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Operation Manual

ASR Series AC Servo Motor-Driven Pumps

Model: ASR*-*-HX*-A00-10/11

- To ensure safe and correct use of the product -

- To ensure proper operation, read this manual thoroughly before use.
- Be sure to follow the instructions described in the safety precautions and the main body of this manual.
- Keep this manual at hand for future reference.
- When creating instruction manuals for systems equipped with the product, be sure to reflect the descriptions in this manual.

YUKEN KOGYO CO., LTD.

About this manual




- Figures and illustrations contained in this manual may be slightly simplified and may differ from the actual product.
 - The content of this manual is subject to change without prior notice as improvements are made to the product.
 - Although this manual has been prepared with great care, please contact the place of purchase or our customer support if you find any ambiguous explanations, errors, or omissions.
 - If there are missing pages or erratic pagination in this manual, please contact our customer support. We will replace them.
 - Reprint, reproduction, or modification of this manual without prior permission of YUKEN KOGYO CO., LTD. is strictly prohibited.
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■ Safety precautions

- This manual is designed for users with adequate knowledge of electrics and hydraulics.
- The product should be handled by users having equivalent knowledge as stated above or under supervision of such personnel.
- Be sure to provide end-users with the instructions, warnings, and cautions described in this manual.
- Be sure to attach this manual when transferring or reselling the product.

In this manual, safety precautions are classified into three levels: "DANGER," "WARNING," and "CAUTION." Be sure to read and understand the safety precautions first and then read the main body of this manual.

Symbols and definitions for safety precautions in this manual are as follows.

	DANGER:	Indicates an imminent danger that is very likely to cause death or severe injury unless the situation is avoided.
	WARNING:	Indicates a potential danger that may cause death or severe injury unless the situation is avoided.
	CAUTION:	Indicates a potential danger that may cause a minor or moderate injury or that may result in property damage.

Even items described by "CAUTION" may result in a serious accident depending on the circumstances. Every item contains important instructions. Be sure to follow each instruction.

YUKEN KOGYO CO., LTD. assumes no liability for an accident or damage arising from any use or operation other than specified in this manual.

■ Always follow the safety precautions

DANGER

- Never use the product in an explosive atmosphere where flammable gases or explosives are handled. It may result in a fatal accident, such as fire or explosion.
- Never work on wiring, assembly, or maintenance/inspection while the product is powered on, as a fatal accident caused by electric shock may occur.
- Before wiring, installation, relocation, or inspection, shut off the power supply and wait for 15 minutes or more. When the CHARGE lamp of the AMSR controller turns off, perform a voltage check using a tester and then conduct the work.

WARNING

- Do not use an input power supply not specified. It may overheat, resulting in fire.
- Do not modify or disassemble the product. Doing so may impair safe operation.
- Install the AMSR controller and regenerative resistors on nonflammable objects. Any flammable object near them may be heated, causing fire.
- Be sure to connect the ground wire as a precaution against electric shock in the event of a short circuit. Never connect the ground wire to any of the followings.
 - Gas pipe - Lightning rod - Water pipe/faucet - Telephone line ground
- Handling emergencies
 - If the product begins to smoke
The continuous use of the product under abnormal conditions, such as when smoking or when unusual odors are rising from it, may result in fire or electric shock. Immediately shut off the power supply and contact your local customer service after checking that the smoke has stopped. The repair of the product by the user is dangerous. The user should never attempt repairs.
 - If the product is broken
If the product is dropped or pulled down, immediately shut off the power supply and contact your local customer service. Continuous use without taking corrective measures may result in fire or electric shock.
 - If water gets into the product
If water gets into the product, immediately shut off the power supply and contact your local customer service. Continuous use without taking corrective measures may result in fire or electric shock.

CAUTION

- Prevent any foreign matter from entering the product, which may damage the components during operation.
- During operation or for some time after power-off, the motor frame temperature is high. Prevent hands or other body parts from contacting the frame in order to avoid burn.
- Do not step on or put any heavy object on the product. Damage to the product/system or injury from collapse/falling may result.

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1. Introduction

1. Introduction

1.1 Intended users of the product

The product should be handled by users with adequate knowledge of electrics and hydraulics or under supervision of such personnel.

1.2 Intended purpose

The product is a motor-driven pump unit for hydraulic equipment. It generates and supplies hydraulic pressure, mainly as a hydraulic power source for hydraulic equipment.

1.3 Product check

Check the following points upon delivery of the product.

If there are any questions or problems, please contact the place of purchase or our local customer support.

- Whether the correct model is delivered as ordered

Check the model number marked on the nameplate (refer to "2.4 Model number designation").

- Whether damage and/or loose screws are observed

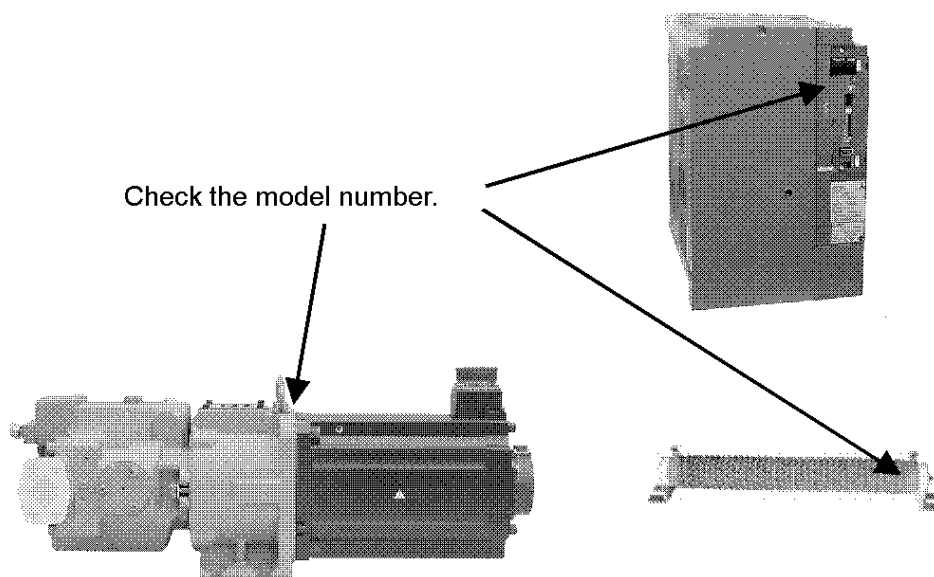


Fig. 1 Product Check

2. About the product

2. About the product

2.1 Basic structure and components

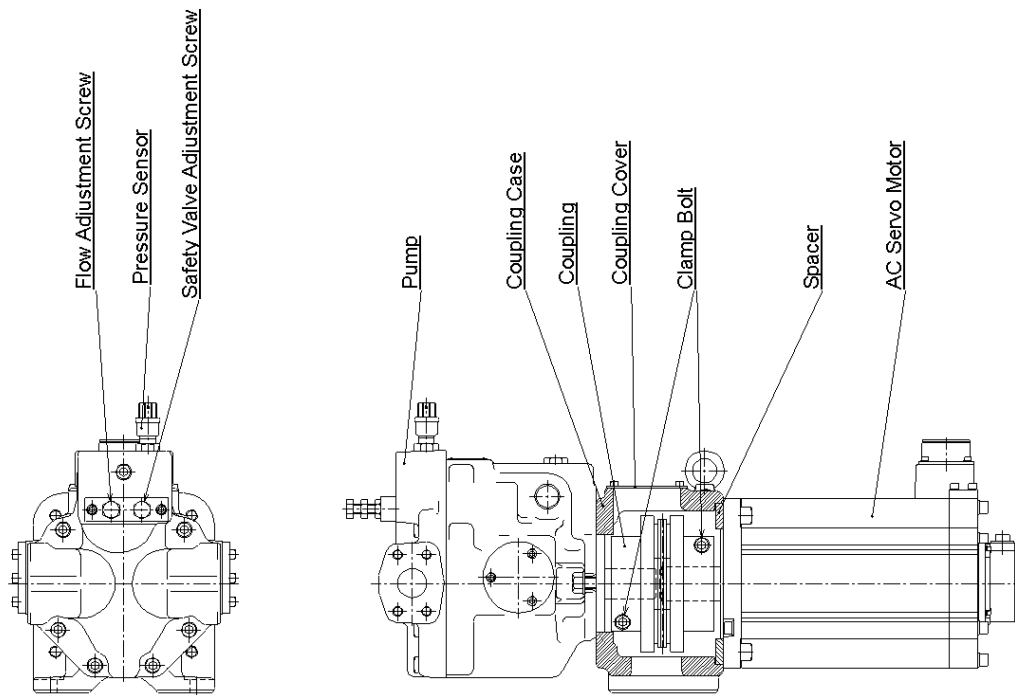


Fig. 2.1a N-ASR*-*-HX*-11

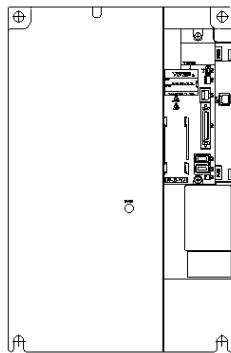


Fig. 2.1b AMSR-★-A*-10

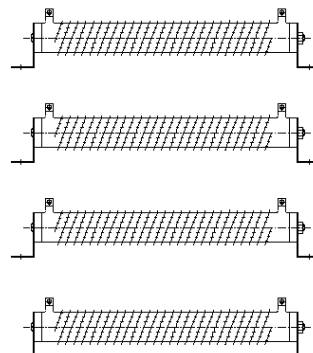


Fig. 2.1c Regenerative Resistor

2. About the product

2.2 Basic system configuration

The product is a compact, energy-saving, and low-noise hydraulic device comprised of an AC servo motor and a piston pump. This unit can be combined with the dedicated controller to facilitate the configuration of a speed and pressure control system.

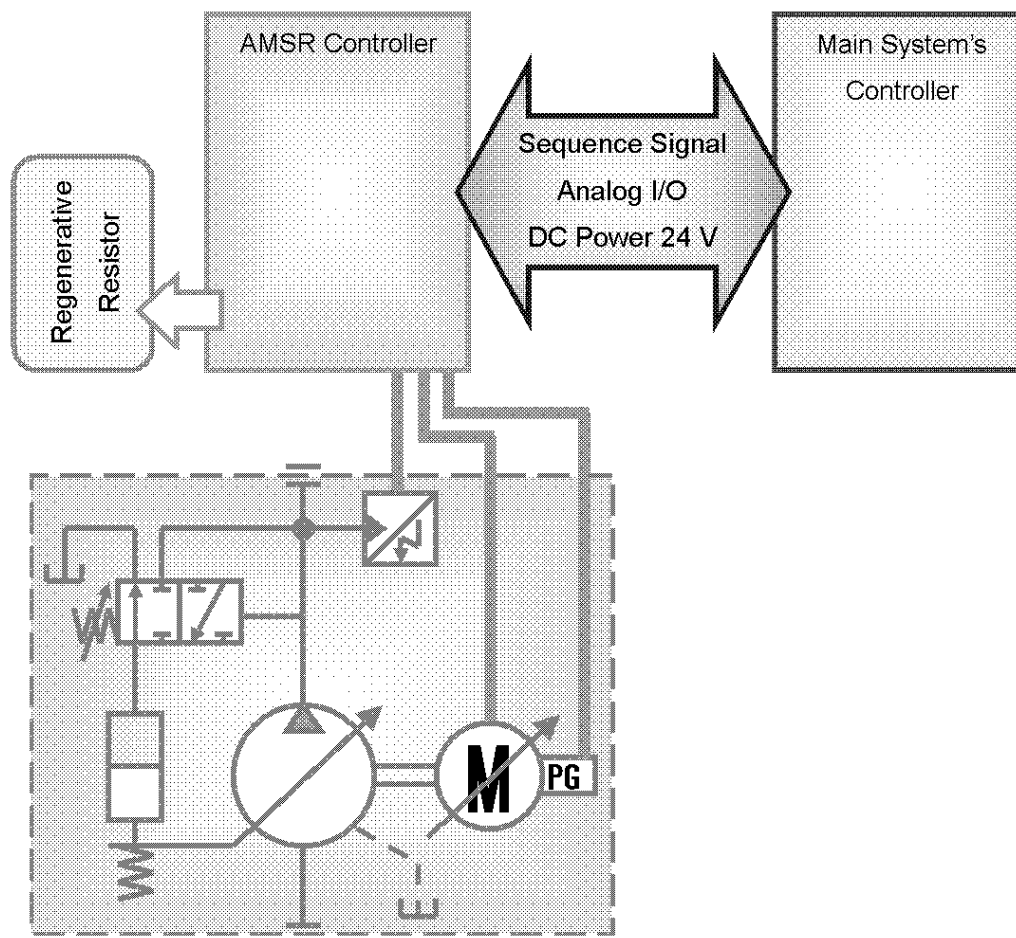


Fig. 2.2a Basic System Configuration

2.3 Control system

The control system provides the variable control of pump discharge pressure and flow by controlling the AC servo motor speed according to externally input pressure and flow commands. The control system is based on closed-loop control with the feedback of signals from the pressure sensor built in the pump unit (pressure control) and the feedback of the AC servo motor speed (flow control).

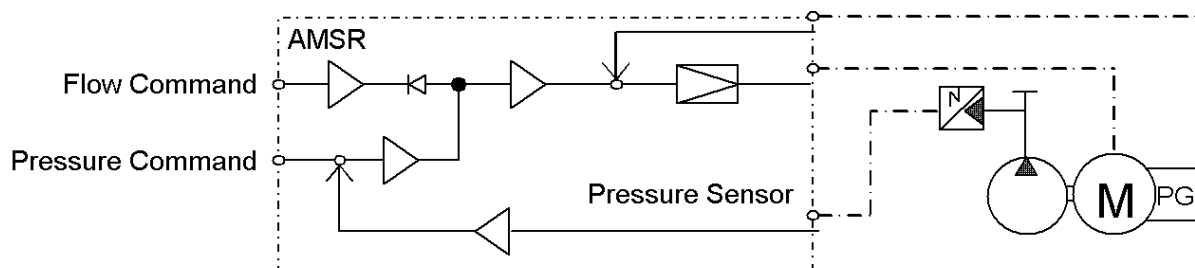
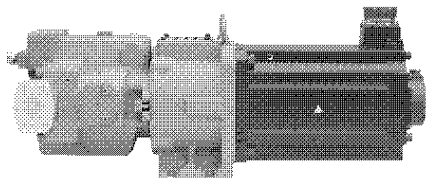


Fig. 2.3a Control System

2. About the product

2.4 Model number designation

2.4.1 N-ASR (pump and motor)



N-ASR3-4G-HXS-11

Series No.
ASR1 ASR2
ASR3 ASR5
ASR10

Input Voltage
 No Symbol: 200 V 4: 400 V

Power capacity
C~M

Max. Operating Pres.
H : 21MPa (ASR2=C : 16MPa)

Flow Adjustment Value
 X: Intended Value (01 Control Pump)

Port Direction
 No Symbol: Axial S: Side port (ASR1 - 5)
 A: Horizontal B: Vertical (ASR10)

Design No.

Fig. 2.4a Model Number Designation for N-ASR

2.4.2 AMSR (controller supplied with regenerative resistors)



AMSR-2FGH-A00-10

Series

Input Voltage
2 : 200V 4 : 400V

Power Capacity
C~M

Control Board
A : ASR

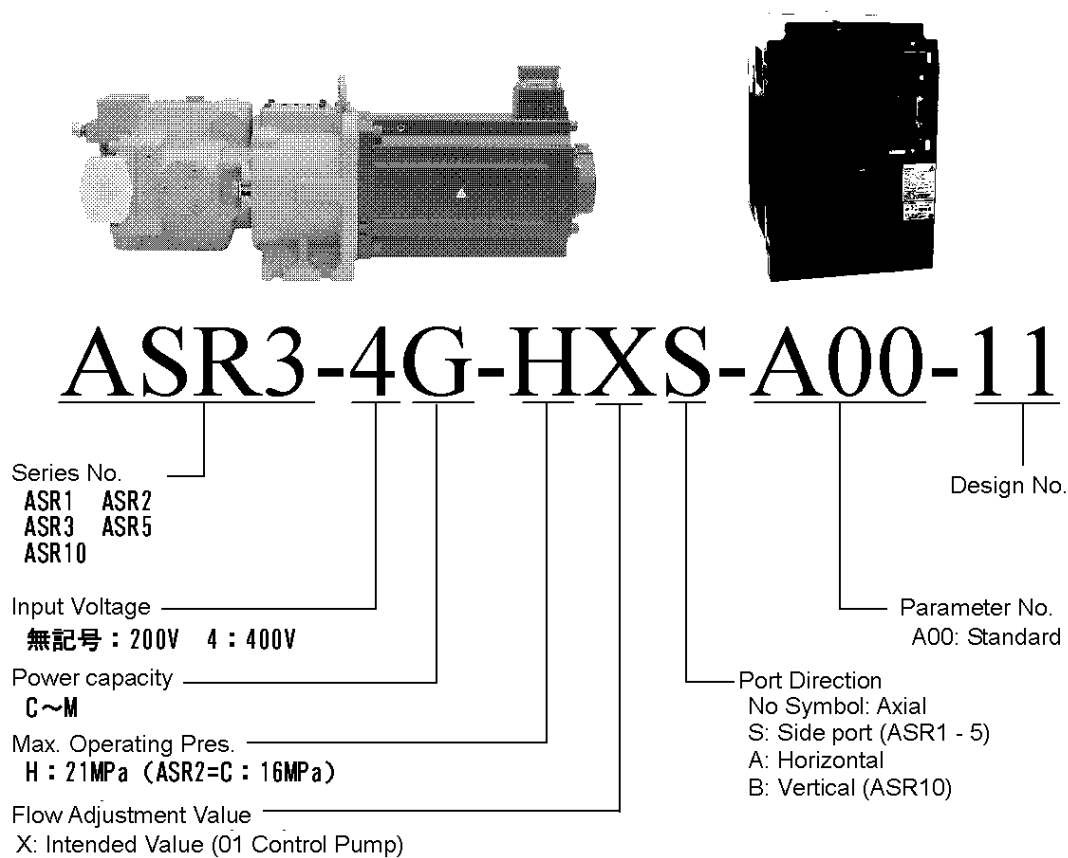
Parameter No.
 00: Standard

Design No.

Fig. 2.4b Model Number Designation for AMSR

2. About the product

2.4.3 ASR (integration of N-ASR and AMSR)



Note) This model is supplied without cables; the cables are available if required.

Fig. 2.4c Model Number Designation

2. About the product

2.4.4 Models of components

The models of the AC servo motors and servopacks/regenerative resistors are listed below.

Table 2.4a Pump

ASR Model	Pump Model
ASR1-	A16-F-R-01-H-*-K-32407
ASR2-	A22-F-R-01-C-*-K-32407
ASR3-	A37-F-R-01-H-*-K-32407
ASR5-	A56-F-R-01-H-*-K-32407
ASR10-	A100-FR01HS-10407

Table 2.4b AC Servo Motor

ASR Model (200 V)	AC Servo Motor Model
ASR□*-C - D-	HF-SP-451M-S2
ASR□*-E - F-	HF-SP-601M-S2
ASR□*-G - H-	HF-SP-801M-S2
ASR□*-I - K-	HF-LP-11K1ME3-S14
ASR□*-L - M-	HF-LP-15K1ME3-S14
ASR Model (400 V)	AC Servo Motor Model
ASR□*-4C-	HF-SP-451M4-S2
ASR□*-4F-	HF-SP-601M4-S2
ASR□*-4G - H-	HF-SP-801M4-S2
ASR□*-4I - K-	HF-LP-11K1M4E3-S14
ASR□*-4L - M-	HF-LP-15K1M4E3-S14

Table 2.4c AMSR/Regenerative Resistor (Supplied with AMSR)

ASR Model (200 V)	AMSR Model	Regenerative Resistor Model
ASR□*-C-	AMSR-2C-A*-10	---
ASR□*-D, E-	AMSR-2DE-A*-10	---
ASR□*-F, G, I-	AMSR-2FGI-A*-10	GRZG400-1.5 Ω x 4
ASR□*-H, J, L-	AMSR-2HJL-A*-10	GRZG400-0.9 Ω x 5
ASR□*-K, M-	AMSR-2KMO-A*-10	GRZG400-0.6 Ω x 5
ASR Model (400 V)	AMSR Model	Regenerative Resistor Model
ASR□*-4C-	AMSR-4C-A*-10	---
ASR□*-4F, G, I-	AMSR-4FGI-A*-10	GRZG400-5.0 Ω x 4
ASR□*-4H, J, L-	AMSR-4HJL-A*-10	GRZG400-2.5 Ω x 5
ASR□*-4K, M-	AMSR-4KMO-A*-10	GRZG400-2.0 Ω x 5

2. About the product

2.5 Specifications

Table 2.5a Specifications

Table 2-3-4 Specifications						
Model		ASR1	ASR2	ASR3	ASR5	ASR10
Flow Control	Max. Flow L/min	39.5	55.5	92.2	129.2	200.0
	Hysteresis	1 % or less				
	Repeatability	1 % or less				
	Input Signal ^{*1}	Max. 6.25 V		Max. 5.75 V		Max. 5.0 V
Pressure Control	Pres. Adj. Range MPa	0.1 to 21.0	0.1 to 16.0	0.1 to 21.0		
	Hysteresis	1 % or less ^{*3}				
	Repeatability	1 % or less ^{*3}				
	Input Signal ^{*2}	6.25 V	4.57 V	6.25 V		
Atmosphere		Indoors (no direct sunlight) No corrosive gas, flammable gas, oil mist, or dust.				
Altitude		1000 m or less above sea level				
Storage ^{*4}	Ambient Temp.	0 to 40 °C (no freezing)				
	Ambient Humidity	80 %RH or less (no condensation)				

*1 Input voltage at a rated motor speed of 2000 r/min (default setting).

*2 Input voltage at a rated pressure of 17.5 MPa (default setting).

*3 Pressure control accuracy depends on system tuning; this value is for reference.

*4 The storage temperature is different from the ambient temperature during operation.

Table 2.5b N-ASR Specifications

Model	Geometric Displacement cm ³ /rev	Operating Pres. MPa	Motor Speed r/min	Rotational Direction	Hydraulic Fluid	Viscosity mm ² /s	Fluid Temp. °C
ASR1	Max. 15.8	0.1 to 21	Max. 2500	Clockwise viewed from the servo motor	Petroleum based fluids or fluids equivalent to ISO VG32 or VG46	20 to 400	0 to 60
ASR2	Max. 22.2	0.1 to 16					
ASR3	Max. 36.9	0.1 to 21					
ASR5	Max. 56.2		Max. 2300				
ASR10	Max. 100.0		Max. 2000				

2. About the product

Table 2.5c AC Servo Motor Specifications for Each Power Capacity

Power Capacity	Max. Current		Insulation Class	Cooling	Environment		
	AC 200 V	AC 400 V			Protection	Ambient Temp.	Ambient Humidity
C	74 A	37 A	F	Totally-enclosed self-cooling	IP65 (except for the shaft through portion)	0 to 40 °C (no freezing)	80 %RH or less (no condensation)
D							
E	130 A	65 A					
F							
G	158 A	79 A					
H							
I	195 A	93 A					
J	228 A	109 A					
K							
L	261 A	123 A					
M	314 A	148 A					

Table 2.5d AMSR Specifications for Each Power Capacity

Power Capacity	Power Supply Capacity	Inrush Current ^{*1}		Regenerative Resistor (Attached)
		AC 200 V	AC 400 V	
C	6.8 kVA	44 A ^{*2}	37 A ^{*3}	Built-in
D		88 A ^{*2}		
E	8.6 kVA			
F				
G	12 kVA			Outboard
H				
I	16 kVA	235 A ^{*2}	325 A ^{*2}	
J				
K				
L	22 kVA			
M				

*1 Inrush current (reference value) in the case of applying the maximum allowable voltage (AC 200 V class: AC 253 V or AC 400 V class: AC 528 V) with a power supply capacity of 2500 kVA and a cable length of 1 m.

*2 The current is reduced to about 20 A in 20 ms.

*3 The current is reduced to about 10 A in 20 ms.

2. About the product

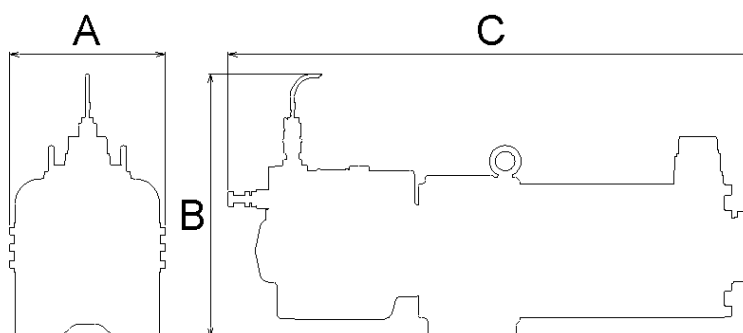
Table 2.5e AMSR Specifications

Control Circuit Power	Voltage	AC 200 V	Single-phase AC 200 to 230 V
		AC 400 V	Single-phase AC 380 to 480 V
	Allowable Voltage Fluctuation	AC 200 V	Single-phase AC 170 to 253 V
		AC 400 V	Single-phase AC 323 to 528 V
	Frequency		50 Hz/60 Hz
	Allowable Frequency Fluctuation		± 5 % or less
	Input		45 W
	Inrush Current	AC 200 V	30 A (reduced to almost 0 A in 3 ms)
AC 400 V		45 A (reduced to almost 0 A in 3 ms)	
Interface	Max. Input Command Voltage		0 to ± 10V DC (pressure/flow input)
	Command Signal Input Impedance		10 kΩ
	Monitor Output Voltage		0 to ± 10 V DC (2 ch: The output can be changed by parameters.)
	Sequence Input Signal		AC photocoupler input (resistance to limit the current: 5.6 KΩ) (8 ch)
	Sequence Output Signal		Photocoupler open collector output (6 ch)
	Voltage		DC 24 V ± 10 %
	Power Supply Capacity		300 mA (when using all sequence I/O signals)
Main Circuit Power	Voltage	AC 200 V	3-phase AC 200 to 230 V
		AC 400 V	3-phase AC 380 to 480 V
	Allowable Voltage Fluctuation	AC 200 V	3-phase AC 170 to 253 V
		AC 400 V	3-phase AC 323 to 528 V
	Frequency		50 Hz/60 Hz
	Allowable Frequency Fluctuation		± 5 % or less
Cooling		Fan-cooling, open (IP00)	
Environment	Ambient Temp.	0 to 55 °C (no freezing)	
	Ambient Humidity	90 %RH or less (no condensation)	
Protection			<div><input type="checkbox"/> Overcurrent shutdown</div> <div><input type="checkbox"/> Regenerative overvoltage shutdown</div> <div><input type="checkbox"/> Encoder error protection</div> <div><input type="checkbox"/> Overspeed protection</div> <div><input type="checkbox"/> Undervoltage protection</div> <div><input type="checkbox"/> Servo motor overheat protection</div> <div><input type="checkbox"/> Instantaneous power failure protection</div> <div><input type="checkbox"/> Excess error protection</div> <div><input type="checkbox"/> Regeneration fault protection</div>

2. About the product

2.6 Outer dimensions and mass

Table 2.6a N-ASR Dimensions and Mass

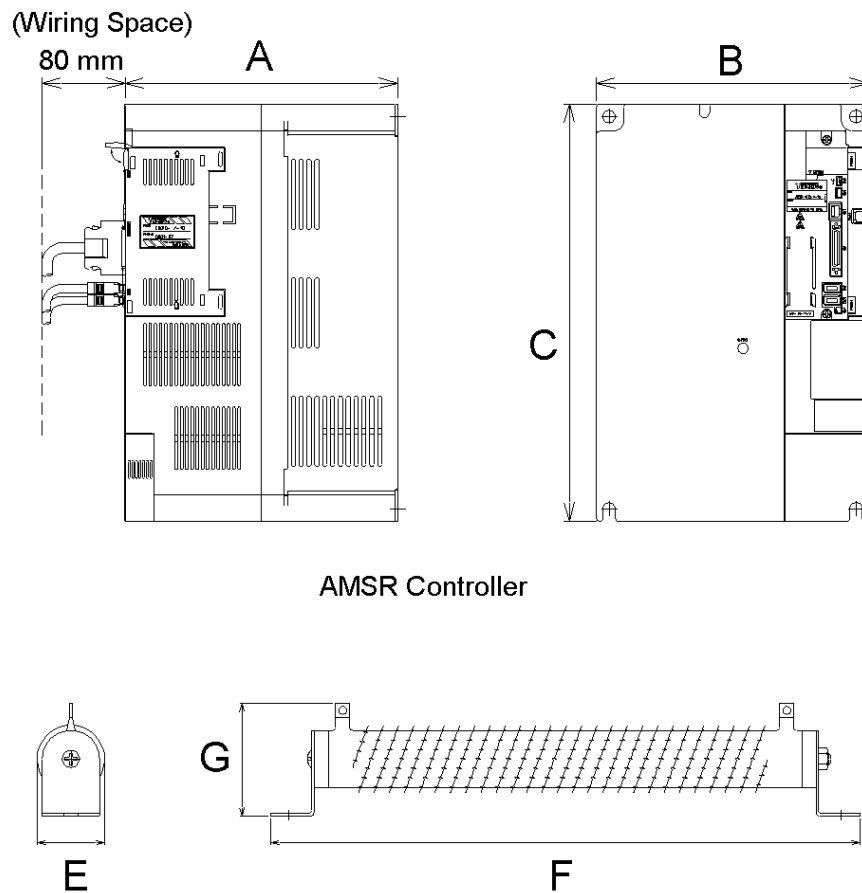


Model	A	B	C	Model	A	B	C	Mass [kg]
N-ASR1/2-*C-HX-A**-	188	317	554.5	N-ASR1/2-*C-HXS-A**-	188	317	554.5	54
N-ASR1/2-*D-HX-A**-				N-ASR1/2-*D-HXS-A**-				
N-ASR3-*C-HX-A**-	202	345	582.5	N-ASR3-*C-HXS-A**-	202	345	582.5	70
N-ASR3-*D-HX-A**-			642.5	N-ASR3-*D-HXS-A**-			642.5	80
N-ASR3-*E-HX-A**-				N-ASR3-*E-HXS-A**-				
N-ASR3-*F-HX-A**-			682.5	N-ASR3-*F-HXS-A**-			682.5	87
N-ASR3-*G-HX-A**-				N-ASR3-*G-HXS-A**-				
N-ASR3-*H-HX-A**-				N-ASR3-*H-HXS-A**-				
N-ASR5-*C-HX-A**-	232	371	595	N-ASR5-*C-HXS-A**-	232	371	595	77
N-ASR5-*D-HX-A**-			655	N-ASR5-*D-HXS-A**-			655	87
N-ASR5-*E-HX-A**-				N-ASR5-*E-HXS-A**-				
N-ASR5-*F-HX-A**-			695	N-ASR5-*F-HXS-A**-			695	94
N-ASR5-*G-HX-A**-				N-ASR5-*G-HXS-A**-				
N-ASR5-*H-HX-A**-				N-ASR5-*H-HXS-A**-				
N-ASR5-*I-HX-A**-	324	448	942.5	N-ASR5-*I-HXS-A**-	442	448	942.5	176
N-ASR5-*J-HX-A**-				N-ASR5-*J-HXS-A**-				
N-ASR5-*K-HX-A**-				N-ASR5-*K-HXS-A**-				
N-ASR10-*I-HXA-A**-		470	1018	N-ASR10-*I-HXB-A**-		395	1018	213
N-ASR10-*J-HXA-A**-				N-ASR10-*J-HXB-A**-				
N-ASR10-*K-HXA-A**-				N-ASR10-*K-HXB-A**-				
N-ASR10-*L-HXA-A**-			1078	N-ASR10-*L-HXB-A**-			1078	233
N-ASR10-*M-HXA-A**-				N-ASR10-*M-HXB-A**-				

Unit (ABC): mm

2. About the product

Table 2.6b Dimensions and Mass of the AMSR Controller and Regenerative Resistor



Regenerative Resistor									
Model (200 V)	A	B	C	Mass [kg]	Regenerative Resistor	E	F	G	Mass [kg]
AMSR-2C-A**	280	140	250	4.6	-	-	-	-	-
AMSR-2DE-A*	280	182	300	6.2	-	-	-	-	-
AMSR-2FGI-A*	340	260	400	18	GRZG400-1.5 Ω	47	411	79	0.8 x 4
AMSR-2HJL-A*				19	GRZG400-0.9 Ω			86	0.8 x 5
AMSR-2KMO-A*					GRZG400-0.6 Ω				
Model (400 V)	A	B	C	Mass [kg]	Regenerative Resistor	E	F	G	Mass [kg]
AMSR-4C-A**	280	140	250	4.6	-	-	-	-	-
AMSR-4FGI-A*	340	260	400	18	GRZG400-5.0 Ω	47	411	79	0.8 x 4
AMSR-4HJL-A*				19	GRZG400-2.5 Ω			86	0.8 x 5
AMSR-4KMO-A*					GRZG400-2.0 Ω				

Unit (ABC): mm Mass: kg

2. About the product

2.7 Interface

2.7.1 Components of the AMSR controller

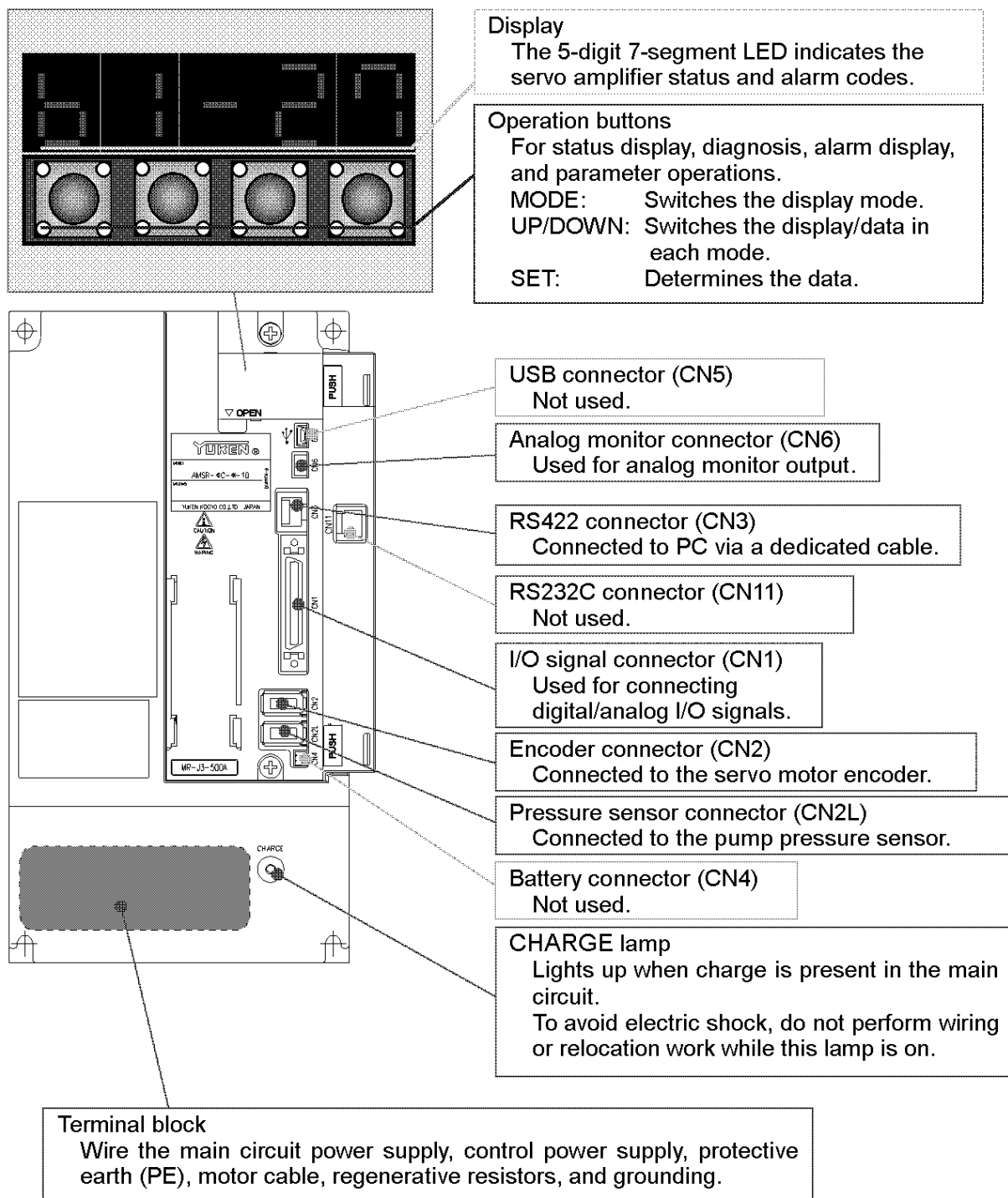


Fig. 2.7a Components of the AMSR Controller

2. About the product

2.7.2 Analog I/O signal

Table 2.7a Analog Input Signals (CN1)

Pin No.	Abbr.	Signal Name	Function/Use				
CN1-2	PIN	Pressure Command Voltage	<p>Applies a voltage of DC 0 to + 5 V (max. 10 V) between PIN and LG. The span of the command voltage is set by the following parameter.</p> <table><tr><td>PO60</td><td>Rated Pressure</td></tr><tr><td>Setting</td><td>Default: 175 [x 0.1 MPa/DC 5 V]</td></tr></table> <p>For the output of pressure beyond the default value, determine the input voltage based on rated pressure = DC 5 V.</p>	PO60	Rated Pressure	Setting	Default: 175 [x 0.1 MPa/DC 5 V]
PO60	Rated Pressure						
Setting	Default: 175 [x 0.1 MPa/DC 5 V]						
CN1-27	QIN	Flow Command Voltage	<p>Applies a voltage of DC 0 to + 5 V (max. 10 V) between QIN and LG. The span of the command voltage is set by the following parameter.</p> <table><tr><td>PO61</td><td>Rated Motor Speed</td></tr><tr><td>Setting</td><td>Default: 2000 [rpm/DC 5 V]</td></tr></table> <p>Discharge flow is calculated based on pump capacity. For the output of flow beyond the default value, determine the input voltage based on rated flow = DC 5 V.</p>	PO61	Rated Motor Speed	Setting	Default: 2000 [rpm/DC 5 V]
PO61	Rated Motor Speed						
Setting	Default: 2000 [rpm/DC 5 V]						
CN1-3 CN1-28	LG	Control Common	Common terminals for command voltage and monitor voltage.				
CN1-1	P15R	DC 15 V Power Output	Outputs DC 15 V between P15R and LG. It can be used as a power source for command voltage (allowable current: 30 mA).				

Table 2.7b Analog Output Signals (CN6)

Pin No.	Abbr.	Signal Name	Function/Use		
CN6-3	MON1 (SMP)	Pressure Monitor Voltage	<p>Applies a voltage of DC 0 to + 5 V (max. 10 V) between MON1 and LG. Monitor signals can be selected by internal parameters. For details, see 6.5 Parameters: PC14/PO63.</p> <table><tr><td>Default</td><td>175 [x 0.1 MPa/DC 5 V] *</td></tr></table> <p>* This value is not applicable when the parameter setting (PO60: Rated Pressure) has been changed from the default.</p>	Default	175 [x 0.1 MPa/DC 5 V] *
Default	175 [x 0.1 MPa/DC 5 V] *				
CN6-2	MON2 (SMN)	Motor Speed Monitor Voltage	<p>Applies a voltage of DC 0 to + 5 V (max. 10 V) between MON2 and LG. Monitor signals can be selected by internal parameters. For details, see 6.5 Parameters: PC15/PO64.</p> <table><tr><td>Default</td><td>2000 [rpm/DC 5 V] *</td></tr></table> <p>* This value is not applicable when the parameter setting (PO61: Rated Motor Speed) has been changed from the default.</p>	Default	2000 [rpm/DC 5 V] *
Default	2000 [rpm/DC 5 V] *				
CN6-1	LG	Control Common	Common terminal for command voltage and monitor voltage.		

2. About the product

2.7.3 Sequence input signal

- * With reference to the description below, connect the controller to an external device.
- * Signals are input with relays or open collector transistors

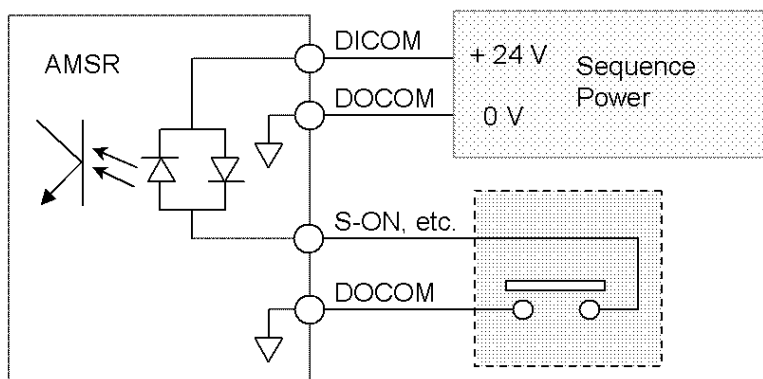


Fig. 2.7b Digital Input Interface

Table 2.7c Sequence input signals (CN1)

Pin No.	Abbr.	Signal Name	Function/Use				
CN1-47	DOCOM	0 V Common	Connects the 0 V power supply.				
CN1-15	SON	Servo ON	Activated to power on the base circuit, making the pump to operate according to commands from the main system. Deactivated to shut off the base circuit, putting the servo motor into a free-running state.				
CN1-16	-	Reserved					
CN1-17	ST1	Forward Rotation Start	Rotates the motor counterclockwise (standard rotational direction for ASR). * When not connected to any external sequence control device, connect the signal to DOCOM.				
CN1-18	ST2	Reverse Rotation Start	* Do not connect this signal.				
CN1-19	RES	Reset	When an alarm occurs, remove its cause and activate RES for 50 ms or more to reset the alarm. Depending on the alarm type, the unit must be powered off and then on for alarm reset. See 7.1 Alarms/warnings.				
CN1-41	-	Reserved	Reserved.				
CN1-42	EMG	Emergency Stop	Deactivated to trigger an emergency stop, shutting off the base circuit and applying the dynamic brake. Activated to reset the emergency stop state.				
CN1-43	HC1	Control Code x 1	Switches the gain according to the load condition (process).				
CN1-44	HC2	Control Code x 2					
CN1-45	L/SI	Swash Plate Angle Large/Small (Two-speed)	Input Signal			Control Code	Parameter No.
			HC2	HC1	L/SI		
			0	0	0	No. 0 control gain	PO02 - 08
			0	1	0	No. 1 control gain	PO09 - 15
			1	0	1	No. 2S control gain	PO16 - 22
			1	0	0	No. 2L control gain	PO23 - 29
			1	1	0	No. 3 control gain	PO30 - 36
* With Swash Plate Angle Large/Small (Two-speed) activated, the control parameter can be switched.							

2. About the product

2.7.4 Digital output signals

* These signals drive relays or photocouplers. Provide a diode for inductive load or an inrush current limiting resistor for lamp load.

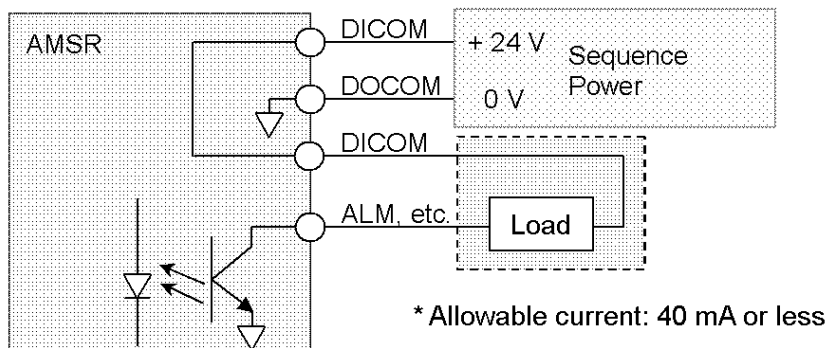


Fig. 2.7c Digital Output Interface

Table 2.7d-1 Sequence Output Signals (CN1)

Pin No.	Abbr.	Signal Name	Function/Use
CN1-21	DICOM	+ 24 V Common	Connects the + DC 24 V power supply.
CN1-22	ACD2	Alarm Code 2	Outputs a 3-bit alarm code when an alarm occurs. Alarm codes and names are listed below.
CN1-23	ACD1	Alarm Code 1	
CN1-24	ACD0	Alarm Code 0	

Input Signal			Display	Name
ACD2	ACD1	ACD0		
			88888	Watchdog
			AL.12	Memory Error 1
			AL.13	Clock Error
			AL.15	Memory Error 2
			AL.17	Board Error
			AL.19	Memory Error 3
			AL.37	Parameter Error
			AL.8A	Serial Communication Timeout
			AL.8E	Serial Communication Error
0	0	0	AL.30	Regeneration Error
			AL.33	Overvoltage
0	1	0	AL.10	Undervoltage
			AL.45	Main Circuit Device Overheat
0	1	1	AL.46	Servo Motor Overheat
			AL.47	Cooling Fan Error
			AL.50	Overload 1
			AL.51	Overload 2
1	0	0	AL.24	Main Circuit Error
			AL.32	Overcurrent
			AL.31	Overspeed
1	0	1	AL.35	Command Pulse Frequency Error
			AL.52	Excess Error
			AL.16	Sensor Error 1
1	1	0	AL.1A	Motor Matching Error
			AL.20	Sensor Error 2
			AL.25	Absolute Position Loss

* For the details of each alarm, see 7.1.

2. About the product

Table 2.7d-2 Sequence Output Signals (CN1)

Pin No.	Abbr.	Signal Name	Function/Use
CN1-25	L/SO	Swash Plate Angle Large	Outputs the signal Swash Plate Angle Large/Small (Two-speed).
CN1-48	ALM	Failure	Deactivated when the unit is powered off or when the protective circuit is activated to shut off the base circuit. Activated in 1.5 s after power-on when no alarm is present.
CN1-49	RD	Ready	Activated when the pump is ready to operate with the Servo ON signal.

3. Installation of N-ASR

3. Installation of N-ASR

3.1 Tools for installation

Prepare the tools listed below.

Table 3.1a Tool for Installing the Unit

Model	Tool (Size)
N-ASR□-C - H	Wrench (width across flat: 19 mm)
N-ASR□-I - M	Wrench (width across flat: 30 mm)

Table 3.1b Tool for Attaching the Suction Pipe Flange

Model	Tool (Size)
N-ASR1 - 5-	Hexagonal wrench (width across flat: 8 mm)
N-ASR10-	Hexagonal wrench (width across flat: 10 mm)

Table 3.1c Tool for Attaching the Discharge Pipe Flange

Model	Tool (Size)
N-ASR1 - 10-	Hexagonal wrench (width across flat: 8 mm)

Table 3.1d Filling Port

Model	Tool (Size)
N-ASR1 - 5-	Wrench (width across flat: 22 mm)
N-ASR10-	Wrench (width across flat: 27 mm)

3.2 Relocation of N-ASR

Take great care not to drop, knock over, or damage the product during transport.



CAUTION

- ◆ Never lift or carry the product in an incorrect posture. Pinching of hands or backache may occur depending on the product mass and the posture of the worker.
- ◆ Do not step on or put heavy objects on the product. These actions may cause damage to the product/system or may result in injury from slipping/falling.

3. Installation of N-ASR

3.3 Preparation for installation

- a) Before starting installation, clean and dust the working area, hands, and clothing to prevent foreign matter from entering into the product/system.



WARNING

- ◆ Do not put any object in the coupling case, which may cause damage to the components during operation.

- b) Remove the protective plug from the port and the protective plates from the port flange mounting surface. When removing the plates, be careful not to damage the mounting surface.

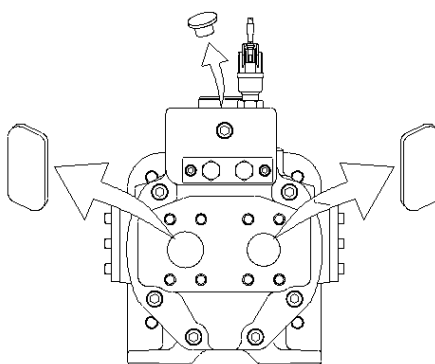


Fig. 3.3a Removing the Protective Plug and Plates

- c) Check for critical scratches on the O-ring sealing surface of each port and the port flange mounting surface. If a scratch is found, eliminate it by mending the mounting surface. If a critical scratch is found that cannot be mended, contact our customer support.



CAUTION

- ◆ A scratch on the mounting surface may cause fluid leakage and result in a major accident.

- d) Clean the O-ring sealing surface of each port and the port flange mounting surface to remove foreign matter, such as metal debris and fibers from waste cloth.
- e) Check for critical scratches on the O-ring mounting surface of the pipe flange and check that the O-ring is properly mounted in the groove. If the O-ring is misplaced, mount it in the groove correctly.



CAUTION

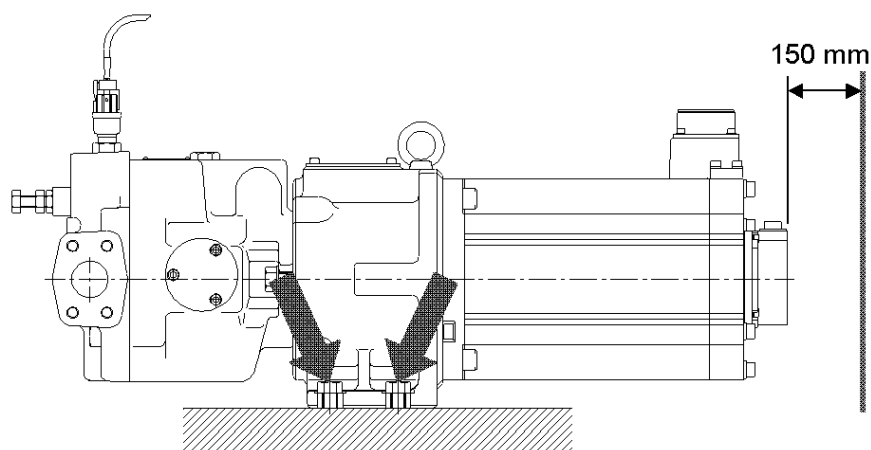
- ◆ If the O-ring is not properly mounted, it may be damaged and cause outflow of hydraulic fluid, resulting in a major accident.

3. Installation of N-ASR

3.4 Installation of N-ASR

3.4.1 Installation orientation

- Install the unit with the filling port facing upward.
- For the fan-mounted models "ASR□-I - M-," a wall clearance of 150 mm or more is required on the fan side.
- Bolt the unit securely using the mounting holes in the bracket.



➡ : Bolt/plain washer location

Fig. 3.4a Installation Example

3.4.2 Bolting

Screw in the bolts listed below gradually and evenly.

Note) Use the washers to tighten the bolts.

Table 3.4a Bolt Size and Tightening Torque

Model	Bolt Size	Quantity	Tightening Torque N·m
N-ASR□-C - H-	JIS B1180 Hexagon head bolt M12 (strength grade: 6.8)	4	50 to 55
N-ASR□-I - M-	JIS B1180 Hexagon head bolt M20 (strength grade: 6.8)		232 to 256



WARNING

- ◆ Use the specified number of bolts of the same material and strength grade and apply the specified tightening torque. Failure to do so may result in a major accident due to damage to the bolts or outflow of hydraulic fluid.

3. Installation of N-ASR

3.5 Piping

3.5.1 Drain piping

- For piping, refer to the table below.
- Make sure that the pipe end is submerged in fluid.
- Do not join the drain pipe to other return lines. Run it independently.

Table 3.5a Drain Pipe Size

Model	Joint Size	Pipe Bore	Pipe Length
N-ASR1/2	3/8 (bore: $\phi 8.5$ or more)	$\phi 10$ or more	1000 mm or less
N-ASR3	1/2 (bore: $\phi 12$ or more)	$\phi 12$ or more	
N-ASR5	3/4 (bore: $\phi 16$ or more)	$\phi 19$ or more	
N-ASR10			

Even when the condition above is satisfied, keep the steady state pressure within the housing at 0.1 MPa or less.

3.5.2 Suction piping

- For suction piping, use pipes of the following sizes.

Table 3.5b Suction Pipe Size

Model	Nominal Diameter
N-ASR1/2	1
N-ASR3	1 1/4
N-ASR5	1 1/2
N-ASR10	3

- Position the suction port 1 m or less above the fluid level.
- When installing the pump in a position higher than the fluid level, keep the suction pipe and filter lower than the pump port to prevent air accumulation in the suction line.
- Keep the suction pressure at the pump inlet between - 16.7 kPa and + 50 kPa.
When the suction pressure exceeds the prescribed value, abnormal noise/vibration may be generated.

3. Installation of N-ASR

3.5.3 Tightening the pipes

Tightening torque for piping is shown in Table 3.5c.



Warning

- ◆ Apply tightening torque for piping as specified. Failure to do so may result in a major accident due to damage to the screws or outflow of hydraulic fluid.

Table 3.5c Screw Size and Tightening Torque

	Model	Screw Size	Tightening Torque N·m
Discharge Pipe	N-ASR1 - 10	Port flange screw: JIS B1176 Hexagon socket head cap screw M10 (strength grade: 12.9)	61 to 74
Suction Pipe	N-ASR1 - 5		
	N-ASR10	Port flange screw: JIS B1176 Hexagon socket head cap screw M12 (strength grade: 12.9)	104 to 127
Drain Pipe	N-ASR1	Rc3/8	34 to 63
	N-ASR3	Rc1/2	52 to 95
	N-ASR5 - 10	Rc3/4	90 to 165

When using four screws for the suction pipe flange, tighten them gradually and evenly in the order shown by the numbers 1 to 4 in Fig. 3.5a and repeat this cycle two to three times.

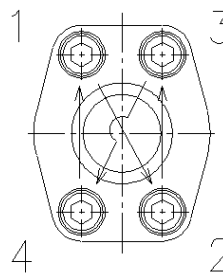


Fig. 3.5a Tightening the Screws



CAUTION

- ◆ Do not tighten the screws with the O-rings misplaced. A major accident may result from damage to the O-rings or outflow of hydraulic fluid.

When using steel pipes, the pipes may place undue weight on the motor-driven pump unit, resulting in noise. If there is a possibility that steel pipes may place weight on the pump unit, use rubber hoses.

4.1 Preparation for installation

- #### 4.1.1 Installation standards (the values below indicate minimum clearances.)

- Multiple



Install the AMSR controller vertically on the wall with its front face (with the operator panel) facing toward the operator.

Referring the Fig. 4.1a, leave enough space around the AMSR controller to allow cooling by the fan and natural convection. The cooling fan is required to keep the temperature in the control panel uniform so that the ambient temperature around the AMSR controller does not locally increase.

No freezing or condensation allowed. Operation at an ambient temperature of 45 °C or less is recommended to ensure long-term reliability.

4. Installation of AMSR

4.1.5 Installation of regenerative resistors (supplied with the AMSR controller)

- ☐ Check the model and quantity of regenerative resistors prior to installation.
- ☐ Be sure to use all regenerative resistors supplied with the controller.
- ☐ Regenerative resistors may be excessively heated. Use heat-resistant and fireproof wires and avoid their contact with the resistors.
- ☐ If the generation capacity exceeding the standard specification level is required, regenerative resistors must be exchanged. Consult us separately.
- ☐ Pay attention to the installation standard below (Fig. 4.1b).

Table 4.1a Regenerative Resistor

- AC 200 V

Applicable Model	Regenerative Resistor Model	Supplied Quantity
AMSR-2FGI-	GPZG400-1.5 Ω	4
AMSR-2HJL-	GPZG400-0.9 Ω	5
AMSR-2KMO-	GPZG400-0.6 Ω	

- AC 400 V

Applicable Mode	Regenerative Resistor Model	Supplied Quantity
AMSR-4FGI-	GPZG400-5.0 Ω	4
AMSR-4HJL-	GPZG400-2.5 Ω	5
AMSR-4KMO-	GPZG400-2.0 Ω	

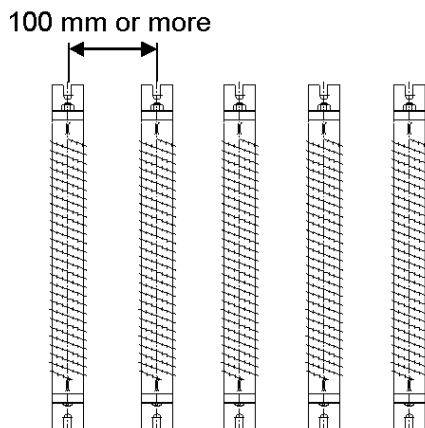


Fig. 4.1b Regenerative Resistor Installation Standard

4. Installation of AMSR

4.2 Cable preparation

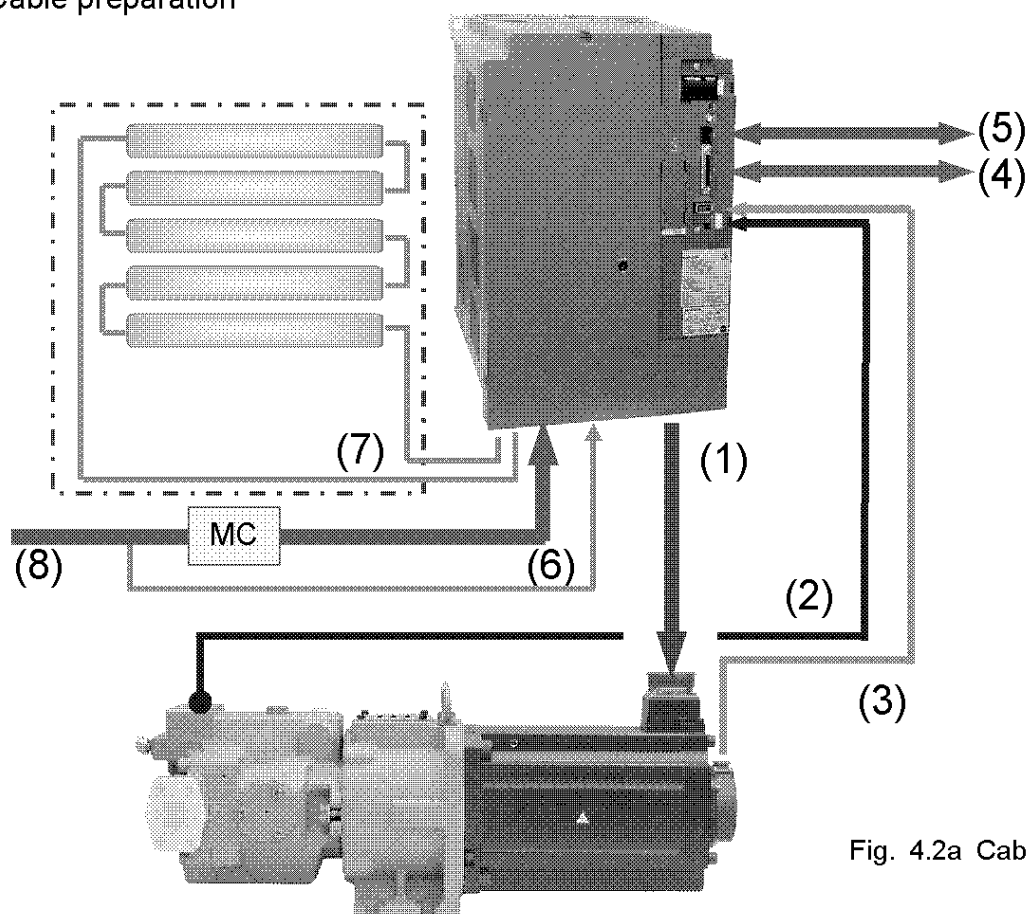


Fig. 4.2a Cables

Table 4.2a Cables

No.	Name	Use
(1)	Motor Cable	Transmits control power from the AMSR controller to the motor.
(2)	Pressure Sensor Cable	Feeds the pump discharge pressure back to the AMSR controller.
(3)	Encoder Cable	Feeds the motor speed back to the AMSR controller.
(4)	Driver Cable	Transmits I/O signals between the AMSR controller and the main system.
(5)	Communication Cable	Communicates with PC for parameter adjustment using dedicated software (not used during normal operation).
(6)	Control Power Cable	Supplies power to the AMSR control board.
(7)	Regenerative Resistor Cable	Feeds motor regenerative power to regenerative resistors.
(8)	Primary Power Cable	Supplies primary power for driving the ASR unit.

- ☐ Basically, the unit is supplied without cables. Determine the required cable length and consult us separately. For the details of cables, see the next section and later.
- ☐ Apply power in the order of the control power cable -> primary power cable.
- ☐ For details, see the wiring diagram of the dimensional drawing corresponding to the purchased model.

4. Installation of AMSR

4.2.1 Cable with an end connector

With reference to the dimensional drawing, fix the cables in the appropriate positions.

The same connectors are used for the encoder cable and the pressure sensor cable. When connecting them, check their end connectors to avoid incorrect wiring.

4.2.2 Wiring of the terminal block on the AMSR controller

- For details, see the wiring diagram of the dimensional drawing corresponding to the purchased model.
- The connection of the primary power supplies (L1, L2, and L3) with the motor power terminals (U, V, and W) is not protected. Incorrect connection immediately results in instant burnout at power-on. Be sure to wire the power supplies correctly.
- Connect the primary power supplies (L1, L2, and L3) with the motor power cables (U, V, and W) in the same phase.

- a) Remove the AMSR terminal block cover. For the models AMSR-FGI/HJL/KMO, there is a fixing bolt on the top of the cover. Unscrew the bolt before removing the cover.

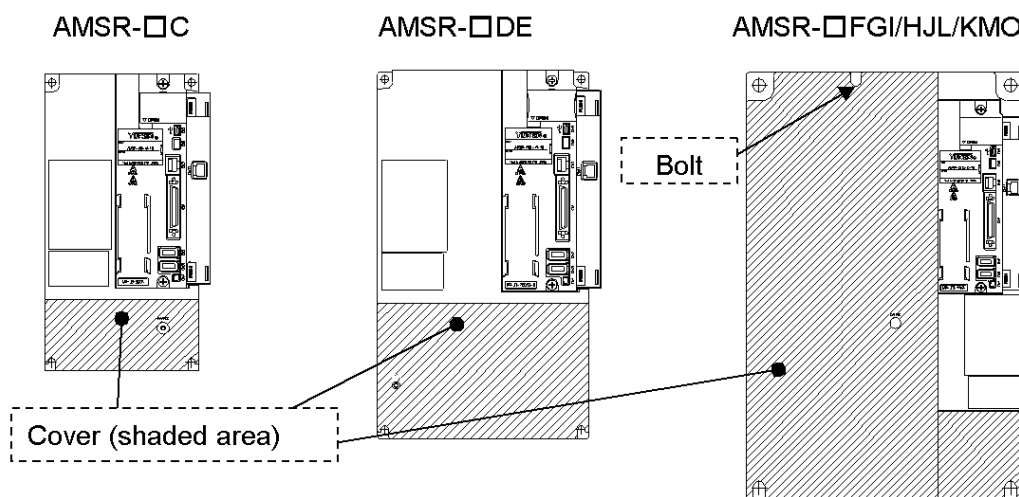


Fig. 4.2b AMSR Terminal Block Cover

- b) Primary power cable

Table 4.2b Power Cable

Power capacity	Model	AMSR-2*-	AMSR-4*-
		200 V/3 φ	400 V/3 φ
C		5.5 (AWG10)	5.5 (AWG10)
D		8 (AWG8)	
E			
F		14 (AWG6)	8 (AWG8)
G		22 (AWG4)	14 (AWG6)
H		14 (AWG6)	8 (AWG8)
I		22 (AWG4)	14 (AWG6)
J		50 (AWG1/0)	
K		22 (AWG4)	
L		50 (AWG1/0)	
M			

Unit: mm²

4. Installation of AMSR

c) Terminal block wiring

1) Terminal block wiring diagram for AMSR-□C-

- Be sure to connect the ground wire.

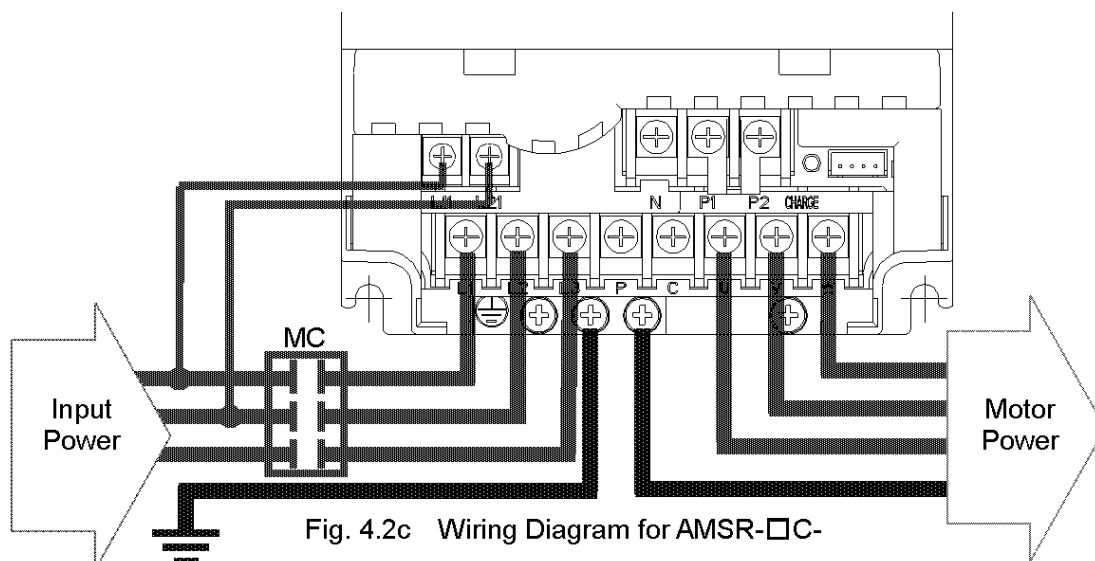


Fig. 4.2c Wiring Diagram for AMSR-□C-

Table 4.2c Terminal Screw Size and Tightening Torque for AMSR-□C-

Terminal	L1, L2, L3, P, C, U, V, W, P1, P2, N	L11, L21
Terminal Screw Size	M4	M3.5
Tightening Torque	1.2 N·m	0.8 N·m

2) Terminal block wiring diagram for AMSR-□DE-

- Be sure to connect the ground wire.

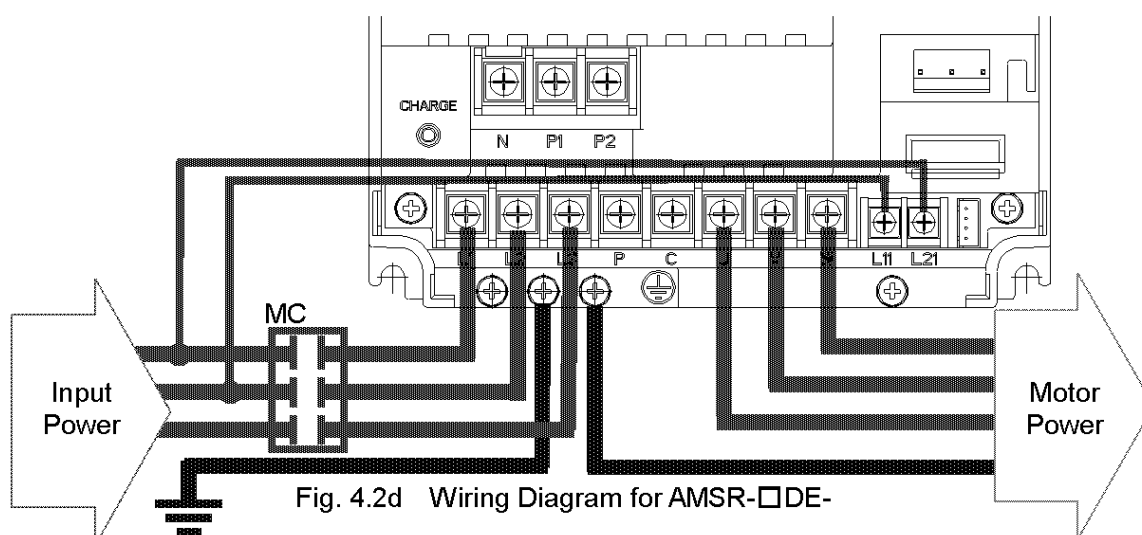


Fig. 4.2d Wiring Diagram for AMSR-□DE-

Table 4.2d Terminal Screw Size and Tightening Torque for AMSR-□DE-

Terminal	L1, L2, L3, P, C, U, V, W, P1, P2, N	L11, L21
Terminal Screw Size	M4	M3.5
Tightening Torque	1.2 N·m	0.8 N·m

4. Installation of AMSR

3) Terminal block wiring diagram for AMSR-□FGI/HJL/KMO-

- Be sure to connect the ground wire.
- Make sure that the motor power cable's U, V, and W phases are connected correctly.
- For the cable type, see 4.2.3 Other cables and Table 4.2h.

Motor Terminal Block (Applicable Model: ASR□-I - M-)

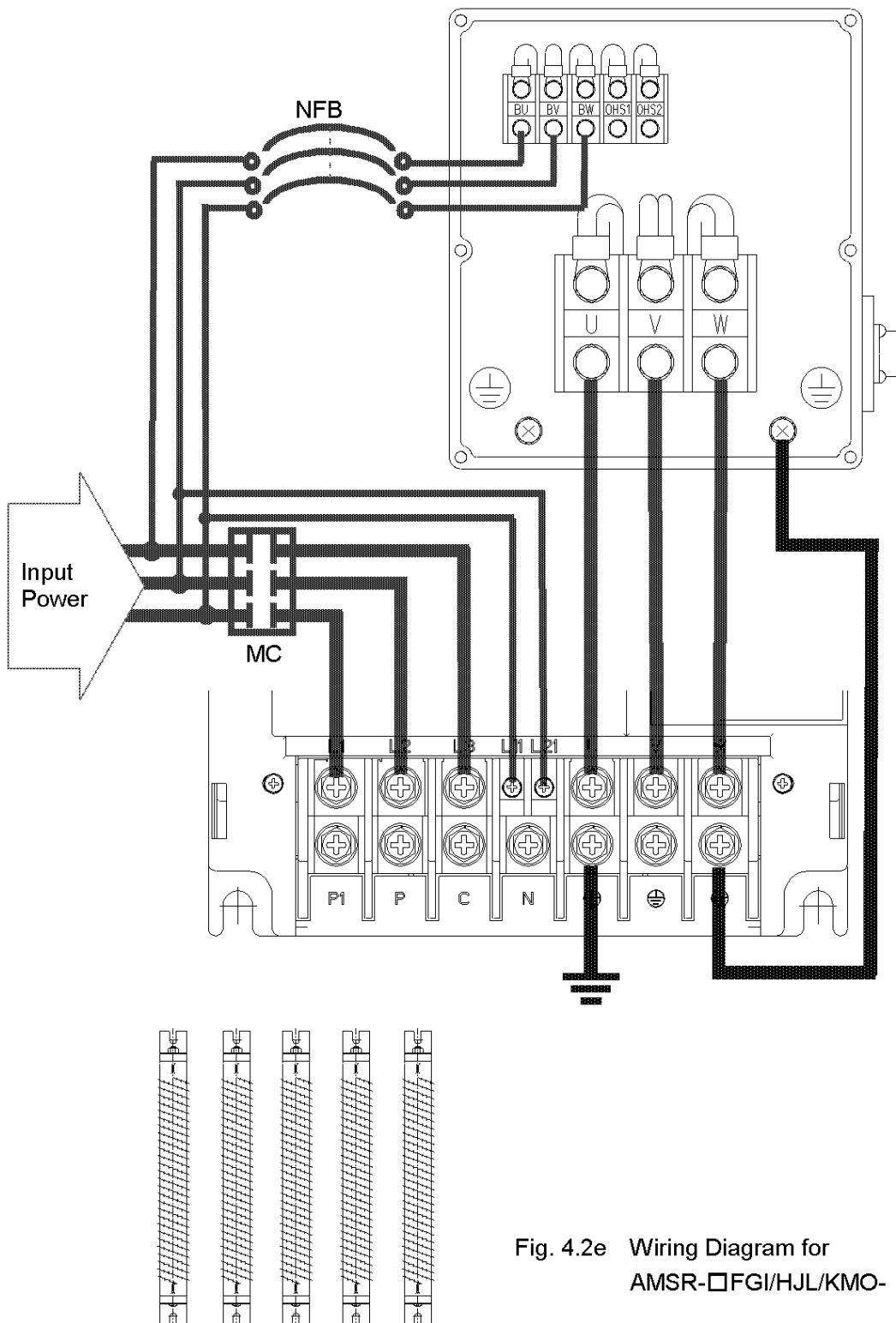


Fig. 4.2e Wiring Diagram for
AMSR-□FGI/HJL/KMO-

4. Installation of AMSR

Table 4.2e Terminal Screw Size and Tightening Torque for AMSR-□FGI/HJL-

Terminal	L1, L2, L3, P, C, U, V, W, P1, N	L11, L21
Terminal Screw Size	M6	M4
Tightening Torque	3.0 N·m	1.2 N·m

Table 4.2f Terminal Screw Size and Tightening Torque for AMSR-□KMO-

Terminal	L1, L2, L3, P, C, U, V, W, P1, N	L11, L21
Terminal Screw Size	M8	M4
Tightening Torque	6.0 N·m	1.2 N·m

4.2.3 Other cables

- Control power cable: 1.25 mm² (AWG16)
- Regenerative resistor cable: 5.5 mm² (AWG10)
- Fan power cable: 2 mm² (AWG14) * Applicable model: ASR□-I - M-
- Regenerative resistors may be excessively heated. Use heat-resistant and fireproof wires and avoid their contact with the resistors.

4. Installation of AMSR

4.2.4 Motor cable

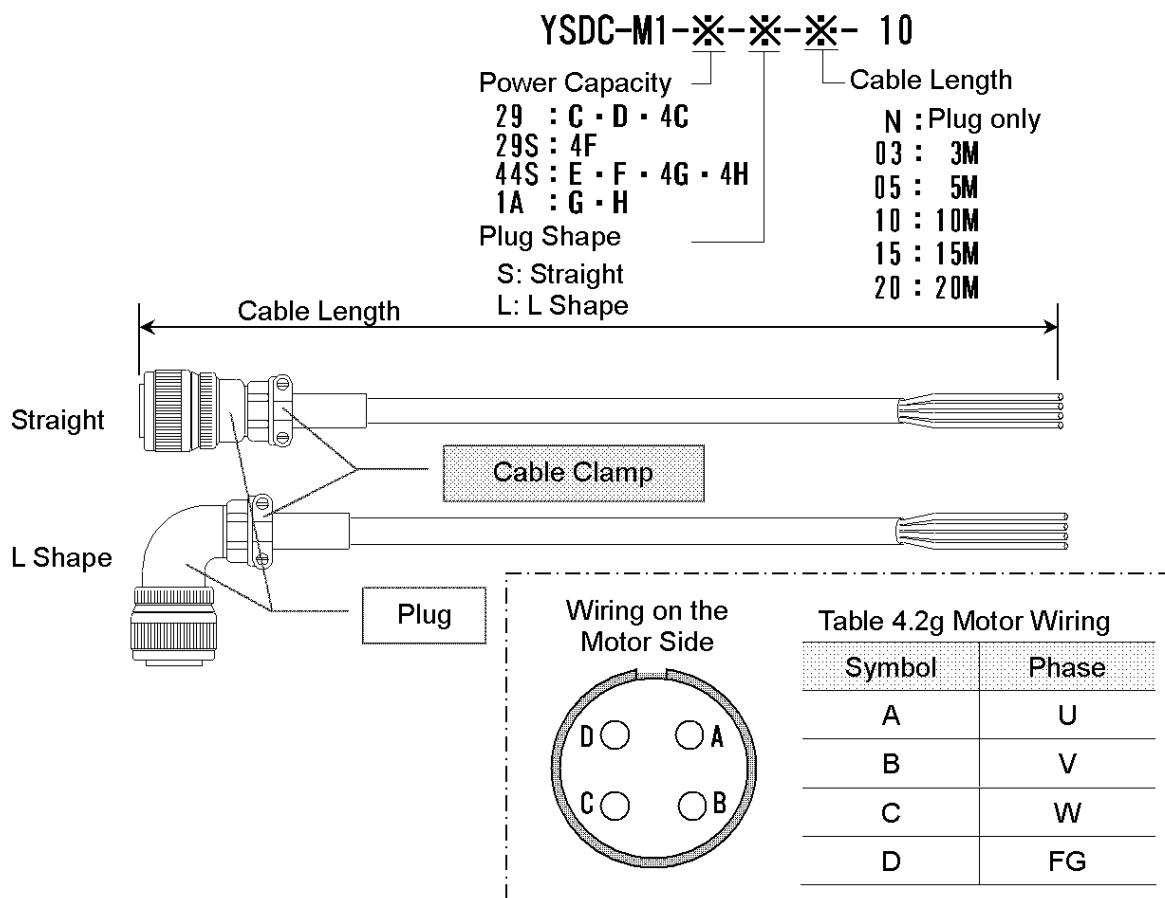


Fig. 4.2f Motor Cable

Table 4.2h Cable Diameter for Each Power Capacity

Power Capacity	Power Cable mm ²		Plug Model (DDK Ltd.)		
	200 V/3 φ	400 V/3 φ	Plug		Cable Clamp
			Straight	L Shape	
C	5.5 (AWG10)	5.5 (AWG10)	MS3106B22-22S	MS3108B22-22S	MS3057-12A
D					
E					
F	8 (AWG8)	5.5 (AWG10)	MS3106B32-17S	MS3108B32-17S	MS3057-20A
G	14 (AWG6)	8 (AWG8)			
H					
I					
J	22 (AWG4)		Terminal Block		
K					
L					
M	60 (AWG2/0)	22(AWG4)			

- The plugs are used for power capacities C to H. The models used for power capacities I to M have terminal block connectors; they do not require the use of plugs (connectors).
- Plugs and cable clamps are also available independently.

4. Installation of AMSR

4.2.5 Pressure sensor cable

YSDC-P2-P~~※~~-~~※~~-10

End Shape _____ Cable Length

PA : Both Sides

P : Pressure Sensor Side

A : AMSR Side

02 : 2m

03 : 3m

05 : 5m

10 : 10m

20 : 20m

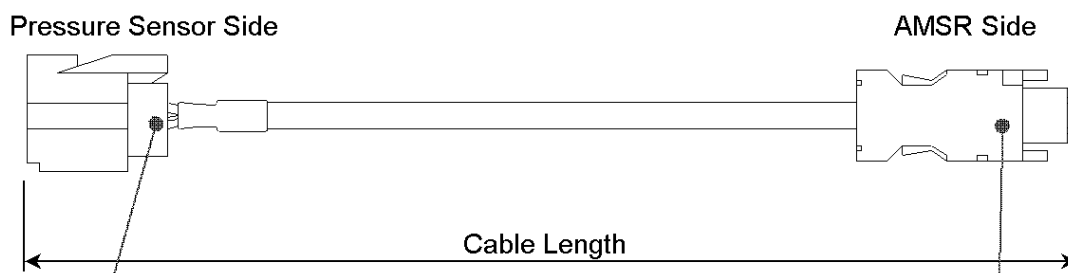


Fig. 4.2g Pressure Sensor Cable

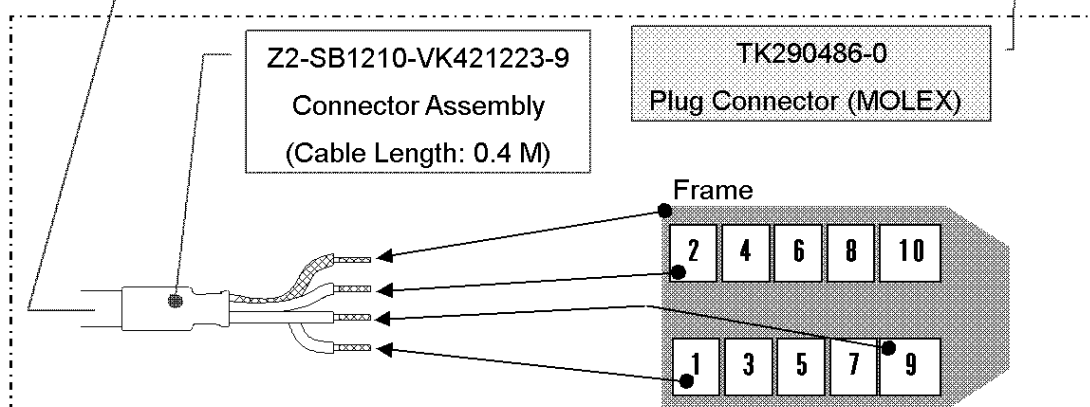
* Wire: 0.5 mm² (AWG20)

Fig. 4.2h Pressure Sensor Wiring Diagram

Table 4.2i Pressure Sensor Wiring Diagram

	Z2-SB1210-VK421223-9	TK290486-0
Power +	Red	1
Common	Black	2
Output	White	7
Shield	SG	SG

4. Installation of AMSR

4.2.6 Encoder cable

YSDC-E7-S-✖-10

Cable Length

02 : 2M

05 : 5M

10 : 10M

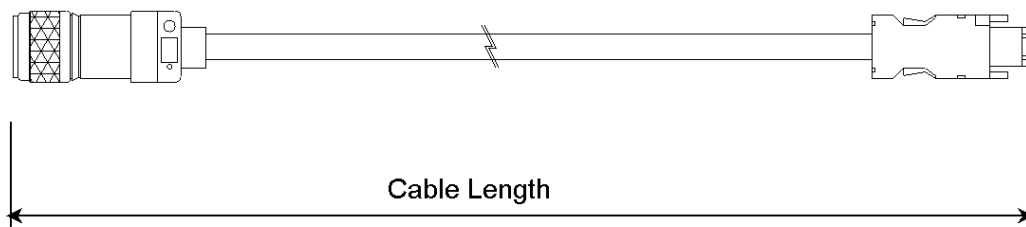


Fig. 4.2i Encoder Cable

4.2.7 Driver cable

YSDC-D14-00-✖-10

Cable Length

01 : 1m

02 : 2m

03 : 3m

05 : 5m

10 : 10m

20 : 20m

Type

D14: Standard

D13: Digital Output of Motor Speed

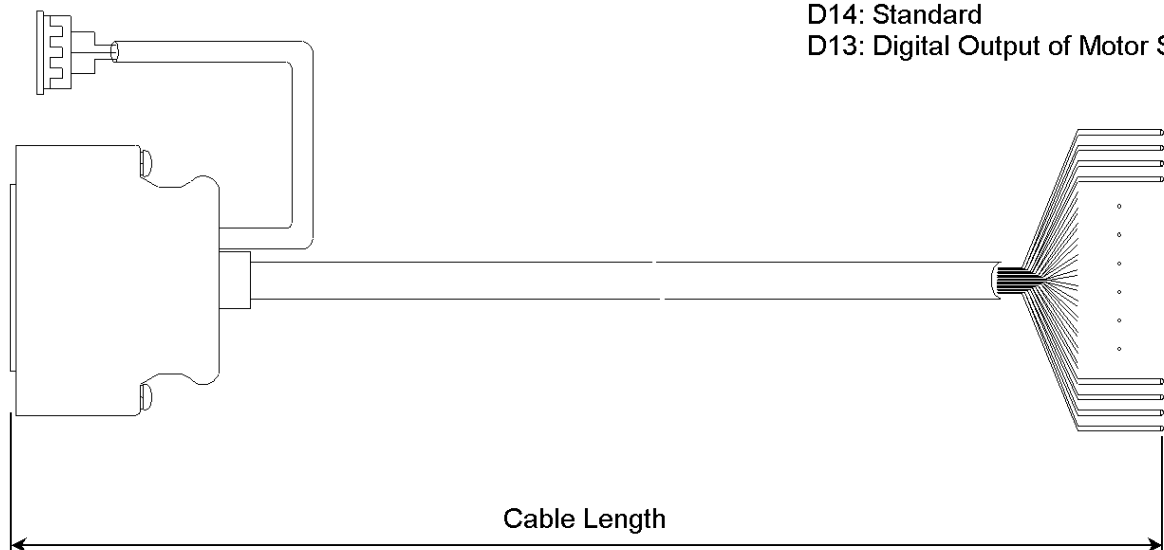


Fig. 4.2j Driver Cable

4. Installation of AMSR

4.3 Driver cable wiring

- In addition to this manual, refer to the wiring diagram of the dimensional drawing corresponding to the purchased model.
- For details on the use of signals and the wiring method, see 2.7 Interface.
- For the cable with the digital output of motor speed (YSDC-D13-*-10), consult us separately.

Table 4.3a Driver Cable

* The wire colors are applicable to "YSDC-D14 (D13)-*-10" only.

Connector	Signal	Pin No.	Signal Name	Symbol	Wire	Color
CN6	Analog Monitor	1	Control Common	LG	Green/ Black	
		2	General Monitor 2	MON2	Yellow/Red	
		3	General Monitor 1	MON1	Green/Red	
CN1	Sequence Power	20	+ 24 V Common	DICOM	Red	
		46	0 V Common	DOCOM	Red/White	
	Sequence Input	15	Servo ON	SON	Black	
		16	Reserved	(N.U)	Black/White	
		17	Forward Rotation Start	ST1	Green	
		18	Reverse Rotation Start	ST2	Green/ White	
		19	Reset	RES	Yellow	
		41	Reserved	(N.U)	Yellow/ White	
		42	Emergency Stop	EMG	Gray	
		43	Control Code x 1	HC1	Gray/White	
		44	Control Code x 2	HC2	Blue	
		45	Swash Plate Angle Large/Small	L/SI	Blue/White	
		47	0 V Common	DOCOM	Brown/ White	
	Sequence Output	22	Alarm Code 2	ACD2	Orange	
		23	Alarm Code 1	ACD1	Orange/ White	
		24	Alarm Code 0	ACD0	Purple	
		25	Swash Plate Angle Large	L/SO	Purple/ White	
		48	Failure	ALM	Bright green	
		49	Ready	RD	Bright green/ White	
		21	+ 24 Common	DICOM	Brown	
	Analog I/O	1	DC 15 V Power Output	P15R	White	
		2	Pressure Command Voltage	PIN	Pink	
		3	Control Common	LG	Pink/White	
		27	Flow Command Voltage	QIN	Pale blue	
		28	Control Common	LG	Pale blue/ White	
		34	Control Common	LG	Yellow/ Black	

4. Installation of AMSR

4.3.1 Analog monitor

a) Use

- Select sensor output items each with an analog voltage of up to ± 10 V.
- The default value is shown in 6.6 Default settings of parameters. The monitor output is set to 1 = SMN/2 = SMP. For changing the output voltage, see 6.5 Parameters.
- The monitor output items below are available. For details, see 6.5 Parameters.

Table 4.3b Monitor Output

Abbr.	Monitor Name	Output Voltage (Default)
REF	Motor Speed Command	± 5 V/ ± 2000 r/min
PIN	Pressure Command	5 V/17.5 MPa
QIN	Flow Command	5 V/2000 r/min
SMP	Achieved Pressure	5 V/17.5 MPa [MON2]
SMN	Achieved Motor Speed	± 5 V/ ± 2000 r/min [MON1]
TRQ	Effective Load Ratio	± 1 V/ ± 100 %
PIN-f	Pressure Command (with the command filtered)	5 V/17.5 MPa
QIN-r	Flow Command (with Q-COMP added)	5 V/2000 r/min
P/Q	Pressure Control Flag	0 V: Flow Control 1 V: Pressure Control

b) Analog monitor power signal and wire color

Table 4.3c Analog Monitor Wire

* The wire colors are applicable to "YSDC-D14 (D13)-*-10" only.

Signal Name	Pin No.	Symbol	Wire	Color
Common	1	LG	Green/ Black	
General Monitor 2	2	MON2	Yellow/ Red	
General Monitor 1	3	MON1	Green/ Red	

4. Installation of AMSR

4.3.2 Sequence power

a) Use

- The sequence power is used for the sequence controller. Make sure that the sequence power is applied before the application of the AMSR drive power.

b) Sequence power signal and wire color

Table 4.3d Sequence Power Wire

* The wire colors are applicable to "YSDC-D14 (D13)-*-10" only.

Signal Name	Pin No.	Symbol	Wire	Color
+ 24 V Common	20	DICOM	Red	
0 V Common	46	DOCOM	Red/ White	

c) Wiring

- Input a voltage of DC 20 to 28 V for DC 24 V.
- Perform wiring in such a way that it does not contact high voltage power cables (motor power cable, etc.).
- Insulation is required between 0 V: DOCOM and Control Common: LG. A short-circuit may result in a shorter service life or damage to the controller.

4. Installation of AMSR

d) Sequence input signal and wire color

Table 4.3e Sequence Input Wire

* The wire colors are applicable to "YSDC-D14 (D13)-*-10" only.

Signal Name	Pin No.	Symbol	Wire	Color
Servo ON	15	SON	Black	
Reserved	16	(N.U)	Black/White	
Forward Rotation Start	17	ST1	Green	
Reverse Rotation Start	18	ST2	Green/ White	
Reset	19	RES	Yellow	
Reserved	41	(N.U)	Yellow/ White	
Emergency Stop	42	EMG	Gray	
Control Code x 1	43	HC1	Gray/White	
Control Code x 2	44	HC2	Blue	
Swash Plate Angle Large/Small	45	L/SI	Blue/White	
0 V Common	47	DOCOM	Brown/ White	

e) Wiring

<Wiring diagram for reference>

The figure below shows a diagram of the wiring for controlling Servo ON, Emergency Stop, and Alarm Reset on the main system side.

In this case, be sure to synchronize Forward Rotation Start (ST1) with Servo ON (SON) or keep it short-circuited with 0 V Common (DOCOM).

Make sure that Emergency Stop is "ON" during operation. If the contact is open, an alarm occurs and prevents the start of operation.

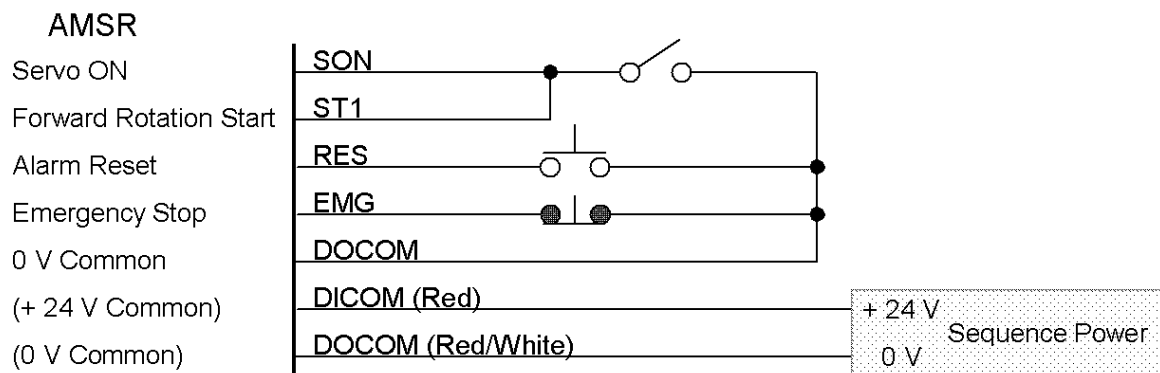


Fig. 4.3a Sequence Input Wiring Diagram

4. Installation of AMSR

4.3.3 Sequence output

a) Use

- Alarm Code: Outputs alarm codes divided into seven categories.

* For details, see 7 Troubleshooting.

Table 4.3f Alarm Code Logics

Code Output	0	1	2	3	4	5	6
Alarm Code 0	OFF	ON	OFF	OFF	ON	OFF	ON
Alarm Code 1	OFF	OFF	ON	OFF	ON	ON	ON
Alarm Code 2	OFF	OFF	OFF	ON	OFF	ON	ON

- Swash Plate Angle Large: Output when a large swash plate angle is used with the signal Swash Plate Angle Large/Small (Two-speed) (not output for ASR□-*X*-).
- Failure: Output when AMSR controller failure is determined.
* For details, see 7 Troubleshooting.
- Ready: Output when the servo is made ready.
- + 24 V Common: Applies a sequence power voltage of + 24 V.

b) Sequence output signal and wire color

Table 4.3g Sequence Output Wire

* The wire colors are applicable to "YSDC-D14 (D13)-*-10" only.

Signal Name	Pin No.	Symbol	Wire	Color
Alarm Code 2	22	ACD2	Orange	
Alarm Code 1	23	ACD1	Orange/White	
Alarm Code 0	24	ACD0	Purple	
Swash Plate Angle Large	25	L/SO	Purple/White	
Failure	48	ALM	Bright green	
Ready	49	RD	Bright green/White	
+ 24 V Common	21	DICOM	Brown	

c) Wiring

- Sequence output signals are output from the open collector.

Note) Allowable current: 40 mA or less - Inrush current: 100 mA or less.

4. Installation of AMSR

4.3.4 Analog I/O

a) Use

- DC 15 V Power Output: Outputs DC 15 V.
- Pressure Command Voltage: Inputs pressure command voltage to Control Common (LG).
- Flow Command Voltage: Inputs flow command voltage to Control Common (LG).
- Control Common: Common terminal for analog input signals.

b) Analog I/O signal and wire color

Table 4.3h Analog I/O Wire

Signal name	Pin No.	Symbol	Wire	Color
DC 15 V Power Output	1	P15R	White	
Pressure Command Voltage	2	PIN	Pink	
Control Common	3	LG	Pink/White	
Flow Command Voltage	27	QIN	Pale blue	
Control Common	28	LG	Pale blue/ White	
Control Common	34	LG	Yellow/ Black	

c) Wiring

- Input pressure (PIN)/flow (QIN) command signals. Use a Control Common terminal for each command signal.

5. Preparation for operation

5. Preparation for operation

5.1 Operating environment

Use the product as a hydraulic power source for hydraulic equipment.

Operate it in the following environment. Operation in other conditions may result in malfunction.

- Installation location: Indoors; no combustible/corrosive/flammable gas or mist, meeting the following requirements.
 - Ambient environment: See 2.5 Specifications, 3. Installation of N-ASR, and 4. Installation of AMSR.
 - No obstruction that may prevent ventilation or make the nameplate invisible.
 - The product is not waterproof and must not be used in water.

**DANGER**

- ◆ Never use the product in an explosive atmosphere where flammable gases or explosives are handled. Doing so may result in fire, explosion, or any other serious and fatal accident.

5.2 Hydraulic fluid

**CAUTION**

- ◆ Use proper hydraulic fluid within the specified ranges of fluid temperature, viscosity, and contamination level. Failure to do so may result in malfunction or fluid leakage, causing fire.

5.2.1 Fluid type

- Petroleum based fluids or fluids equivalent to ISO VG32 or VG46

Note) To use hydraulic fluids other than petroleum based one (synthetic fluids, water based fluids, etc.), consult us separately.

5.2.2 Fluid viscosity and temperature

Meet the following requirements for fluid viscosity and temperature during operation.

Viscosity: 20 to 400 mm²/s

Fluid temperature: 0 to 60 °C

5.2.3 Prevention of foreign matter invasion

Foreign matter entering hydraulic fluid may result in a shorter service life or failure of the pump. Always keep the fluid clean (contamination level: NAS 9 or better).

5. Preparation for operation

5.3 Operation of ASR



WARNING

- ◆ Never fail to check piping before starting the motor-driven pump unit. Failure to do so may result in damage to the components or outflow of hydraulic fluid, causing a serious accident.
- ◆ When any abnormal condition is observed (noise, fluid leakage, smoke, etc.), immediately stop operation and take appropriate measures. Continued operation under such conditions may result in an accident.



CAUTION

- ◆ Use the product as specified in the catalog, drawings, and specifications. Failure to do so may result in malfunction or damage to the product, causing injury.
- ◆ Perform adjustment work while ensuring safety, e.g. keeping people away from the movable parts of the unit.

- Note) - Do not join the drain line to other return lines. Doing so may result in malfunction or failure.
- Long-time operation with reverse rotation may result in pump burnout or damage to the components.
 - Do not increase the pressure setting until normal operation starts. Doing so may result in pressure oscillation or abnormal noise.

5. Preparation for operation

5.3.1 Initial operation



CAUTION

- ◆ Upon initial operation, make sure that the hydraulic circuit and electric wiring have been correctly installed, that fastened parts are not loose, and that displacement and operating pressure are as specified in the nameplate.

- a) Pour clean hydraulic fluid through the filling port on the pump.

Failure to do so may result in burnout of the unit or damage to the components.

Table 5.3a Fluid Filling Amount for Each Model

Model	Filling Amount
ASR1/2	600 cm ³
ASR3	1200 cm ³
ASR5	1200 cm ³
ASR10	2500 cm ³

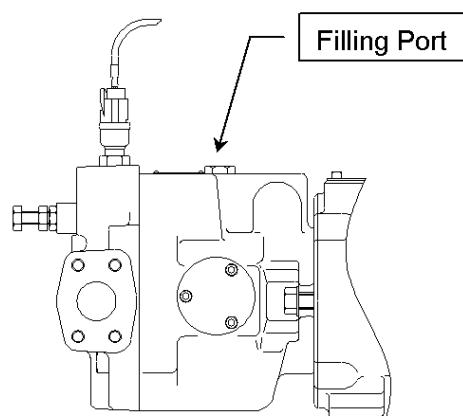


Fig. 5.3a Filling the Pump with Hydraulic Fluid

- b) If possible, adjust control valves so that the pump discharge fluid circulates directly into the tank or so that the actuator runs with no load.

Note) Do not start the pump with its discharge blocked.

- c) Operate the pump under the following recommended conditions and check the two points below.

<Power application>

Start and run the ASR pump as follows.

Turn on the AMSR control power supply. -> Turn on the AMSR drive power supply.

-> Turn on the AMSR servo.

* The repetition of turning on the servo and the driver power supply at the same time may result in damage.

<Recommended operating conditions>

Motor speed: 1000 r/min or less

Pressure: 7 MPa or less

<Check points>

i) Check if the motor rotation direction is as specified in the nameplate.

ii) Check if the pump sucks the fluid in a normal manner.

- d) After checking that there is no problem in Step c), go on the test run and air-bleed the system.

Note) Upon startup, air enters hydraulic fluid, causing noise; this is not an indication of failure.

If the noise is not eliminated after some time, air-bleed the circuit.

5. Preparation for operation

5.4 Flow adjustment

The pump discharge flow is set to a certain level by default. If required, adjust the discharge flow with reference to the description below. If the motor stops due to overload depending on the operation condition or when the pump is replaced by a spare one, the discharge flow must be adjusted with reference to the description below.

* The values shown below are approximate. After adjustment, perform fine tuning by operating the actual unit.

5.4.1 Flow adjustment and dimension measurement

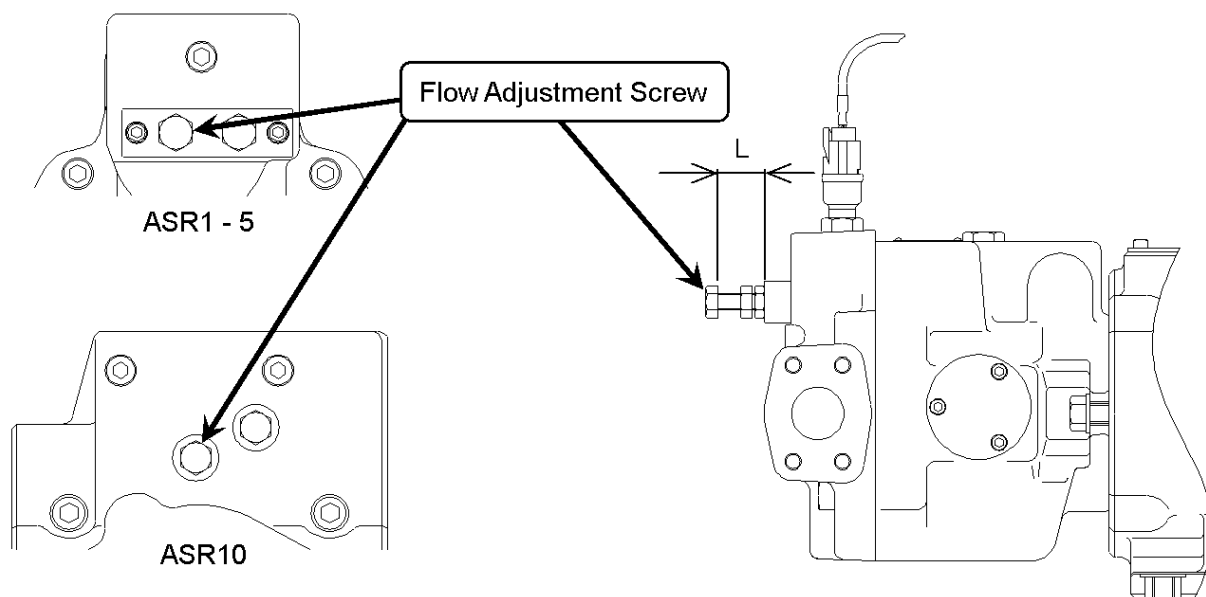


Fig. 5.4a Flow Adjustment/Dimension Measurement

5.4.2 Adjustment screw length

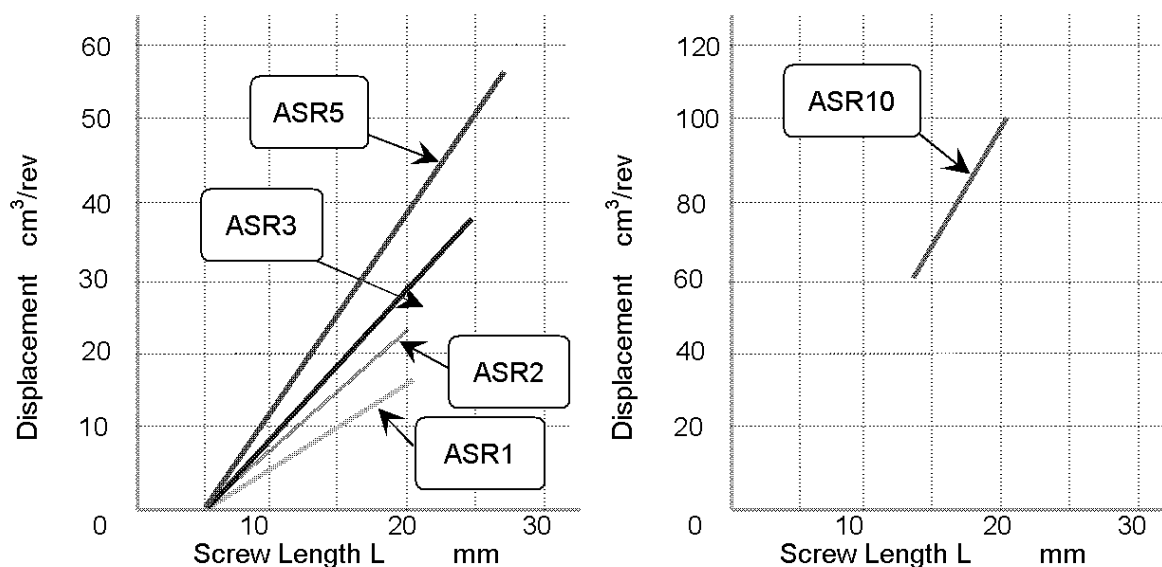


Fig. 5.4b Displacement vs. Flow Adjustment Screw Length

5. Preparation for operation

5.4.3 Default setting of the flow adjustment screw and displacement changed by one turn of the screw

Table 5.4a Default Setting for Each Model

Model	Default Value *	Displacement Changed by One Turn of the Flow Adjustment Screw
ASR1	15.8 cm ³ /rev	1.40 cm ³ /rev
ASR2	22.2 cm ³ /rev	2.00 cm ³ /rev
ASR3	36.9 cm ³ /rev	2.90 cm ³ /rev
ASR5	56.2 cm ³ /rev	3.90 cm ³ /rev
ASR10	100.0 cm ³ /rev	5.35 cm ³ /rev

* When selecting ASR□-*X*-

5. Preparation for operation

5.5 Safety valve adjustment

The safety valve is set to a certain pressure by default. If required, adjust the setting with reference to the description below. To regulate the maximum operating pressure according to the specification of the actual unit, adjust the pressure with reference to the description below.

* The values shown below are approximate. After adjustment, perform fine tuning by operating the actual unit.

5.5.1 Pressure adjustment and dimension measurement

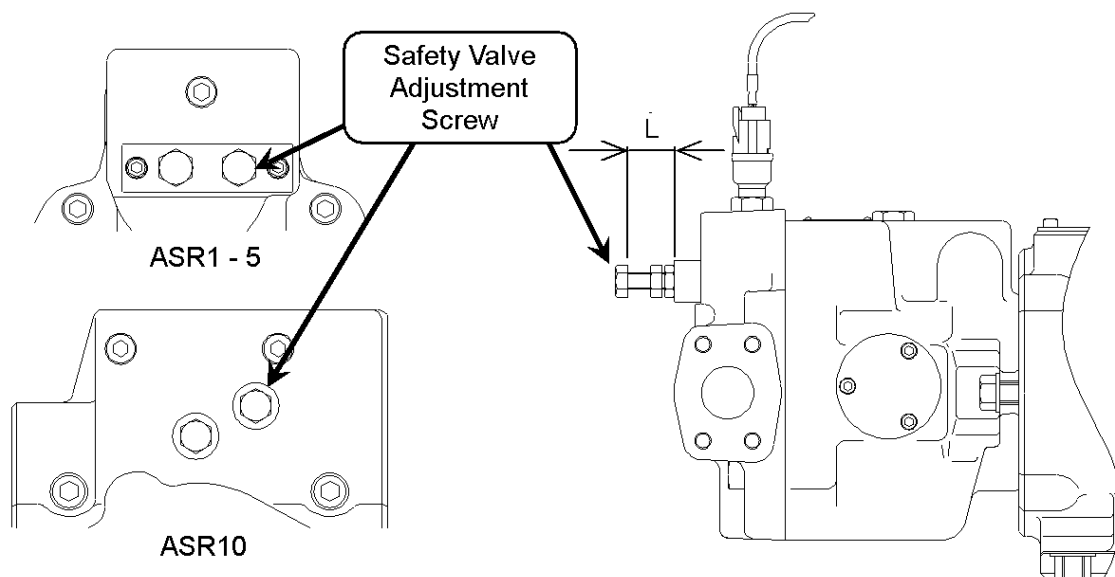


Fig. 5.5a Safety Valve Adjustment/Dimension Measurement

5.5.2 Adjustment screw length

- The safety valve is set according to the model by default. Do not adjust it if not required.
- To make accurate adjustments, loosen the safety valve adjustment screw and operate the pump at about 1000 r/min. With the discharge circuit blocked, set the valve while observing the pressure gauge on the actual unit.

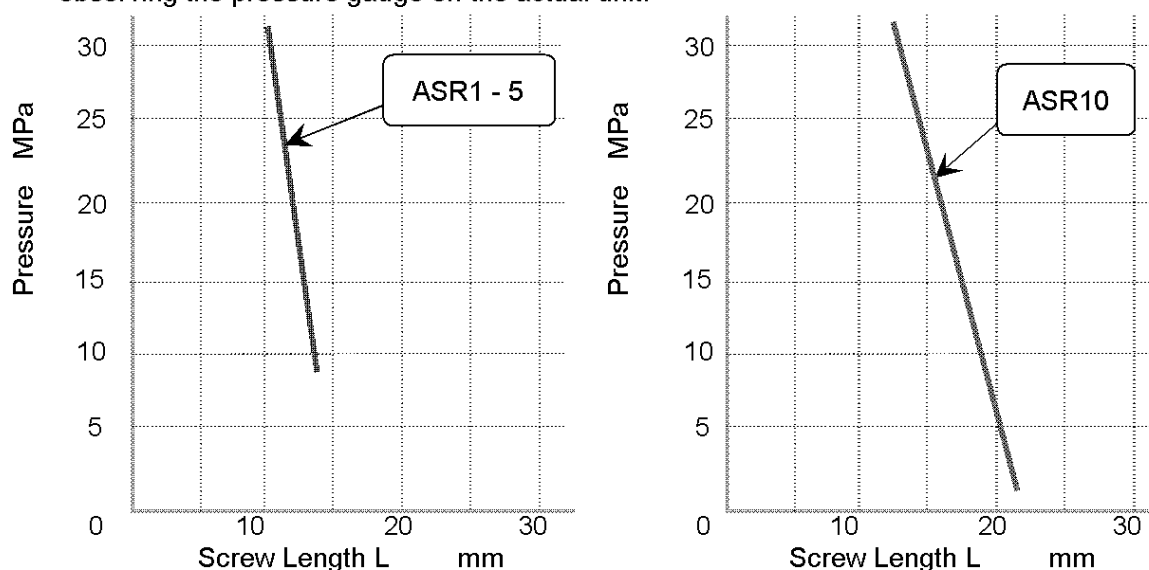


Fig. 5.5b Length of the Safety Valve Adjustment Screw

5. Preparation for operation

5.5.3 Default setting of the safety valve adjustment screw and pressure changed by one turn of the screw

Table 5.5a Safety Valve Setting Pressure for Each Model

Model	Default Value	Max. Setting Value	Pressure Changed by One Turn of the Safety Valve Adjustment Screw
ASR1	21 MPa	24.5 MPa*	4.4 MPa
ASR2	19.5 MPa	19.5 MPa*	
ASR3	21 MPa	24.5 MPa*	
ASR5			
ASR10			

* The value is different from the maximum operating pressure.

6. Operation adjustment

6. Operation adjustment

6.1 Display and operation buttons

6.1.1 Overview

The AMSR controller has a display (5-digit 7-segment LED) and four operation buttons that allow you to view the servo amplifier status and to set alarms/parameters.

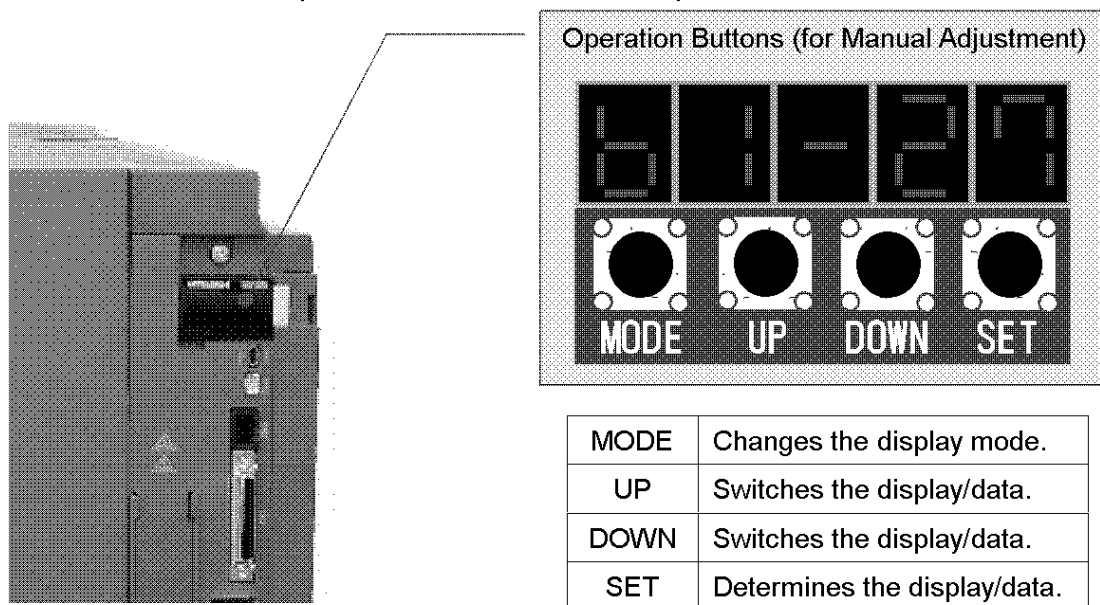


Fig. 6.1a Display and Operation Buttons

6.1.2 Display flow

The display mode changes each time the “MODE” button is pressed. For the details of each display mode, see 6.3 and later.

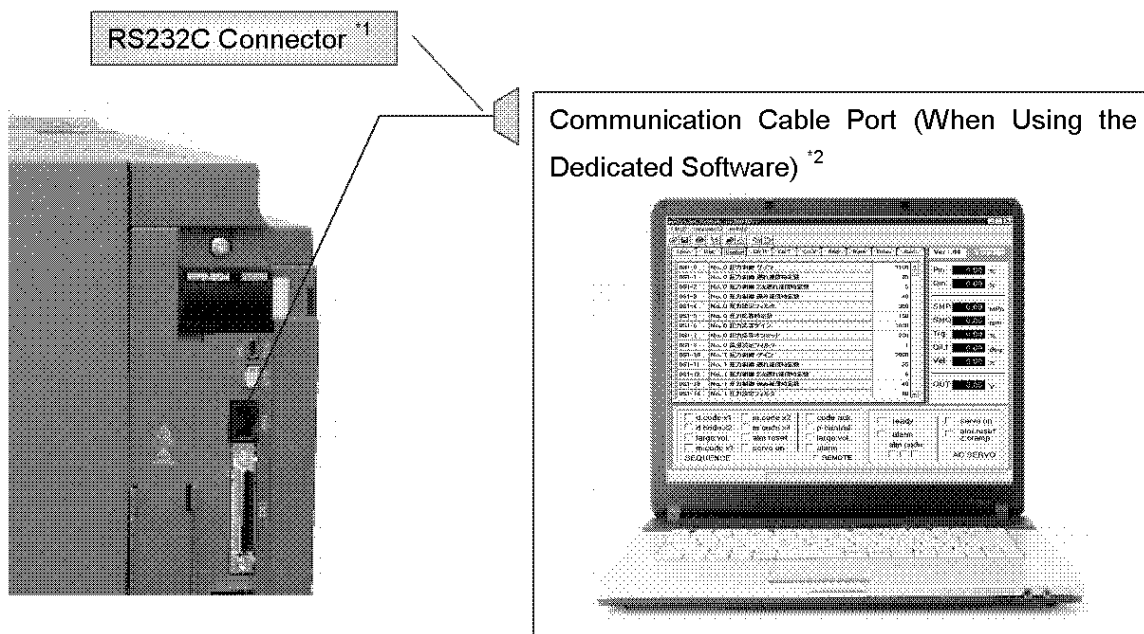
Table 6.1a Display Mode (Press the “MODE” button.)

Display Mode	Display	Function	Reference
Status Display	C	Displays the servo motor status (at power-on).	
Diagnosis	Rd-oF	Displays the sequence, external signals, etc.	
Alarm	AL --	Displays current alarms and alarm history.	
Basic Parameters	P A01	Displays and sets the parameters.	
Gain/Filter Parameters	P b01	Displays and sets the parameters.	
Extended Parameters	P C01	Displays and sets the parameters.	
I/O Parameters	P d01	Displays and sets the parameters.	
Hydraulic Control Parameters	P 001	Displays and sets the parameters.	

6. Operation adjustment

6.2 Communication cable <for setup by the manufacturer>

- "DSV-CABV," a RS-485/RS-232C conversion cable manufactured by Diatrend Corporation, is used. Consult us if required.
- Dedicated software for ASR is used for ASR monitoring and parameter adjustment. It eliminates the necessity of manually adjusting the parameters.



*1 When using PC with USB ports only, a RS232C/USB conversion cable is separately required.

*2 For the details of the dedicated software, consult us separately.

Fig. 6.2a Parameter Adjustment

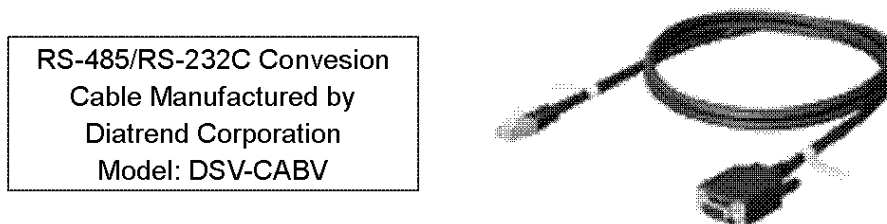


Fig. 6.2b Communication Cable

6. Operation adjustment

6.3 Status display

This mode displays the status of servo operation by the segment LED. The “UP” and “DOWN” buttons can be used to select the display items listed below.

After selecting a display item, press the “SET” button to display the corresponding data.

Table 6.3a Status Display Mode (Press the “MODE” button and select “C.” Then, use the “UP” and “DOWN” buttons.)

Status Display Mode	Initial Screen	Function (“SET” Button)
Cumulative Feedback Pulse	C	Not used.
Servo Motor Speed	r	Displays the servo motor speed (r/min).
Droop pulse	E	Not used.
Command Pulse	P	Not used.
Command Pulse Frequency	n	Not used.
Analog Speed Command Voltage	F	Displays the speed command from the hydraulic control board (V).
Analog Torque Command Voltage	U	Displays the analog torque command voltage.
Regenerative Load Ratio	L	Displays the percentage of regenerative voltage to the allowable regenerative power in %.
Effective Load Ratio	J	Displays the effective load ratio over the past 15 seconds in % with the rated torque considered as 100 %.
Peak Load Ratio	b	Displays the peak load ratio over the past 15 seconds in % with the rated torque considered as 100 %.
Instantaneous Torque	Γ	Displays the current torque value on a real-time basis in % with the rated torque considered as 100 %.
Within One-revolution Position (in 1 pulse)	CY1	Not used.
Within One-revolution Position (in 100 pulse)	CY2	Not used.
ABS Counter	LS	Not used.
Load Inertia Moment Ratio	dC	Not used.
Bus Voltage	Pn	Display the voltage of the main circuit converter (between P and N).

6. Operation adjustment

6.4 Diagnosis

This mode displays the sequence and external signals, forcibly turns on/off the output of digital signals, performs test operation, indicates the software version, performs automatic VC offset, and displays the motor series ID, motor type ID, and encoder ID.

Table 6.4a Diagnosis Mode (Press the “MODE” button and select “Rd-oF.” Then, use the “UP” and “DOWN” buttons.)

Diagnosis Mode	Initial Screen	Function (“SET” Button)
Sequence	Rd-of	Preparation is not completed yet.
	Rd-on	The servo is ready to turn on.
External I/O Signal Display		Displays the on/off status of external I/O signals. * For details, consult us separately.
Forcible Output of Digital Signals	do-on	Forcibly turns on/off the output of digital signals. * For details, consult us separately.
JOG Operation	Γ ES Γ 1	Allows operation with no command from an external command device (pressure control is disabled).
Positioning Operation	Γ ES Γ 2	Not used.
Motorless Operation	Γ ES Γ 3	Allows the generation of output signals or displays the status without connecting the servo motor as if the servo motor were running according to externally input signals.
Machine Analyzer Operation	Γ ES Γ 4	Not used.
Amplifier Diagnosis	Γ ES Γ 5	A dedicated cable is required. * Consult us separately.
Software Version Low	-AO	Displays the software version.
Software Version High	=OO	Displays the system number of the software.
Automatic VC Offset	HI 0	Not used.
Motor Series ID	H2 0	Displays the motor series ID of the currently connected motor when the “SET” button is pressed.
Motor Type ID	H3 0	Displays the motor type ID of the currently connected motor when the “SET” button is pressed.
Encoder ID	H4 0	Displays the encoder ID of the currently connected encoder when the “SET” button is pressed.
For Setup by the Manufacturer	H5 0	For setup by the manufacturer.
For Setup by the Manufacturer	H6 0	For setup by the manufacturer.

6. Operation adjustment

6.5 Parameters

The parameters for the servo amplifier are divided into the following groups according to their functions. To adjust hydraulic control for injection molding machines, use the hydraulic control parameters (No. PO□□).

Table 6.5a Classification of Parameters

Parameter Group	Description
Basic Parameters (No. PA□□)	Set basic parameters, including servo amplifier mode selection.
Gain/Filter Parameters (No. PB□□)	These parameters are related to the adjustment of motor speed control. Use them to adjust the gain manually.
Extended Parameters (No. PC□□)	Set the parameters for speed control mode and those related to communication and monitoring.
I/O Setting Parameters (No. PD□□)	These parameters are used to change I/O signals for the servo amplifier.
Hydraulic Control Parameters (No. PO□□)	These parameters are related to hydraulic control adjustment.

Note) This manual describes parameters required for hydraulic control adjustment. For other parameters, settings are made at the time of shipping inspection by YUKEN; it is prohibited to change the settings.

If any of the settings is changed, the unit may become inoperable.

To avoid improper setting, it is recommended to enable the function of parameter write-protection (PA19) after adjusting the actual unit.

6. Operation adjustment

Table 6.5b Basic Parameters (No. PA□□)

No.	Name	Function/Use	Default	Unit																																																																																																		
PA09	Auto-tuning Response	Decreases the setting value when the hunting of the equipment occurs or when the noise level is high. Increase the setting value for improving the performance (shortening the stabilization time, etc.). Low response Middle response High response Value 1 - 16 - 32 (10 Hz) (60 Hz) (400 Hz)	16																																																																																																			
PA15	Encoder Output Pulse	Sets encoder A-phase and B-phase pulses output by the servo amplifier. Set a value by quadrupling the A-phase and B-phase pulses.	4000	pulse/rev																																																																																																		
PA19	Parameter Write-protection	Enables write-protection for avoiding incorrect changes in the parameter values. <table><tr><th>Setting</th><th>Operation</th><th>PA</th><th>PB</th><th>PC</th><th>PD</th><th>PO</th></tr><tr><td rowspan="2">0000h</td><td>View</td><td>○</td><td>/</td><td>/</td><td>/</td><td>/</td></tr><tr><td>Write</td><td>○</td><td>/</td><td>/</td><td>/</td><td>/</td></tr><tr><td rowspan="2">000Bh</td><td>View</td><td>○</td><td>○</td><td>○</td><td>/</td><td>/</td></tr><tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>/</td><td>/</td></tr><tr><td rowspan="2">000Ch</td><td>View</td><td>○</td><td>○</td><td>○</td><td>○</td><td>/</td></tr><tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>○</td><td>/</td></tr><tr><td rowspan="2">000Fh</td><td>View</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>Write</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td rowspan="2">100Bh</td><td>View</td><td>○</td><td>/</td><td>/</td><td>/</td><td>/</td></tr><tr><td>Write</td><td>/</td><td>/</td><td>/</td><td>/</td><td>/</td></tr><tr><td rowspan="2">100Ch</td><td>View</td><td>○</td><td>○</td><td>○</td><td>/</td><td>/</td></tr><tr><td>Write</td><td>/</td><td>/</td><td>/</td><td>/</td><td>/</td></tr><tr><td rowspan="2">100Fh</td><td>View</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr><tr><td>Write</td><td>/</td><td>/</td><td>/</td><td>/</td><td>/</td></tr></table>	Setting	Operation	PA	PB	PC	PD	PO	0000h	View	○	/	/	/	/	Write	○	/	/	/	/	000Bh	View	○	○	○	/	/	Write	○	○	○	/	/	000Ch	View	○	○	○	○	/	Write	○	○	○	○	/	000Fh	View	○	○	○	○	○	Write	○	○	○	○	○	100Bh	View	○	/	/	/	/	Write	/	/	/	/	/	100Ch	View	○	○	○	/	/	Write	/	/	/	/	/	100Fh	View	○	○	○	○	○	Write	/	/	/	/	/	000Fh	
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6. Operation adjustment

Table 6.5c Extended Parameters (No. PC□□)

No.	Name	Function/Use	Default	Unit																																										
PC14	Analog Monitor 1 Output	Select the analog monitor output signal. <div><div><div>0</div><div>0</div><div></div><div></div></div><div>Select the analog monitor output.</div></div> <table><thead><tr><th>Setting</th><th>Output</th></tr></thead><tbody><tr><td>00</td><td>Motor speed (± 8 V/max. motor speed)</td></tr><tr><td>01</td><td>Torque (± 8 V/max. torque)</td></tr><tr><td>02</td><td>Motor speed (+ 8 V/max. motor speed)</td></tr><tr><td>03</td><td>Torque (+ 8 V/max. torque)</td></tr><tr><td>04</td><td>Current command (± 8 V/max. current command)</td></tr><tr><td>05</td><td>Speed command (± 8 V/max. motor speed)</td></tr><tr><td>06</td><td>Droop pulse (± 10 V/100 pulses [encoder basis])</td></tr><tr><td>07</td><td>Droop pulse (± 10 V/1000 pulses [encoder basis])</td></tr><tr><td>08</td><td>Droop pulse (± 10 V/10000 pulses [encoder basis])</td></tr><tr><td>09</td><td>Droop pulse (± 10 V/100000 pulses [encoder basis])</td></tr><tr><td>0A</td><td>F/B position (± 10 V/1,000,000 pulses [encoder basis])</td></tr><tr><td>0B</td><td>F/B position (± 10 V/10,000,000 pulses [encoder basis])</td></tr><tr><td>0C</td><td>F/B position (± 10 V/100,000,000 pulses [encoder basis])</td></tr><tr><td>0D</td><td>Bus voltage (+ 8 V/400 V or 200 V amplifier) Bus voltage (+ 8 V/800 V or 400 V amplifier)</td></tr><tr><td>0E - 0F</td><td>Reserved (output of 0)</td></tr><tr><td>20</td><td>Hydraulic control board analog data 1</td></tr><tr><td>21</td><td>Hydraulic control board analog data 2</td></tr><tr><td>22</td><td>Pressure command voltage</td></tr><tr><td>23</td><td>Flow command voltage</td></tr><tr><td>24</td><td>Pressure sensor voltage</td></tr></tbody></table>	Setting	Output	00	Motor speed (± 8 V/max. motor speed)	01	Torque (± 8 V/max. torque)	02	Motor speed (+ 8 V/max. motor speed)	03	Torque (+ 8 V/max. torque)	04	Current command (± 8 V/max. current command)	05	Speed command (± 8 V/max. motor speed)	06	Droop pulse (± 10 V/100 pulses [encoder basis])	07	Droop pulse (± 10 V/1000 pulses [encoder basis])	08	Droop pulse (± 10 V/10000 pulses [encoder basis])	09	Droop pulse (± 10 V/100000 pulses [encoder basis])	0A	F/B position (± 10 V/1,000,000 pulses [encoder basis])	0B	F/B position (± 10 V/10,000,000 pulses [encoder basis])	0C	F/B position (± 10 V/100,000,000 pulses [encoder basis])	0D	Bus voltage (+ 8 V/400 V or 200 V amplifier) Bus voltage (+ 8 V/800 V or 400 V amplifier)	0E - 0F	Reserved (output of 0)	20	Hydraulic control board analog data 1	21	Hydraulic control board analog data 2	22	Pressure command voltage	23	Flow command voltage	24	Pressure sensor voltage	0020h	
Setting	Output																																													
00	Motor speed (± 8 V/max. motor speed)																																													
01	Torque (± 8 V/max. torque)																																													
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22	Pressure command voltage																																													
23	Flow command voltage																																													
24	Pressure sensor voltage																																													
PC15	Analog Monitor 2 Output		0021h	mV																																										
PC18	Alarm History Clear	Clears alarm history. When this parameter is enabled, the alarm history is cleared at the next power-on. After history clearing, the parameter is automatically disabled. <div><div><div>0</div><div>0</div><div>0</div><div></div></div><div>Alarm History Clear 0: Disable 1: Enable</div></div>	0000h																																											

6. Operation adjustment

Table 6.5d Extended Parameters (No. PC□□)

No.	Name	Function/Use	Default	Unit
PC19	Encoder Pulse Output Selection	<p>Selects the encoder output pulse direction and encoder pulse output selection.</p> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 20px;"></div> </div> <p style="margin-left: 150px;">Encoder pulse output phase 0: 1:</p> <p style="margin-left: 150px;">Encoder output pulse setting 0: Output pulse setting 1: Dividing ratio setting 2: Automatically setting the ratio in command pulse unit</p>	0000h	
PC36	Status Display Selection	<p>Selects the status item displayed at power-on.</p> <div style="display: flex; align-items: center; margin-bottom: 10px;"> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; margin-right: 5px;">0</div> <div style="border: 1px solid black; padding: 5px; width: 30px; height: 20px;"></div> </div> <div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>Status display at power-on according to the control mode 0: Depending on the control mode 1: Depending on the setting of the rightmost digit</p> </div> <div style="width: 50%;"> <p>Select the status item displayed at power-on. 0: Cumulative Feedback Pulse 1: Servo Motor Speed 2: Droop pulse 3: Cumulative Command Pulse 4: Command Pulse Frequency 5: Analog Speed Command Voltage 6: Analog Torque Command Voltage 7: Regenerative Load Ratio 8: Effective Load Ratio 9: Peak Load Ratio A: Instantaneous Torque B: Within One-revolution Position (in 1 pulse) C: Within One-revolution Position (in 100 pulse) D: ABS Counter E: Load Inertia Moment Ratio F: Bus Voltage</p> </div> </div>	0000h	
PC39	Analog Monitor 1 Offset	Sets the offset voltage for Analog Monitor 1.	0	mV
PC40	Analog Monitor 2 Offset	Sets the offset voltage for Analog Monitor 2.	0	mV

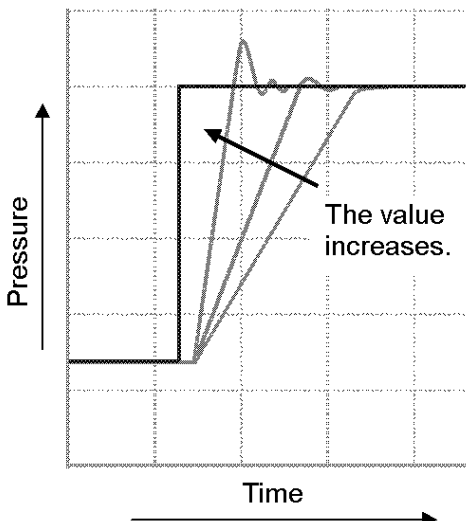
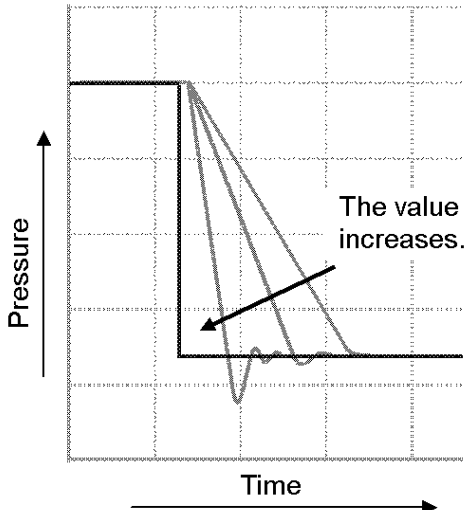
6. Operation adjustment

Table 6.5e I/O Setting Parameters (No. PD□□)

No.	Name	Function/Use	Default	Unit
PD26	Pressure Command Voltage Offset	Sets the offset of pressure command (PIN) voltage in mV. * Do not change the value since it is adjusted by YUKEN upon shipment.	-	mV
PD27	Flow Command Voltage Offset	Sets the offset of flow command (QIN) voltage in mV. * Do not change the value since it is adjusted by YUKEN upon shipment.	-	mV
PD28	Pressure Sensor Voltage Offset	Sets the offset of pressure sensor voltage in mV. * Do not change the value since it is adjusted by YUKEN upon shipment.	-	mV

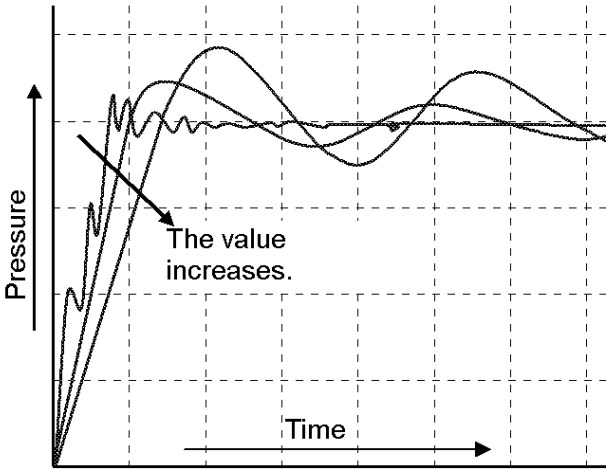
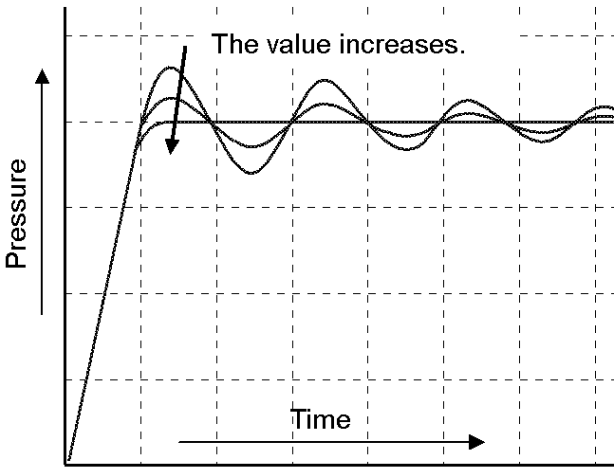
6. Operation adjustment

Table 6.5f Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO02	No. 0 Rise Time Gain	<p>Set the pressure control gain at the pressure rise time. Increasing the setting value improves the response, but an excessively high value may result in vibrations.</p> 	1500	
PO09	No. 1 Rise Time Gain			
PO16	No. 2S Rise Time Gain			
PO23	No. 2L Rise Time Gain			
PO30	No. 3 Rise Time Gain			
PO03	No. 0 Fall Time Gain	<p>Set the pressure control gain at the pressure fall time. Increasing the setting value improves the response, but an excessively high value may result in vibrations.</p> 	1500	
PO10	No. 1 Fall Time Gain			
PO17	No. 2S Fall Time Gain			
PO24	No. 2L Fall Time Gain			
PO31	No. 3 Fall Time Gain			

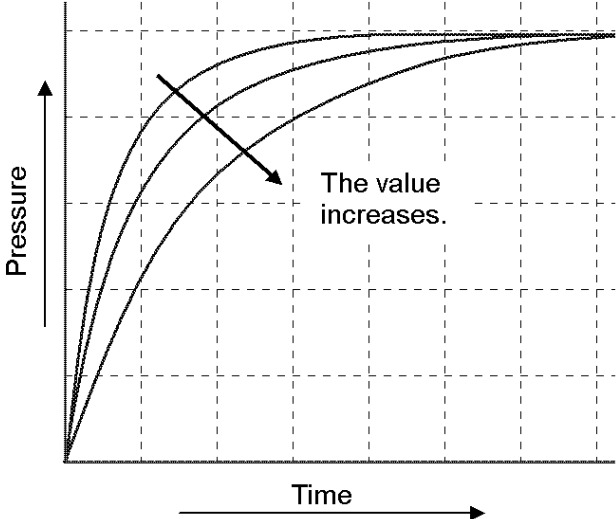
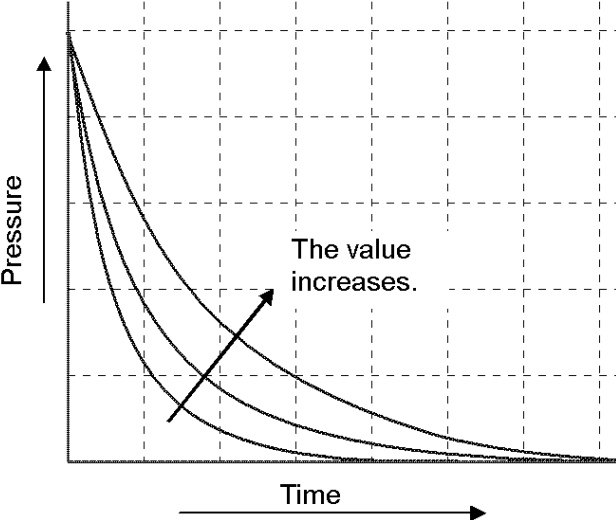
6. Operation adjustment

Table 6.5g Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO04	No. 0 Lag Compensation	<p>Set the pressure control lag time constant. Lag compensation is used when the control gain cannot be increased, and the operation is not stabilized. It can prevent oscillations in the frequency band of several Hz. Excessively increasing the value deteriorates response and overshoot properties; it is recommended to adjust it in combination with lead compensation.</p> 	50	
PO11	No. 1 Lag Compensation			
PO18	No. 2S Lag Compensation			
PO25	No. 2L Lag Compensation			
PO32	No. 3 Lag Compensation			
PO05	No. 0 Lead Compensation	<p>Set the pressure control lead time constant. Lead compensation is used to improve damping characteristics by preventing overshooting. Excessively increasing the value may result in oscillations in the high frequency band.</p> 	65	
PO12	No. 1 Lead Compensation			
PO19	No. 2S Lead Compensation			
PO26	No. 2L Lead Compensation			
PO33	No. 3 Lead Compensation			

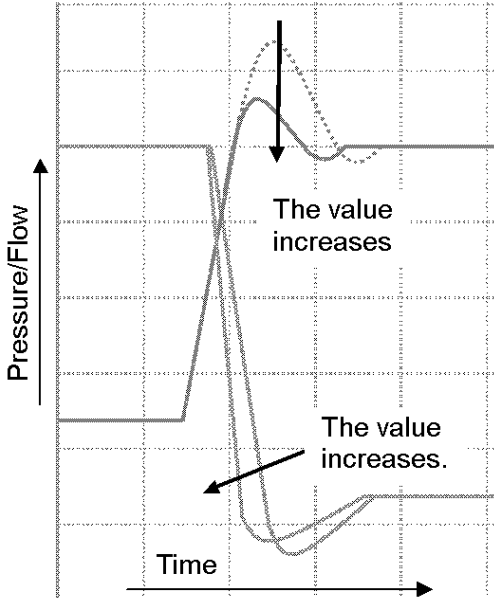
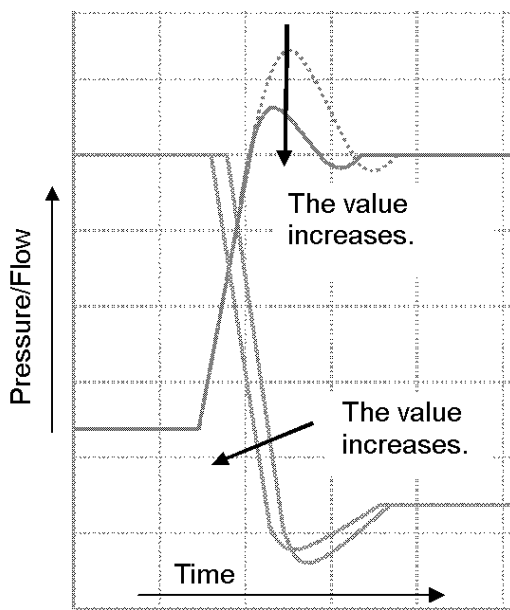
6. Operation adjustment

Table 6.5h Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO06	No. 0 Rise Time Pressure Command Filter	Set the first-order lag filter for pressure command input. It can be set at the pressure rise time. It prevents overshooting in the case of stepped change in pressure command voltage.	300	
PO13	No. 1 Rise Time Pressure Command Filter		300	
PO20	No. 2S Rise Time Pressure Command Filter			
PO27	No. 2L Rise Time Pressure Command Filter			
PO34	No. 3 Rise Time Pressure Command Filter			
PO07	No. 0 Fall Time Pressure Command Filter	Set the first-order lag filter for pressure command input. It can be set at the pressure fall time. It prevents undershooting in the case of stepped change in pressure command voltage.	300	
PO14	No. 1 Fall Time Pressure Command Filter		300	
PO21	No. 2S Fall Time Pressure Command Filter			
PO28	No. 2L Fall Time Pressure Command Filter			
PO35	No. 3 Fall Time Pressure Command Filter			

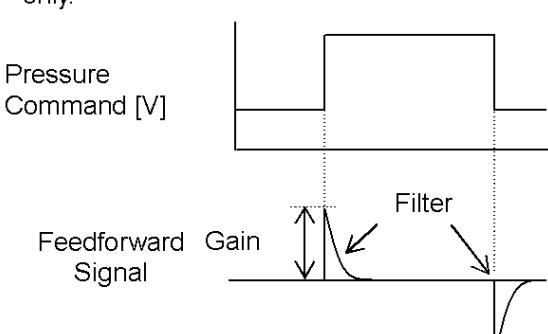
6. Operation adjustment

Table 6.5i Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO08	No. 0 Pressure Response Sensitivity	<p>Set the pressure response sensitivity for switching from flow control to pressure control. Increasing the value reduces the surge upon switching to pressure control but deteriorates override characteristics.</p> 	150	
PO15	No. 1 Pressure Response Sensitivity			
PO22	No. 2S Pressure Response Sensitivity			
PO29	No. 2L Pressure Response Sensitivity			
PO36	No. 3 Pressure Response Sensitivity			
PO37	Pressure Response Gain	Sets the pressure response gain to the above deviation.	150	
PO38	Pressure Response Offset	<p>Sets the pressure deviation for switching from flow control to pressure control. The timing of switching from flow control to pressure control is changed to reduce the surge pressure. Note that the parameter also affects override characteristics.</p> 	200	

6. Operation adjustment

Table 6.5j Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO39	Pressure Proportional Gain	This is a proportional gain independent of control compensation, unlike the rise or fall time gain. It improves response and minimizes disturbance. Note that, without response regulation by control compensation, an excessively high value may result in oscillations.	0	
PO40	Pressure Feedforward Gain	Performs the feedforward control of change in pressure command voltage (derivative) for improving the pressure wave response. - Feedforward Gain: Sets the sensitivity added to pressure control in relation to the change described above.	0	
PO41	Pressure Feedforward Filter	- Feedforward Filter: Filters the return of the feedforward signal to keep the function effective against sudden changes. - Feedforward Function Selection: Selects the method of adding feedforward signals. 0: Adding to pressure control at both the pressure rise and fall times. 1: Adding to pressure control at the pressure rise time only. 2: Adding to flow control at both the pressure rise and fall times. 3: Adding to flow control at the pressure rise time only.	1	
PO42	Pressure Feedforward Function Selection	<p>0: Adding to pressure control at both the pressure rise and fall times. 1: Adding to pressure control at the pressure rise time only. 2: Adding to flow control at both the pressure rise and fall times. 3: Adding to flow control at the pressure rise time only.</p> 	0	

6. Operation adjustment

Table 6.5k Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO43	Q-damping Gain	<p>Detect the motor speed during pressure control and add its derivative to pressure control. This setting is effective when the pressure trackability is not good due to a large compression volume on the load side.</p> <p>- Q-damping Gain: Sets the sensitivity added to pressure control in relation to the change described above.</p>	0	
PO44	Q-damping filter	<p>- Q-damping Filter: Filters the return of the Q-damping control signal to keep the function effective against sudden changes.</p> <div style="text-align: center;"> <p>Motor Speed [r/min]</p> <p>Q-damping Signal</p> <p>Gain</p> <p>Filter</p> </div>	1	

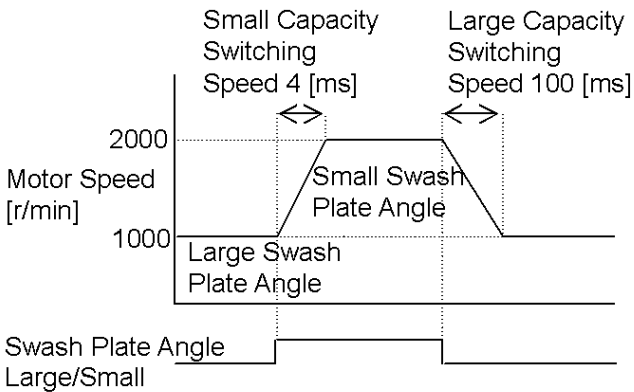
6. Operation adjustment

Table 6.5I Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO50	QIN Mini	<p>Sets the lower limit of the motor speed controlled by flow (motor speed) command voltage. It prevents reverse rotation of the pump due to command voltage variations caused by noise or due to improper operation/input.</p> <p>e.g.) If the parameter is set to 10 (1.0 %) with a rated motor speed of 2000 rpm, the minimum motor speed is 20 rpm.</p> <p>Motor Speed [rpm]</p> <p>Setting Value of Command Voltage</p>	3	x 0.1 %
PO51	PIN Mini	<p>Sets the lower limit of the pressure controlled by pressure command voltage. It prevents reverse rotation of the pump due to command voltage variations caused by noise or due to improper operation/input.</p> <p>e.g.) If the parameter is set to 10 (1.0 %) with a rated pressure of 17.5 MPa, the minimum pressure is 0.175 MPa (calculated value).</p> <p>Pressure [MPa]</p> <p>Setting Value of Command Voltage</p>	3	x 0.1 %
PO52	Q-COMP	<p>Compensates for leakage in the pump in relation to load pressure. As load pressure increases, the leakage level in the pump rises, resulting in lower flow. To prevent this, a compensation value proportional to load pressure is added to the flow command.</p> <p>e.g.) If the parameter is set to 15 with a rated pressure of 17.5 MPa/a rated motor speed of 2000 rpm, the compensation value at 17.5 MPa is about 2 rpm.</p> <p>Motor speed [rpm]</p> <p>Pressure [MPa]</p> <p>The value increases.</p>	15	

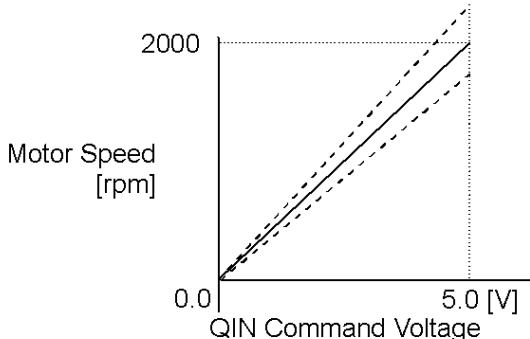
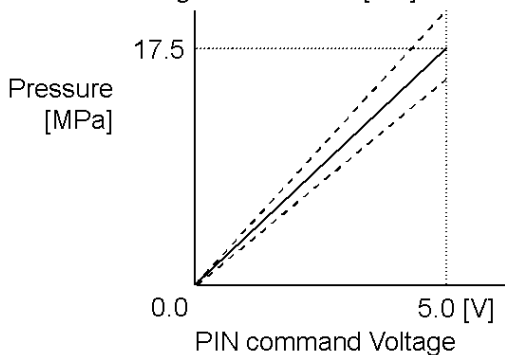
6. Operation adjustment

Table 6.5m Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO53	Large Capacity Switching Speed	<p>Note) This parameter is not used for the model described in the manual.</p> <p>These parameters serve to provide the variable control of the motor speed in proportion to pump discharge controlled by the flow command from the main system when the sequence input command "Swash Plate Angle Large/Small" is input.</p>	25	
PO54	Small Capacity Switching Speed	<p>e.g.) Suppose a two-speed pump with:</p> <ul style="list-style-type: none"> - Capacity at large swash plate angle: 56 cc/rev - Capacity at small swash plate angle: 28 cc/rev. <p>For the variable control of motor speed with the flow command from the main system, set the internal parameters as follows.</p> <ul style="list-style-type: none"> - Rated Motor Speed (PO26): 2000 [r/min] - Capacity Ratio (PO55): 2000 [x 0.1 %] - Large Capacity Switching Speed (PO53): 25 (default) - Small Capacity Switching Speed (PO54): 1 (default) 	1	
PO55	Capacity Ratio	<p>When a flow command voltage of 2.5 V is applied from the main system under the conditions above, the "Swash Plate Angle Large/Small" signal changes the motor speed as shown below.</p>  <p><Calculation></p> <ul style="list-style-type: none"> - Capacity ratio = $\text{Large capacity/small capacity} \times 100 [\%]$ $56 [\text{cc/rev}]/28 [\text{cc/rev}] \times 100 = 200 [\%]$ - Large capacity switching speed: When the default value is "25," the value is 4 [ms] for a 100 [%] change ($100/25 = 4 [\text{ms}]$). - Small capacity switching speed: When the default value is "1," the value is 100 [ms] for a 100 [%] change ($100/1 = 100 [\text{ms}]$). 	1000	x 0.1 %

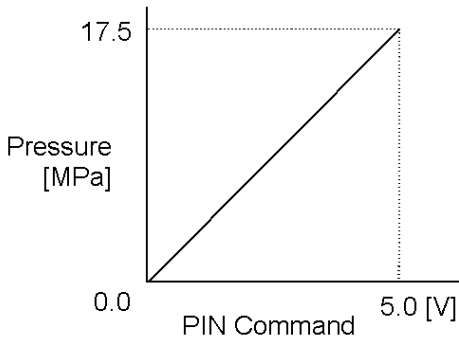
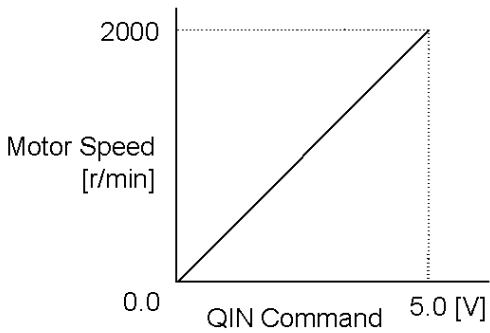
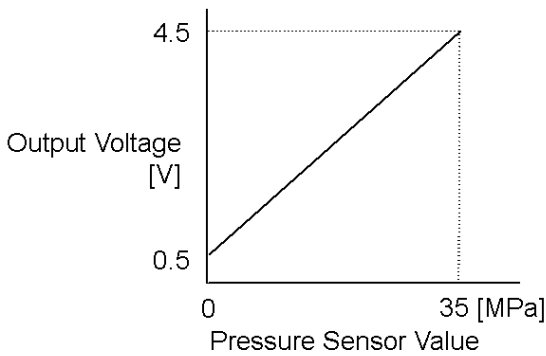
6. Operation adjustment

Table 6.5n Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit																	
PO56	Flow Command Voltage Span	<p>Adjusts the span of flow (motor speed) command voltage. This parameter provides the variable control of pump motor speed in relation to command voltage. At the default value, or 1000 (100.0 %), the rated motor speed is achieved with the input of command voltage of 5 V. The zero point of command voltage is adjusted by the parameter "Flow Command Voltage Offset PD27 [mV]."</p> <div></div>	1000	x 0.1 %																	
PO57	Pressure Command Voltage Span	<p>Adjusts the span of pressure command voltage. This parameter provides the variable control of pressure in relation to command voltage. At the default value, or 1000 (100.0 %), the rated pressure is achieved with the input of command voltage of 5 V. The zero point of command voltage is adjusted by the parameter "Pressure Command Voltage Offset PD26 [mV]."</p> <div></div>	1000	x 0.1 %																	
PO58	Pressure Sensor Span	<p>Adjust the zero point/span of pressure sensor input voltage. According to the output voltage specification of the pressure sensor, set the parameters as follows.</p> <table><tr><th rowspan="2">Output Voltage Specification of the Pressure Sensor</th><th>Zero Point</th><th>Span</th></tr><tr><th>PO59 [mV]</th><th>PO58 [x 0.1 %]</th></tr><tr><td>0.5 to 4.5 V</td><td>500</td><td>1250</td></tr><tr><td>0 to 5 V</td><td>0</td><td>1000</td></tr><tr><td>1 to 5 V</td><td>1000</td><td>1250</td></tr><tr><td>0 to 10 V</td><td>0</td><td>500</td></tr></table>	Output Voltage Specification of the Pressure Sensor	Zero Point	Span	PO59 [mV]	PO58 [x 0.1 %]	0.5 to 4.5 V	500	1250	0 to 5 V	0	1000	1 to 5 V	1000	1250	0 to 10 V	0	500	1250	x 0.1 %
Output Voltage Specification of the Pressure Sensor	Zero Point	Span																			
	PO59 [mV]	PO58 [x 0.1 %]																			
0.5 to 4.5 V	500	1250																			
0 to 5 V	0	1000																			
1 to 5 V	1000	1250																			
0 to 10 V	0	500																			
PO59	Pressure Sensor Zero	<p>* By default, the values for the 0.5 to 4.5 V specification are set.</p>	500	mV																	

6. Operation adjustment

Table 6.5o Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit
PO60	Rated Pressure	<p>Sets the pressure at a pressure command voltage of DC + 5 V. This parameter is used to change the rated pressure without changing the pressure command voltage. When “Achieved Pressure” (SMP) is selected for monitor output, the set pressure is output at DC + 5 V.</p> 	175	x 0.1 MPa
PO61	Rated Motor Speed	<p>Sets the motor speed at a flow command voltage of DC + 5 V. This parameter is used to change the rated motor speed without changing the flow command voltage. When “Achieved Motor Speed” (SMN) is selected for monitor output, the set motor speed is output at DC + 5 V.</p> 	2000	r/min
PO62	Pressure Sensor Rated Value	<p>Sets the rated pressure for the pressure sensor. The rated output of the pressure sensor for the ASR pump system is obtained at DC 0.5 to 4.5 V/0 to 35 MPa. Thus, the rated value is 350 (35.0 MPa).</p> 	350	x 0.1 MPa

6. Operation adjustment

Table 6.5p Hydraulic Control Parameters (No. PO□□)

No.	Name	Function/Use	Default	Unit																																										
PO63	Monitor Output 1 Selection	Select the monitor items to be controlled by the hydraulic control board. These parameters are enabled when the extended parameters PC14 and 15 are set as follows. <table><tr><th>Setting Value</th><th>Description</th></tr><tr><td>0020h</td><td>Enables the selection of monitor 1 by the hydraulic control board [PO63].</td></tr></table>	Setting Value	Description	0020h	Enables the selection of monitor 1 by the hydraulic control board [PO63].	3																																							
Setting Value	Description																																													
0020h	Enables the selection of monitor 1 by the hydraulic control board [PO63].																																													
PO64	Monitor Output 2 Selection	<table><tr><td>0021h</td><td>Enables the selection of monitor 2 by the hydraulic control board [PO64].</td></tr></table> <p>Parameter selection</p> <table><tr><th>Setting</th><th>Abbr.</th><th>Monitor Name</th><th>Output Voltage</th></tr><tr><td>0</td><td>REF</td><td>Motor Speed Command</td><td>± 5 V/± Rated Motor Speed [PO61 (rpm)]</td></tr><tr><td>1</td><td>PIN</td><td>Pressure Command</td><td>5V/Rated Pressure [PO62 (x 0.1 MPa)]</td></tr><tr><td>2</td><td>QIN</td><td>Flow Command</td><td>5V/Rated Motor Speed [PO61 (rpm)]</td></tr><tr><td>3</td><td>SMP</td><td>Achieved Pressure</td><td>5V/Rated Pressure [PO62 (x 0.1 MPa)]</td></tr><tr><td>4</td><td>SMN</td><td>Achieved Motor Speed</td><td>± 5 V/± Rated Motor Speed [PO61 (rpm)]</td></tr><tr><td>5</td><td>TRQ</td><td>Effective Load Ratio</td><td>± 1 V/± 100 %</td></tr><tr><td>6</td><td>PIN-f</td><td>Pressure Command (with the command filtered)</td><td>5 V/Rated Pressure [PO62 (x 0.1 MPa)]</td></tr><tr><td>7</td><td>QIN-r</td><td>Flow Command (after Q-COMP added)</td><td>5 V/Rated Motor Speed [PO61 (rpm)]</td></tr><tr><td>8</td><td>P/Q</td><td>Pressure Control Flag</td><td>0 V: Flow Control 1 V: Pressure Control</td></tr></table>	0021h	Enables the selection of monitor 2 by the hydraulic control board [PO64].	Setting	Abbr.	Monitor Name	Output Voltage	0	REF	Motor Speed Command	± 5 V/± Rated Motor Speed [PO61 (rpm)]	1	PIN	Pressure Command	5V/Rated Pressure [PO62 (x 0.1 MPa)]	2	QIN	Flow Command	5V/Rated Motor Speed [PO61 (rpm)]	3	SMP	Achieved Pressure	5V/Rated Pressure [PO62 (x 0.1 MPa)]	4	SMN	Achieved Motor Speed	± 5 V/± Rated Motor Speed [PO61 (rpm)]	5	TRQ	Effective Load Ratio	± 1 V/± 100 %	6	PIN-f	Pressure Command (with the command filtered)	5 V/Rated Pressure [PO62 (x 0.1 MPa)]	7	QIN-r	Flow Command (after Q-COMP added)	5 V/Rated Motor Speed [PO61 (rpm)]	8	P/Q	Pressure Control Flag	0 V: Flow Control 1 V: Pressure Control	4	
0021h	Enables the selection of monitor 2 by the hydraulic control board [PO64].																																													
Setting	Abbr.	Monitor Name	Output Voltage																																											
0	REF	Motor Speed Command	± 5 V/± Rated Motor Speed [PO61 (rpm)]																																											
1	PIN	Pressure Command	5V/Rated Pressure [PO62 (x 0.1 MPa)]																																											
2	QIN	Flow Command	5V/Rated Motor Speed [PO61 (rpm)]																																											
3	SMP	Achieved Pressure	5V/Rated Pressure [PO62 (x 0.1 MPa)]																																											
4	SMN	Achieved Motor Speed	± 5 V/± Rated Motor Speed [PO61 (rpm)]																																											
5	TRQ	Effective Load Ratio	± 1 V/± 100 %																																											
6	PIN-f	Pressure Command (with the command filtered)	5 V/Rated Pressure [PO62 (x 0.1 MPa)]																																											
7	QIN-r	Flow Command (after Q-COMP added)	5 V/Rated Motor Speed [PO61 (rpm)]																																											
8	P/Q	Pressure Control Flag	0 V: Flow Control 1 V: Pressure Control																																											

6. Operation adjustment

6.6 Default settings of parameters

- There are many parameters available that are not described in this manual. It is not required to change the settings of those parameters from the default values. If the parameters are set improperly, the unit may become inoperable in the worst case.
- For parameters listed below with their names, you can check their settings on the dedicated software by using the communication cable described in 6.2.

Table 6.6a Basic Parameters (No. PA□□)

No.	Name	Default	Unit
PA-01	Control Mode	0002	
PA-02	Optional regeneration unit	0000	
PA-03		0000	
PA-04	Function Selection A-1	0000	
PA-05		0	
PA-06		1	
PA-07		1	
PA-08	Auto-tuning Mode	0001h	
PA-09	Auto-tuning Response	16	
PA-10		100	
PA-11	Forward Rotation Torque Limit	100.0	%
PA-12	Reverse Rotation Torque Limit	100.0	%
PA-13		0000	
PA-14		0	
PA-15	Encoder Output Pulse	4000	Pulse/rev
PA-16		0000	
PA-17		FFFF	
PA-18		0000	
PA-19	Parameter Write-protection	000F	

6. Operation adjustment

Table 6.6b Servo Motor Gain/Filter Parameters (No. PB□□)

No.	Name	Default	Unit
PB-01	Adaptive Tuning Mode	0000	
PB-02		0000	
PB-03		0	
PB-04		0	
PB-05		500	
PB-06	Load Inertia Moment Ratio for the Servo Motor	*1)	times
PB-07		*1)	
PB-08		*1)	
PB-09	Speed Control Gain	*1)	rad/s
PB-10	Speed Integral Compensation	*1)	Ms
PB-11	Speed Derivative Compensation	980	
PB-12		0	
PB-13	Mechanical Resonance Control Filter 1	4500	Hz
PB-14	Notch Shape Selection 1	0000	
PB-15	Mechanical Resonance Control Filter 2	4500	Hz
PB-16	Notch Shape Selection 2	0000	
PB-17		0009	
PB-18	Low Pass Filter Setting	*1)	rad/s
PB-19		100.0	
PB-20		100.0	
PB-21		0.00	
PB-22		0.00	
PB-23	Low Pass Filter Selection	0000	
PB-24		0000	
PB-25		0000	
PB-26	Gain Switching Selection	0000	
PB-27	Gain Switching Condition	10	
PB-28	Gain Switching Time Constant	1	ms
PB-29	Load Inertia Moment Ratio for the Gain Switching Servo Motor	7.0	times
PB-30		37	
PB-31	Gain Switching Speed Control Gain	823	rad/s
PB-32	Gain Switching Speed Integral Compensation	33.7	Ms
PB-33		100.0	
PB-34		100.0	
PB-35		0.00	
PB-36		0.00	
PB-37		100	
PB-38		0.0	
PB-39		0.0	
PB-40		0.0	
PB-41		1125	
PB-42		1125	
PB-43		0004	
PB-44		0000	
PB-45		0000	

*1) Automatically set (no input required)

6. Operation adjustment

Table 6.6c Extended Parameters (No. PC□□)

No	Name	Default	Unit
PC-01	Acceleration Time Constant	0	ms
PC-02	Deceleration Time Constant	0	ms
PC-03	S-curve Acceleration/Deceleration Time Constant	0	ms
PC-04		0	
PC-05		100	
PC-06		500	
PC-07		1000	
PC-08		200	
PC-09		300	
PC-10		500	
PC-11		800	
PC-12		4000	
PC-13		100	
PC-14	Analog Monitor 1 Output	0020	
PC-15	Analog Monitor 2 Output	0021	
PC-16	Electromagnetic Brake Sequence Output	100	ms
PC-17	Zero Speed	50	r/min
PC-18	Alarm History Clear	0000	
PC-19	Encoder Pulse Output Selection	0000	
PC-20	Communication Channel Setting	0	Channel
PC-21	Communication Function Selection	0020	
PC-22	Function Selection C-1	0000	
PC-23	Function Selection C-2	0000	
PC-24		0000	
PC-25		0000	
PC-26	Function Selection C-5	0110	
PC-27		0000	
PC-28		0000	
PC-29		0000	
PC-30		0	
PC-31		0	
PC-32		1	
PC-33		1	
PC-34		1	
PC-35	Internal Torque Limit 2	100.0	%
PC-36	Status Display Selection	0000	
PC-37		0	
PC-38		0	
PC-39	Analog Monitor 1 Offset	0	mV
PC-40	Analog Monitor 2 Offset	0	mV
PC-41 - 50		0000	

6. Operation adjustment

Table 6.6d Output Setting Parameters (No. PD□□)

No.	Name	Default	Unit
PD-01	Automatic Activation of Input Signals	0C00	
PD-02		0000	
PD-03		00020202	
PD-04		00212100	
PD-05		00070804	
PD-06		00080705	
PD-07		00030303	
PD-08		00202006	
PD-09		00000000	
PD-10		00000A0A	
PD-11		00000B0B	
PD-12		00232323	
PD-13		0004	
PD-14		000C	
PD-15		0004	
PD-16		0007	
PD-17		0003	
PD-18		0002	
PD-19	Input Filter Selection	0002	
PD-20	Function Selection D-1	0000	
PD-21		0000	
PD-22		0000	
PD-23		0000	
PD-24		0001	
PD-25	Hydraulic Control Board Option 1	0001	
PD-26	Pressure Command Voltage Offset	(0) *2)	mV
PD-27	Flow Command Voltage Offset	(0) *2)	mV
PD-28	Pressure Sensor Voltage Offset	(0) *2)	mV
PD-29		0000	
PD-30		0000	

*2) Factory default value set by YUKEN. The value differs depending on the ASR model. The values in parentheses are reference values.

6. Operation adjustment

Table 6.6e Control Parameters (No. PO□□)

No.		Name	Default	Unit
PO-02	No. 0	Rise Time Gain	1500	
PO-03		Fall Time Gain	1500	
PO-04		Lag Compensation	50	
PO-05		Lead Compensation	65	
PO-06		Rise Time Pressure Command Filter	300	
PO-07		Fall Time Pressure Command Filter	300	
PO-08		Pressure Response Sensitivity	150	
PO-09	No. 1	Rise Time Gain	1500	
PO-10		Fall Time Gain	1500	
PO-11		Lag Compensation	50	
PO-12		Lead Compensation	65	
PO-13		Rise Time Pressure Command Filter	300	
PO-14		Fall Time Pressure Command Filter	300	
PO-15		Pressure Response Sensitivity	150	
PO-16	No. 2S	Rise Time Gain	1500	
PO-17		Fall Time Gain	1500	
PO-18		Lag Compensation	50	
PO-19		Lead Compensation	65	
PO-20		Rise Time Pressure Command Filter	300	
PO-21		Fall Time Pressure Command Filter	300	
PO-22		Pressure Response Sensitivity	150	
PO-23	No. 2L	Rise Time Gain	1500	
PO-24		Fall Time Gain	1500	
PO-25		Lag Compensation	50	
PO-26		Lead Compensation	65	
PO-27		Rise Time Pressure Command Filter	300	
PO-28		Fall Time Pressure Command Filter	300	
PO-29		Pressure Response Sensitivity	150	
PO-30	No. 3	Rise Time Gain	1500	
PO-31		Fall Time Gain	1500	
PO-32		Lag Compensation	50	
PO-33		Lead Compensation	65	
PO-34		Rise Time Pressure Command Filter	300	
PO-35		Fall Time Pressure Command Filter	300	
PO-36		Pressure Response Sensitivity	150	
PO-37		Pressure Response Gain	100	
PO-38		Pressure Response Offset	100	
PO-39		Pressure Proportional Gain	0	
PO-40		Pressure Feedforward Gain	0	
PO-41		Pressure Feedforward Filter	1	
PO-42		Pressure Feedforward Function Selection	0	
PO-43		Q-damping Gain	0	
PO-44		Q-damping Filter	1	

6. Operation adjustment

Table 6.6f Control Parameters (No. PO□□)

No.	Name	Default	Unit
PO-45			
PO-46			
PO-47			
PO-48			
PO-49			
PO-50	QIN Mini	3	x 0.1 %
PO-51	PIN Mini	3	x 0.1 %
PO-52	Q-COMP	15	
PO-53	Large Capacity Switching Speed	25	x 0.1 ms
PO-54	Small Capacity Switching Speed	1	x 0.1 ms
PO-55	Capacity Ratio	1000	x 0.1 %
PO-56	Flow Command Voltage (QIN) Span	(1000) *2)	x 0.1 %
PO-57	Pressure Command Voltage (PIN) Span	(1000) *2)	x 0.1 %
PO-58	Pressure Sensor Voltage Span	(1250) *2)	x 0.1 %
PO-59	Pressure Sensor Voltage Zero	(500) *2)	mV
PO-60	Rated Pressure	175	x 0.1 MPa
PO-61	Rated Motor Speed	2000	r/min
PO-62	Pressure Sensor Rated Value	350	x 0.1 MPa
PO-63	Monitor Output 1 Selection	3	
PO-64	Monitor Output 2 Selection	4	

*2) Factory default value set by YUKEN. The value differs depending on the ASR model. The values in parentheses are reference values.

7. Troubleshooting

7. Troubleshooting

7.1 Alarms/warnings

Alarms/warnings are displayed when failure occurs during operation. Take appropriate measures in the event of an alarm/warning. Alarm occurrence deactivates the output of ALM signals, resulting in the output of the alarm codes listed below. No alarm code is assigned to warnings.

Table 7.1a Alarm Codes

Display	Alarm code			Name	Alarm Reset		
	ACD2	ACD1	ACD0		Power Off -> On	Pressing SET in the Alarm screen	Alarm reset (RES)
AL 10	0	1	0	Undervoltage	○	○	○
AL 12	0	0	0	Memory Error 1 (RAM)	○	/	/
AL 13	0	0	0	Clock Error	○	/	/
AL 15	0	0	0	Memory Error 2 (EEP-ROM)	○	/	/
AL 16	1	1	0	Encoder Error 1 (at power-on)	○	/	/
AL 17	0	0	0	Board Error	○	/	/
AL 19	0	0	0	Memory Error 3 (Flash-ROM)	○	/	/
AL 1A	1	1	0	Motor Matching Error	○	/	/
AL 20	1	1	0	Encoder Error 2	○	/	/
AL 24	1	0	0	Main Circuit Error	○	○	○
AL 25	1	1	0	Absolute Position Loss	○	/	/
AL 30	0	0	1	Regeneration Error	(*1) ○	(*1) ○	(*1) ○
AL 31	1	0	1	Overspeed	○	○	○
AL 32	1	0	0	Overcurrent	○	/	/
AL 33	0	0	1	Overvoltage	○	○	○
AL 35	1	0	1	Command Pulse Frequency Error	○	○	○
AL 37	0	0	0	Parameter Error	○	/	/
AL 45	0	1	1	Main Circuit Device Overheat	(*1) ○	(*1) ○	(*1) ○
AL 46	0	1	1	Servo Motor Overheat	(*1) ○	(*1) ○	(*1) ○
AL 47	0	1	1	Cooling Fan Error	○	/	/
AL 50	0	1	1	Overload 1	(*1) ○	(*1) ○	(*1) ○
AL 51	0	1	1	Overload 2	(*1) ○	(*1) ○	(*1) ○
AL 52	1	0	1	Excess Error	○	○	○
AL 74	1	1	1	Hydraulic Control Board Error	○	/	/
AL 8A	0	0	0	Serial Communication Timeout	○	○	○
AL 8E	0	0	0	Serial Communication Error	○	○	○
8888	/	/	/	Watchdog	○	/	/

*1) After removing the alarm cause, wait for about 30 minutes until the unit cools down.

7. Troubleshooting

Table 7.1b Warnings

Display	Name
AL E0	Over Regeneration Warning
AL E1	Overload Warning 1
AL E6	Servo Emergency Stop Warning
AL E8	Cooling Fan Speed Low Warning
AL E9	Main Circuit Off Warning
AL EC	Overload Warning 2
AL ED	Output Watt Excess Warning

Note) Contact us when other warning codes are output.

7. Troubleshooting

7.2 Measures against alarms/warnings



CAUTION

- ◆ When an alarm occurs, remove its cause and ensure safety. Then, reset the alarm and restart operation.
- ◆ When an alarm occurs, immediately turn off SON and shut off the power supply.
- ◆ If the following alarms occur, do not restart operation by resetting the alarm. Doing so may cause failure of the servo amplifier or motor. In such cases, remove the alarm cause and wait for 30 minutes or more until the unit cools down. Then, restart operation.
 - Regeneration Error (AL.30) - Overload 1 (AL.50) - Overload 2 (AL.51)

An alarm can be reset by powering off and then powering on the unit, pressing the “SET” button in the Alarm screen, or turning on RES.

Table 7.2a Measures Against Alarms

Alarm	Name	Description	Cause	Remedy
AL.10	Undervoltage	Power voltage is low (AC 160 V or less).	1. Low power voltage. 2. A control power interruption of 60 ms or more. 3. Low power voltage at startup due to insufficient power capacity. 4. Low bus voltage.	Check the power supply.
			5. Failure of any servo amplifier component.	Replace the servo amplifier.
AL.12	Memory Error 1 (RAM)	RAM error.	Failure of any servo amplifier component.	Replace the servo amplifier.
AL.13	Clock Error	Printed circuit board error.	Failure of any servo amplifier component.	
AL.15	Memory Error 2 (EEP-ROM)	EEP-ROM error.	1. Failure of any servo amplifier component. 2. The number of writes to EEPROM has exceeded 100 thousand.	
AL.16	Encoder Error 1 (at power-on)	Communication between the encoder and the servo amplifier has failed.	1. Disconnection of the encoder connector (CN2). 2. Encoder failure. 3. Encoder cable failure (disconnection or short-circuit). 4. Incorrect parameter setting.	Connect the connector properly. Replace the servo motor. Repair or replace the cable. Set PC22 properly.
AL.17	Board Error	CPU/component error.	Failure of any servo amplifier component.	Replace the servo amplifier.
AL.19	Memory Error 3 (Flash-ROM)	ROM error.		
AL.1A	Motor Matching Error	The combination of the servo amplifier and the servo motor is improper.	Improper combination of the servo amplifier and the servo motor.	Correct the combination.

7. Troubleshooting

Table 7.2b Measures Against Alarms

Alarm	Name	Description	Cause	Remedy
AL.20	Encoder Error 2	Communication between the encoder and the servo amplifier has failed.	1. Disconnection of the encoder connector (CN2).	Connect the connector properly.
			2. Encoder failure.	Replace the servo motor.
			3. Encoder cable failure (disconnection or short-circuit).	Repair or replace the cable.
AL.24	Main Circuit Error	A ground fault of the servo amplifier's servo motor power cable (U, V, W) has occurred.	1. The power input cable is in contact with the servo motor power cable.	Correct the wiring.
			2. Ground fault due to a deteriorated coating of the servo motor power cable.	Replace the cable.
			3. Failure of the servo amplifier's main circuit.	Replace the servo amplifier.
AL.30	Regeneration Error	The allowable regenerative power of the built-in regenerative resistors or optional regeneration unit has been exceeded.	1. Improper parameter setting (PA02).	Set the parameter properly.
			2. Disconnection of the resistors or optional regeneration unit.	Connect them properly.
			3. Allowable regenerative power of the optional regeneration unit has been exceeded due to high frequency or continuous regeneration.	Check the capacity of the optional regeneration unit.
			4. Abnormal power voltage.	Check the power supply.
			5. Failure of the resistors or optional regeneration unit.	
		Regenerative transistor failure.	Regenerative transistor failure.	
AL.31	Overspeed	The permissible instantaneous speed has been exceeded.	1. Unstable servo (overshooting).	Readjust the servo gain.
			2. Encoder failure.	Replace the servo motor.
AL.32	Overcurrent	The allowable current of the servo amplifier has been exceeded.	1. Short-circuit of the servo motor power cable (U, V, W).	Correct the wiring.
			2. Failure of the servo amplifier transistor (IPM).	Replace the servo amplifier.
			3. Ground fault of the servo motor power cable (U, V, W).	Correct the wiring.
			4. The overcurrent detection circuit has malfunctioned with external noise.	Implement anti-noise measures.

7. Troubleshooting

Table 7.2c Measures Against Alarms

Alarm	Name	Description	Cause	Remedy
AL.33	Overvoltage	The input value of converter bus voltage is DC 400 V or more.	1. No optional regeneration unit is used.	Use an optional regeneration unit.
			2. An optional regeneration unit is used, but the setting of PA02 is "□□00."	Set the parameter properly.
			3. The lead wire of the built-in regenerative resistors or optional regeneration unit has been broken or disconnected.	Replace or properly connect the lead wire.
			4. Regenerative transistor failure.	Replace the servo amplifier.
			5. Disconnection of the built-in regenerative resistors or optional regeneration unit.	Replace the servo amplifier or optional regeneration unit.
			6. Insufficient capacity of the built-in regenerative resistors or optional regeneration unit.	Add an optional regeneration unit or check its capacity.
			7. High power voltage.	Check the power supply.
			8. Ground fault of the servo motor power cable (U, V, W).	Correct the wiring.
AL.37	Parameter Error	Improper parameter setting.	1. Parameter setting has been changed due to servo amplifier failure.	Replace the servo amplifier.
			2. The selected optional regeneration unit does not match the servo amplifier used for PA02.	Set the parameter properly.
			3. The number of writes to EEP-ROM (parameter write, etc.) has exceeded 100 thousand.	Replace the servo amplifier.
AL.45	Main Circuit Device Overheat	The main circuit has overheated.	1. Servo amplifier failure.	Replace the servo amplifier.
			2. Power-on/off has been repeated under overload conditions.	Check the operating conditions.
			3. The ambient temperature around the servo amplifier is beyond 55 °C.	Check the ambient environment.
			4. Specified mounting density has been exceeded.	Comply with the specification.
			5. Ground fault due to a deteriorated coating of the servo motor power cable.	Replace the cable.
			6. Failure of the servo amplifier's main circuit.	Replace the servo amplifier.

7. Troubleshooting

Table 7.2d Measures Against Alarms

Alarm	Name	Description	Cause	Remedy
AL.46	Servo Motor Overheat	The servo motor temperature has risen, tripping the thermal sensor.	1. The ambient temperature around the servo motor is beyond 40 °C.	Improve the environment to obtain an ambient temp. of 0 to 40 °C.
			2. Servo motor overload.	Check the operation pattern.
			3. Failure of the encoder's thermal sensor.	Replace the servo amplifier.
AL.47	Cooling Fan Error	The cooling fan for the servo amplifier has stopped. Or, the fan speed is at or lower than the alarm level.	1. The cooling fan's life has been reached.	Replace the fan.
			2. The fan has stopped due to foreign matter clogging.	Remove foreign matter.
			3. Failure of the cooling fan power supply.	Replace the servo amplifier.
AL.50	Overload 1	The servo amplifier overload protection level has been exceeded.	1. Allowable continuous output current of the servo amplifier has been exceeded.	Check the operation pattern.
			2. Unstable servo (hunting).	Check the auto-tuning.
			3. Servo amplifier output terminals U/V/W and servo motor input terminals U/V/W are improperly connected.	Correct the wiring.
			4. Encoder failure.	Replace the servo motor.
AL.51	Overload 2	The maximum output current has continued for several seconds.	1. Unstable servo (hunting).	Check the auto-tuning.
			2. Servo amplifier output terminals U/V/W and servo motor input terminals U/V/W are improperly connected.	Correct the wiring.
			3. Encoder failure.	Replace the servo motor.
AL.74	Hydraulic Control Board Error	Failure of the hydraulic control board detected.	1. No hydraulic control board mounted.	Mount the board properly.
			2. Board failure.	Replace the servo amplifier.
			3. Hydraulic control failure.	
AL.8A	Serial Communication Timeout	RS422 communication interrupted for a longer time than specified.	1. Communication cable disconnection.	Replace the cable.
			2. Communication cycle longer than specified.	Shorten the cycle.
			3. The protocol is improper.	Correct the protocol.
AL.8E	Serial Communication Error	Serial communication between the servo amplifier and the communication device has failed.	1. Communication cable failure (disconnection or short-circuit)	Replace the cable.
			2. Communication device failure.	Replace the communication device.
88888	Watchdog	CPU/component error.	Failure of any servo amplifier component.	Replace the servo amplifier.

7. Troubleshooting

Table 7.2e Measures Against Warnings

Alarm	Name	Description	Cause	Remedy
AL.E0	Over Regeneration Warning	The allowable regenerative power of the built-in regenerative resistors or optional regeneration unit may be exceeded.	A regenerative power level equivalent to 85 % of the allowable level for the resistors or optional regeneration unit has been reached.	Replace the optional regeneration unit with one having larger capacity or reduce its load.
AL.E1	Overload Warning 1	Overload Alarm 1 or 2 may occur.	A load equivalent to 85 % of the Overload Alarm 1 or 2 level has been reached.	See AL50/AL51.
AL.E6	Servo Emergency Stop Warning	EMG is OFF.	Emergency stop activated (EMG turned off).	Ensure safety and reset the emergency stop.
AL.E8	Cooling Fan Speed Low Warning	The fan speed is at or lower than the warning level.	1. The cooling fan's life has been reached.	Replace the cooling fan.
			2. Failure of the cooling fan power supply.	Replace the servo amplifier.
AL.E9	Main Circuit Off Warning	SON has been turned on with the main circuit powered off.		Power on the main circuit.
AL.EC	Overload Warning 2	An overrated current has repeatedly flowed in either U, V, or W phase of the servo motor.	An overrated current has repeatedly flowed in either U, V, or W phase of the servo motor, exceeding the warning level.	Replace the servo amplifier or motor with one having larger capacity or reduce their load.
AL.ED	Output Watt Excess Warning	The output watt of the servo motor (speed x torque) is constantly beyond the rated level.	Continued operation with the output watt of the servo motor (speed x torque) exceeding 150 % of the rated output level.	Reduce the servo motor speed or load.

8. Maintenance

8. Maintenance

This product requires no periodic overhaul during normal operation.

**CAUTION**

- ◆ Maintenance should be performed by a qualified person who has adequate knowledge of electrics and hydraulics (skilled worker equivalent to the 2nd grade Certified Skilled Worker of Hydraulic Device Assembly (Yuatsu Kiki Chosei Ginoshi) or higher or who has received our technical training).

8.1 Contamination control of hydraulic fluid

Foreign matter in hydraulic fluid often obstructs normal operation of the pump. It may cause failure or shorten the pump life. Keep hydraulic fluid clean (contamination level: JIS B9933 18/16/13 or within NAS 9 class or better). Also apply 100 μm (150 mesh) filters to the suction line and 10 μm or less filters to the discharge or return line.

8.2 Daily inspection

Perform daily inspections for the items in Table 8.2a.

The items listed below are standard check points after general hydraulic equipment has started steady operation. The frequency of inspection should be increased for a while after the initial operation. Taking into account the operational status/operating environment, perform maintenance, including maintenance of the actuator, as elaborately as possible.

Table 8.2a Daily Inspection Items

Inspection Place/Item	Frequency	Inspection Method and Measure
(1) Pump Noise	Once a day	When abnormal noise (differing from the normal sound of operation) occurs, stop operation and check the pump.
(2) Operating Condition of the Cylinder	Once a day	Check for any unstable phenomenon, including knocking. When detected, stop operation and check the cylinder.
(3) Rusty/Loose Joint	Once a day	Check that there is no looseness of or no dust/water entering the joints.
(4) Fluid Leakage	Once a day	Perform periodic inspection to prevent fluid leakage. When the fluid level is considerably lowered due to fluid leakage, pump performance may be degraded. Fluid leakage must be avoided to ensure against fire.

8. Maintenance

8.3 Inspection of the AC servo motor

Employing a brushless motor makes daily inspection of the AC servo motor easy. Use Table 8.3a for reference. Determine the appropriate inspection frequency in terms of the operational status/operating environment.

Table 8.3a Inspection of the AC Servo Motor

Inspection Place/Item	Frequency	Inspection Method and Measure
(1) Vibration and Acoustic Check	Once a day	Comparing to normal conditions, check that there is no increase in vibration and noise by touch and by listening.
(2) External Inspection	Depending on damage	Clean with cloth or air, if required.
(3) Overall Check	Once every 20000 hours or every 5 years (at least)	Contact the place of purchase or our customer support.

8.4 Guideline for replacing the AC servo motor components

See Table 8.4a for the component replacement intervals. The replacement period may vary depending on the condition of use or the operating environment. Replacement is required every time any failure is found. Contact the place of purchase or our customer support to request for component replacement. The requirement of component replacement will be determined after inspection.

Table 8.4a Component Replacement Intervals for the AC Servo Motor

Component	Replacement Interval	Remarks
(1) Bearing	20 to 30 thousand hours	When any failure is found, replacement is required even before the specified interval is reached.
(2) Encoder	20 to 30 thousand hours	
(3) Cooling Fan	20 thousand hours	

8.5 Inspection of the AMSR controller

No daily inspection is required. Inspect the controller at least once a year.

Table 8.5a Inspection of the AMSR Controller

Inspection Place/Item	Interval	Inspection Method and Measure
(1) External Inspection	Once a year (at least)	Check that there is no dust, dirt, or oil contamination. If required, perform cleaning with cloth or air.
(2) Check for Loose Screws		Check for loose mounting screws for the terminal block or connectors. If required, retighten them.

8.6 Guideline for replacing the components of the AMSR controller

The electric or electronic components of the AMSR controller are subject to mechanical wear and aging. Periodically inspect them as part of preventive maintenance.

Also, contact the place of purchase or our customer support according to Table 8.6a Component Replacement Intervals for the AMSR Controller. The requirement of component replacement will be determined after inspection. For the AMSR controller returned to/overhauled by us, parameter settings are reset to default values before shipment. Be sure to use the controller after setting the parameters appropriately.

Table 8.6a Component Replacement Intervals for the AMSR Controller

Component	Standard Replacement Interval	Condition of Use
(1) Cooling Fan	2 to 3 years	- Ambient temp.: 30 °C (annual average) - Load ratio: 80 % or less - Operating time: 20 hours or less/day
(2) Smoothing Condenser	8 to 10 years	
(3) Relays	(100 thousand times of power-on)	

9. Storage of unused units, 10. Disposal, 11. Customer service

9. Storage of unused units

Store and manage unused and spare units in a proper indoor storage place.

- Storage temperature range: 0 to 40 °C (no freezing)
- Storage humidity range: 80 % or less (no condensation)
- To avoid rust, corrosion, degradation of seals, etc., do not store the unit in the following and similar places.
 - a) Places potentially exposed to the direct influence of weather
 - b) Places where chemicals, such as organic solvents, acids, and alkalis, are present or the effect of vaporized gas potentially exists
 - c) Places where dew condensation potentially occurs due to substantial temperature fluctuations.

10. Disposal

This unit is categorized as industrial waste for the purpose of disposal. When disposing of the unit, its components, and hydraulic fluid, follow the procedures set out in the Waste Disposal and Public Cleansing Law and have them disposed of by an industrial waste disposal contractor.

11. Customer service

If there are requests for our products or if any services are required, please contact the place of purchase, our customer support, or the following sales department.

- YUKEN KOGYO CO., LTD.

International Sales Department
Hamamatsucho Seiwa Bldg.,
4-8, Shiba-Daimon 1-Chome
Minato-ku, Tokyo 105-0012, Japan
Phone: +81-3-3432-2110
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