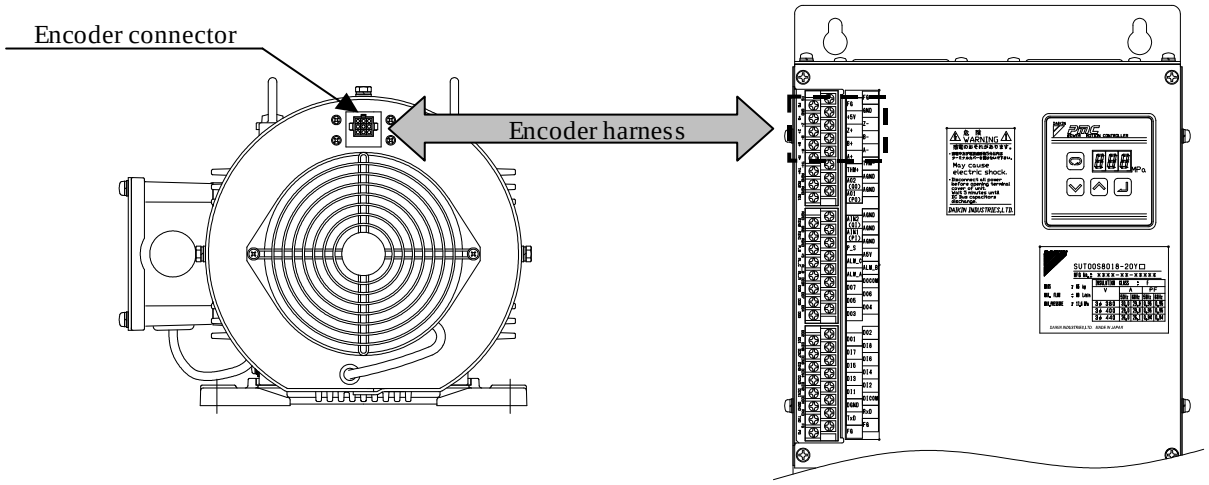
1) To protect the cable and prevent a foreign object from entering the terminal box during wiring, use a cable clamp suitable for the wiring hole.
   The cable clamp used for wiring is not included in the product. It should be prepared by the user.

2) Connect the motor thermistor harness to the thermistor connection terminals. Recommended tightening torque is 0.8 [N•m]. The thermistor connection terminals have no polarity.

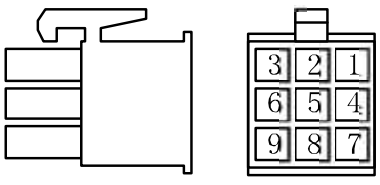
**⚠ WARNING**

- After completion of the wiring, be sure to re-mount the cover to the motor terminal box. Otherwise, you may get an electric shock.

## 9.9 Connecting the Encoder




1) Prepare the encoder harness, crimp terminals, connector and dedicated wiring tool.

<table>
<tr><td>Encoder harness</td><td>Wire cross-section area: 0.3 mm$^2$ or more, Rated voltage: 150 V<br>Recommended: KVC-36SB  0.3 mm$^2$ × 8 wires, Kuramo Electric Co., Ltd.<br><br>The encoder harness is optionally available.
<table>
<tr><th>Unit model</th><th>Option model</th><th>Cable length</th></tr>
<tr><td rowspan="2">SUT00S5021<br>SUT00S8018<br>SUT00S13018<br>SUT00S13021<br>SUT00S20018</td><td>PM-SEH05-P22-A09R</td><td>5 m</td></tr>
<tr><td>PM-SEH10-P22-A09R</td><td>10 m</td></tr>
</table></td></tr>
<tr><td>Crimp terminal on the controller side</td><td>Crimp terminal with insulation sheath (R type), Round terminal for M3 screw<br>Recommended: RBP1.25-3</td></tr>
<tr><td>Connector on the motor side</td><td>Manufacturer: Tyco Electronics AMP K. K.<br>Housing: 172169-1<br>Contact: 170366-1<br>Dedicated tool: 91522-1


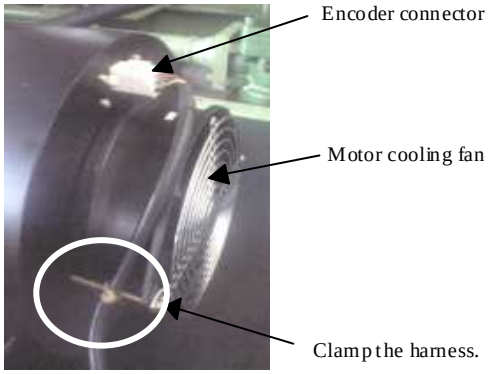
<table>
<tr><th>Terminal No.</th><th>Terminal code</th><th>Name</th></tr>
<tr><td>1</td><td>A+</td><td>Encoder A phase +</td></tr>
<tr><td>2</td><td>A–</td><td>Encoder A phase –</td></tr>
<tr><td>3</td><td>B+</td><td>Encoder B phase +</td></tr>
<tr><td>4</td><td>B–</td><td>Encoder B phase –</td></tr>
<tr><td>5</td><td>Z+</td><td>Encoder Z phase +</td></tr>
<tr><td>6</td><td>Z–</td><td>Encoder Z phase –</td></tr>
<tr><td>7</td><td>+5V</td><td>+5 V power supply</td></tr>
<tr><td>8</td><td>GND</td><td>Ground</td></tr>
<tr><td>9</td><td>FG</td><td>Frame ground</td></tr>
</table></td></tr>
</table>

2) Verify specifications of each signal by referring to the connection diagram shown in “9.4.2 Connections to the controller”, and connect the signal cable to the I/O terminal block. Recommended tightening torque is 0.6 [N•m].

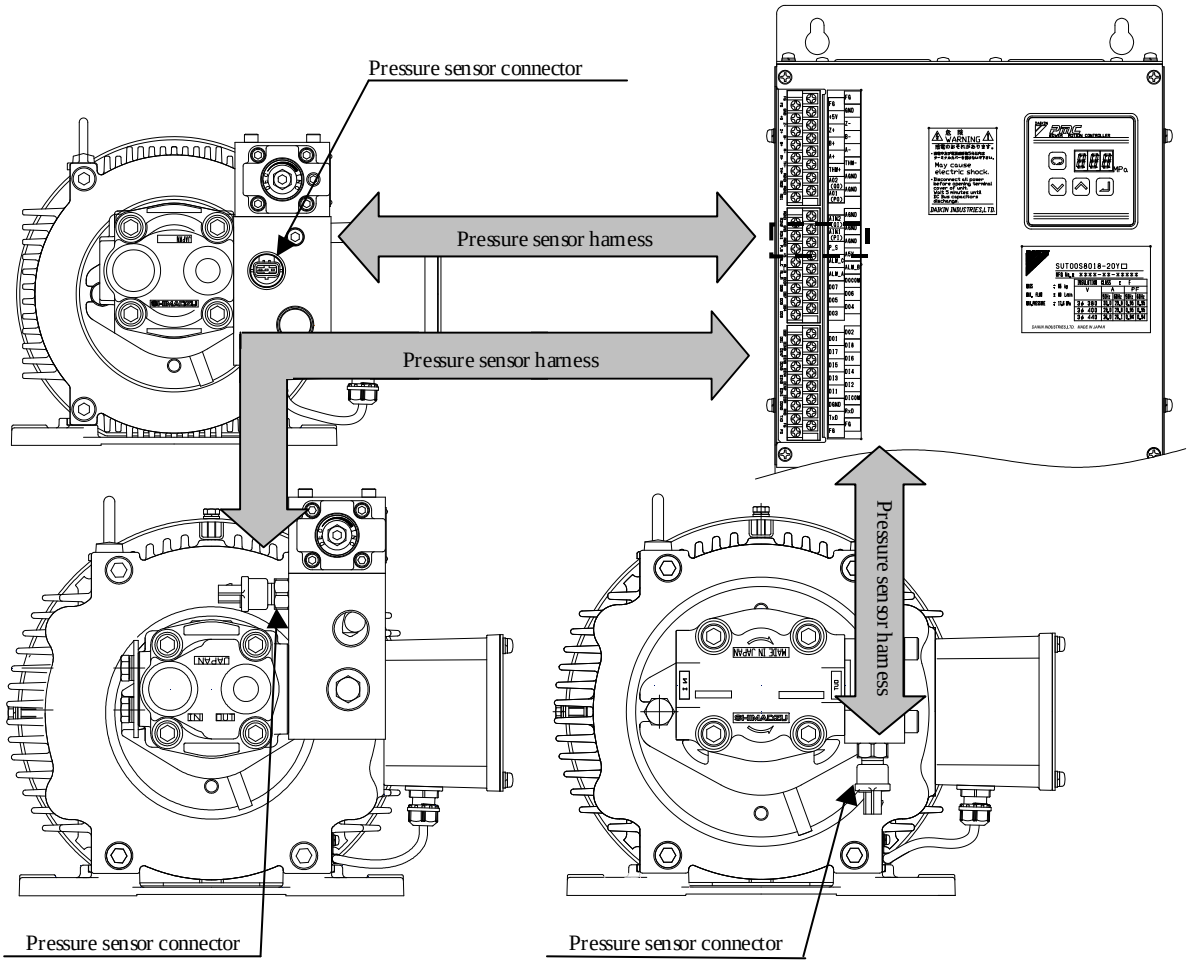
3) Connect to the connector to the encoder connector.

**CAUTION**

- Make sure that the encoder connections are correct. Incorrect wiring may result in unintended operation of the motor (reverse rotation etc.).
- Clamp the encoder harness on the motor cooling fan mounting base, in order to prevent excessive force from being applied to the encoder connector. If excessive force is applied to the harness, it may cause a harness wire break.



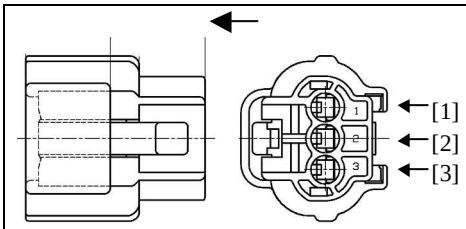
## 9.10 Connecting the Pressure Sensor Harness




The pressure sensor mounting position varies depending on the unit model. Refer to “3.5.1 Motor pump outer dimensions”.

1) Prepare the pressure sensor harness, crimp terminals, connector and dedicated wiring tool.

<table>
<tr><td>Pressure sensor harness</td><td>Wire cross-section area: 0.5 mm$^2$ or more, Rated voltage: 300 V<br>Recommended: KVC-36SB  0.5 mm$^2$ × 3 wires, Kuramo Electric Co., Ltd.<br><br>The pressure sensor harness is optionally available.
<table>
<tr><th>Unit model</th><th>Option model</th><th>Cable length</th></tr>
<tr><td rowspan="2">SUT00S5021<br>SUT00S8018<br>SUT00S13018<br>SUT00S13021<br>SUT00S20018</td><td>PM-SPH05-003</td><td>5 m</td></tr>
<tr><td>PM-SPH10</td><td>10 m</td></tr>
</table></td></tr>
<tr><td>Crimp terminal on the controller side</td><td>Crimp terminal with insulation sheath (R type), Round terminal for M3 screw<br>Recommended: RBP1.25-3</td></tr>
<tr><td>Connector on the motor side</td><td>Manufacturer: Tyco Electronics AMP K. K.<br>Housing: 174357-2<br>Contact: 171630-1<br>Rubber plug; 172746-1<br>Double lock plate: 1-174358-1<br>Dedicated tool: 91583-1</td></tr>
</table>

<table>
<tr>
<td></td>
<td>


<table>
<tr><th>Terminal No.</th><th>Terminal code</th><th>Name</th></tr>
<tr><td>1</td><td>AGND</td><td>Analog ground</td></tr>
<tr><td>2</td><td>P_S</td><td>Pressure sensor signal</td></tr>
<tr><td>3</td><td>A5V</td><td>Pressure sensor power supply</td></tr>
</table>
</td>
</tr>
<tr>
<td>Ferrite core</td>
<td>Manufacturer: Kitagawa Industries Co., Ltd.<br>Ferrite core: TRM-47-27-15E-WE<br>* Attach the ferrite core to the pressure sensor harness by three turns, at 100 mm distance from the terminal on the controller side, and fasten it.</td>
</tr>
</table>

2) By referring to specifications of each signal with the connection diagram shown in “9.4.2 Connections to the controller”, and connect the signal cable to the I/O terminal block. Recommended tightening torque is 0.6 [N•m].

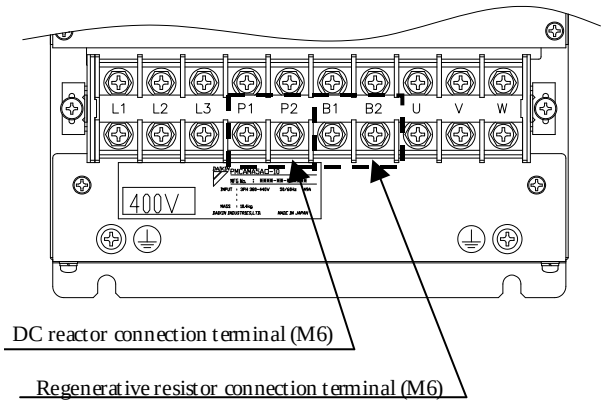
3) Connect the connector to the pressure sensor.

**CAUTION**

Clamp the pressure sensor harness at a part near the sensor, to prevent excessive force from being applied to the connector due to influence of motor pump vibration. If excessive force is applied to the harness, it may cause a harness wire break.

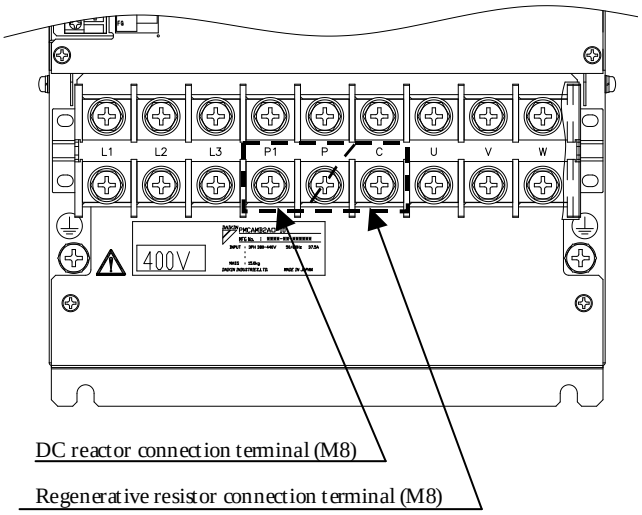
## 9.11 Connecting Peripheral Equipment

● SUT00S5021/SUT00S8018/
SUT00S13018/SUT00S13021




◆ Recommended tightening torque: 3.5 [N•m]

● SUT00S20018




◆ Recommended tightening torque: 8.0 [N•m]

### 9.11.1 Connecting the DC reactor

1) Prepare the following DC reactor.

| Unit model | Type of option | Manufacturer |
|---|---|---|
| SUT00S5021<br>SUT00S8018<br>SUT00S13018<br>SUT00S13021 | PM-SDL04 | Daikin Industries, Ltd. |
| SUT00S20018 | PM-SDL05 | |

2) Prepare the DC reactor connection cable and crimp terminals

● SUT00S5021/SUT00S8018

| | | | |
|---|---|---|---|
| When using 60°C cable | DC reactor connection cable | | Wire cross-section area: 8 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 8 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd |
| | Crimp terminal | Controller side | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R8-6 |
| | | DC reactor side | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R8-5 |
| When using 70°C cable | DC reactor connection cable | | Wire cross-section area: 6 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 6 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Controller side | Crimp terminal with insulation sheath (R type), Round terminal for M6 screw<br>Recommended: RBP5.5-6 |
| | | DC reactor side | Crimp terminal with insulation sheath (R type), Round terminal for M5 screw<br>Recommended: RBP5.5-5 |

● SUT00S13018/SUT00S13021

| | | | |
|---|---|---|---|
| When using 60°C cable | DC reactor connection cable | | Wire cross-section area: 14 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 14 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd |
| | Crimp terminal | Controller side | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R14-6 |
| | | DC reactor side | Bare crimp terminal (R type), Round terminal for M6 screw<br>Recommended: R8-5 |
| When using 70°C cable | DC reactor connection cable | | Wire cross-section area: 6 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 6 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Controller side | Crimp terminal with insulation sheath (R type), Round terminal for M6 screw<br>Recommended: RBP5.5-6 |
| | | DC reactor side | Crimp terminal with insulation sheath (R type), Round terminal for M6 screw<br>Recommended: RBP5.5-5 |

● SUT00S20018

| | | | |
|---|---|---|---|
| When using 60°C cable | DC reactor connection cable | | Wire cross-section area: 38 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: VCT360 38 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd |
| | Crimp terminal | Controller side | Bare crimp terminal (R type), Round terminal for M8 screw<br>Recommended: R38-8 |
| | | DC reactor side | Bare crimp terminal (R type), Round terminal for M8 screw<br>Recommended: R38-8 |
| When using 70°C cable | DC reactor connection cable | | Wire cross-section area: 16 $mm^2$ or more, Rated voltage: 600 V<br>Recommended: CE362 16 $mm^2$ × 2 wires, Kuramo Electric Co., Ltd. |
| | Crimp terminal | Controller side | Crimp terminal with insulation sheath (R type), Round terminal for M8 screw<br>Recommended: RBP14-8 |
| | | DC reactor side | Crimp terminal with insulation sheath (R type), Round terminal for M8 screw<br>Recommended: RBP14-8 |

3) Connect the DC reactor connection cable between the [P1] and [P2] terminals on the main power supply terminal block. Recommended tightening torque is 3.5 [N•m] (except for SUT00S20018). For SUT00S20018, Connect the DC reactor connection cable between the [P] and [P1] terminals on the main power supply terminal block. Recommended tightening torque is 8.0 [N•m]

4) Connect the DC reactor connection cable to the DC reactor. The DC reactor connection cable should be as short as possible. Place the DC reactor connection cable away from a signal line as far as possible. Do not tie the DC reactor connection cable together with signal cables.

**⚠ CAUTION**

- For connection of DCL, use thorough caution not to short-circuit the wiring. Short-circuited wiring causes damage to the controller.
- Do not touch DCL, because it becomes hot.

## 9.11.2 Connecting the regenerative breaking resistor

1) Prepare the regenerative breaking resistor conforming to the following specifications: DAIKIN supplies the following regenerative breaking resistors as optional accessories. For details, refer to "9.2.2 Regenerative breaking resistor".

| Unit model | Capacity | Combination resistance |
|---|---|---|
| SUT00S5021<br>SUT00S8018 | 1 kW or more | 34.0 Ω |
| SUT00S13018<br>SUT00S13021 | 2 kW or more | 17.0 Ω |
| SUT00S20018 | 3 kW or more | 11.3 Ω |

2) Prepare crimp terminals. To extend the cable length, use a cable with 2 $mm^2$ wire cross-section area or larger size.

● SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021

| | |
|---|---|
| Crimp terminal | • Controller side<br>Crimp terminal with insulation sheath (R type), Round terminal for M6 screw<br>Recommended: RBP2-6 |
| | • Regenerative resistor side<br>Crimp terminal with insulation sheath (R type), Round terminal for M4 screw<br>Recommended: RBP2-4 |

● SUT00S20018

| | |
|---|---|
| Crimp terminal | • Controller side<br>Crimp terminal with insulation sheath (R type), Round terminal for M8 screw<br>Recommended: RBP2-8 |
| | • Regenerative resistor side<br>Crimp terminal with insulation sheath (R type), Round terminal for M4 screw<br>Recommended: RBP2-4 |

3) Connect the regenerative resistor connection cable between the [B1] and [B2] terminals on the main power supply terminal block. Recommended tightening torque is 3.5 [N•m] (except for SUT00S20018). For SUT00S20018, Connect the regenerative resistor connection cable between the [P] and [C] terminals on the main power supply terminal block. Recommended tightening torque is 8.0 [N•m]

**⚠ CAUTION**

- When connecting the regenerative resistor, use thorough caution so that the regenerative resistor is not short-circuited. Short-circuiting the regenerative resistor results in damage to the internal circuit.
- When a regenerative resistor is externally mounted, it may become hot (200°C or higher temperature). For installation of the regenerative resistor, use a heat-resistant cable, and cover the resistor to prevent burns.
- To ensure safety, provide a thermal switch. Connect the switch so as to activate a protective circuit.
- If the combination resistance is less than 34 Ω, the internal circuit may be damaged. Be sure to connect a resistor that provides resistance of 34 Ω.

## 9.12 Connecting the I/O Signal Cables

1) Prepare the I/O signal cables and crimp terminals.
   - SUT00S5021/SUT00S8018/SUT00S13018/SUT00S13021/SUT00S20018

| | |
|---|---|
| I/O signal cable | Wire cross-section area: 0.3 $mm^2$ or more, Rated voltage: 150 V<br>Recommended: KVC-36SB 0.3 $mm^2$, Kuramo Electric Co., Ltd. |
| Crimp terminal | Crimp terminal with insulation sheath (R type), Round terminal for M3 screw<br>Recommended: RBP1.25-3 |

2) Verify specifications of each signal, and connect the signal cable to the I/O terminal block.
   Recommended tightening torque is 0.6 [N•m].

**⚠ WARNING**

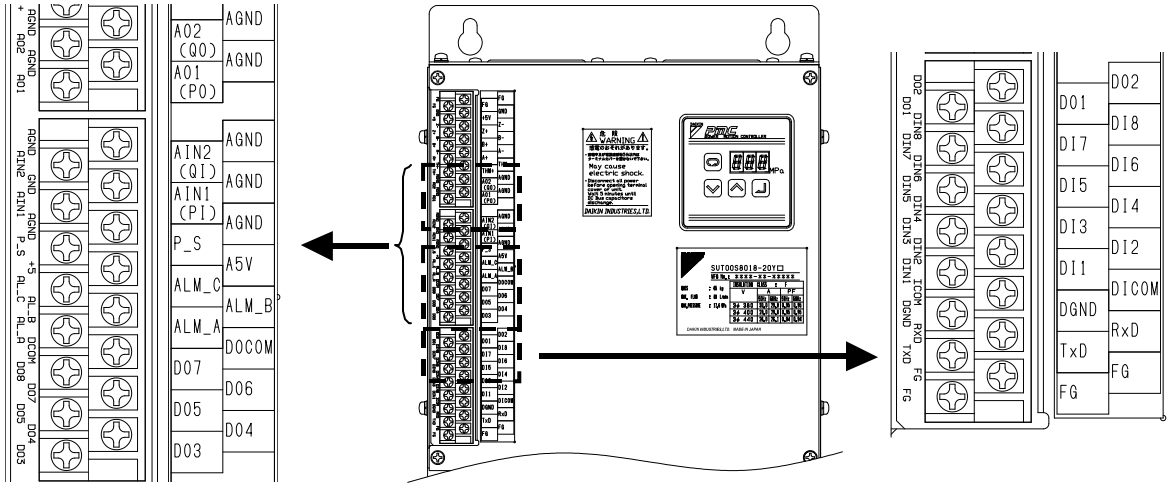
- When you unsheathe each cable, be careful not to damage the conductors.
- Make sure that the cable conductors are not protruding from the terminal block.

**⚠ CAUTION**

- Do not connect the I/O signal cables to the power supply terminal block.
- Verify specifications of each signal cable before connecting the cable.
- Terminate the shielded cable securely, and connect the cable to the shield cable ground terminal.
- If noise cannot be eliminated even when the signal cables are connected to the shielded cable ground terminal, ground your equipment singly. (Disconnect the ground terminal of the hydraulic unit.)

## 9.12.1 Specifications of I/O signals

Specifications of the I/O signal terminals used for external interface are as follows:




◆ Analog input

The hydraulic unit inputs pressure command and flow rate command analog voltages from the main machine.

| Terminal No. | Terminal name | Signal name | Rated capacity | Function |
|---|---|---|---|---|
| 33 | AI2 (QI) | Analog input 2 | 0 to 10 VDC<br>Input resistance:<br>20 kΩ ± 2% | Inputs a flow rate command. The relationship between the input voltage and target flow rate can be adjusted with the parameter. For details, refer to “11.2.1 Input command voltage scaling value”. |
| 9 | AGND | Analog ground | | Ground for AI2 circuit |
| 34 | AI1 (PI) | Analog input 1 | | Inputs a pressure command. The relationship between the input voltage and target pressure can be adjusted with the parameter. For details, refer to “11.2.1 Input command voltage scaling value”. |
| 10 | AGND | Analog ground | | Ground for AI1 circuit |

◆ Analog output

Current pressure and flow rate can be monitored with analog voltages.

| Terminal No. | Terminal name | Signal name | Rated capacity | Function |
|---|---|---|---|---|
| 31 | AO2 (QO) | Analog output 2 | –10 to 10 VDC | Outputs the current flow rate value. |
| 7 | AGND | Analog ground | | Ground for AO2 circuit |
| 32 | AO1 (PO) | Analog output 1 | 0 to 10 VDC | Outputs the current pressure value. |
| 8 | AGND | Analog ground | | Ground for AO1 circuit |

◆ Digital input

| Terminal No. | Terminal name | Signal name | Rated capacity | Function |
|---|---|---|---|---|
| 18 | DI8 | (Unused) | 24 VDC<br>5 mA | – |
| 42 | DI7 | (Unused) | | – |
| 19 | DI5 | (Unused) | | – |
| 43 | DI5 | (Unused) | | – |
| 20 | DI4 | (Unused) | | – |
| 44 | DI3 | (Unused) | | – |
| 21 | DI2 | (Unused) | | – |
| 45 | DI1 | Digital input 1 | | Starts or stops the motor.<br>With the "P00" parameter, you can specify the start input signal logic.<br>For details, refer to "11.2.4 [P00:DI_A] ". |
| 22 | DICOM | Digital input common | | Positive common/Negative common |

**CAUTION**

- For an external power supply, prepare a 24 VDC ± 1 V power supply with 0.5 A or more current capacity.
- This controller cannot feed power to external equipment.
- A current of 5 mA (typical) flows through each input circuit. To build a circuit with a contact, use caution about the minimum current capacity of the contact.

◆ Digital output

| Terminal No. | Terminal name | Signal name | Rated capacity | Function |
|---|---|---|---|---|
| 14 | DOCOM | Digital output common | 24 VDC,<br>30 mA max. | Negative common |
| 38 | DO7 | (Unused) | | – |
| 15 | DO6 | (Unused) | | – |
| 39 | DO5 | (Unused) | | – |
| 16 | DO4 | Digital output 4 | | When a warning condition occurs, the signal turns ON. For details of warning output, refer to "13.1.2 Description of warnings". |
| 40 | DO3 | (Unused) | | |
| 17 | DO2 | (Unused) | | – |
| 41 | DO1 | Digital output 1 | | – |
| | | | | When the hydraulic unit is ready for operation, the signal turns ON. |

**CAUTION**

- Prepare an external power supply with 24 VDC ± 1 V and 0.5 A ratings.
- This controller cannot feed power to external equipment.
- The controller output circuit is connected with negative common.
- The maximum output current of the output circuit is 40 mA (resistance load) per circuit.
  If the circuit drives a load exceeding the allowable current, the circuit may be damaged. Be sure to connect a load less than the maximum output current.
- To drive an inductive load, provide surge-suppressing measures.

◆ Contact output

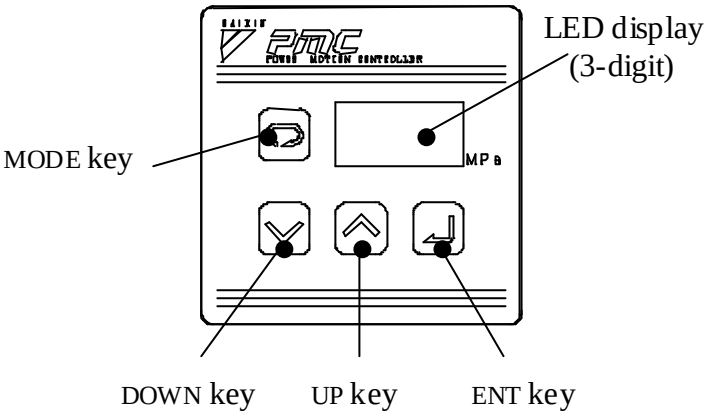
| Terminal No. | Terminal name | Signal name | Rated capacity | Function |
|---|---|---|---|---|
| 36 | ALM_C | Contact output common | 24 VDC, 0.5 A max. Minimum load current: 10 mA | Activates an alarm output under negative logic. [Normal status] ALM_A = ON, ALM_B = OFF [Error] ALM_A = OFF, ALM_B = ON For details of alarms, refer to “13.1.1 |
| 13 | ALM_B | Contact output b | | |
| 37 | ALM_A | Contact output a | | |

**CAUTION**

- The contact switching capacity is 30 VDC/0.5 A (resistance load). If the circuit drives a load exceeding the allowable current, the contact may be damaged. Use caution about the current capacity.
- For contact output, the minimum applicable load is 10 mA DC/10 μA. However, this value is the standard value of the lower limit that enables contact switching under minute load. This value varies depending on switching frequency and environmental conditions of the contact. It is recommended that you verify the minimum allowable current with actual load.
- To drive an inductive load, provide surge-suppressing measures.

# Chapter 10 Panel Operations

## 10.1 Parts Names and Principal Functions of the Operation Panel




The controller provides a 3-digit, 7-segment display and four key switches, as shown on the left.
In the normal mode, the display indicates a current pressure value (MPa).

| Name | | | Principal function |
|---|---|---|---|
| LED display | | | Displays a pressure/flow rate monitor value, or a set value of each function.<br>In the normal mode, a current pressure value is displayed. |
| MODE key | | | Operate this key to select the normal mode or the monitor mode. |
| Setting keys | DOWN key | | Operate these keys to select a monitor item and parameter No., and to change a parameter setting. Pressing the UP key increments a set value. Pressing the DOWN key decrements a set value. |
| | UP key | | |
| ENT key | | | Operate this key to register a parameter No., parameter setting or other selected condition. |

## 10.2 Functions of the Operation Panel

### 10.2.1 Outline of functions

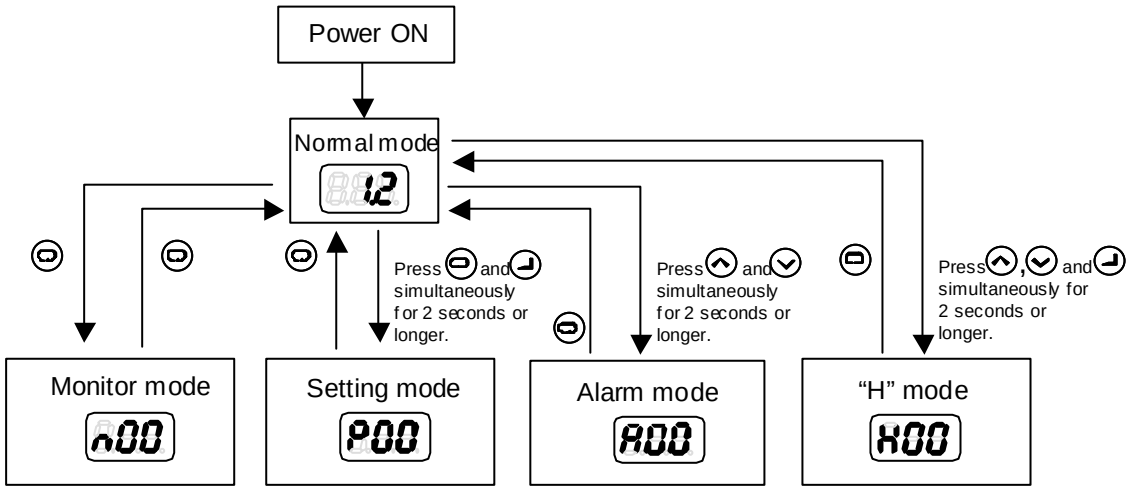
The operation panel provides the following functions:

◆ Functions of the operation panel

| Mode | Description |
|---|---|
| Normal mode | A current pressure value is displayed. |
| Monitor mode | You can confirm a pressure/flow rate command voltage and current value with the LED display. |
| Setting mode | You can specify various parameters. |
| Alarm mode | The LED display shows ten alarm events in the past in the order of occurrence. |
| “H” mode | Used to specify various parameters related to the system.<br>Normally, users need not set the “H” mode parameters. |

### 10.2.2 Shift between individual modes

You can shift between individual modes as shown below. For details on operating procedures, refer to the description for each mode.



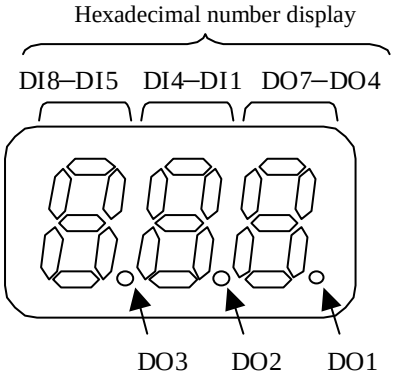

## 10.3 Monitor Mode Display

### 10.3.1 Monitor mode display items

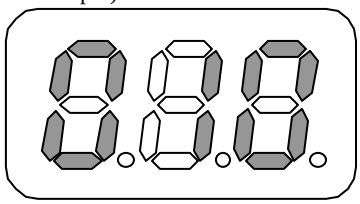
| Mode | Monitor item | Unit | Description |
|---|---|---|---|
| n00 | Pressure command voltage (Pi) | [V] | Displays a pressure command input voltage to the AI1 terminal. (Display range: 0.00 to 9.99) |
| n01 | Flow rate command voltage (Qi) | [V] | Displays a flow rate command input voltage to the AI2 terminal. (Display range: 0.00 to 9.99) |
| n02 | Pressure monitor voltage (Po) | [V] | Displays an output voltage to the AO1 terminal. (Display range: 0.00 to 9.99) |
| n03 | Flow rate monitor voltage (Qo) | [V] | Displays an output voltage to the AO2 terminal. (Display range: 0.00 to 9.99) |
| n04 | Pressure command value (Pi) | [MPa] | Displays a pressure command input value. |
| n05 | Flow rate command value (Qi) | [× 10 $min^{-1}$] | Displays a flow rate command input value as a motor rotation speed. |
| n06 | Actual flow rate | [L/min] | Displays a theoretical flow rate value by multiplication of "motor rotation speed × pump volume". |
| n07 | Actual rotation speed | [× 10 $min^{-1}$] | Displays a motor rotation speed. |
| n08 | Digital I/O signal status | – | Displays digital input/output status. For indication of each signal status, see the figure below. |
| n09 | Regenerative load ratio | % | Displays the regenerative resistor's load ratio. When a specified time elapses under 25% or higher load, the alarm is activated to stop the unit. |
| n10 | (Unused) | – | – |
| n11 | Motor load ratio | % | Displays a motor load ratio. "100%" indicates the rated load of the motor. When the load ratio reaches 110%, the alarm is activated to stop the unit. |
| n12 | Controller load ratio | % | Displays a controller load ratio. "100%" indicates the rated load of the controller. When the load ratio reaches 120%, the alarm is activated to stop the unit. |
| n13 (*1) | Software type | – | Displays a software type. |
| n14 (*1) | Software version | – | Displays a software version. |

(*1): Displayed for software revision No. "28" or subsequent number. For details, refer to "3.1.2 Manufacturing No.".

DIO status indication for “n08: DIO monitor”

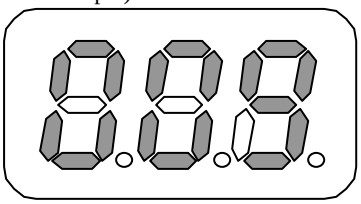



Example) When DI1 is ON:



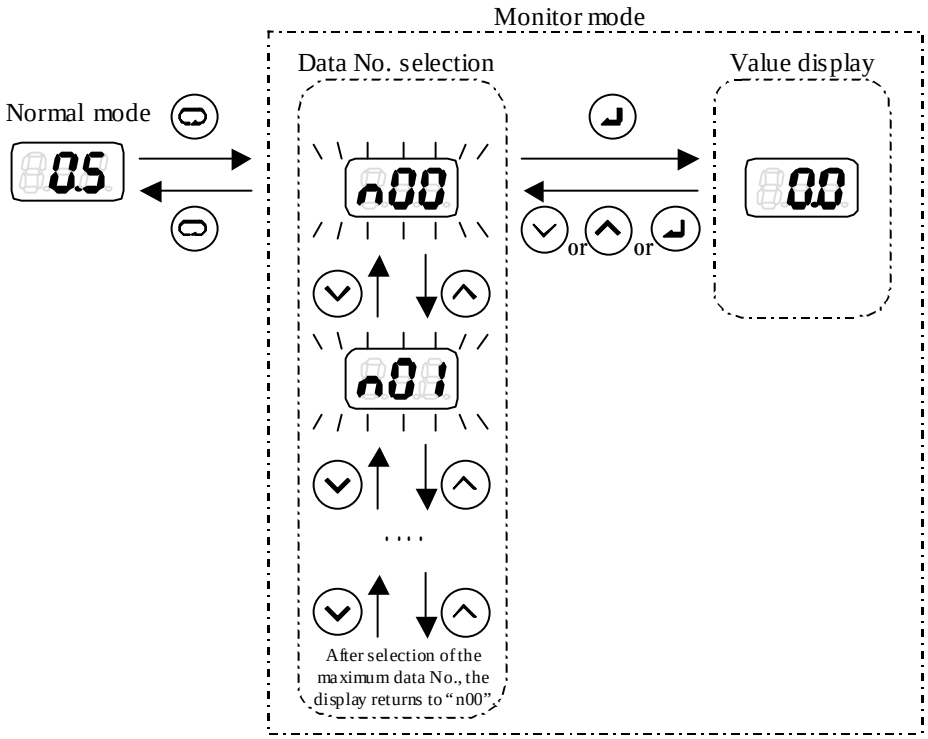
DI1 (1st bit)

Example) When DO4 and DO7 are ON:



DO4 (1st bit) and DO7 (4th bit) are simultaneously ON.
⇒ 9 (Hexadecimal number display)

## 10.3.2 Operation in the monitor mode




[1] Press the key in the normal mode. The displays will shift to the monitor mode.

[2] Select a data number to be displayed with the or key. During selection of a data number, the display blinks.

[3] Press the key to register the data number. The selected number is displayed.

[4] If you press the , or key, you will return to the data number selection step.

## 10.4 Setting Mode Display

### 10.4.1 Setting mode display items

| No. | Code | Name | Description |
|---|---|---|---|
| P00 | DI_A | Start/stop signal switching | 0: When the input signal turns ON, the motor starts running.(When the signal turns OFF, the motor stops.)<br>1: When the input signal turns OFF, the motor starts running. |
| P01 | SW_L | (System reserved) | (Unused) |
| P02 | T_SW | (System reserved) | (Unused) |
| P03 | K_RT | Regenerative load command ratio | Motor protection constant for motor reverse rotation |
| P04 | INIF | Initialize | When this parameter is set at “1”, all parameters will be reset to the default settings when the power supply is turned OFF and then turned ON again. |
| P05 | VMAX | Input command voltage scaling value | Input command voltage scaling value |
| P06 | PMAX | Pressure command scaling value | Pressure setting corresponding to the maximum pressure command (Pi = VMAX [V]) |
| P07 | QMAX | Flow rate command scaling value | Flow rate setting corresponding to the maximum flow rate command (Qi = VMAX [V]) |
| P08 | P_UG | Pressure rising gain | When a pressure error is a positive value (Pe = Pi – Po > 0), this gain is active. |
| P09 | P_DG | Pressure falling gain | When a pressure error is a negative value (Pe = Pi – Po < 0), this gain is active. |
| P10 | Q_UG | Flow rate rising gain | When a flow rate error is a positive value (Qe = Qi – Qo > 0), this gain is active. |
| P11 | Q_DG | Flow rate falling gain | When a flow rate error is a negative value (Qe = Qi – Qo < 0), this gain is active. |
| P12 | SC_L | Surge pressure detection level | Surge pressure detection level |
| P13 | SC_G | Surge pressure reduction gain | When this parameter is set larger, surge pressure can be suppressed. |
| P14 | D_TM | Delay time setting | Wait time until pump startup after pressure/flow rate command input in standby status |
| P15 | BIAS | Bias pressure | Pressure command value in standby status |
| P16 | V_KD | Speed differential gain | Speed differential gain |
| P17 | P_P1 | Pressure proportional gain [for DH range] | When a pressure error is in the DH control range, this proportional gain is active. |
| P18 | P_P2 | Pressure proportional gain [for override range] | When a pressure error is in the override range, this proportional gain is active. |
| P19 | P_I1 | Pressure integral time [for small pressure error] | When a pressure error is a small positive value, this integral time (gain) is active. |
| P20 | P_I2 | Pressure integral time [for large positive pressure error] | When a pressure error is a large positive value, this integral time (gain) is active. |
| P21 | P_I3 | Pressure integral time [for negative pressure error] | When a pressure error is a negative value, this integral time (gain) is active. |
| P22 | P_UT | Pressure rising time constant | Time constant of the internal command rising ramp filter relative to a stepped change in pressure command |
| P23 | P_DT | Pressure falling time constant | Time constant of the internal command falling ramp filter relative to a stepped change in pressure command |
| P24 | P_SP | Cutoff width | P-Q control override (cutoff) pressure width |
| P25 | BR_R | Regenerative resistance value | Regenerative resistance value |
| P26 | BR_W | Regenerative resistance capacity | Regenerative resistance capacity |
| P27 | AR_A | (System reserved) | (Unused) |
| P28 | ARFS | (System reserved) | (Unused) |

| No. | Code | Name | Description |
|---|---|---|---|
| P29 | WN_L | Overload warning output judgment level | “L49: Overload warning” judgment level |

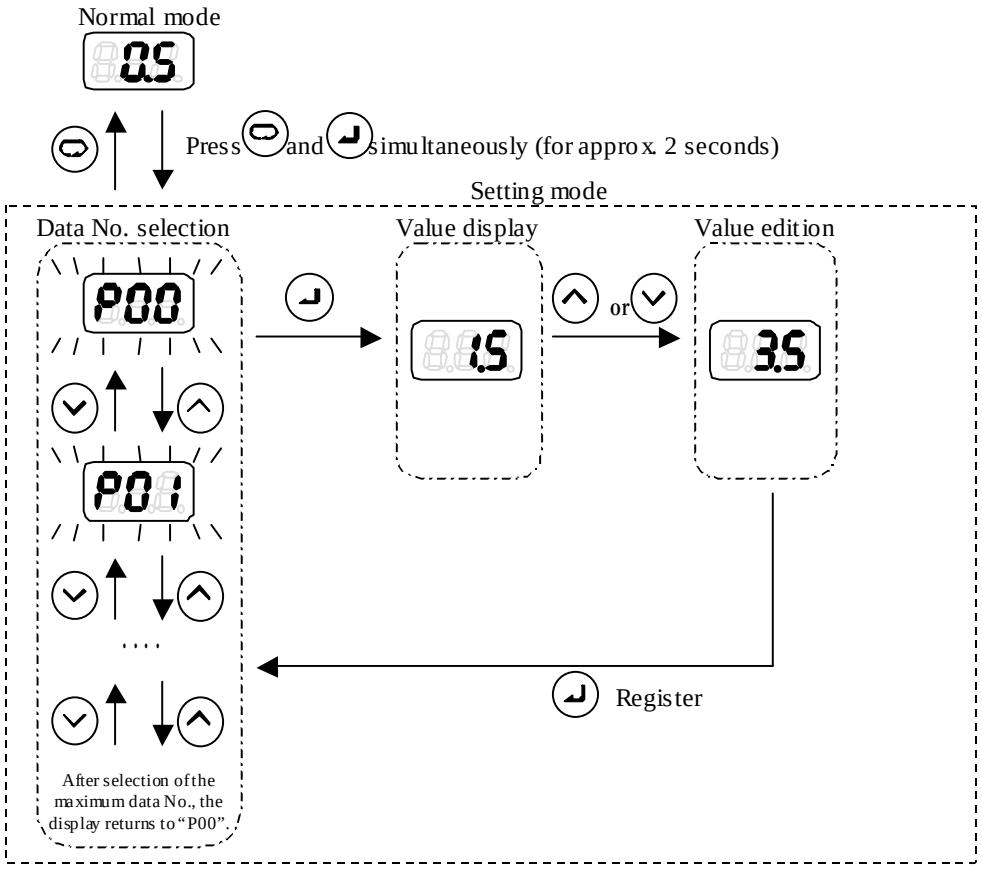
## 10.4.2 Setting mode default setting

| No. | Name | Range/Unit | Model: SUT00S | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5021 | 8018 | 13018 | 13021 | 20018 |
| P00 | Start/stop signal switching | 0–1 | 0 | 0 | 0 | 0 | 0 |
| P01 | (System reserved) | 0–0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| P02 | (System reserved) | 0–0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| P03 | Regenerative load command ratio | 30–100 [%] | 50 | 50 | 50 | 50 | 50 |
| P04 | Initialize | 0–1 | 0 | 0 | 0 | 0 | 0 |
| P05 | Input command voltage scaling value | 0–10 [Volt] | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| P06 | Pressure command scaling value | See description on the right. [MPa] | 20.6 (2–21) | 17.6 (2–18) | 17.6 (2–18) | 20.6 (2–21) | 17.6 (2–18) |
| P07 (*1) | Flow rate command scaling value | See description on the right. [$10min^{-1}$] | 240 (2–270) | 246 (2–262) | 296 (2–310) | 296 (2–310) | 268 (2–310) |
| P08 | Pressure rising gain | 1–999 | 200 | 300 | 250 | 250 | 100 |
| P09 | Pressure falling gain | 1–999 | 160 | 170 | 200 | 200 | 130 |
| P10 | Flow rate rising gain | 1–200 | 200 | 200 | 200 | 200 | 130 |
| P11 | Flow rate falling gain | 1–200 | 200 | 200 | 200 | 200 | 130 |
| P12 | Surge pressure detection level | 0–999 | 100 | 100 | 50 | 50 | 10 |
| P13 | Surge pressure reduction gain | 0–999 | 50 | 60 | 100 | 100 | 70 |
| P14 | Delay time setting | 0–100 [ms] | 20 | 20 | 20 | 20 | 20 |
| P15 | Bias pressure | 0–20 [× 0.1 MPa] | 5 | 5 | 5 | 5 | 5 |
| P16 | Speed differential gain | 0–100 | 20 | 20 | 10 | 10 | 10 |
| P17 | Pressure proportional gain [for DH range] | 1–999 | 200 | 250 | 250 | 250 | 150 |
| P18 | Pressure proportional gain [for override range] | 1–999 | 250 | 400 | 300 | 300 | 170 |
| P19 | Pressure integral time [for small pressure error] | 10–999 | 100 | 100 | 100 | 100 | 80 |
| P20 | Pressure integral time [for large positive pressure error] | 10–999 | 100 | 50 | 80 | 80 | 20 |
| P21 | Pressure integral time [for negative pressure error] | 10–999 | 50 | 50 | 50 | 50 | 50 |
| P22 | Pressure rising time constant | 0–200 [ms] | 60 | 80 | 80 | 80 | 80 |
| P23 | Pressure falling time constant | 0–200 [ms] | 60 | 80 | 80 | 80 | 70 |
| P24 | Cutoff width | 0–100 [× 0.1 MPa] | 10 | 10 | 10 | 10 | 10 |
| P25 | Regenerative resistance value | 1–999 [Ω] | 34 | 34 | 17 | 17 | 11 |
| P26 | Regenerative resistance capacity | 0.01–9.99 [kW] | 1.00 | 1.00 | 2.00 | 2.00 | 3.00 |
| P27 | (System reserved) | 0–0 | 0 | 0 | 0 | 0 | 0 |
| P28 | (System reserved) | 1–1 | 1 | 1 | 1 | 1 | 1 |

| No. | Name | Range/Unit | Model: SUT00S | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5021 | 8018 | 13018 | 13021 | 20018 |
| P29 | Overload warning output judgment level | 0–120[%] | 105 | 105 | 105 | 105 | 105 |

(*1) The default setting is specific to each unit, because this parameter has been adjusted depending on differences among individual pumps so that the maximum value of actual flow rate conforms to the specifications.

### 10.4.3 Operation in the setting mode




[1] Press the and keys simultaneously in the normal mode. After approx. 2 seconds, the display will shift to the setting mode.

[2] Select a data number to be displayed with the or key. During selection of a data number, the display blinks.

[3] Press the key to register the data number. The selected number is displayed.

[4] To change the set value, increment or decrement the value with the ⌄ or ⌃ key.

[5] Press the ↵ key to register the set value. Then, you will return to the data number selection step.

## 10.5 "H" Mode

The "H" mode parameters are related to the system. Normally, users need not set these parameters.

### 10.5.1 "H" mode display items

| No. | Code | Name | Description |
|---|---|---|---|
| H00 (*1) | | Current command ratio display | 100 [%]: Maximum current of the controller |
| H01 (*1) | – | Motor load ratio display | 100 [%]: Motor rated current |
| H02 (*1) | – | (Unused) | – |
| H03 (*1) | – | Motor thermo temperature display | Motor thermo temperature |
| H04 (*1) | – | Fin thermo temperature display | Controller radiation fin temperature |
| H05 (*1) | – | Power supply voltage display | Main circuit DC voltage |
| H06 (*1) | – | (Unused) | – |
| H07 (*1) | – | (Unused) | – |
| H08 (*1) | – | (Unused) | – |
| H09 | L_G_ | Load gain | 100% = 7 MPa, 5000 rpm |
| H10 | V_KP | Speed proportional gain | Speed proportional gain |
| H11 | V_KI | Speed integral gain | Speed integral gain |
| H12 (*6) | V_KD | Speed differencial gain | Speed differencial gain |
| | P_FF | Pressure feed-forward gain | Motor current correction during pressure rise |
| H13 | V_SP | Gain schedule point | Gain schedule point |
| H14 | AC_M | (Unused) | (Unused) |
| H15 (*2) | Q_EV | Volume efficiency correction | Pump volume efficiency correction |
| H16 | POCH | Pressure monitor channel | Digital output terminal AO1 output data |
| H17 | QOCH | Flow rate monitor channel | Digital output terminal AO2 output data |
| H18 | V_NP | Speed proportional neutral gain | Speed proportional neutral gain |
| H19 | E_TM | Motor startup error judgment time | Motor startup error judgment time |
| H20 | FLOC | Panel setting change lock | 0: Enables panel setup change<br>1: Disables panel setup change |
| H21 (*4) | PI_Z | PI Zero | Pressure command (Pi) zero point |
| H22 (*4) | PI_G | PI Gain | Pressure command (Pi) gain |
| H23 (*4) | QI_Z | QI Zero | Flow rate command (Qi) zero point |
| H24 (*4) | QI_G | QI Gain | Flow rate command (Qi) gain |
| H25 (*4) | PO_Z | PO Zero | Pressure monitor (Po) zero point |
| H26 (*4) | PO_G | PO Gain | Pressure monitor (Po) gain |

| No. | Code | Name | Description |
|---|---|---|---|
| H27 (*4) | QO_Z | QO Zero | Flow rate monitor (Qo) zero point |
| H28 (*4) | QO_G | QO Gain | Flow rate monitor (Qo) gain |
| H29 | ZP10 | Z phase Plus 10 value | Z phase Plus 10 value |
| H30 (*3) | PS_G | Pressure sensor gain | Pressure sensor gain |
| H31 | DR_L | Dry operation judgment level | Dry operation judgment standard pressure |
| H32 | DR_T | Dry operation judgment time | Dry operation judgment time |
| H33 | PNG1 | (Unused) | (Unused) |
| H34 | PNG2 | (Unused) | (Unused) |
| H35 | DRTN | Bias dry operation judgment time | Dry operation judgment time in standby status |
| H36 - H46 | – | System reserved | – |

## 10.5.2 “H” mode default setting

| No. | Name | Range/Unit | Model: SUT00S | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5021 | 8018 | 13018 | 13021 | 20018 |
| H00 (*1) | Current command ratio display | [%] | – | – | – | – | – |
| H01 (*1) | Motor load ratio display | [%] | – | – | – | – | – |
| H02 (*1) | (Unused) | – | – | – | – | – | – |
| H03 (*1) | Motor thermo temperature display | [°C] | – | – | – | – | – |
| H04 (*1) | Fin thermo temperature display | [°C] | – | – | – | – | – |
| H05 (*1) | Power supply voltage display | [Volt] | – | – | – | – | – |
| H06 (*1) | (Unused) | – | – | – | – | – | – |
| H07 (*1) | (Unused) | – | – | – | – | – | – |
| H08 (*1) | (Unused) | – | – | – | – | – | – |
| H09 | Load gain | 0–200 | 125 | 80 | 93 | 93 | 88 |
| H10 | Speed proportional gain | 0–300 [×10] | 200 | 200 | 150 | 150 | 100 |
| H11 | Speed integral gain | 0–200 [×10] | 50 | 50 | 100 | 100 | 50 |
| H12 | Pressure feed-forward gain | 0–200 | 100 | 0 | 100 | 100 | 100 |
| H13 | Gain schedule point | 0–999 | 100 | 100 | 100 | 100 | 100 |
| H14 | (Unused) | 200–400 | 268 | 268 | 268 | 268 | 268 |
| H15 (*2) | Volume efficiency correction | 0–999 [$min^{-1}$] | 90 | 100 | 80 | 80 | 32 |
| H16 | Pressure monitor channel | 0–50 | 0 | 0 | 0 | 0 | 0 |
| H17 | Flow rate monitor channel | 0–50 | 0 | 0 | 0 | 0 | 0 |
| H18 | Speed proportional neutral gain | 0–300 | 50 | 200 | 150 | 150 | 50 |

| No. | Name | Range/Unit | Model: SUT00S | | | | |
|---|---|---|---|---|---|---|---|
| | | | 5021 | 8018 | 13018 | 13021 | 20018 |
| H19 | Motor startup error judgment time | 0.01–9.99 [sec] | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| H20 (*6) | Panel setting change lock | 0–1 | 0 | 0 | 0 | 0 | 0 |
| H21 (*4) | PI Zero | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H22 (*4) | PI Gain | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H23 (*4) | QI Zero | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H24 (*4) | QI Gain | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H25 (*4) | PO Zero | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H26 (*4) | PO Gain | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H27 (*4) | QO Zero | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H28 (*4) | QO Gain | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H29 | Z phase Plus 10 value | 0–360 [×10] | 0 | 0 | 0 | 0 | 0 |
| H30 (*3) | Pressure sensor gain | 0–999 | 500 | 500 | 500 | 500 | 500 |
| H31 | Dry operation judgment level | 0–200 | 50 | 50 | 50 | 50 | 50 |
| H32 | Dry operation judgment time | 0–9.9[sec] | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| H33 | (Unused) | 1–999 | 200 | 200 | 200 | 200 | 200 |
| H34 | (Unused) | 1–999 | 100 | 100 | 100 | 100 | 100 |
| H35 | Bias dry operation judgment time | 0–99.9 [sec] | 60.0 | 60.0 | 60.0 | 60.0 | 60.0 |
| H36 – H46 (*5) | System reserved | – | 0 | 0 | 0 | 0 | 0 |

(*1) For value monitoring only

(*2) To correct differences in pump volume efficiency among individual units, the default setting has been adjusted for each unit.

(*3) To correct differences among individual pressure sensors and controllers, the default setting has been adjusted for each unit. The pressure sensor zero point is automatically adjusted, regardless of a parameter setting.

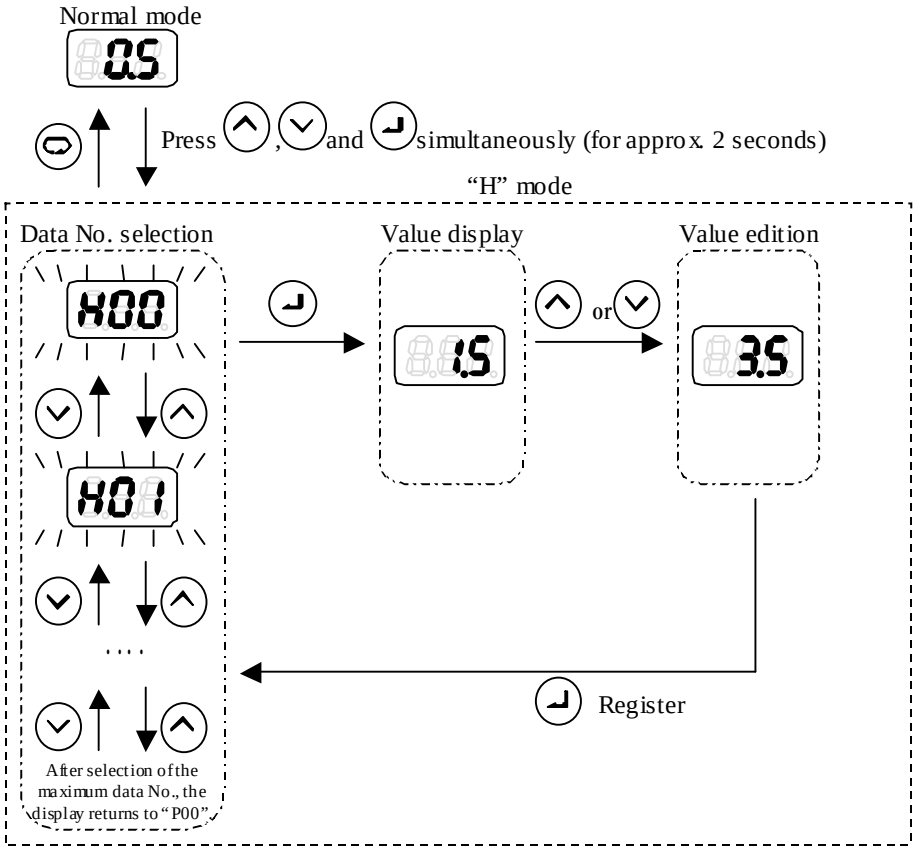
(*4) To correct differences among individual controllers, the default setting has been adjusted for each unit.

(*5) Displayed for software revision No. “28” or subsequent number. For details, refer to “3.1.2 Manufacturing No.”.

(*6) If “H20” (Panel setting change lock) is set to “1”, the system prohibits parameter change operations with the operation panel.
Use this function to prohibit end users’ parameter changes from machine manufacturer’s default settings.

| IMPORTANT | Do not change the default settings of the “system reserved” parameters.<br>If the default settings are changed, it may result in unexpected operation of the hydraulic unit. |
|---|---|

### 10.5.3 Operation in the “H” mode




| NOTE | For the items indicated as (*1) in “10.5.2 “H” mode default setting”, you can only view a set value, and cannot change the set value by conducting the (4) and (5) steps below. |
|---|---|

[1] Press and hold the , and keys simultaneously in the normal mode. After approx. 2 seconds, the display will shift to the “H” mode.

[2] Select a data number to be displayed with the or key. During selection of a data number, the display blinks.

[3] Press the key to register the data number. The selected number is displayed.

[4] To change the set value, increment or decrement the value with the or key.

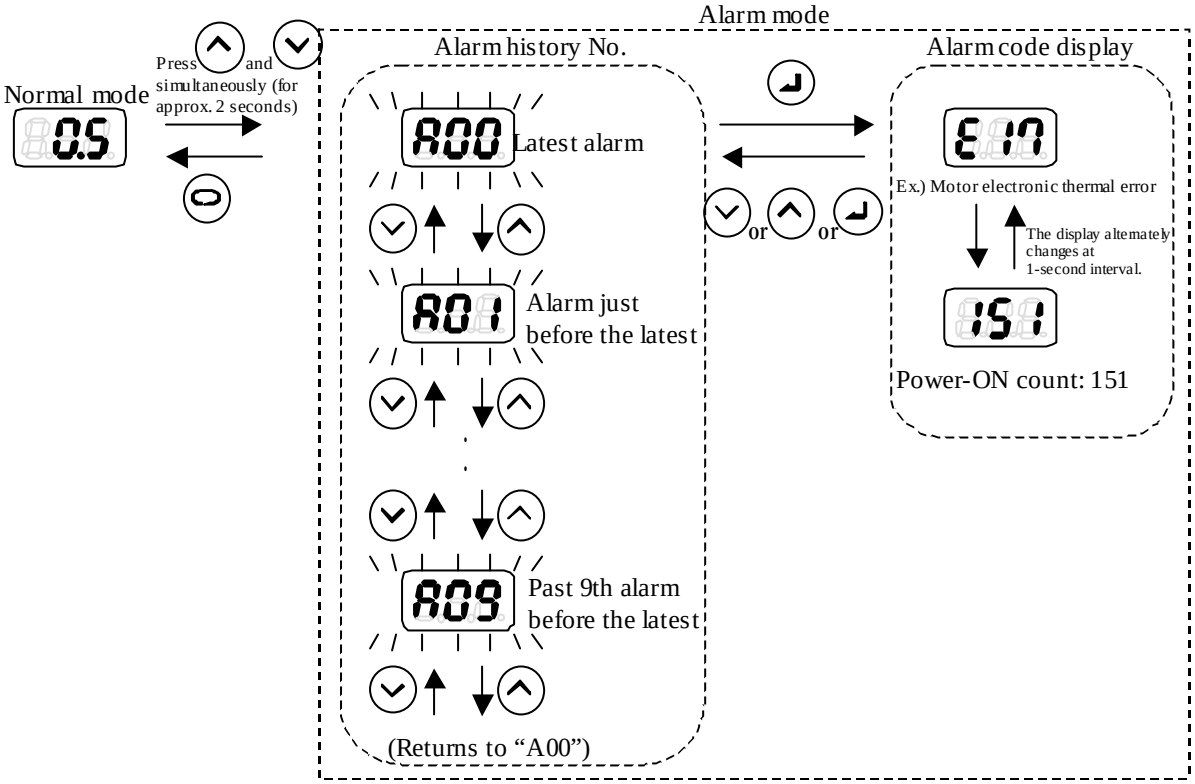
[5] Press the key to register the set value. Then, you will return to the data number selection step.

## 10.6 Alarm Mode Display

### 10.6.1 Alarm list

For details of each alarm, refer to “13.1.1 Description of alarms”.

## 10.6.2 Operation in the alarm mode




[1] Press and hold the ^ and v keys simultaneously in the normal mode. After approx. 2 seconds, the displays will shift to the alarm mode.

[2] Select an alarm record number to be displayed with the v or ^ key. During selection of an alarm record number, the display blinks.
"A00" indicates the latest alarm. Alarms in the past are indicated as "A01 → A02 →" in sequence from the newest one.

[3] Press the ↵ key to register the alarm record number. The corresponding alarm code and the power-ON count at occurrence of the alarm are alternately displayed.

| NOTE | If the power-ON count exceeds "650", it will be cleared to "0". |
|---|---|

[4] If you press the v , ^ or ↵ key, you will return to the alarm record number selection step.

# Chapter 11 Trial Run/Operation

**CAUTION**

- In preparation for a case of emergency, connect wiring so that the power supply can be immediately turned OFF.
- If this hydraulic unit operates in an unexpected way, ensure safety before starting operation.
- Before turning ON the power supply, attach the motor and controller terminal block covers. Do not remove the controller terminal block covers while the power supply is ON. Failure to observe this instruction may result in an electric shock.

## 11.1 Rurning power ON

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

- Check if the hydraulic unit is properly installed. (Refer to “7.2 Installation of Motor Pump”, “7.3 Installation of the controller”.)
- Check if the piping is properly connected. (Refer to “Chapter 8 Hydraulic Piping”.)
- Check if the wiring is properly connected. (Refer to “Chapter 9 Electric Wiring”.)
- Check if the digital input signal is OFF. (Refer to “11.2.4 [P00:DI_A] ”.)
- Check if the power supply voltage is normal. (Refer to “3.2 Specifications”.)

## 11.2 Description of Parameters

### 11.2.1 [P05:VMAX] Input command voltage scaling value

Specify a maximum value of command voltage input from the main machine. The input voltage is converted into a command value based on the settings of this parameter and [P06: PMAX] and [P07: QMAX] (“11.2.2”).
Pressure and flow rate monitor voltages are also converted by using these parameters.

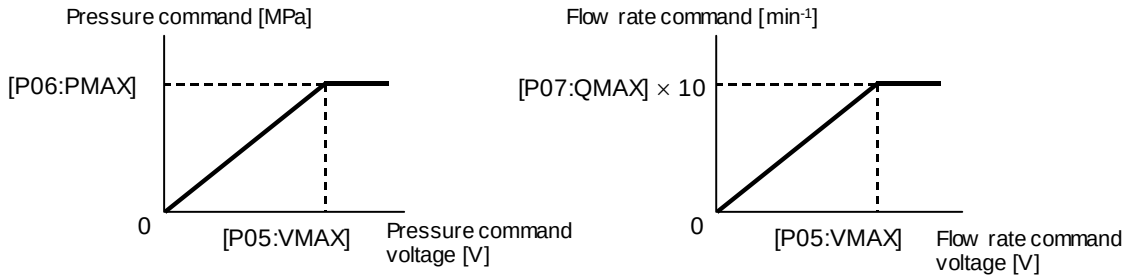
| No. | Code | Parameter name | Setting range | Unit |
|---|---|---|---|---|
| P05 | VMAX | Input command voltage scaling value | 0.0–10.0 | V |

| | |
|---|---|
| NOTE | If the unit cannot operate at the maximum pressure and the maximum flow rate, perform the following procedure:<br>1) With maximum command voltage input from the main machine, check the monitor values of “n00: Pressure command voltage” and “n01: Flow rate command voltage” to verify the input voltage recognized by the unit.<br>2) Specify the voltage displayed in the monitor as “P05: Input command voltage scaling value”. |

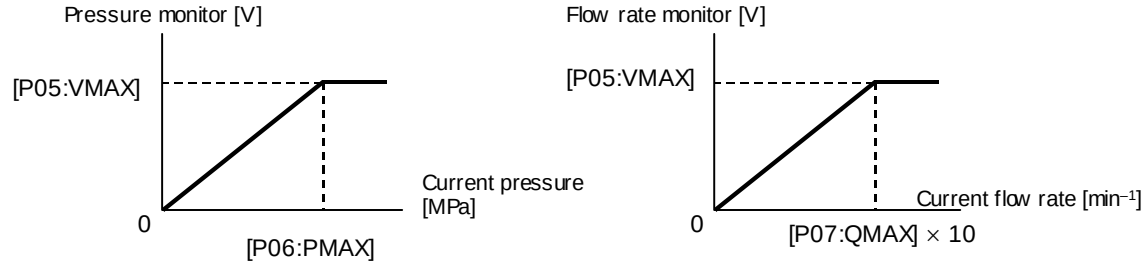
### 11.2.2 [P06:PMAX], [P07:QMAX] Pressure/flow rate command scaling

Specify the pressure command value and flow rate command value corresponding to the pressure/flow rate command voltage of “P05: Input command voltage scaling value”.
Based on the settings of these parameters and the setting of “11.2.1 Input command voltage scaling value”, an input voltage is converted into a command value as shown below: Pressure and flow rate monitor voltages are also converted as shown below.

■ command voltage




■ Monitor voltage conversion




| No. | Code | Parameter name | Setting range | |
|---|---|---|---|---|
| P06 | PMAX | Pressure command scaling value | * | MPa |
| P07 | QMAX | Flow rate command scaling value | * | $\times 10 min^{-1}$ |

* The setting range varies on the unit model. For details, refer to “10.4.2 Setting mode default setting”.

| | |
|---|---|
| IMPORTANT | The flow rate command scaling value is defined as motor rotation speed.<br>The default setting has been adjusted depending on differences among individual pumps, so that the maximum value of actual flow rate conforms to the specifications.<br>If you change the maximum flow rate, calculate a set value of this parameter so as to ensure accuracy of actual flow rate, as described below:<br><br>Example)<br>When the maximum flow rate is 80 L/min relative to the maximum flow rate setting of 70 L/min,<br><br>“P07: Flow rate scaling” set value = “P07: Flow rate scaling” default setting × (70/80) |

| | |
|---|---|
| NOTE | The pressure command and flow rate command relative to a command voltage are calculated as shown above. Therefore, if the command voltage input from the main machine is not linear, intended characteristics may not be obtained.<br>While monitoring an input command voltage with “n00: Pressure command voltage” and “n01: Flow rate command voltage”, verify and adjust the linearity of the command voltage from the main machine. |

### 11.2.3 [P15:BIAS] Pressure command in standby status

If the following conditions are simultaneously satisfied, it is defined as standby status.

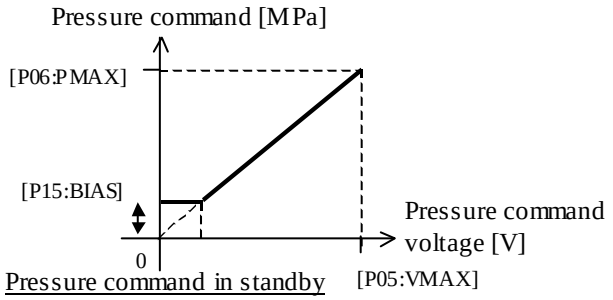
◆ Pressure command is less than “P15: Bias pressure”.

◆ Flow rate:

| Model: SUT00S | Flow rate condition |
|---|---|
| 5021<br>8018 | Flow ratecommand < “P07: Flow rate command scaling value”×0.08 |
| 13018<br>13021<br>20018 | Flow ratecommand < “H13: Gain schedule point”×2 |

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P15 | BIAS | Bias pressure | 0–20 | 0.1MPa |

If both pressure command and flow rate command input voltages are low, the hydraulic unit becomes standby status. In this condition, the control pressure does not conform to the pressure command input value. The pressure command in standby status is limited depending on this parameter setting, as shown on the right.




| | |
|---|---|
| IMPORTANT | ● When a solenoid selector valve is used in the hydraulic circuit, switching response may be delayed if the pilot pressure is too low. In this case, increase the setting of this parameter so as to ensure sufficient pilot pressure in standby status.<br>● When both “Pi” and “Qi” are set at 0 [V], the hydraulic unit is in standby status, to be controlled at the pressure specified in this parameter. To execute pressure control at low pressure (e.g. for clamping a die at low pressure), set the flow rate command value 15% or higher than the “QMAX” setting. With this setting, the hydraulic unit does not become standby status, enabling pressure control at pressure that does not exceed the bias pressure. |

### 11.2.4 [P00:DI_A] Start/stop signal switching

The motor start/stop command is activated by an input signal to the digital input signal terminal (DI1).

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P00 | DI_A | Start/stop signal switching | 0: When the input signal turns ON, the motor starts running.<br>1: When the input signal turns OFF, the motor starts running. | – |

| Set value | DI1 terminal status | |
|---|---|---|
| | OFF | ON |
| 0 | Pump stop | Pump start |
| 1 | Pump start | Pump stop |

**CAUTION**

- If the pump is frequently started and stopped by turning ON/OFF the power supply, the controller service life is shortened. To start/stop the pump, use the digital input signal (DI1) (except for an emergency case).

| NOTE | To run the hydraulic unit without using the digital input signal, set this parameter to "1". With this setting, the hydraulic unit automatically starts when the power supply is turned ON. |
|---|---|

### 11.2.5 [P25:BR_R], [P26:BR_W] Regenerative resistor setting

Normally, use these parameters at the default settings.
If a regenerative resistor is prepared by user, set the following parameters to define resistance and capacity of the regenerative resistor being used.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P25 | BR_R | Regenerative resistance value | 1–999 | Ω |
| P26 | BR_W | Regenerative resistance capacity | 0.01–99.9 | kW |

**CAUTION**

- Check specifications of the regenerative resistor connected to the controller, and set this parameter at a proper value. An improper setting of this parameter may result in abnormal heating of the regenerative register, or damage to the controller.
- To connect several regenerative resistors in parallel, select regenerative resistors so that all resistors provide equal resistance and capacity. Failure to observe this instruction may result in abnormal heating of the regenerative registers.
- Select regenerative resistors so that the resultant resistance of the regenerative resistors connected to the controller conforms to the default setting of the "P25: Regenerative resistance value" parameter. Failure to observe this instruction may result in damage to the controller. For details, refer to "10.4.2Setting mode".

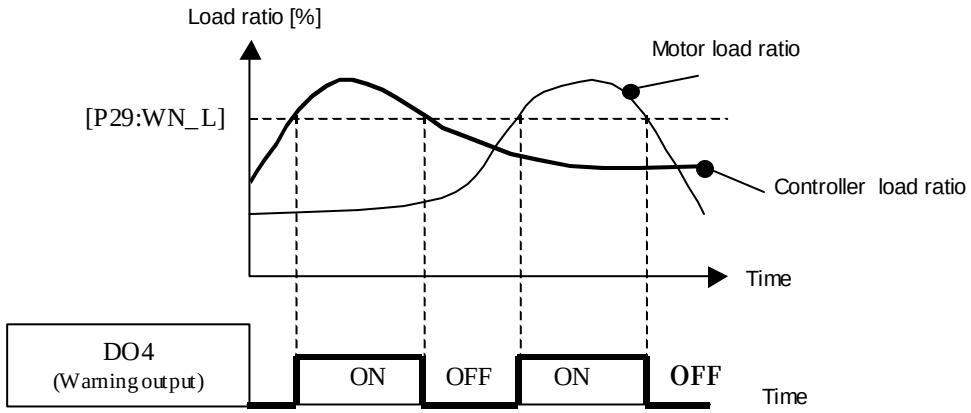
| IMPORTANT | ● Set the resultant resistance of the regenerative resistors connected to the controller.<br>(Example) When three resistors of 500 W and 30 Ω are connected in parallel:<br>Resultant resistance = 10 Ω $\left[ \frac{1}{\frac{1}{30[\Omega]}+\frac{1}{30[\Omega]}+\frac{1}{30[\Omega]}} = 10[\Omega] \right]$<br>Resultant capacity = 1.5 kW (500 W × 3 resistors in parallel = 1.5 kW)<br>Therefore, set [P25: BR_R] at "10 [W]", and set [P26: BR_W] at "1.50 [kW]".<br>● The setting of this parameter becomes active when the power supply is turned ON again. |
|---|---|

### 11.2.6 [P29:WN_L] Overload warning output judgment level

Specify a judgment value for “L49: Overload warning output”.
If a load value is judged as overload warning status, “L49: Overload warning” is indicated on the panel, and the digital output signal on the DO4 terminal is turned ON.

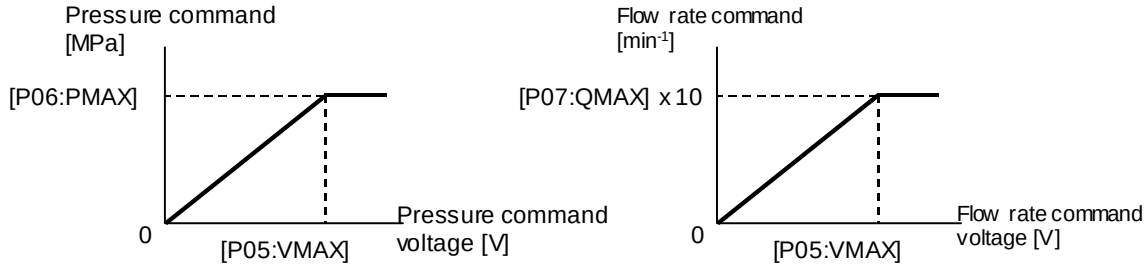
| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P29 | WN_L | Overload warning output judgment level | 0–120 | % |

* If the overload warning indication and output are not required, set this parameter at “120”.




## 11.3 Confirmation of linearity of command voltage Pi/Qi

When this hydraulic unit is used as a substitute for a proportional valve system, linearity may not be provided for the pressure/flow rate command voltage on the molding machine.
This hydraulic unit executes pressure/flow rate control in proportion to a command voltage value, as shown below:




Therefore, adjust the command value relative to each pressure/flow rate setting on the molding machine to ensure linearity, by referring to the table below:

◆ Example of command voltage adjustment value on molding machine

| Pressure/flow rate set value [%] | Voltage adjustment value [V] |
|---|---|
| 0 | 0.00±0.01 |
| 20 | 2.00±0.01 |
| 40 | 4.00±0.01 |
| 60 | 6.00±0.01 |
| 80 | 8.00±0.01 |
| 100 | 10.00±0.01 |

## 11.4 Pump Operation/Air Purge

1) Before operating this product, connect another pump and filter for flushing operation to the tank and piping circuit of the molding machine, to flush the tank and piping thoroughly (for at least two hours).
After flushing operation, check the filter element for a foreign object.

2) Replace the hydraulic oil with new oil, and fill the tank with a specified level of hydraulic oil. After completion of piping and electrical wiring, conduct a trial run of the SUT pump.
Check the electrical wiring with the connection diagram to ensure that the electrical parts (e.g. noise filter, DC reactor) are properly connected.

3) Turn ON the power supply for the molding machine, and make the pump ready for operation with the start/stop signal.
After setting the pressure command voltage (Pi) and flow rate command voltage (Qi) parameters to “0.0 V”, start the pump in the unload operation mode.
Check for abnormal sound during pump operation, and verify that the pressure increases to the unload pressure with the display of the controller panel.

4) Verify cooling air from the motor cooling fan. Because the cooling fan is the single-phase AC type, the fan rotates in a fixed direction.

5) Check hydraulic operations of the injection table forward/backward movement and the ejector operation.

6) Turn ON the solenoid valve, and set the pressure (Pi) to 1 to 2 MPa, and set the flow rate (Qi) to 10 to 20%.
While moving the injection table or ejector in the full stroke through “manual operation” under low pressure and at a low speed, check for an oil leak from the piping, and abnormal sound from the pump.
If hunting occurs in the middle of the injection table forward/backward movement, it may be caused by air contained in hydraulic oil, or the pump may be running in the pressure override range because of high load pressure. In this case, reduce the pressure setting (Pi) a little (to approx. 50% of PMAX), and check the operating condition while running the pump in the flow rate control mode.
While repeating the injection table forward/backward movement in the full stroke several times, release air from the circuit.

7) Verify that the molding machine enables injection and mold operation without resin.
In the same manner, operate each unit of the molding machine in the full stroke at the lowest pressure and speed (Pi and Qi: 20 to 30%) to release air from each cylinder and circuit. Also, check for a loose connection or oil leak in the piping, and correct a defective part.
If hunting occurs during operation, change the pressure setting so that it is higher than the specified load pressure to run the pump in the flow rate control mode.
If hunting persists even in the flow rate control mode, adjust the following parameters:
   - Reduce “P_P2” from the default setting.
   - Increase “P_I1” from the default setting.

   It is recommended that you should record the parameter settings before change.

8) Continue to operate each cylinder until air release from the circuit is completed.
Note that the “E17: Motor electronic thermal” alarm may be activated, if the pump is kept running in the high-pressure DH status for a specified time. If this alarm is activated, turn OFF the power supply once, and then turn it ON again, and run the pump in a condition that does not cause overload.

## 11.5 Management of parameters

When a machine equipped with the SUT series undergoes adjustment before shipment from the main machine manufacturer, and if a parameter setting is changed from the default value specified in “10.4.2 Setting mode default setting”, “10.5.2 “H” mode default setting”, the parameter data that has been changed by the machine manufacturer must be kept in record for the purpose of machine maintenance.
If a parameter change from the main machine manufacturer’ settings may cause a trouble, parameter change operation through the controller panel is prohibited by the following procedure:

- About “H20: Panel setting change lock”
  If “H20” (Panel setting change lock) is set to “1”, parameter change operation through the controller panel is prohibited. To unlock the parameter change lock status, set this parameter to “0”.
  For the “H20” parameter setting change procedure, refer to “10.5.3 Operation in the “H” mode”.

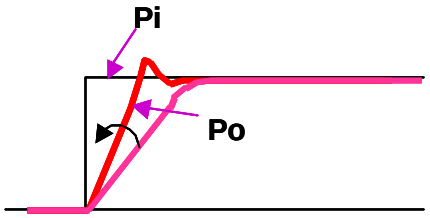
# Chapter 12 Gain Adjustment

To adjust response time and stability in pressure/flow rate control, set the parameters described in this chapter.

| | |
|---|---|
| IMPORTANT | ● Before changing a parameter, record a preset value. It is required when you restore the unit to the original condition in the middle of adjustment.<br>● After a parameter is changed, the changed value should be also kept in record. |

## 12.1 [P08: P_UG] Pressure Rising Gain

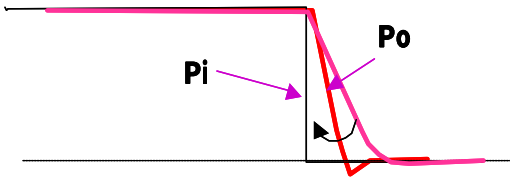
Adjust the control pressure (Po) rising response relative to rising of the pressure command signal (Pi).
If this parameter is set larger, the response time is shortened as shown on the right, but it easily results in overshoot.




| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P08 | P_UG | Pressure rising gain | 1–999 | – |

## 12.2 [P09: P_DG] Pressure Falling Gain

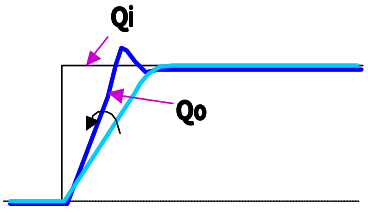
Adjust the control pressure (Po) falling response relative to falling of the pressure command signal (Pi).
If this parameter is set larger, the response time is shortened as shown on the right, but it easily results in undershoot.




| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P09 | P_DG | Pressure falling gain | 1–999 | – |

## 12.3 [P10: Q_UG] Flow Rate Rising Gain

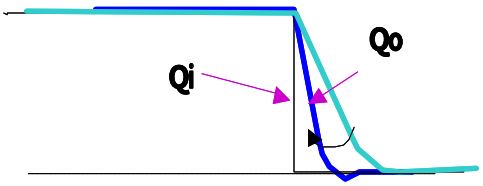
Adjust the control flow rate (Qo) rising response relative to rising of the flow rate command signal (Qi).
If this parameter is set larger, the response time is shorted as shown on the right, but it easily results in overshoot.




| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P10 | Q_UG | Flow Rate Rising Gain | 1–200 | – |

## 12.4 [P11: Q_DG] Flow Rate Falling Gain

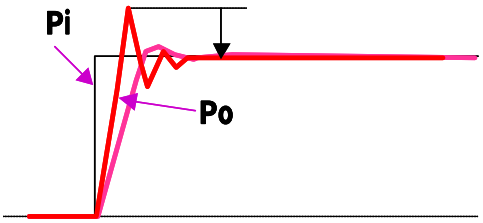
Adjust the control flow rate (Qo) falling response relative to falling of the flow rate command signal (Qi).
If this parameter is set larger, the response time is shorted as shown on the right, but it easily results in undershoot.




| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P11 | Q_DG | Flow Rate Falling Gain | 1–200 | – |

## 12.5 [P13: SC_G] Surge Pressure Reduction Gain

Reduce surge of control pressure (Po) relative to rising of the pressure command signal (Pi).
If this parameter is set larger, the surge pressure can be suppressed as shown on the right, but the response time becomes long.

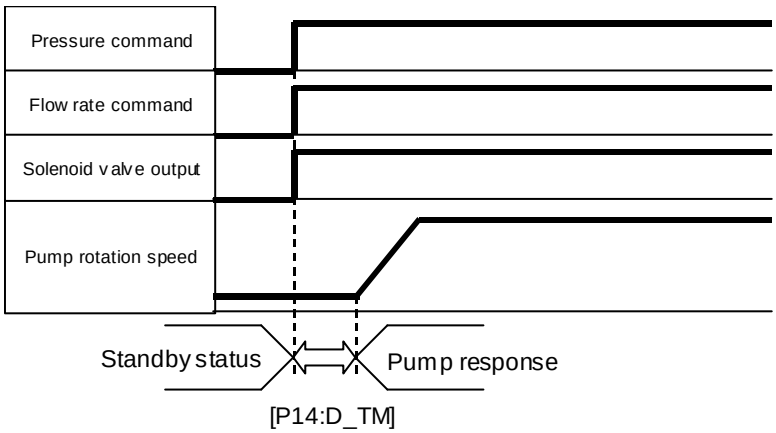



| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P13 | SC_G | Surge Pressure Reduction Gain | 0–999 | – |

## 12.6 [P14: D_TM] Delay time setting

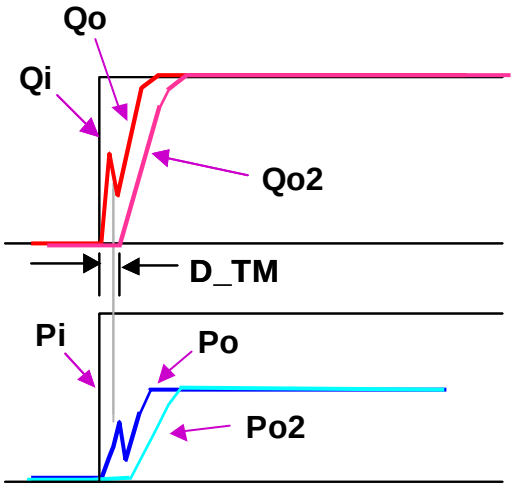
Setting this parameter can delay start of pump response when the pump starts up from the hydraulic unit standby status.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P14 | D_TM | Delay time setting | 0–100 | ms |



If the pump makes response upon rising of the command voltage from the standby status, the pump starts up before switching operation of the solenoid valve in the hydraulic circuit is completed. This may cause an abrupt change in pressure and flow rate, resulting in a shock as “Po” and “Qo” shown on the right.

Setting this parameter enables the pump to start up after the solenoid valve is completely switched, resulting in a smooth response waveform (shockless control) as “Po2” and “Qo2” shown in the right.

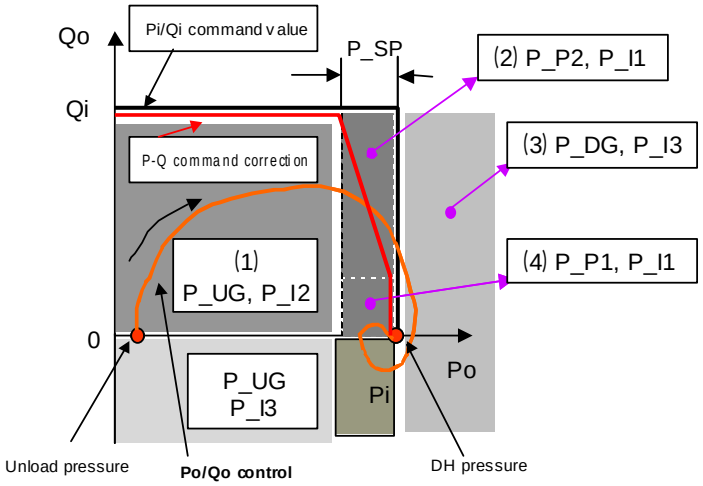



| NOTE | • This parameter is active only for response from standby status. |
|---|---|

## 12.7 Pressure Proportional Gain/Integral Time

### 12.7.1 Control response trace

The following chart plots trace of pressure and flow rate response until the hydraulic unit becomes pressure-holding status from standby status according to “Pi” and “Qi” command voltages.
When the load pressure “Po” reaches the value specified in “P24: P_SP” relative to “Pi” and “Qi” command values, the hydraulic unit decreases flow rate, and executes control so that “Po” and “Qo” become the target values, as shown below.



In each status, the hydraulic unit autonomously selects and changes the proportional gain and integral time according to the table below.

| Area No. | Status | Proportional gain | | Integral time | |
|---|---|---|---|---|---|
| | | No. | Code | No. | Code |
| (1) | Standby status → Acceleration | P08 | P_UG | P20 | P_I2 |
| (2) | (Pressure command value – "P24: Pressure cutoff") < Current pressure | P18 | P_P2 | P19 | P_I1 |
| (3) | Overshoot | P09 | P_DG | P21 | P_I3 |
| (4) | Pressure control mode | P17 | P_P1 | P19 | P_I1 |

| NOTE | • When selected proportional gain and integral time parameters are changed, the gain will be smoothly and continuously changed to prevent unstable operation.<br>• If the "P24: Pressure cutoff" setting is too small, pressure override occurs, resulting in unstable operation. |
|---|---|

## 12.7.2 [P17:P_P1],[P18:P_P2] Pressure Proportional Gain

Generally, as this parameter is set larger, the response is improved. However, if the set value is too large, overshoot or undershoot may occur.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P17 | P_P1 | Pressure proportional gain [for DH range] | 1–999 | – |
| P18 | P_P2 | Pressure proportional gain [for override range] | 1–999 | – |

## 12.7.3 [P19:P_I1],[P20:P_I2],[P21:P_I3] Pressure Integral Time

If this parameter is specified, the pump enables response even to a minute input. Generally, as this parameter is set smaller, the response is improved. However, if the set value is too small, overshoot or undershoot may occur.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P19 | P_I1 | Pressure integral time [for small pressure error] | 10–999 | – |
| P20 | P_I2 | Pressure integral time [for large positive pressure error] | 10–999 | – |
| P21 | P_I3 | Pressure integral time [for negative pressure error] | 10–999 | – |

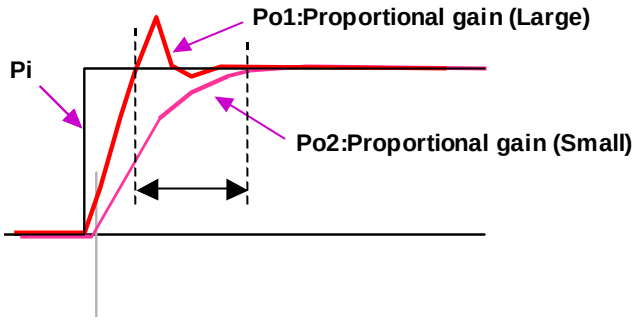
## 12.7.4 [P24:P_SP] Cutoff width

When the load pressure "Po" reaches the value specified in "P24: P_SP" relative to "Pi" and "Qi" command values, this hydraulic unit executes control so that flow rate gradually decreases.
If this parameter is set to a smaller value, operation in the pressure override range becomes unstable.

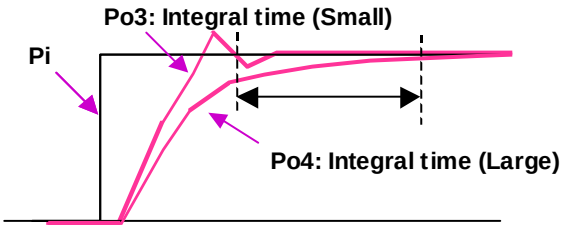
| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P24 | P_SP | Cutoff width | 0–100 | 0.1MPa |

## 12.8 Pressure Proportional Gain/Integral Time

According to the proportional gain setting, the hydraulic unit can adjust an amount of correction in proportion to a control error.
If the proportional gain parameter is set larger, the response time is shortened (as “Po1” in the figure), but surge pressure easily occurs.
If the proportional gain parameter is set smaller, surge pressure can be suppressed (as “Po2” in the figure), but the response time becomes longer.



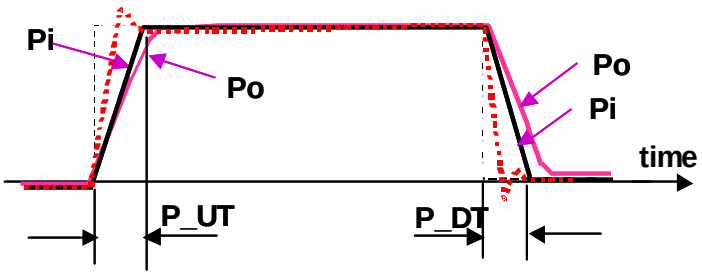

According to the integral time setting, the hydraulic unit can adjust an amount of correction by totalizing control errors in the specified time.
If the integral time parameter is set smaller, a quicker response is enabled relative to a control error (as “Po3” in the figure), but surge pressure easily occurs.
If the integral time parameter is set longer, surge pressure can be suppressed (as “Po4” in the figure), but the response time becomes longer.




As described above, when the proportional gain setting is large and the integral time setting is small, a response time relative to a command is shortened, but operating condition easily becomes unstable (e.g. hunting occurs.) because the amount of correction becomes large. While monitoring actual operating conditions, change the proportional gain and integral time settings, to adjust the response time and stability.

## 12.9 Pressure Rising Time Constant/Pressure Falling Time Constant

If the “Pressure rising time constant” and “Pressure falling time constant” parameters are specified, the internal pressure command and flow rate command can be changed in a ramp form relative to a command voltage change in a stepped form. This function can prevent overshoot and undershoot, and reduce shock during acceleration and during stop.




For the pressure rising time constant, specify a time required to increase a pressure command from “0” to “P06: PMAX”.
For the pressure falling time constant, specify a time required to decrease a pressure command from “P06: PMAX” to “0”.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P22 | P_UT | Pressure rising time constant | 0–200 | ms |
| P23 | P_DT | Pressure falling time constant | 0–200 | ms |

| NOTE | If high response is required, set the ramp response time of the molding machine to “0” before adjusting the above parameters. |
|---|---|

## 12.10 Speed Differential Gain

Differentiation of motor rotation speed provides damping effect, resulting in stable response.

Normally, this parameter should be retained as the default setting. User need not change the set value.
To change the default setting, adjust it in a range of approx. 10 to 20. Setting a larger value increases the speed differentiation effect.

| No. | Code | Name | Setting range | Unit |
|---|---|---|---|---|
| P16 | V_KD | Speed differential gain | 0–100 | – |

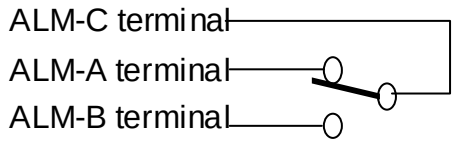
# Chapter 13 Maintenance and Inspection

## 13.1 Protective Functions

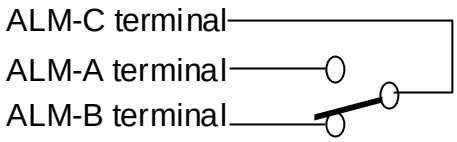
### 13.1.1 Description of alarms

If any of the protective functions is activated, the corresponding alarm is output, and the following alarm code is displayed on the LED display of the operation panel.
When an alarm is output, the pump stops. Depending on the condition, the contact output is switched as follows:

(Normal condition)




(During alarm output)




If any of the protective functions is activated, conduct inspections according to the table below to remove the cause of the alarm and take corrective actions.
To reset the alarm condition, perform the following procedure:

•Turn OFF the power supply once, and then turn it ON again.

| Alarm code | Name | Cause | Corrective action |
|---|---|---|---|
| E10 | Output device error<br><br>The output device overcurrent protection is activated. | The motor rotation speed is unstable due to contamination. | • Replace the motor pump and hydraulic oil. |
| | | The pump started in the reverse rotating direction due to return of load volume. | • Reduce the load volume.<br>• Review the startup timing. |
| | | The pump is running under vacuum due to excessive load of inertial, resulting in out-of-control condition. | • Review the hydraulic circuit.<br>• Reduce the load of inertial. |
| | | The pump or motor has been stuck up or locked. | • Replace the motor or the pump. |
| | | Short-circuit or ground fault of the motor | • Replace the motor. |
| | | Fault of the encoder | • Replace the motor. |
| | | Fault of the controller | • Replace the controller. |
| | | Operation error due to excessive noise | • Reduce ambient noise.<br>• Review the wiring.<br>• Insert a ferrite core. |
| E11 | Instantaneous overcurrent<br><br>The motor output current is higher than the specified value.<br><br>SUT00S / Specified value:<br>5021, 8018: 60Apeak<br>13018: 120Apeak<br>20018: 180Apeak | The motor rotation speed is unstable due to contamination. | • Replace the pump and hydraulic oil. |
| | | The pump started in the reverse rotating direction due to return of load volume. | • Reduce the load volume.<br>• Review the startup timing. |
| | | The pump is running under vacuum due to excessive load of inertial, resulting in out-of-control condition. | • Review the hydraulic circuit.<br>• Reduce the load of inertial. |
| | | The pump or motor has been stuck up or locked. | • Replace the motor or the pump. |

<table>
<tr><th>Alarm code</th><th>Name</th><th>Cause</th><th>Corrective action</th></tr>
<tr><td></td><td></td><td>Short-circuit or ground fault of the motor</td><td>• Replace the motor.</td></tr>
<tr><td></td><td></td><td>Fault of the encoder</td><td>• Replace the motor.</td></tr>
<tr><td></td><td></td><td>Fault of the controller</td><td>• Replace the controller.</td></tr>
<tr><td></td><td></td><td>Operation error due to excessive noise</td><td>• Reduce ambient noise.<br>• Review the wiring.<br>• Insert a ferrite core.</td></tr>
<tr><td>E12</td><td>Overspeed<br><br>The motor rotation speed is higher than the specified value (120% of the maximum rotation speed).<br><br><table><tr><th>SUT00S</th><th>Specified value</th></tr><tr><td>5021</td><td rowspan="2">3240min$^{-1}$</td></tr><tr><td>8018</td></tr><tr><td>13018</td><td rowspan="2">3720min$^{-1}$</td></tr><tr><td>20018</td></tr></table></td><td>The pump is running in the reverse rotating direction at high speed due to return of load volume.</td><td>• Reduce the load volume.</td></tr>
<tr><td></td><td></td><td>The pump is running under vacuum at high speed due to excessive load of inertial.</td><td>• Review the hydraulic circuit.<br>• Reduce the load of inertial.</td></tr>
<tr><td></td><td></td><td>Fault of the encoder</td><td>• Replace the motor.</td></tr>
<tr><td>E13</td><td>Regenerative brake overcurrent<br><br>The regenerative current is higher than the specified value.</td><td>The regenerative resistor is short-circuited.</td><td>• Replace the regenerative resistor.</td></tr>
<tr><td></td><td></td><td>The regenerative resistor’s resistance is too small.</td><td>• Check the resistance of the regenerative resistor.</td></tr>
<tr><td></td><td></td><td>Regenerative energy of the motor is too large.</td><td>• Extend the acceleration/deceleration time.<br>• Reduce the load.</td></tr>
<tr><td>E14</td><td>Regenerative brake overload<br><br>The regenerative resistor’s overload protection is activated.<br>The overload protection is activated at elapse of a specified time after “n09: Regenerative load ratio” exceeds the specified value (25%).</td><td>The regenerative energy is too large relative to the capacity of the regenerative resistor connected.</td><td>• Review the capacity of the regenerative resistor.<br>• Extend the acceleration/deceleration time.<br>• Reduce the load.<br>• Review the operation cycle.</td></tr>
<tr><td></td><td></td><td>Incorrect setting of “P25: Regenerative resistance value” or “P26: Regenerative resistance capacity”</td><td>• Check the set value.</td></tr>
<tr><td></td><td></td><td>The power feed voltage is too high.</td><td>• Measure the power feed voltage, and set the voltage in the specified range.</td></tr>
<tr><td>E15</td><td>Undervoltage<br><br>The main circuit DC voltage is lower than the specified value (under any of the following conditions).</td><td>The power supply voltage is low.</td><td>• Set the power supply voltage at the specified value.</td></tr>
<tr><td></td><td></td><td>Fault of the controller</td><td>• Replace the controller.</td></tr>
</table>

| Alarm code | Name | Cause | Corrective action |
|---|---|---|---|
| | | | |

| Specified value | Power supply voltage conversion value |
|---|---|
| 330 VDC or less: 21 ms<br>300 VDC or less: Instantaneously | 233 VAC or less<br>212 VAC or less |

■ Models with "SUT00S8018-20YA" software revision No. "28" or smaller number
Relevant models are detected under the following conditions. For details of the software revision information, refer to "3.1.2 Manufacturing No.".

| Specified value | Power supply voltage conversion value |
|---|---|
| 380 VDC or less: 21 ms<br>300 VDC or less: Instantaneously | 269 VAC or less<br>212 VAC or less |

| Alarm code | Name | Cause | Corrective action |
|---|---|---|---|
| E16 | Overvoltage<br><br>The main circuit DC voltage is higher than the specified value of 800 VDC (power supply voltage conversion: 566 VAC). | The power supply voltage is high. | • Set the power supply voltage at the specified value. |
| | | No connection or incorrect connection of regenerative resistor, or large resistance | • Connect a regenerative resistor.<br>• Review the wiring. |
| | | Increased regenerative power due to rapid deceleration | • Extend the deceleration time.<br>• Reduce the load of inertial. |
| E17 | Motor electronic thermal<br><br>The motor overload protection is activated due to electronic thermal error.<br>The motor overload protection is activated when "n11: Motor electronic thermal load ratio" exceeds the specified value (110%). | The operation duty ratio is high. | • Extend the stop time.<br>• Review the operation duty ratio.<br>• Extend the acceleration/deceleration time. |
| | | The load pressure is high. | • Review the hydraulic circuit. |
| | | Increased leak in the hydraulic circuit | • Check for an external leak in hydraulic piping, etc.<br>• Conduct cylinder maintenance. (Replace the packing, etc.)<br>• Replace the cylinder. |
| | | Increased current due to pump stuck-up | • Replace the pump. |
| | | Fault of the encoder | • Replace the motor. |
| E18 | Magnetic pole detection error<br><br>Magnetic pole detection is not completed within the specified time. | Stuck-up pump | • Replace the pump and hydraulic oil. |
| | | Incorrect wiring of the motor | • Review the wiring. |
| | | Incorrect wiring of the encoder | |
| | | Fault of the encoder | • Replace the motor |
| | | Fault of the motor | |
| | | Fault of the controller | • Replace the controller. |
| E20 | Encoder wiring disconnection<br><br>The encoder wiring is disconnected. | Disconnection of encoder wiring | • Review the wiring. |
| | | Fault of the encoder | • Replace the motor. |
| | | Fault of the motor | |
| | | Fault of the controller | • Replace the controller. |
| E21 | Motor wiring disconnection<br><br>The motor wiring is disconnected. | Disconnection or incorrect wiring of the motor | • Review the wiring. |
| | | Fault of the output device | • Replace the controller. |
| E24 | Power supply open phase<br><br>The power supply, U, V or W phase is open. | Disconnection or contact failure of the power supply wiring | • Check the power supply wiring. |
| E27 | Controller electronic thermal | The operation duty ratio is high. | • Extend the stop time.<br>• Review the operation duty ratio. |

<table>
<tr><th>Alarm code</th><th>Name</th><th>Cause</th><th>Corrective action</th></tr>
<tr><td></td><td>The controller overload protection is activated due to electronic thermal error.<br>The controller overload protection is activated when “n12: Controller electronic thermal load ratio” exceeds the specified value (120%).</td><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td rowspan="3">E28</td><td rowspan="3">Short-time over rating<br><br>Overload protection is activated because short-time operation rating is exceeded.</td><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td>Increased leak in the hydraulic circuit</td><td>• Check for an external leak in hydraulic piping, etc.<br>• Conduct cylinder maintenance. (Replace the packing, etc.)<br>• Replace the cylinder.</td></tr>
<tr><td rowspan="4">E30</td><td rowspan="4">Pressure sensor error<br><br>The pump pressure sensor is disconnected or short-circuited, or abnormal pressure is detected.</td><td>Incorrect wiring of the pressure sensor harness</td><td>• Check the wiring.</td></tr>
<tr><td>Disconnection, short-circuit or contact failure of the pressure sensor harness</td><td>• Check the pressure sensor harness.<br>• Replace the pressure sensor harness.</td></tr>
<tr><td>Detection of abnormal pressure</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td>Fault of the pressure sensor</td><td>• Replace the pressure sensor.</td></tr>
<tr><td rowspan="2">E31</td><td rowspan="2">Motor startup error<br><br>The motor rotating direction is different from the command for 2 seconds or longer.</td><td>Incorrect connections of the U, V, and W phases of the motor wiring</td><td>• Check the motor wiring.</td></tr>
<tr><td>“P15: Bias pressure” is set at “0”, and the command from the main machine is “0”.</td><td>• Adjust the setting of “P15: Bias pressure”.<br>• Set a bias pressure with the main machine.</td></tr>
<tr><td rowspan="4">E40</td><td rowspan="4">Motor thermistor wiring disconnection/short-circuit<br><br>The motor thermistor is disconnected or short-circuited.</td><td>Incorrect wiring of the motor thermistor</td><td rowspan="3">• Review the wiring.</td></tr>
<tr><td>Disconnection or short-circuit of the motor thermistor wiring</td></tr>
<tr><td>Contact failure of the motor thermistor wiring</td></tr>
<tr><td>Fault of the motor thermistor</td><td>• Replace the motor.</td></tr>
<tr><td rowspan="5">E41</td><td rowspan="5">Motor temperature rise error<br><br>The motor temperature is higher than the specified value for 2 seconds or longer.<br><br><table><tr><th>SUT00S</th><th>Specified value</th></tr><tr><td>5021</td><td rowspan="2">145°C</td></tr><tr><td>8018</td></tr><tr><td>13018</td><td rowspan="2">140°C</td></tr><tr><td>20018</td></tr></table></td><td>The motor cooling fan has stopped.</td><td>• Check the fan power supply connection.<br>• Replace the motor cooling fan.</td></tr>
<tr><td>The ambient temperature is high.</td><td>• Install the unit in a place where ambient temperature is within the specified range.<br>• Install the unit in a well-ventilated place.</td></tr>
<tr><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">E42</td><td rowspan="2">Radiator fin thermistor disconnection<br><br>The radiator fin thermistor is disconnected or short-circuited</td><td>Disconnection or short-circuit of the radiator fin thermistor wiring</td><td rowspan="2">• Replace the controller.</td></tr>
<tr><td>Contact failure of the radiator fin thermistor wiring.</td></tr>
</table>

<table>
<tr><th>Alarm code</th><th>Name</th><th>Cause</th><th>Corrective action</th></tr>
<tr><td rowspan="4">E43</td><td rowspan="4">Radiator fin temperature rise error<br><br>The radiator fin temperature is higher than the specified value for 30 seconds or longer.<br><br><table><tr><th>SUT00</th><th>Specified value</th></tr><tr><td>5021</td><td rowspan="3">75°C</td></tr><tr><td>8018</td></tr><tr><td>13018</td></tr><tr><td>20018</td><td>85°C</td></tr></table></td><td>The ambient temperature is high.</td><td>• Install the unit in a place where ambient temperature is within the specified range.<br>• Install the unit in a well-ventilated place.</td></tr>
<tr><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td></td><td></td></tr>
<tr><td rowspan="2">E64</td><td rowspan="2">Dry operation error<br><br>The pump started with a low oil level.</td><td>The oil level is low.</td><td>• Refill hydraulic oil.</td></tr>
<tr><td>Air release failure</td><td>• Release air.</td></tr>
</table>

## 13.1.2 Description of warnings

When a warning condition occurs, the following warning code appears on the LED display of the operation panel.
At occurrence of a warning condition indicated with (*) in the table below, “DO4: Digital output 4” turns ON. When the warning condition is reset, DO4 turns OFF.

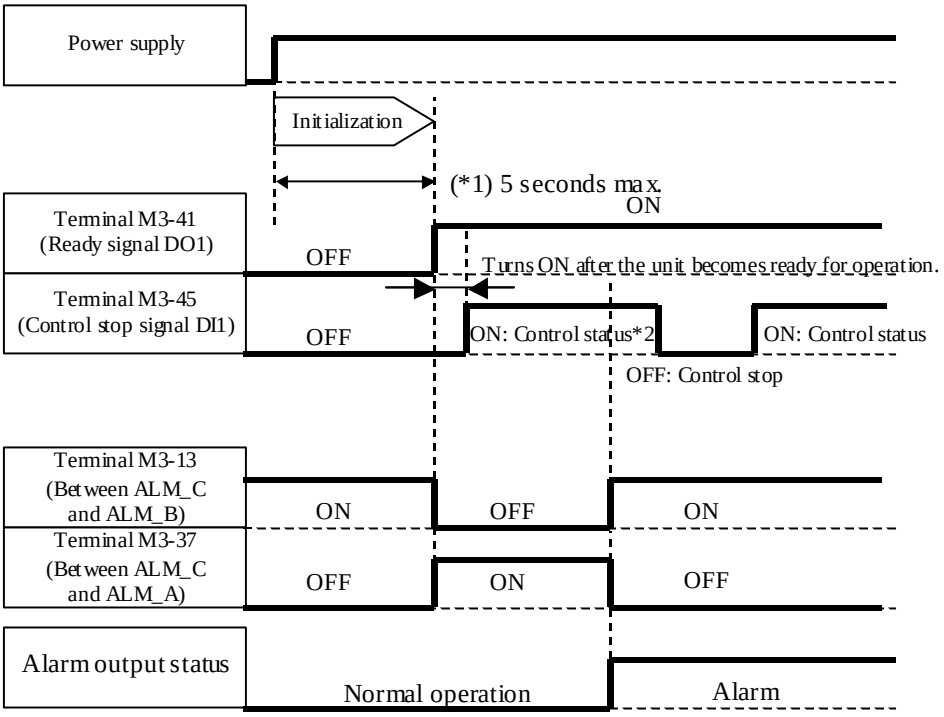
| | |
|---|---|
| IMPORTANT | If you keep operating the unit regardless of a warning condition, the protective function is activated to output an alarm. |

<table>
<tr><th>Warning code</th><th>Name</th><th>Cause</th><th>Corrective action</th></tr>
<tr><td rowspan="4">L44</td><td rowspan="4">Motor temperature abnormal warning<br><br>The motor temperature is higher than the specified value.<br><br><table><tr><th>SUT00S</th><th>Specified value</th></tr><tr><td>5021</td><td rowspan="2">143°C-2sec</td></tr><tr><td>8018</td></tr><tr><td>13018</td><td rowspan="2">138°C-2sec</td></tr><tr><td>20018</td></tr></table></td><td>The motor cooling fan has stopped.</td><td>• Check the wiring.<br>• Replace the motor cooling fan.</td></tr>
<tr><td>The ambient temperature is high.</td><td>• Install the unit in a place where ambient temperature is within the specified range.<br>• Install the unit in a well-ventilated place.</td></tr>
<tr><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
</table>

<table>
<tr><th>Warning code</th><th>Name</th><th>Cause</th><th>Corrective action</th></tr>
<tr><td rowspan="3">L45</td><td rowspan="3">Radiator fin temperature abnormal warning<br><br>The radiator fin temperature is higher than the specified value<br><br><table><tr><th>SUT00</th><th>Specified value</th></tr><tr><td>5021</td><td rowspan="3">73°C-10sec</td></tr><tr><td>8018</td></tr><tr><td>13018</td></tr><tr><td>20018</td><td>83°C-10sec</td></tr></table></td><td>The ambient temperature is high.</td><td>• Install the unit in a place where ambient temperature is within the specified range.<br>• Install the unit in a well-ventilated place.</td></tr>
<tr><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The load pressure is high.</td><td>• Review the hydraulic circuit.</td></tr>
<tr><td rowspan="2">L49</td><td rowspan="2">Overload warning<br><br>“n11: Motor electronic thermal load ratio” or “n12: Controller electronic thermal load ratio” is higher than “P29: Overload warning output judgment level”.</td><td>The operation duty ratio is high.</td><td>• Extend the stop time.<br>• Review the operation duty ratio.</td></tr>
<tr><td>The “P29: Overload warning output judgment level” setting is low.</td><td>• Review the parameter setting.</td></tr>
<tr><td rowspan="2">L50</td><td rowspan="2">Power supply voltage drop warning<br>The main circuit DC voltage is lower than the specified value (430 VDC, Power supply voltage conversion: 304 VAC, for 2 seconds).</td><td>The power supply voltage is low.</td><td>• Set the power supply voltage at the specified value.</td></tr>
<tr><td>Fault of the controller</td><td>• Replace the controller.</td></tr>
<tr><td rowspan="2">L60</td><td rowspan="2">Rressure error warning<br><br>Control pressure cannot increase to a target pressure due to low output torque, resulting in current command saturation.</td><td>The power supply voltage is low.</td><td>• Set the power supply voltage at the specified value.</td></tr>
<tr><td>Fault of the encoder</td><td>• Replace the controller.</td></tr>
</table>

## 13.2 Contact Output at Power-ON

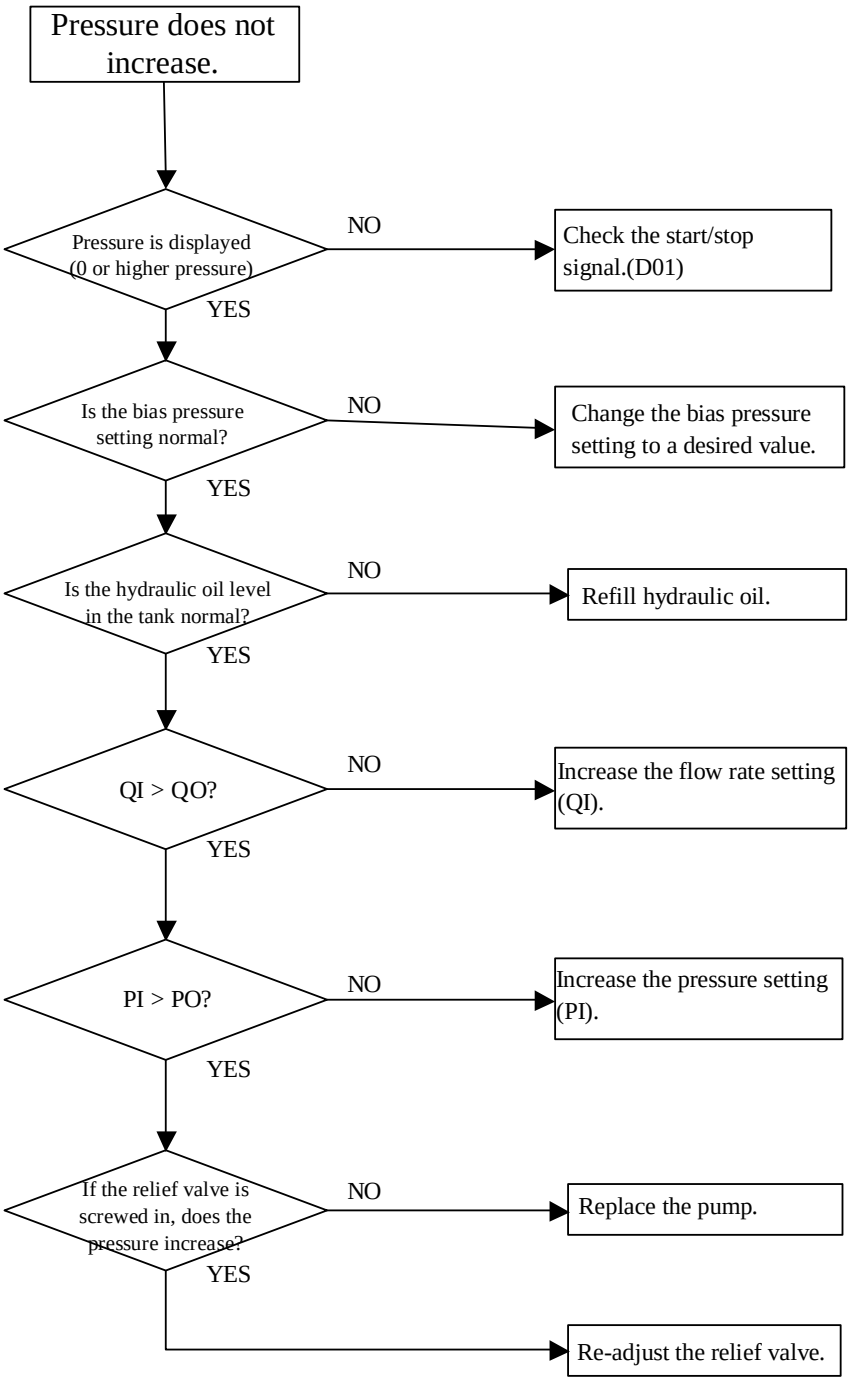
When the power supply is turned ON, the contact output is as follows:
Prepare such a sequence that the main machine does not detect an alarm condition until initialization is completed after the power supply is turned ON.

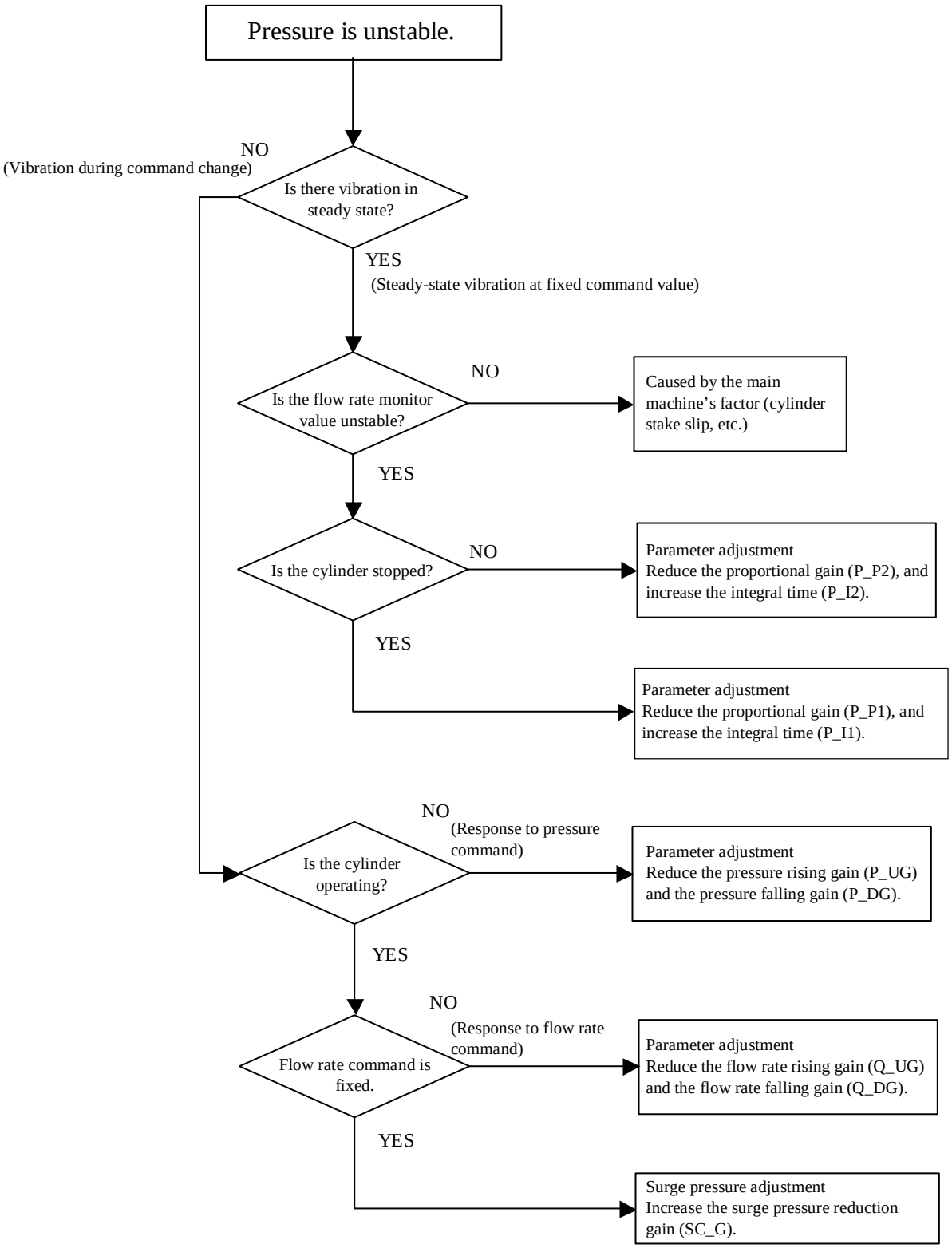


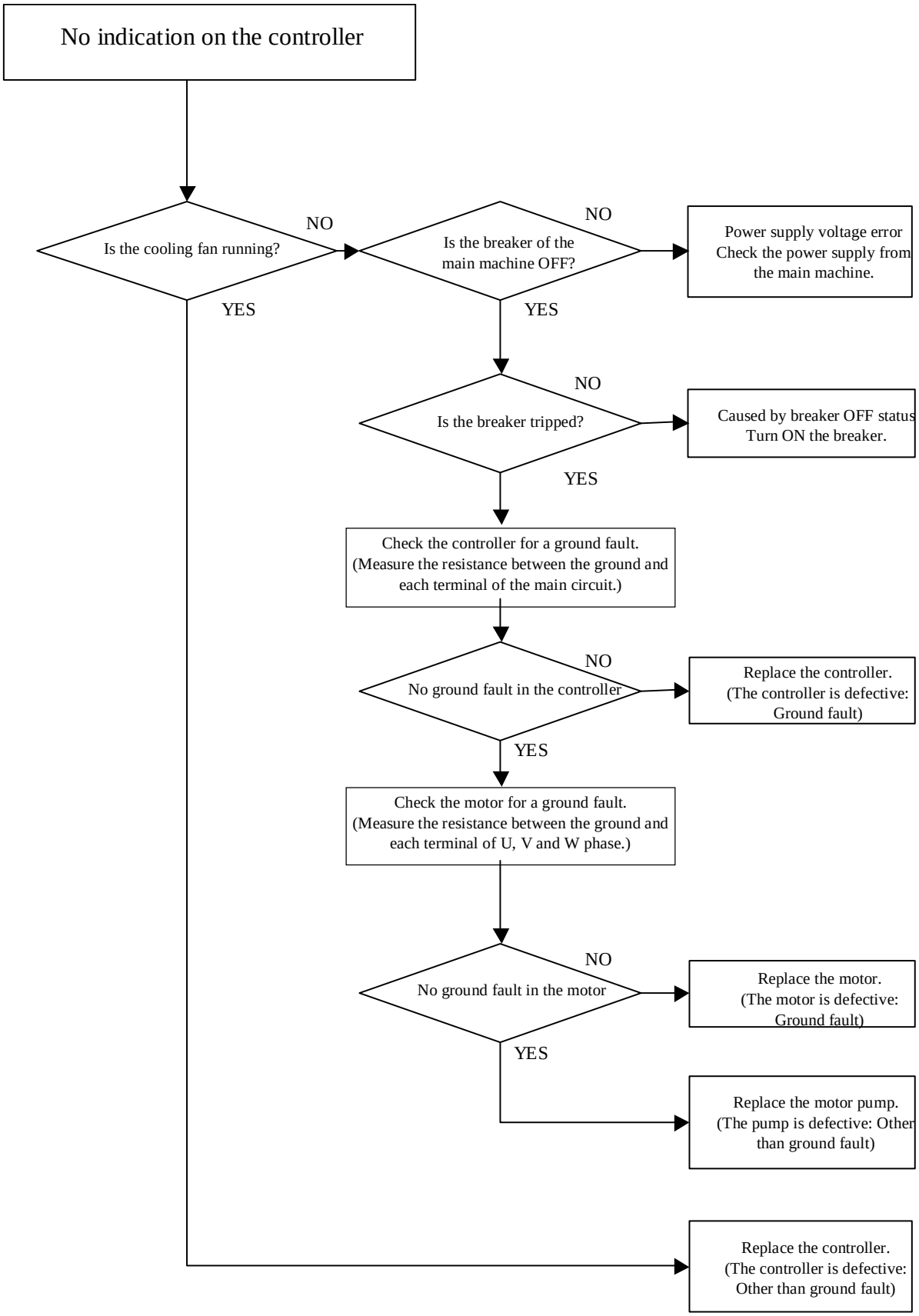

*1. Initialization time at ambient temperature of approx. 15°C.
When the ambient temperature is lower than 15°C, the system increases the initialization time (up to 15 seconds, when the ambient temperature is 0°C).

*2. The above example shows control stop signal ON/OFF status in a case where the “P00” (Start/stop signal switching) parameter is set at “0”. To start/stop the unit with the control stop signal, input the signal after the ready signal turns ON. With a system combining two or more units, the main unit should be set in control status first, and then the sub unit should be set in control status.

### 13.2.1 Troubleshooting




Pressure is unstable.
NO
(Vibration during command change)
Is there vibration in steady state?
YES
(Steady-state vibration at fixed command value)
Is the flow rate monitor value unstable?
NO
Caused by the main machine's factor (cylinder stake slip, etc.)
YES
Is the cylinder stopped?
NO
Parameter adjustment
Reduce the proportional gain (P_P2), and increase the integral time (P_I2).
YES
Parameter adjustment
Reduce the proportional gain (P_P1), and increase the integral time (P_I1).
NO
(Response to pressure command)
Is the cylinder operating?
Parameter adjustment
Reduce the pressure rising gain (P_UG) and the pressure falling gain (P_DG).
YES
NO
(Response to flow rate command)
Flow rate command is fixed.
Parameter adjustment
Reduce the flow rate rising gain (Q_UG) and the flow rate falling gain (Q_DG).
YES
Surge pressure adjustment
Increase the surge pressure reduction gain (SC_G).


No indication on the controller
Is the cooling fan running?
NO
YES
Is the breaker of the main machine OFF?
NO
YES
Power supply voltage error
Check the power supply from the main machine.
Is the breaker tripped?
NO
YES
Caused by breaker OFF status
Turn ON the breaker.
Check the controller for a ground fault.
(Measure the resistance between the ground and each terminal of the main circuit.)
No ground fault in the controller
NO
YES
Replace the controller.
(The controller is defective: Ground fault)
Check the motor for a ground fault.
(Measure the resistance between the ground and each terminal of U, V and W phase.)
No ground fault in the motor
NO
YES
Replace the motor.
(The motor is defective: Ground fault)
Replace the motor pump.
(The pump is defective: Other than ground fault)
Replace the controller.
(The controller is defective: Other than ground fault)

## 13.3 Periodic Inspection

**CAUTION**

- To conduct inspection work, wear protective goggles and globes, and turn OFF the power supply.
- During air blowing, be careful that foreign objects will not touch your eyes.
  When disassembling the unit, be careful about oil running out of the piping. Before inspection, make sure that there is no residual pressure in the piping.
  If hydraulic oil remaining in the cylinder and piping returns to the tank, it may overflow out of the tank. Do not return hydraulic oil from the cylinder into the tank. Collect the hydraulic oil separately with an oil pan etc.
- Check for abnormal sound, abnormal vibration or abnormal heating from the product.

| Inspection part/item | Inspection cycle | Inspection method |
|---|---|---|
| ◆ Hydraulic oil | | |
| • Oil level check | • Occasionally | • Make sure that hydraulic oil is filled to the specified level. Check for whitish muddiness and air bubbles in hydraulic oil. |
| • Oil temperature check | • Occasionally | • Make sure that the oil temperature is 60°C or lower. (Normally, the hydraulic oil operating temperature range is 15 to 50°C.) |
| • Oil color check | • Semiannually | • Deterioration of hydraulic oil can be checked by color. If hydraulic oil turns brownish (ASTM level L4: bright yellow), replace the oil. |
| | | * For specifications of hydraulic oil, see "3.2 Specifications". |
| ◆ Motor cooling fan | • Monthly | • Check if the cooling fan is normally rotating. Check for dust in the fan. |
| ◆ Motor body | • Monthly | • If the fan is clogged with much dust, cooling effect deteriorates. Clean the fan. |
| | | • Check if the ambient temperature is not too high. |
| ◆ Controller | • Monthly | • Check for dust in the air inlet port at the bottom of the controller.<br>• Check for dust in the cooling fan at the top of the controller.<br>• Check if the ambient temperature is not too high. |
| ◆ Electrical wiring | • Semiannually | • Check the cable sheath for a crack or damage.<br>• Measure the insulation resistance to check for insulation resistance reduction.<br>• Make sure that the ground cable is securely connected. |
| ◆ Gear pump | • Occasionally | • If oil leaks from the oil seal, replace the pump. The leak oil will be drained through the oil groove on the motor side. Check for oil leak. |
| ◆ Screws and pipes | • Occasionally | • Check screws and pipes for looseness and oil leak. |
| ◆ Hoses | • Occasionally | • Check hoses for a crack, damage or flaw. |

- During operation, be careful not to access or touch a rotating part (e.g. motor cooling fan).
- To access inside of the controller, observe the following procedure to prevent electric shock.
  1) Turn OFF the main power supply for the controller. Turn OFF the power supply breaker for all power supply circuits of the molding machine. To ensure safety, post an "Do Not Operate (During Maintenance)" sign on the power supply breaker, so that the unit will not be accidentally operated during maintenance.

2) Before you access terminals, wait for at least 5 minutes after turning OFF the controller power supply. The controller uses a large-capacitance capacitor. If you work with the capacitor charged, you may get electric shock. Be sure to leave the controller for 5 minutes or longer (to discharge electricity from the capacitor) before you touch or disconnect the terminals.
3) To restart the unit, mount all covers to the live parts (terminals in the controller, etc.) before turning ON the power supply.

## 13.4 Cleaning and Replacement

### 13.4.1 Replacement of oil

Replace hydraulic oil periodically. If the oil is used without replacement for a long period, it will adversely affect operation and service life of the hydraulic equipment and pump.

### 13.4.2 Cleaning of motor cooling fan

Check rotation of the motor cooling fan and the controller cooling fan. Periodically clear dust off the covers and fan surfaces.

### 13.4.3 Replacement of the controller

The controller parameters may have been changed from the default settings for the purpose of response gain adjustment and so on. In this case, when the controller is replaced with a spare, the controller's parameter settings are different from those of the original controller, so that the molding machine will not be restored to the original condition. The default parameter settings of the molding machine should be kept by the user. After replacement of the controller, change the parameters to the original settings.
Note: Parameters "H21" to "H28" are specific to each controller. Do not change these parameters of a new controller.
The parameters of flow rate correction ratio "H15" (Q_EV), pressure sensor gain "H30" (PS_G) and flow rate command scaling value "P07" (QMAX) have been set for operation with a pair of pump and controller before shipment. Therefore, these parameters are not matched with those of the spare controller. You must register the original controller's "H15" (Q_EV), "H30" (PS_G) and "P07" (QMAX) settings in the new controller after replacement.

### 13.4.4 Replacement of the pressure sensor

After the pressure sensor of the pump unit is replaced, the pressure sensor gain setting should be changed with the "H30" (PS_G) parameter.

1) In the pressure control mode, set "Pi" at "10.0 V" (= PMAX) or a highest allowable pressure value.
2) While checking the control pressure with a pressure gauge (high-precision pressure gauge), adjust the "H30" parameter so that the control pressure becomes equal to PMAX or the specified pressure value.
3) For pressure sensor zero-point adjustment, turn OFF the controller power supply, and after confirming pressure reduction, turn ON the power supply again. Then, the pressure sensor zero point will be automatically corrected. Perform this procedure before pressure gain adjustment.

### 13.4.5 Replacement of the pump

After replacement of the pump, the settings of flow rate correction ratio “H15” (Q_EV) and flow rate command scaling value “P07” (QMAX) should be changed.

- If a pressure increase error occurs with the small flow rate setting after pump replacement, re-adjust the flow rate correction ratio “H15” (Q_EV).
  1) Run the unit in the pressure control mode for (injection) cylinder end.
  2) Enter “10 V” (99.9%) for the pressure command, and enter “0.05 V” [0.1 V] (1%) for the flow rate command.
  3) Adjust the “H15” (Q_EV) parameter so that the pressure increases to the maximum value (PMAX) with the pressure gauge.
- If a speed error (overspeed or underspeed error) occurs with the maximum flow rate setting after pump replacement, re-adjust the flow rate command scaling value “P07” (QMAX).
  1) While running the main machine in the measurement mode, perform the following adjustment.
  2) Enter “10 V” (99.9%) for the pressure command.
  3) Increase the flow rate command, and run the measurement motor.
  4) While monitoring the “n04 (Qo)” value in the monitor mode, make sure that the monitor value conforms to the flow rate command voltage.
     (Make sure that the monitor value is not in the power control range or override range.)
  5) Adjust the “P07” (QMAX) parameter so that the flow rate value based on the measurement motor rotation speed is equal to the original value before replacement.

## 13.5 Safety Valve Adjustment

The safety valves mounted to this hydraulic unit have been factory-set at the following value:

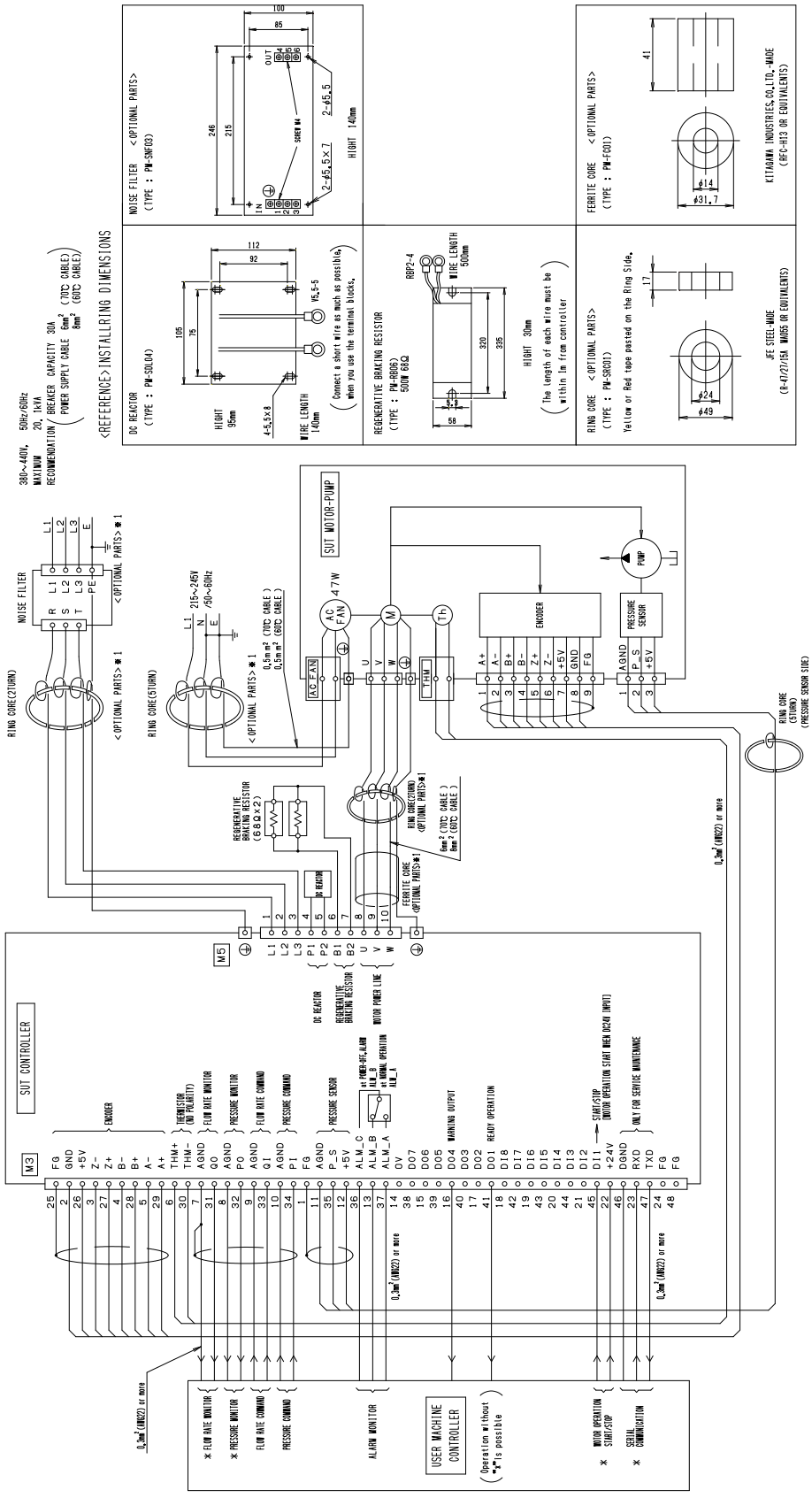
| Unit model | SUT00S8018,SUT00S13018<br>SUT00S20018 | SUT00S5021 |
|---|---|---|
| Safety valve default setting | 19 | 21 |

The safety valves mounted to this hydraulic unit have been set at the above pressure before shipment. However, the safety valve pressure setting may decrease during long-term repeated operations of a machine, and because of contaminant in hydraulic oil. If the hydraulic unit is continuously used with the safety valve activated, it may output alarm due to a temperature rise and so on. In this case, re-adjust the pressure setting of the safety valves by following the procedure below:

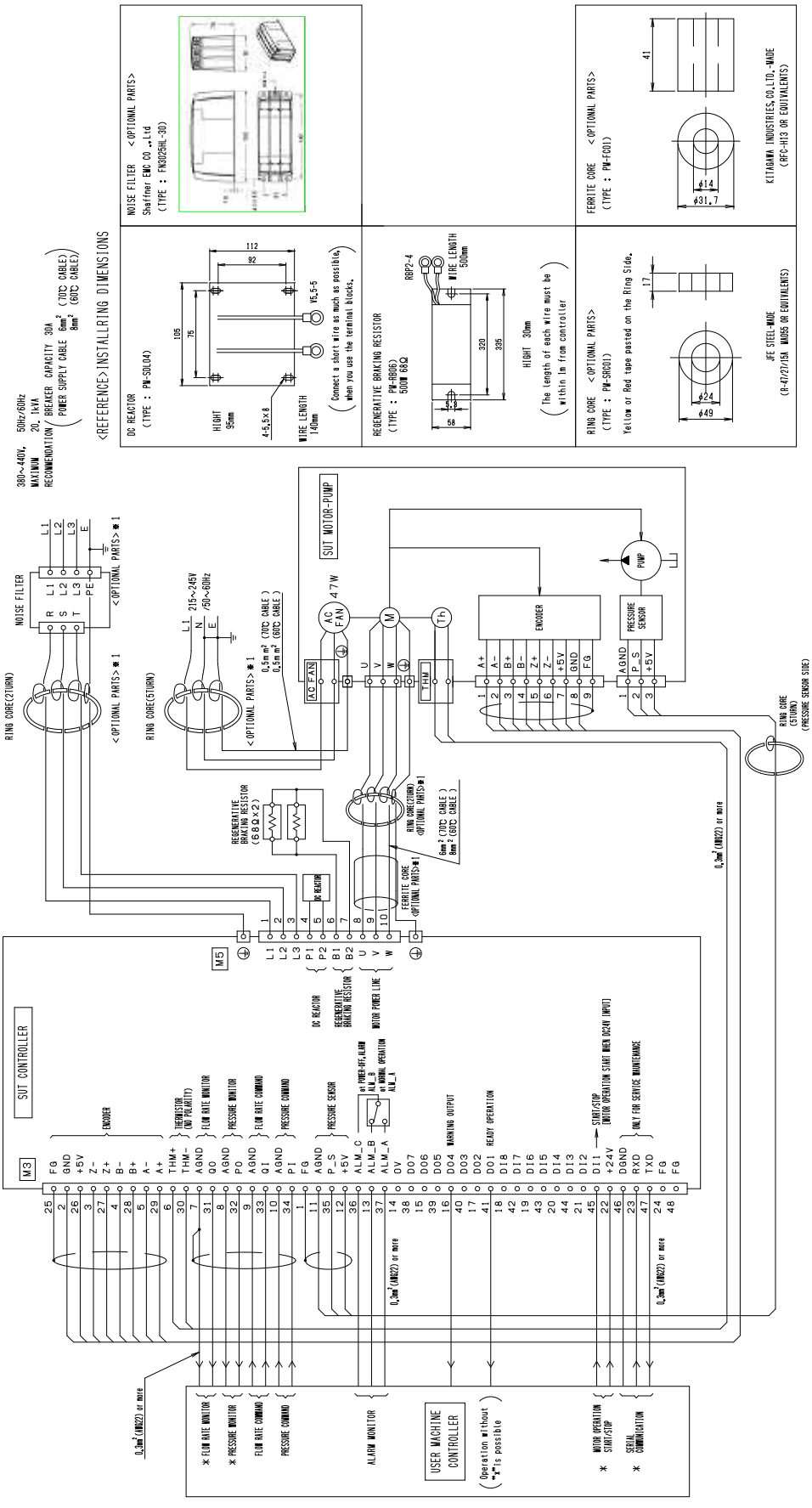
1. Select a process in which the hydraulic unit is to be under pressure control (pressure holding status etc.).
2. Set the pressure and flow rate command values at “Pi = PMAX” and “Qi = QMAX × 10%”.
3. Loosen the pressure adjusting screw of the safety valve so that the control pressure becomes lower than PMAX (maximum control pressure) by 2 MPa. If the safety valve is activated: If the safety valve is activated for a long period, the hydraulic unit outputs an alarm to stop operation. (Set the pressure and flow rate command values to “0” within 20 seconds.)
4. The pressure increase rate of the safety valve pressure adjusting screw is 4 MPa/180°. (A half turn of the safety valve pressure adjusting screw corresponds to 4 MPa pressure rise.) Therefore, if the safety valve pressure adjusting screw is turned clockwise by a half turn from the setting condition of the above step 3, the control pressure increases by 4 MPa, resulting in the safety valve pressure setting of “PMAX control pressure + 2 MPa”. In this step, “Pi” and “Qi” should be 0 V (the hydraulic unit is in standby status). If adjustment is conducted for a long time with the hydraulic unit operated at high pressure, overload alarm may be output.
5. In pressure holding status, execute pressure control with the “Pi = PMAX” and “Qi = QMAX x 30%” setting conditions, and check the Qo value in the monitor mode of the display. If the Qo value is 0.3 V or lower (indicating that the unit is in pressure control status without activating the safety valve), you can ensure that the safety valve is not activated in pressure control status. (If the safety valve is activated, the Qo monitor voltage exceeds 0.3 V). If there is much leak in a molding machine circuit, the Qo monitor voltage becomes large in pressure control status. This means that the pump is running to compensate for the leak volume and hold the circuit pressure. In case where the Qo monitor voltage is extremely large, it is necessary to check for a leak in the circuit and repair it as required.

# Chapter 14 Connection Diagram

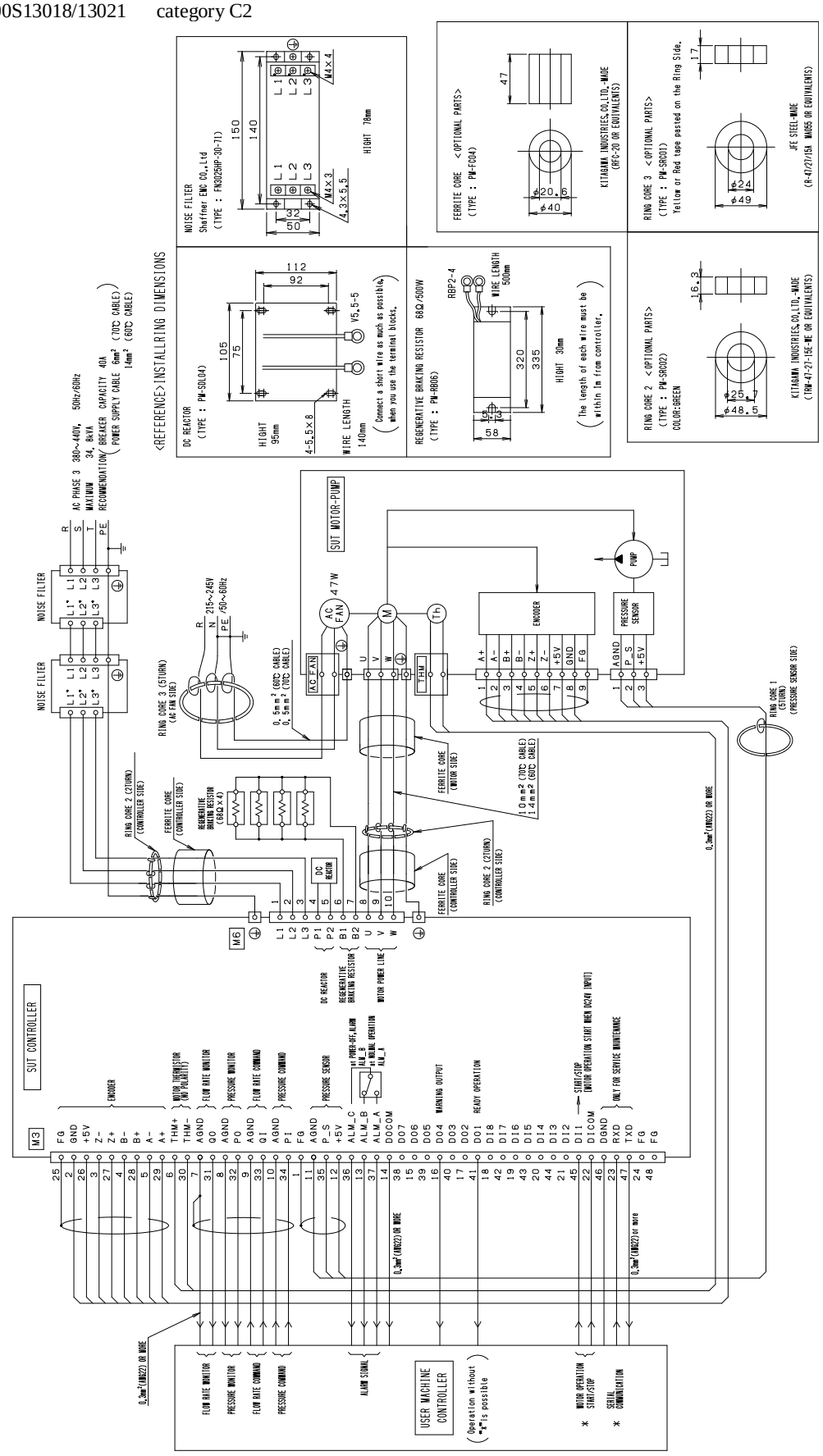
- SUT00S5021/8018 category C2



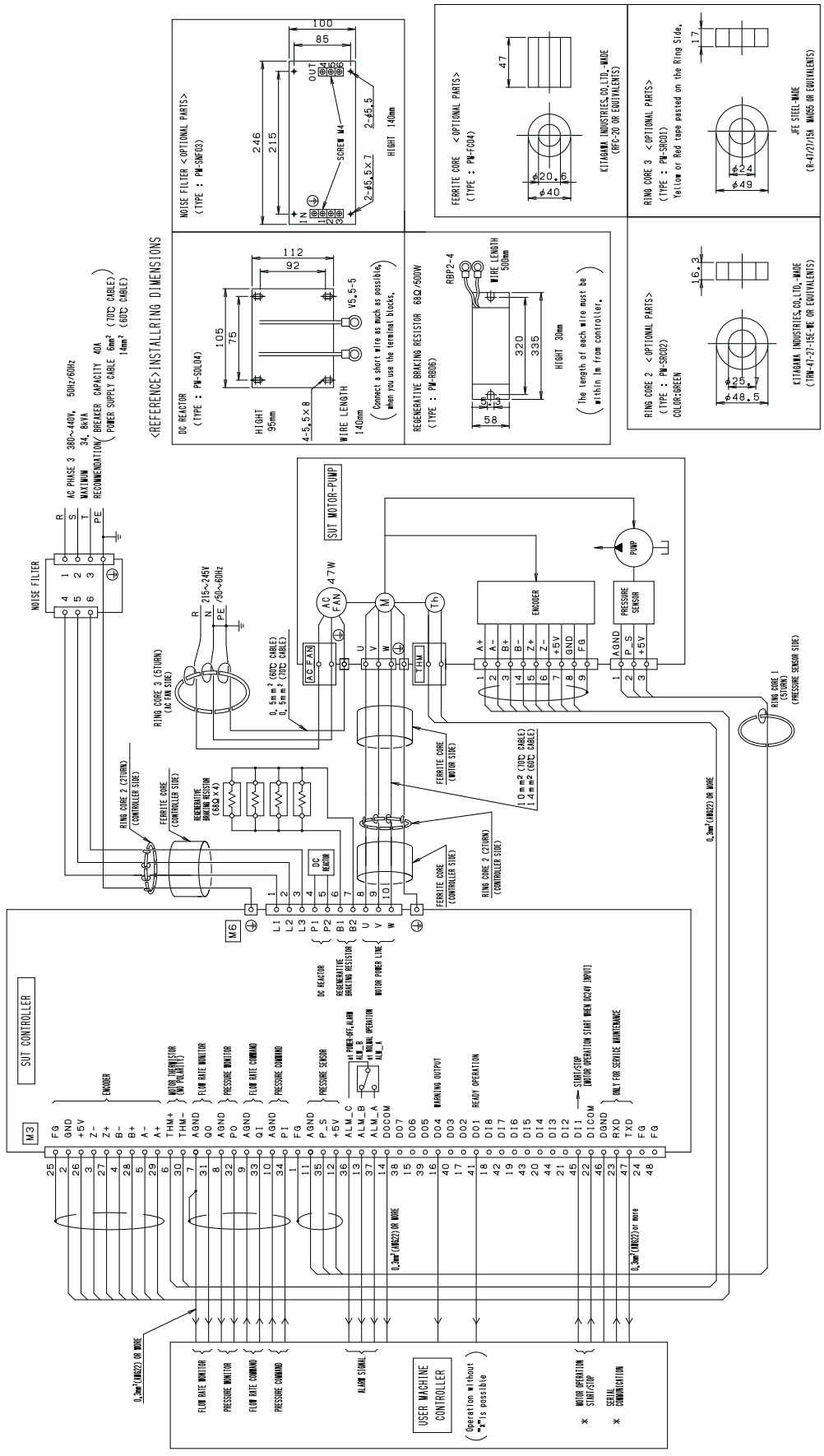
- SUT00S5021/8018 category C3



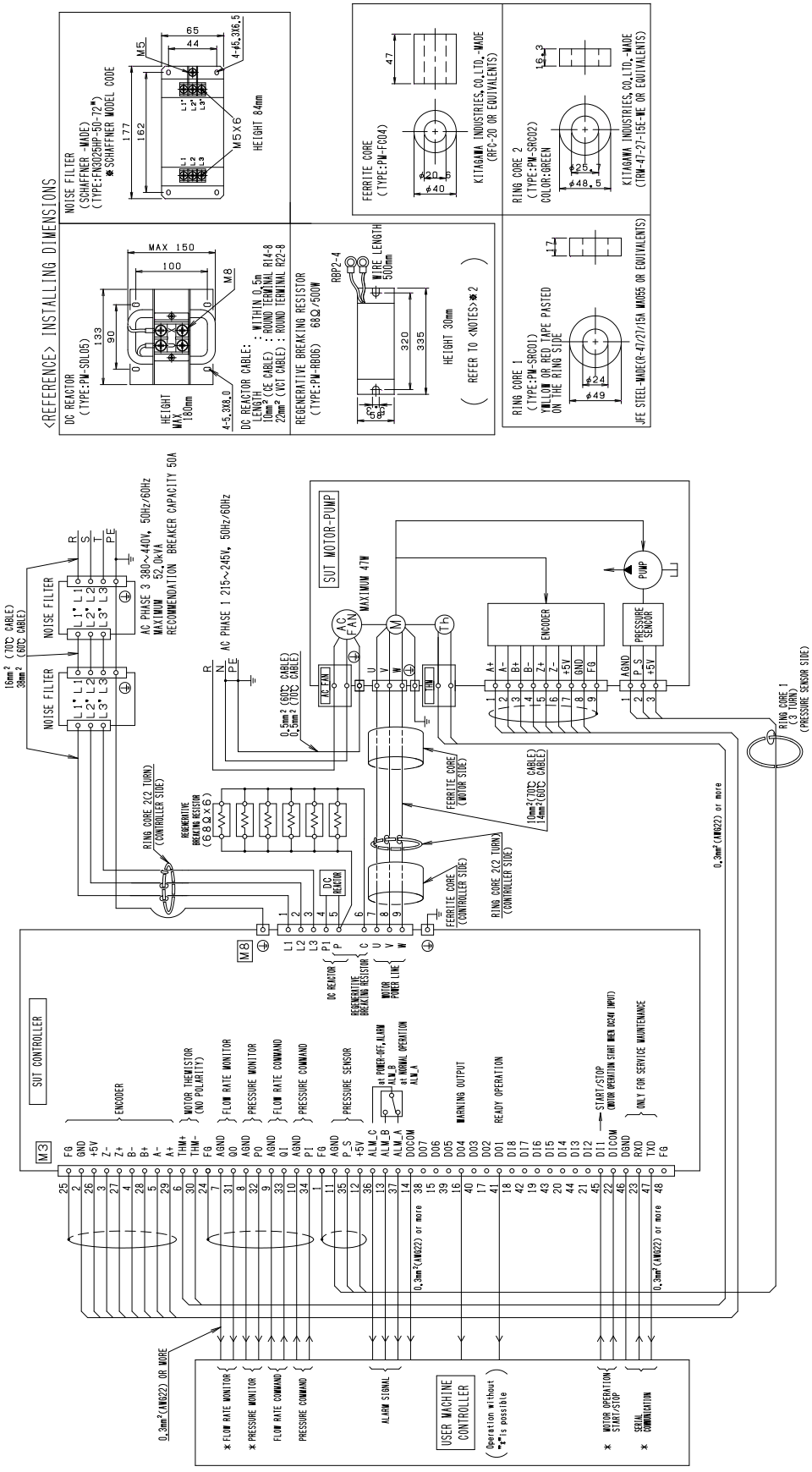
- SUT00S13018/13021 category C2



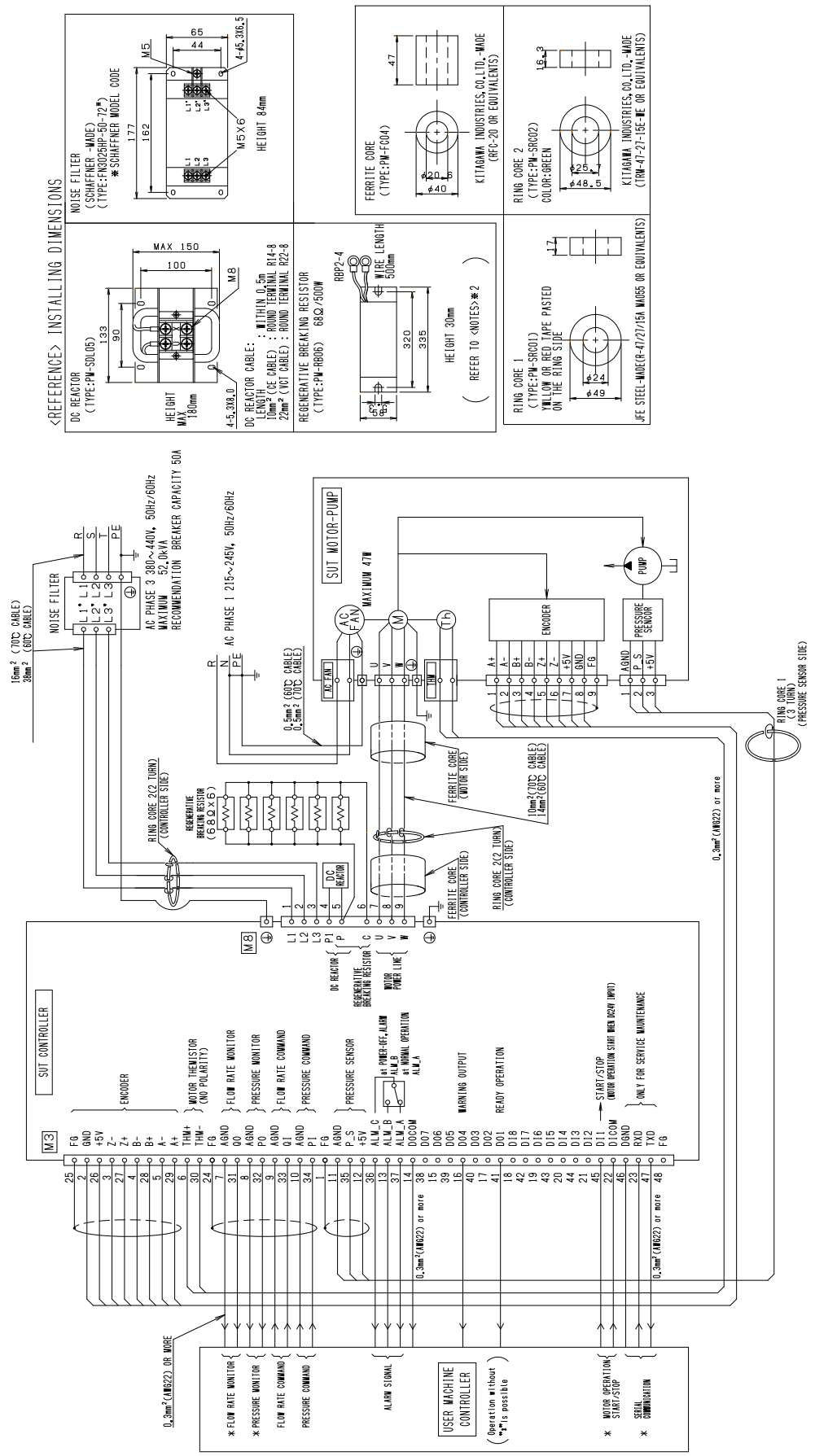
- SUT00S13018/13021 category C3



- SUT00S20018 category C2



- SUT00S20018 category C3



# Chapter 15 Machinery Directive

Declaration of corporation of a subassembly according to Article 4(2) of EC Directive 98/37/EC (Machinery Directive). 2006/42/EC(Machinery Directive) is applied on Dec 29, 2009.

## 15.1 The manufacture

DAIKIN INDUSTRIES,LTD.
1-1 Nishi-hitotsuya, Settsu-shi, Osaka 566-8585, Japan

## 15.2 the authorized representative

Technical Documentation is obtained by the following authorized.

| | |
|---|---|
| Authorized representative | Sauer Bibus GmbH |
| Address | Lise - Meitner - Ring 13, D-89231 Neu – Ulm |
| Country | Germany |

## 15.3 Provisions

### 15.3.1 Machinery directive

Complies with the provisions of the machinery directive (Directive 2006/42/EC, as amended) and the regulations transposing it into national law. But it may not be put into service before the machinery in which be incorporated is declared to comply with the provisions of Directive 2006/42/EC, as amended, and with the regulation transposing it into national law.Conforms to the ssential requirements of the Directive 2006/42/EC, described in the technical documentation: Document Number of PE01000.

### 15.3.2 EMC directive

Also complies with the provisions of the following European Directives:
**EMC Directive 2004/108/EC.**
Relevant information that should be transmitted in response to a reasoned request by the national authorities, by the electronic method or other according to the request.

### 15.3.3 Harmonised standards

Complies with the provisions of the following harmonised standard:
**Machinery Directive: EN 60204-1:2006**
**EMC Directive: EN 61800-3:2004**

## 15.4 Declared place

Done at Osaka, Japan

## 15.5 Declared date

On 18. Nov. 2009