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SUPER VEXTA®

OPERATING MANUAL

AC Servo-motor
KXP Series



- Standard type
- Electromagnetic brake type

Single-phase 100V input
Single-phase 200V input

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Thank you for purchasing an Oriental Motor product. To obtain the best performance from your motor, please read this manual thoroughly before use.

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Suitable Motor-Driver Combinations

KXP Series motors and drivers are shipped as a set. When you receive the product, check to see that you have an appropriate motor-driver combination by referring to the tables below.

■ For 100V Power Supply

Output (W)	Motor Installing Base Size (mm)	Unit Model	Motor Model	Driver Model
30	60	KXP230-ABZ	KXPM230-AB	KXPD30-ABZ
		KXP230-ABZM	KXPM230-ABM	
		KXP230GD-ABZ	KXPM230GD-AB	
		KXP230GD-ABZM	KXPM230GD-ABM	
60	80	KXP460-ABZ	KXPM460-AB	KXPD60-ABZ
		KXP460-ABZM	KXPM460-ABM	
		KXP460GD-ABZ	KXPM460GD-AB	
		KXP460GD-ABZM	KXPM460GD-ABM	
120	90	KXP5120-ABZ	KXPM5120-AB	KXPD120-ABZ
		KXP5120-ABZM	KXPM5120-ABM	
		KXP5120GD-ABZ	KXPM5120GD-AB	
		KXP5120GD-ABZM	KXPM5120GD-ABM	
180	104	KXP6180-ABZ	KXPM6180-AB	KXPD180-ABZ
		KXP6180-ABZM	KXPM6180-ABM	
		KXP6180GD-ABZ	KXPM6180GD-AB	
		KXP6180GD-ABZM	KXPM6180GD-ABM	

■ For 200V Power Supply

Output (W)	Motor Installing Base Size (mm)	Unit Model	Motor Model	Driver Model
30	60	KXP230-CBZ	KXPM230-CB	KXPD30-CBZ
		KXP230-CBZM	KXPM230-CBM	
		KXP230GD-CBZ	KXPM230GD-CB	
		KXP230GD-CBZM	KXPM230GD-CBM	
60	80	KXP460-CBZ	KXPM460-CB	KXPD60-CBZ
		KXP460-CBZM	KXPM460-CBM	
		KXP460GD-CBZ	KXPM460GD-CB	
		KXP460GD-CBZM	KXPM460GD-CBM	
120	90	KXP5120-CBZ	KXPM5120-CB	KXPD120-CBZ
		KXP5120-CBZM	KXPM5120-CBM	
		KXP5120GD-CBZ	KXPM5120GD-CB	
		KXP5120GD-CBZM	KXPM5120GD-CBM	
180	104	KXP6180-CBZ	KXPM6180-CB	KXPD180-CBZ
		KXP6180-CBZM	KXPM6180-CBM	
		KXP6180GD-CBZ	KXPM6180GD-CB	
		KXP6180GD-CBZM	KXPM6180GD-CBM	

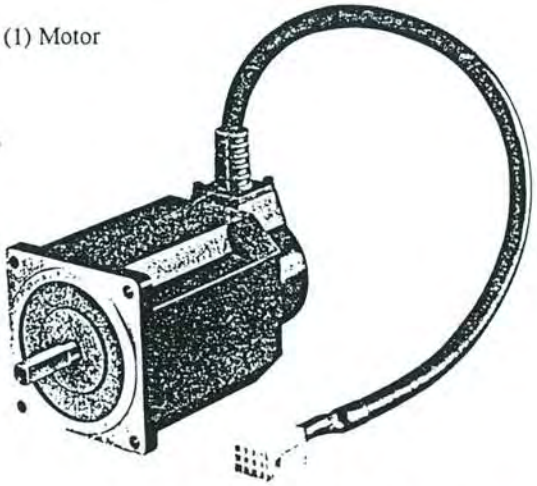
※ Products requiring an extension cable (sold separately) are designated by a 1 or -1 at the end of the unit model (e.g. KXP230-ABZ-1 , KXP230-ABZM1).

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Before Use

Check to see that you have received the complete product set, including accessories. If any parts are missing or damaged, please contact your nearest Oriental Motor.

(1) Motor



(2) Driver



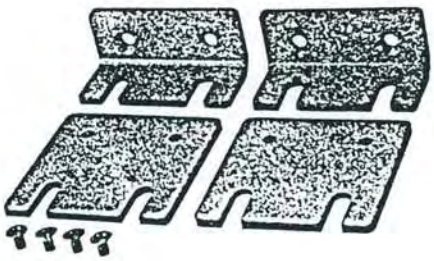
・The photographs shows a standard type (one not equipped with an electromagnetic brake).

(3) Junction cable

・A junction cable is not included with products which require an extension cable.



(4) Driver mounting brackets: One 4-piece set
Flat-headed screws: 4



(5) Connector for control I/O
MR-34LM(Honda Communications Industry)



(6) Operating manual (1 volume)

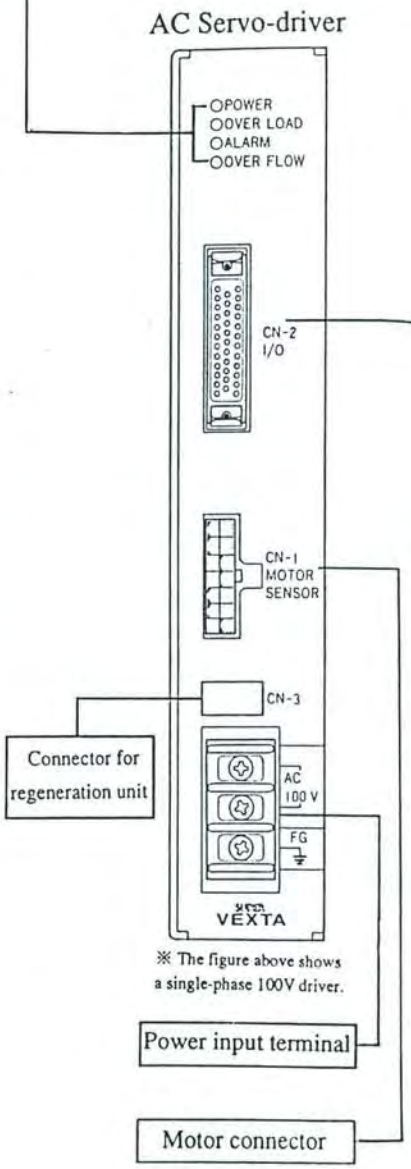
▼ Note :
Connecting the driver to an incorrect power supply voltage will result in damage . Before use, check the driver model name on the front panel. -ABZ models use 100V input , - CBZ models 200V input .

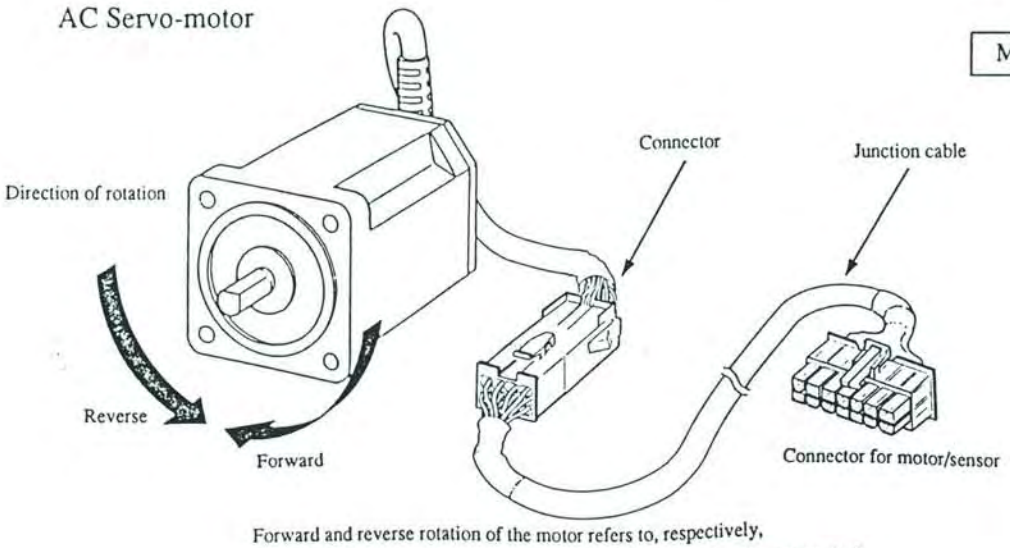
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Names and Functions of Components

LED Indications

Indication	Function	Lighting Conditions
POWER	Power indication	Lights when power is on.
OVER LOAD	Overload protection	① When the motor is operated for a continuous period under a load exceeding the rated torque. ② When the peak torque is output for more than 5 seconds during acceleration / deceleration.
ALARM	Overcurrent protection Overvoltage protection Overheat protection	Lights when the following protection functions are activated : ① Overcurrent detection : Activated when an excessive current has flowed through the power MOSFET of the driver's inverter. ② Overvoltage detection : Activated when the primary voltage of the driver's inverter exceeds the permissible value. ③ Overheat detection : Activated when the temperature of the driver's internal radiator rises to about 85℃. ◇ When a protective function is activated, the alarm signal is output and the motor stops. Operation can be restored by turning power back on, or by inputting the counter - clear signal.
OVER FLOW	Speed error protection	Activated when the motor does not follow-up a pulse speed command normally.

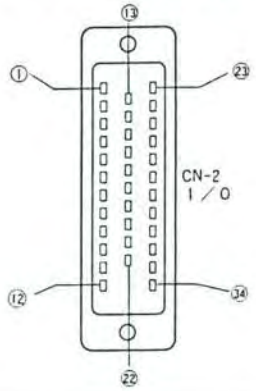




Forward and reverse rotation of the motor refers to, respectively, clockwise and counterclockwise rotation as seen when facing the output shaft.

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· The pin configuration of the CN-2 connector is as shown in the diagram below (view as seen facing soldered parts).



Control Input/Output Signals (CN-2 I/O)

Pin Number	Signal Code	Signal Name	Function / Use
⑪	CW/(PLS)	Forward pulse input	Pulse input for forward rotation command
⑫	$\overline{\text{CW}}$/($\overline{\text{PLS}}$)	(pulse input)※	(pulse input) . ※
⑨	CCW/(DRE)	Reverse pulse input	Pulse input for reverse rotation command
⑩	$\overline{\text{CCW}}$/($\overline{\text{DRE}}$)	(direction of rotation input)※	(rotation direction input) . ※
㉝	HOF	Hold-off input	This signal puts the motor in a non - excitation state. The deviation counter still functions in this state, which means that if the motor shaft is moved manually, it will return to the position immediately preceding movement when the hold-off signal input is canceled. To cancel this return function, input the counter-clear signal at the same time as the hold - off signal .
㉞	$\overline{\text{HOF}}$		
㉑	CCR	Counter-clear input	This signal clears the deviation counter and the alarm. This signal is used primarily for returning to home. This signal can also be used when a protection circuit is activated to clear the alarm signal without switching off the power (see note below) .
㉒	$\overline{\text{CCR}}$		
⑮	ASG	Encoder A-phase pulse output	This signal is used when monitoring encoder output or when setting the origin ASG and BSG signals are output at a rate of 400 pulses for each motor shaft revolution,and ZSG signals at a rate of one pulse per revolution. (During forward rotation , BSG is delayed with respect to ASG by 90° as expressed in electric degrees .)
⑯	$\overline{\text{ASG}}$		
⑬	BSG	Encoder B-phase pulse output	
⑭	$\overline{\text{BSG}}$		
㉓	ZSG	Encoder Z-phase pulse output	
㉔	$\overline{\text{ZSG}}$		
㉙	END	Positioning completion output	This signal is output upon completion of positioning (low voltage level) .
㉚	$\overline{\text{END}}$		
㉕	ALM	Alarm output	This signal is output when a protection circuit is activated (high voltage level). At this time , the ALARM indication lights , and the motor stops .
㉖	$\overline{\text{ALM}}$		
①	VCC	Encoder power supply input	Power input for encoder signal output (+15V or less).
②	GND		

※Signals given in parentheses are selectable by internal switches.

▼ Note : When the alarm is activated, be sure to correct the problem that caused this before inputting the alarm clear signal.

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Connections

Before operating the motor, the proper connections must be made between the motor, driver and external controller.

1. Before Connecting the Equipment

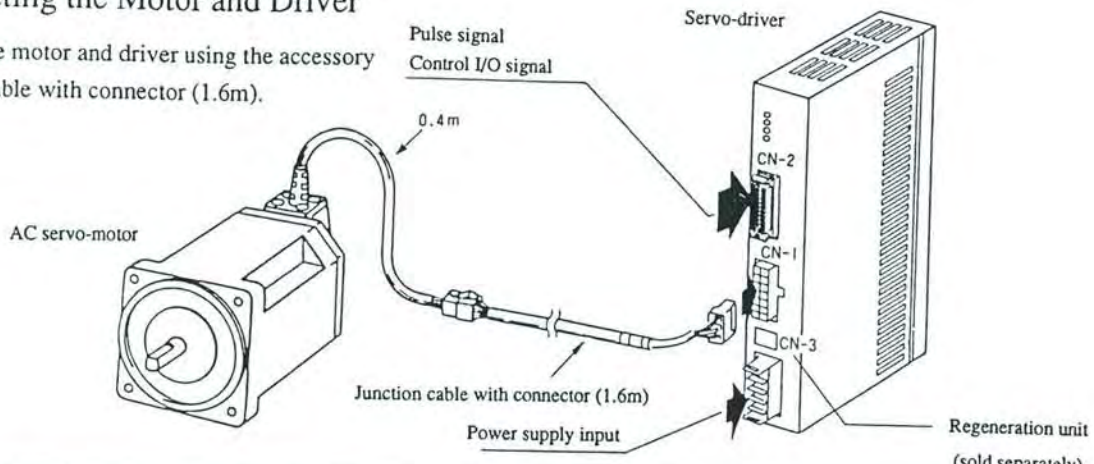
○ Cables for the power supply and the CN-2 control I/O signal port must be furnished by the user.
○ Power must be off in all equipment before making connections.
○ Be sure that all connectors and plugs are fully inserted. Faulty connections can cause operational errors.

Equipment should be connected in the sequence given below.

(1) Motor and driver → (2) Driver and power supply → (3) Driver and controller

2. Connecting the Motor and Driver

●Connect the motor and driver using the accessory junction cable with connector (1.6m).

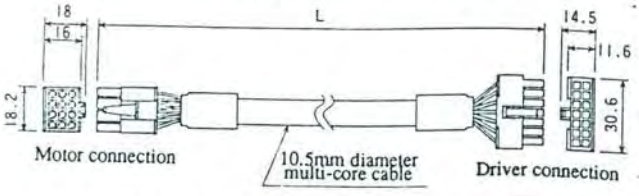


▼Notes:

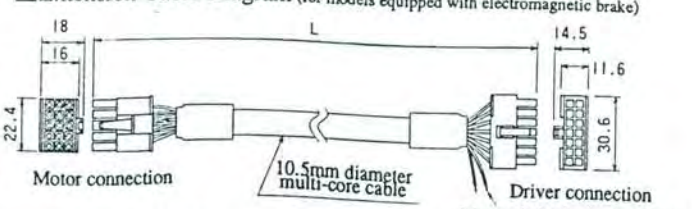
1. Under no circumstances shoud cabling work be performed when connecting the unit, since this can vesult in damage to the driver or motor, or cause errors in operation.
2. The junction cable and extension cable (see below) are not designed to be bent. For applications in which the motor is mounted on a movable device and the cable repeatedly bent and straightened out, use the optional flexible cable. For further information, contact your nearest Oriental Motor.
3. When using the motor in applications that could put tension on the driver connector, fasten down the junction cable at some point or take other measures to ensure that this does not occur.

● The distance between the motor and driver can be extended to up to 10meters using the extension cable (sold separately).

■Extension Cable Diagram (cable for standard type)



■Extension Cable Diagram (for models equipped with electromagnetic brake)



■Cable Model

Cable Model	L [m]
CC01SKF	1
CC03SKF	3
CC05SKF	5
CC07SKF	7
CC10SKF	10

■Cable Model

Cable Model	L [m]
CC01SPFM	1
CC03SPFM	3
CC05SPFM	5
CC07SPFM	7
CC10SPFM	10

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3. Connecting the Driver and Power Supply

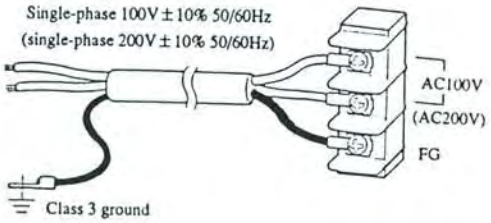
Use a 3 - core cable with a conductor cross - sectional area of at least 1.25mm² for the power supply cable . Power supply voltage is single - phase 100V±10% 50/60Hz or single-phase 200V±10% 50/60Hz. However, power supply input current varies with motor output (see table below). Also, the frame ground (FG) terminal should be connected to a Class 3 (or better) ground (grounding resistance of 100Ω or less) .

▼ Notes:

(1) Connecting the driver to an incorrect power supply voltage will result in damage to the driver. Therefore, before turning on power , check once again that the correct voltage is being used.

(2) Before turning on power , check to see that the motor's cable is properly connected.

Power Supply Connection



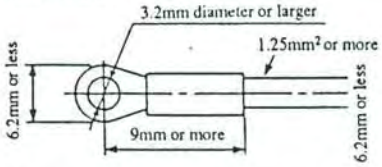
Power supply input current (single - phase 100V)

Unit Models		Maximum Driver Input Current
Round Shaft Type	Pinion Shaft Type	
KXP230-ABZ	KXP230GD-ABZ	2.4A
KXP460-ABZ	KXP460GD-ABZ	4A
KXP5120-ABZ	KXP5120GD-ABZ	7A
KXP6180-ABZ	KXP6180GD-ABZ	9A

Terminal Block Connection

(Suitable crimp terminals)

● Round terminals with insulation



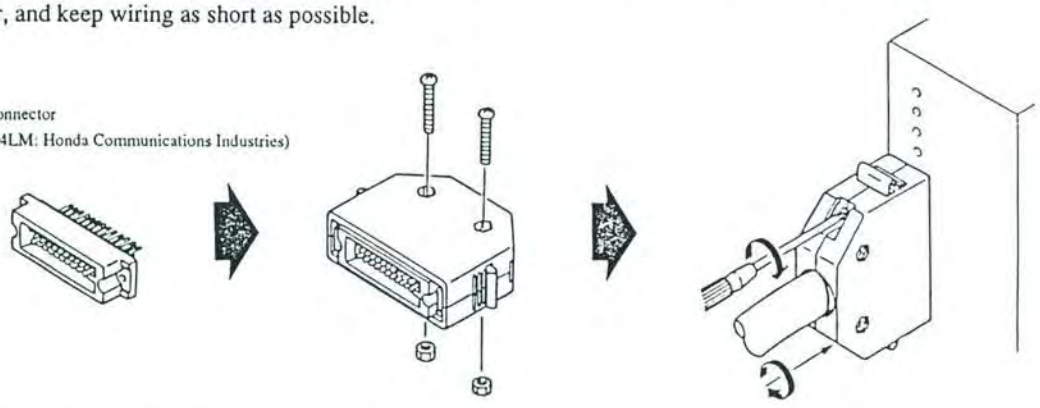
Power Supply Input Current (single - phase 200V)

Unit Models		Maximum Driver Input Current
Round Shaft Type	Pinion Shaft Type	
KXP230-CBZ	KXP230GD-CBZ	1.5A
KXP460-CBZ	KXP460GD-CBZ	2.1A
KXP5120-CBZ	KXP5120GD-CBZ	3.3A
KXP6180-CBZ	KXP6180GD-CBZ	4.5A

4. Connecting the Controller and Control Input/Output Port

Use the accessory connector to connect the controller to the control Input/Output port. To suppress noise, use as the lead a multi-core, twisted-pair, blanket shielding cable that contains at least 20 core wires , each 0.14mm or more in diameter, and keep wiring as short as possible.

I/O connector
(MR-34LM: Honda Communications Industries)



Solder the lead wires to the required pin numbers in accordance with the connection diagram.

Use screws to close the case.

After inserting the connector, tighten the two screws to fasten it to the driver.

Details regarding control Input/Output are given beginning on page 8.

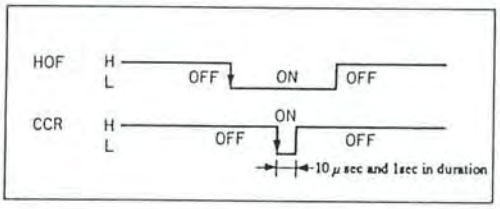
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Use of Control Input/Outp... (I/O)

1. Control Input/Output Signals

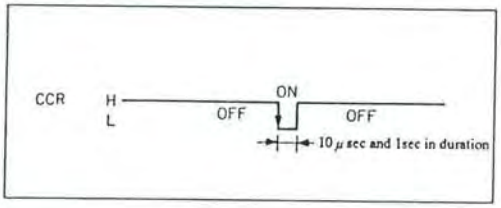
(1) Hold-off input [㉝㉞ : HOF]

Inputting the hold-off signal puts the motor in a non-excitation (free) state, which is used when turning the motor shaft externally or when positioning manually. However, since the driver's deviation counter still functions when the hold-off signal is input, the motor returns to the position before input when the hold-off signal is canceled. Therefore, when setting an origin manually, always be sure to input the counter-clear (CCR) signal before canceling the hold-off signal.



(2) Counter-clear input [㉑㉒ : CCR]

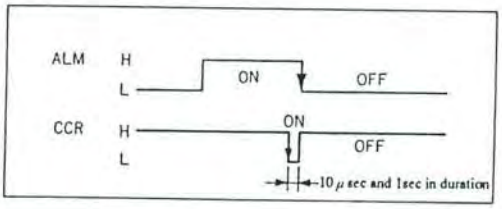
This signal clears the deviation counter and resets the alarm. This signal is used primarily for returning to home. This signal is used when returning to an origin or, when a protection circuit has been activated, for canceling the alarm without turning off power.



▼ Note : Do not reset the alarm until the problem which caused the protection circuit to activate has been corrected.
Always input the counter-clear (CCR) signal as a single impulse of between 10msec and 1sec in duration.

(3) Alarm output (positive logic output) [㉕㉖ : ALM]

This signal indicates that one of the driver's protection circuits has been activated. When an abnormality such as an overload or overcurrent is detected, the alarm signal is output, the ALARM indicator lights, and the motor stops. Similarly, if the motor does not follow-up a pulse speed command normally, the alarm signal is input, the OVER FLOW indicator lights, and the motor stops.

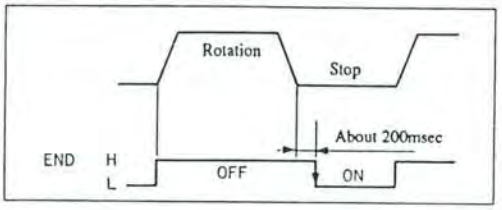


▼Note : Since alarm output uses positive logic, other outputs use negative logic.

(4) Positioning completion output (negative logic output)[㉙㉚ : END]

This signal is output at low level when positioning is completed.

※ This signal is output when the deviation counter's accumulated pulsesare 8 or less.

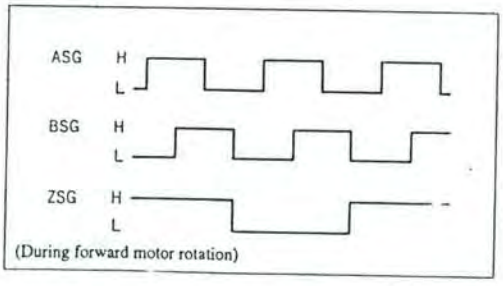


(5) Encoder output [⑮⑯ : ASG, ⑬⑭ : BSG, ㉓㉔ : ZSG]

These signals are used when monitoring encoder output or returning to an origin.

ASG / BSG ····· 400 pulses are output for each motor revolution. The phase difference between ASG and BSG is 90° as expressed in electric degrees.

ZSG····· 1 pulse is output for each motor revolution.



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2. Pulse Input Systems

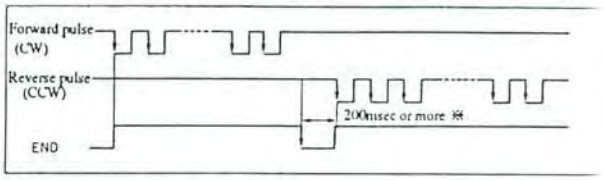
In the KXP series of AC servo-motors, pulse signals are used to control the motor's speed, amount of revolutions and direction of rotation. There are two pulse input modes (described below), which can be selected to match the controller's pulse output system. (At shipment, motors are set to the 2-pulse input mode.)

(1) 2-Pulse and 1-Pulse Input Mode

●2-pulse input mode

This mode is used for input of forward pulses (CW) and reverse pulses (CCW).

When forward pulses are input, the motor rotates clockwise (if viewed facing the motor shaft); when reverse pulses (CCW) are input, the motor rotates counterclockwise.



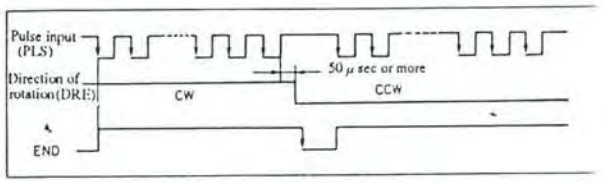
※Upon output of the positioning completion (END) signal, a delay time of 200msec or more must be allowed. This delay time varies depending on the pulse signal input method and the motor's load conditions.

●1-pulse input mode

This mode is used for pulse (PLS) signals and direction of rotation selection (DRE) signals. DRE signals input at high level (i.e. input photocoupler is off) produce forward rotation ; low level input (i.e. input photocoupler is on) produces reverse rotation.

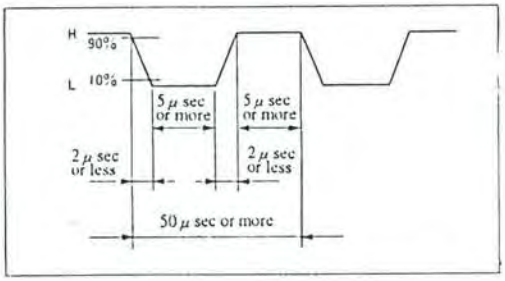
[Direction of rotation input signal]

High : forward Low : reverse



(2) Pulse shape

As shown in the diagram at right, pulse signals should be input to produce a pulse shape that sharply rises and falls between pulselengths of 5 μ sec or more.

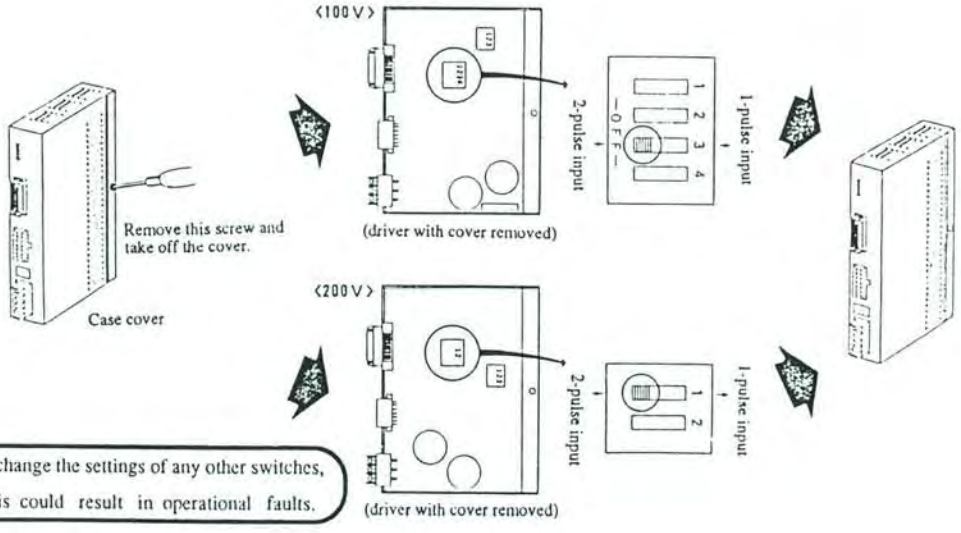


(3) Selecting the pulse input mode

The pulse input mode is selected using the dip switches inside the driver.

〈Instructions for changing dip switch settings〉

(1) Remove the case cover. (2) Change the setting of Switch 3 in the four-switch set (two-switch set for 200V models). (3) Replace the case cover.



▼ Note : Do not change the settings of any other switches, since this could result in operational faults.

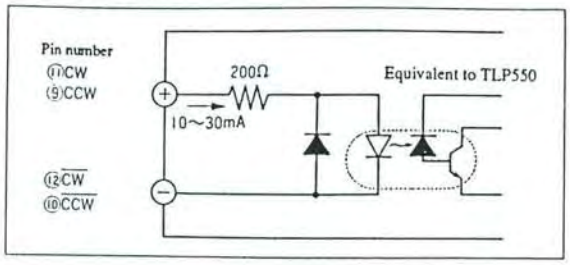
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3. Control Input / Output Circuits (I/O:CN-2)

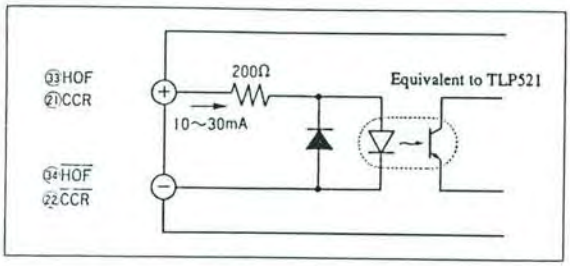
(1) Input Circuits

● Forward pulse input (CW [PLS])
Reverse pulse input (CCW [DRE])

(Internal circuits)



●Hold-off input (HOF)
Counter-clear input (CCR)



▼ Note : Direct connections are possible so long as the signal voltage applied is 5V or less. If used with a signal voltage exceeding 5V, connect an external resistance to keep current within 30mA. Applying a voltage exceeding 5V without using an external resistance can cause damage to circuit elements.

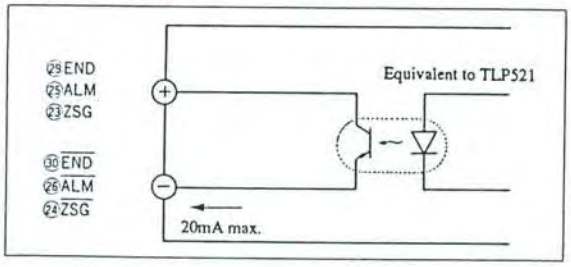
Example : When using with 24V : At least 820Ω · more than 2W

When using with 12V : At least 430Ω · more than 1W

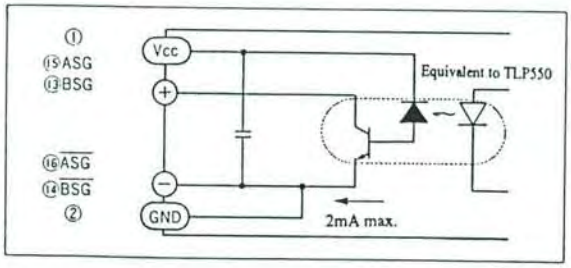
(2) Output Circuits

(Internal circuits)

●Positioning completion output (END)
Alarm output (ALM)
Encoder Z-phase pulse output (ZSG)
Circuits for use with 30V, 20mA maximum:



●Encoder A-phase pulse output (ASG)
Encoder B-phase pulse output (BSG)
Circuits for use with 15V, 2mA maximum:



※Vcc is the power supply for the encoder output photocoupler and should be connected directly to a power supply of DC15V max.
(This power supply is only required when using A/B phase pulse output.)

▼ Note: Because different types of photocouplers are used for the encoder's A-phase and B-phase pulse outputs, the voltage specifications for the external power supply and the permissible value of the output current will differ for these outputs.

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2. Operation Requirements

The operation requirements given below must be taken into consideration when both selecting and operating motors. These requirements have been established in respect of motor temperature rises, which are related to factors such as large load or large inertial load and high positioning frequency (starting/stopping). To ensure that such temperature rises do not occur, operate the motor strictly in accordance with these requirements.

● Values for rated torque, suitable load inertial moment and peak torque are given in the specifications table on page 22.

(1) Requirements for continuous operation

$T_L \leqq T_M$ ····· The load torque T_L at the motor shaft must be less than or equal to the rated torque T_M.

(2) Requirements for inertial load

$GD_L^2 \leqq 5GD_M^2$ $(J_L \leqq 5J_M)$ ····· The inertial load GD_L^2 (J_L) at the motor shaft must be no more than 5 times the rotor's inertial moment GD_M^2 (J_M).

(3) Requirements for acceleration/deceleration torque

$T_a+T_L \leqq T_{max}$ ····· When adjusting the speed of the inertial load GD_L^2, the sum of the required acceleration/deceleration torque T_a (T_d) and the load torque T_L must be less than or equal to the peak torque T_{max}.

(4) Requirements for effective load torque

$T_{rms} \leqq T_M$ ····· When performing frequency positioning control, the effective load torque T_{rms} for one cycle must be less than or equal to the rated torque T_M.

(5) Calculating the torque

● Acceleration torque T_a

$$T_a = \frac{(GD_L^2 + GD_M^2)}{37500} \times \frac{N_M}{t_1} \text{ [kgcm]} \qquad T_a = \frac{J_L + J_M}{9.55} \times \frac{N_M}{t_1} \text{ [N · m]}$$

● Effective load torque T_{rms}

$$T_{rms} = \sqrt{\frac{(T_a + T_L)^2 \cdot t_1 + T_L^2 \cdot t_2 + (T_d - T_L)^2 \cdot t_1}{t_f}} \text{ [kgcm] (N · m)}$$

$GD_L^2(J_L)$: Load inertial moment [kgcm²] (kgm²) at the motor shaft

$GD_M^2(J_M)$: Rotor inertial moment [kgcm²] (kgm²)

N_M: Motor's maximum speed [r/min]

T_a (T_d): Acceleration torque (deceleration torque) [kgcm] (N · m)

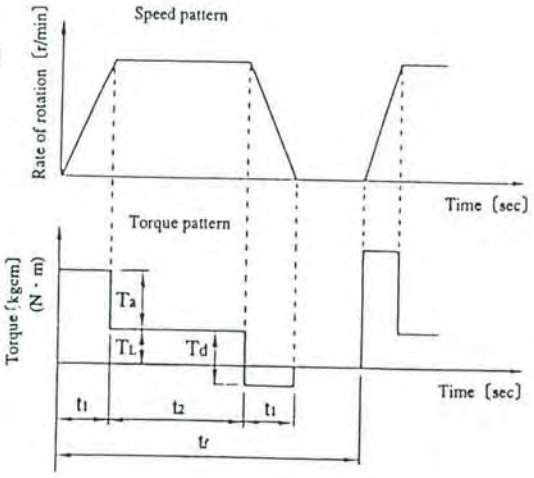
T_L: Load torque [kgcm] (N · m)

t_1: Acceleration/deceleration time [sec]

t_2: Fixed speed time [sec]

t_f: Operating cycle time [sec]

〈Operation pattern〉



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3. Cautions for Operation

(1) Speed control.

The motor's speed N_M [r/min] is proportional to the pulse speed f(Hz).

$$N = \frac{60 \cdot f}{400} = 0.15 \text{ [r/min]}$$

(KXP series models use a 400P/R encoder)

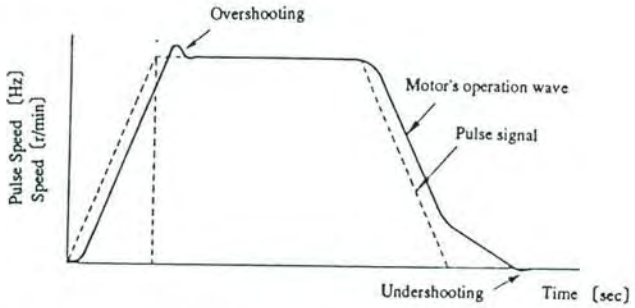
Pulse Speed f [Hz]	Motor Speed N_M [r/min]
1000	150
2000	300
10000	1500
20000	3000

However, speed fluctuates ±3 r/min about setting speed. When the input pulse speed is 20kHz, the motor's speed is 3000r/min.

If the motor is linked directly to a ball screw with a lead pitch of 5mm, a feed speed of 250 mm/sec can be obtained when the pulse speed is 20kHz.

(2) Acceleration/Deceleration

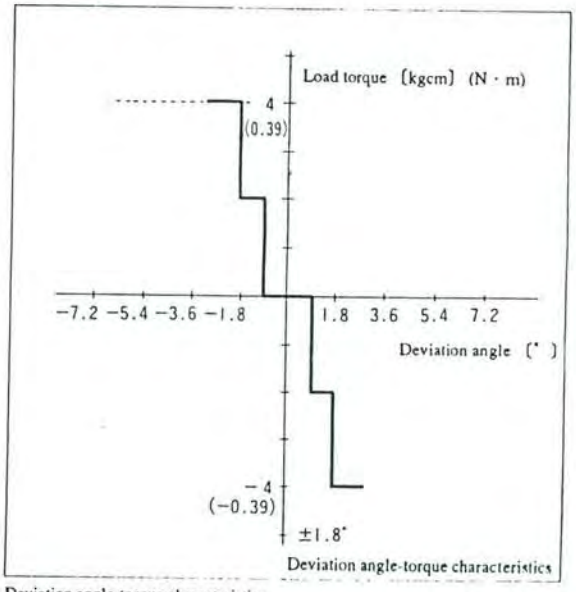
When operating the motor under an inertial load exceeding the rotor's inertia, be sure to perform acceleration/deceleration operation (at least 5msec/kHz) to reduce overshooting and undershooting. Sudden acceleration/deceleration may cause the alarm indicator to light. Setting a suitable acceleration/deceleration duration can minimize overshooting and undershooting.



(3) Positioning Accuracy

The motor's positioning accuracy when not under load is ±0.9° (±1 pulse). However, as shown in the diagram at right, positioning accuracy under load varies with the load torque. Positioning accuracy when load torque equals the rated torque is ±1.8°(±2 pulse).

▼ Note: Stopping accuracy during positioning may vary due to the load torque.



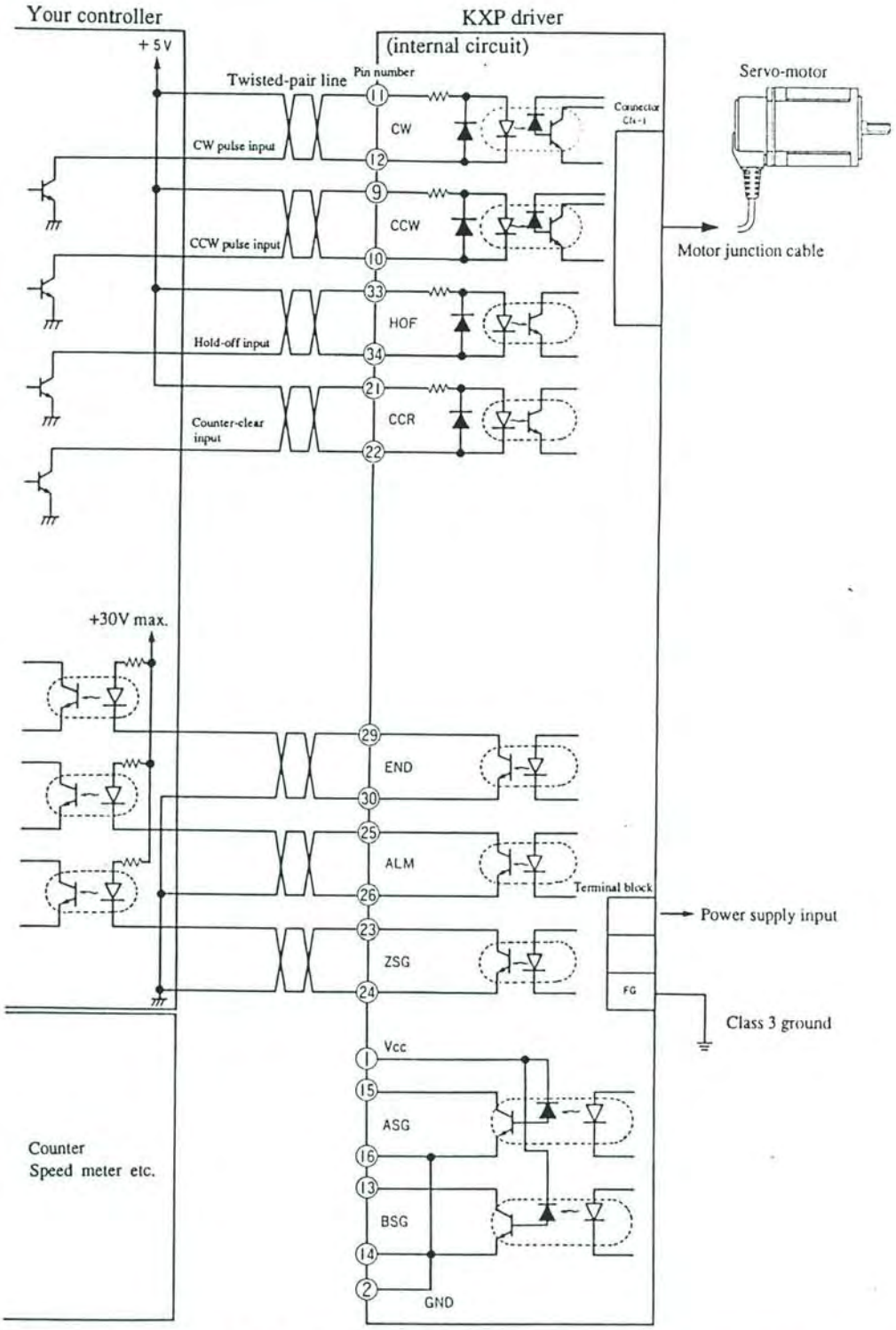
Deviation angle-torque characteristics
(for KXP5120-ABZ)

Time [sec]

Time [sec]

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4. Connection Diagram



▼ Notes :

1. Use for the control Input/Output signal line (CN-2) a multi-core, twisted-pair, blanket shielding wire with a core diameter of at least 0.14mm, and keep it as short as possible (within 2m).
2. For the connection between the motor and servo - driver, use either the junction cable included with the motor or an extension cable (no more than 10m).
3. For the power line, use a 3-core cable with a conductor cross-sectional diameter of at least 1.25mm^2.
4. The control Input / Output signal line and the encoder signal line should be separated from power lines (circuits carrying large current such as AC lines or the motor line) by a distance of at least 30cm. Also , they should not be run through the same duct or pipe with power lines.
5. Cables for the power supply line and the control Input / Output signal line must be furnished by the customer.
6. The FG terminal ground should be a spot ground of at least Class 3 (ground resistance of 100 Ω or less) , and the line should be as thick as possible.

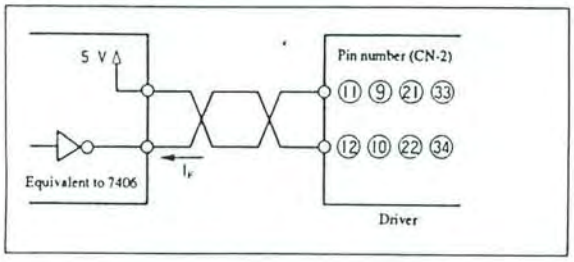
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5. Controller and Control Input / Output Signal Connections

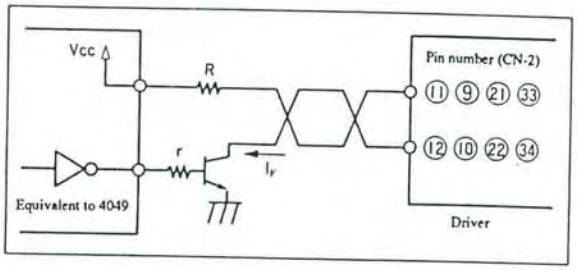
Connections to control Input/Output signals (CN-2) differ according to the controller's input/output system. Use a connection method suitable for your controller referring to the diagrams below.

(1) Controller output system

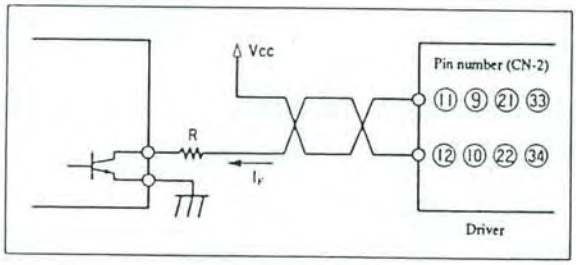
● TTL (equivalent to 7406)



● C-MOS (equivalent to 4049)



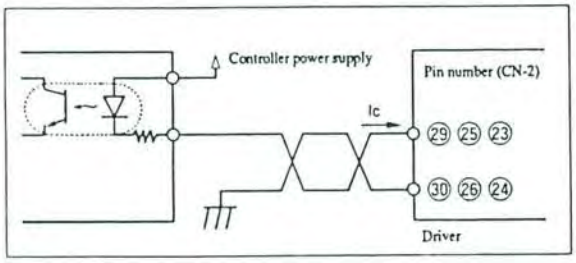
● Open collector



▼ Note : When Vcc is 5V, the current I_F is about 20mA. If a voltage exceeding 5V is used for Vcc,be sure to connect an external resistance to keep current within 30mA.

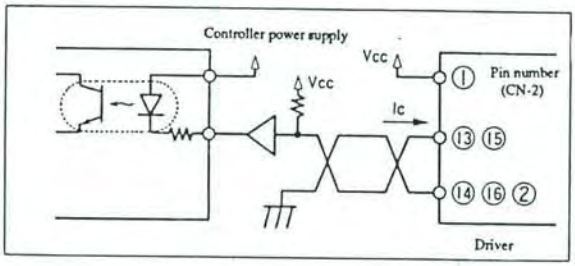
(2) Controller input system (when using photocoupler)

● Positioning completion (END) signal, alarm signal, encoder Z-phase pulse signal



▼ Note : The controller's power supply should be from 5V to 30V. Current Ic should be 20mA maximum.

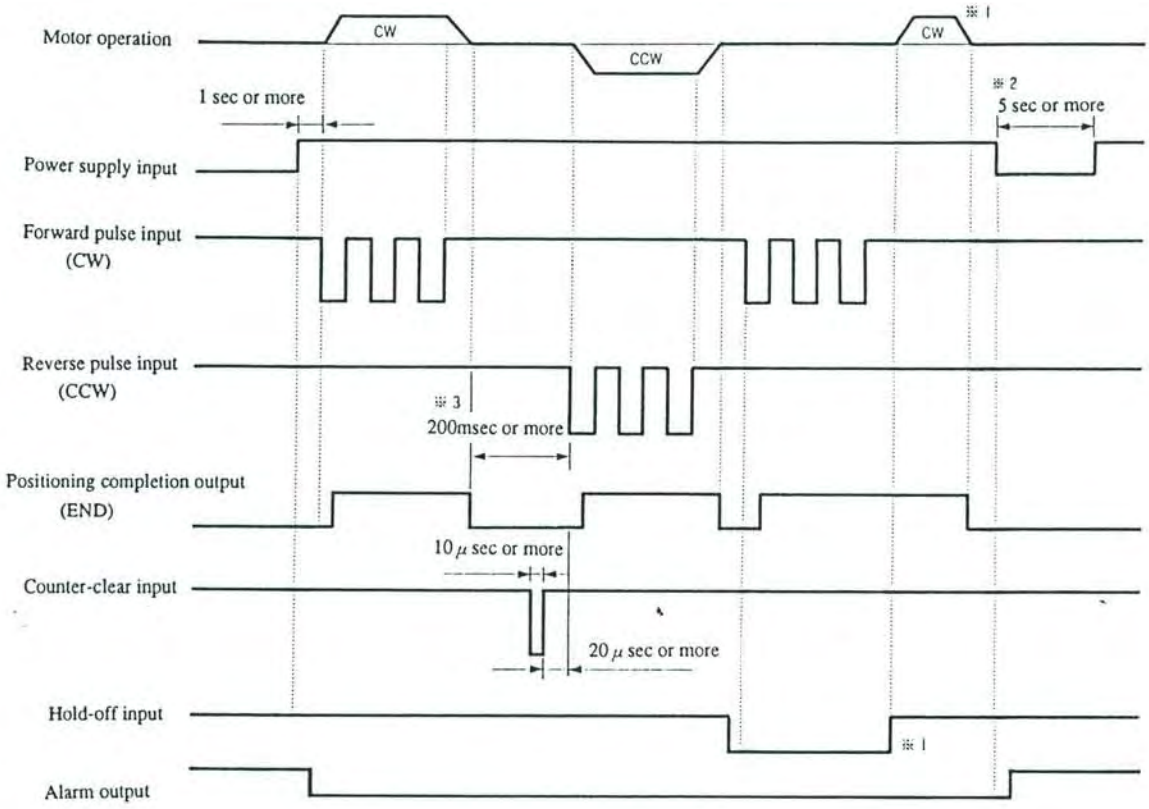
● Encoder A-phase and B-phase pulse signals



▼ Note : The current Ic should be 2mA maximum. If the photocoupler cannot be driven by a direct connection to the controller, amplify th current as shown in the diagram.

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6. Timing Chart



※1 During hold - off signal input, the motor's servo - lock is disengaged (motor in non-excitation state), but the deviation counter still functions. Therefore, when the hold-off signal is canceled, the motor responds to the pulse signals that were input during the period of hold - off signal input.

※2 Once power has been turned off, wait at least 5 seconds before turning it on again.

※3 The cumulative amount of pulses for END signal input is set to ±8 pulses. This means that the positioning completion (END) signal may not be output at precisely the same time that the motor completes positioning. Therefore, some amount of delay time must be allowed after output of the positioning completion (END) signal. This delay time varies depending on the pulse signal acceleration/deceleration rate and the motor's load conditions.

●The timing chart for the electromagnetic brake is given on page 25.

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