



Driver for 2-phase Stepping Motor

UI2120G

OPERATING MANUAL



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Thank you for purchasing an Oriental Motor product.

This Operating Manual describes product handling procedures and safety precautions.

- Please read it thoroughly to ensure safe operation.
- Always keep the manual where it is readily available.

Introduction

The **UI2120G** driver is a 2-phase stepping motor driver with built-in pulse generator allowing operation in a total of six motor drive modes.

This product is designed to be incorporated into general industrial machinery, and must not be used for other purposes. It should be noted that we are not responsible for any damages caused by ignoring this warning.

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1. Safety precautions

Only qualified personnel should work with the product.

Before using it, carefully read the “ Safety precautions ” to ensure correct operation.

Cautions described below are intended to ensure correct use of the product and to prevent the customer and other people from being injured.

Warning

Handling the product without observing the instructions that accompany a “ Warning ” symbol may result in serious injury or death.

Caution

Handling the product without observing the instructions that accompany a “ Caution ” symbol may result in injury or property damage.

Note

The items under this heading contain important handling instructions that the user should observe to ensure the safe use of the product.

Warning



General

Do not use the product in an explosive, flammable, corrosive or atmosphere to avoid possible fire, an electric shock or personal injury. Do not use it where it may be splashed with water, or near the combustible substances.

Only qualified installers should be assigned to the work of installation, connection, running, operation, inspection and trouble diagnosis. This is intended to prevent fire, an electric shock and injury.

Do not move, install, connect, inspect, or set the functions of the product when power is applied. Turn off power before starting such work. This caution is to prevent possible an electric shock.

Start the work 30sec. or more after turning off driver power. This caution is to prevent possible an electric shock.

Do not touch the marked positions when power is turned on. Marks  and  on the driver front panel indicate the terminal where high voltage is applied. This is prevent fire and an electric shock.

Installation

Install the driver and motor inside a cabinet. This is to prevent an electric shock and injury.

Electrical connections

The driver power input voltage should be within the rated range. Otherwise, fire and an electric shock may occur. Electrical connections must be made in strict accordance with the connection diagram. Otherwise, fire and an electric shock may occur.

Do not bend or pull the electrical cable and motor lead wire. Do not force them into other parts. This is to prevent fire and an electric shock.

Do not touch the motor and driver with a bare hand or provide grounding in order to prevent possible an electric shock when you want to install them on the equipment.

Running

Turn off drive power in the event of power interruption. When the power is restored, the motor may start up suddenly and cause injuries or damage to the equipment.

Take position holding measures for movable parts when the automatic current off function is set to ACO (Enabled) position. If the driver overheat preventing function has activated, the motor will be stopped and holding force will be lost. This caution is to prevent possible personal injury or equipment damage. This function is set to ACO (Enabled) position at the time of shipment.

When you have set the automatic current off function to OFF (Disabled), monitor the driver alarm output and stop the motor if an alarm is signaled. This caution is to prevent possible fire hazards.

Do not turn ON the output current off input during motor operation. The motor will be stopped and holding force will be lost. This caution is to prevent the movable parts from being dropped, thereby causing personal injury or equipment damage.

Maintenance and inspection

Do not touch the driver connection terminal immediately (within 30sec.) after turning off driver power. This caution is to prevent possible an electric shock due to residual voltage.

Repair, disassembly and modification

Do not disassemble or modify the driver. Otherwise you may get an electric shock or injury. When internal inspection and repair must be made, contact your local sales office.

Caution

General

Do not use the driver and motor in excess of ratings. Otherwise, you may get an electric shock, injury or the equipment may be damaged.

Do not put your finger and other objects into the driver opening. This is to prevent possible fire, an electric shock or personal injury.

During running and for some time after stopping the equipment, do not touch the driver and motor. You may be burnt by high temperature on the surfaces of the driver and motor.

Installation

Do not place combustibles around the driver and motor. Otherwise, fire may occur or you may be burnt.

Do not place around the driver and motor any obstacle which may interfere with ventilation. Otherwise, the equipment may be damaged.

The driver should be firmly secured on the metallic plate in order to prevent personal injury or the equipment may be damaged.

Connection

Mount the terminal cover of the driver terminal after connection. This is to prevent possible an electric shock.

Running

Remove the CN1 to adjust motor current. If a wrong signal is input, the motor will make a sudden start, resulting in possible personal injury or damage of the equipment.

Adjust the driver current adjustment potentiometer with an insulated screwdriver. This caution is to prevent an electric shock.

Use the driver and motor in it's specified combination. This is to prevent fire or the equipment may be damaged. Start running after making sure that the emergency stop can be used whenever required. Otherwise, injury may occur.

Set all driver signal inputs to off before turning on the driver. If not, the motor will start up to cause personal injury and equipment damage.

Make sure that the output power off input of the driver is turned on if you want to move the motor shaft directly (e.g. for manual positioning). This caution is to prevent personal injury.

Immediately when trouble has occurred, stop running and turn off the driver power. This is intended to prevent fire, an electric shock and injury.

Set the acceleration and deceleration time in conformity to load and avoid sudden changes in load. This caution is to prevent possible personal injury or equipment damage because of the motor getting out of synchronism and the movable parts moving in an unexpected direction.

Immediately after the protection function has been activated, turn off the power and remove the cause. Then turn on power again. If the motor operation is continued without removing the cause, the driver and motor may operate incorrectly and cause personal injury and equipment damage.

Maintenance

When testing the insulation resistance or dielectric strength, do not touch the terminal. Otherwise, an electric shock may occur.

Scrapping

When scrapping the driver, scrap it as industrial waste.

2. Product verification

⚠ Caution Use the driver and motor in its specified combination. This is to prevent fire or the equipment may be damaged.

2.1 Equipment checklist

Confirm the following equipment is included in your package.

Contact your nearest sales office if something is either not included or damaged.

- Driver 1
- Connector for I/O signals 1
 - { Connector (MOLEX) 1 }
 - { Connector cover (MOLEX) 1 }
- Operating manual 1

Note

The driver and the motor are precision equipments and should not be dropped or subject to any physical shocks.

2.2 Checking the product name and applicable motor

This operating manual is intended for **UI2120G**. Check for driver product name.

The driver **UI2120G** is capable of driving the following 2-phase stepping motors.

Adjust the current in conformity to the motor to be used.

■ PK series standard type

Model		Basic step angle	Maximum holding Torque [N·m (oz-in)]	Rated current [A/phase]
Single shaft	Double shaft			
PK243-01AA	PK243-01BA	1.8 °	0.16 (22.2)	0.95
PK244-01AA	PK244-01BA	1.8 °	0.26 (36.1)	1.2
PK245-01AA	PK245-01BA	1.8 °	0.32 (44.4)	1.2
PK264-02A	PK264-02B	1.8 °	0.39 (54.1)	2.0
PK266-02A	PK266-02B	1.8 °	0.9 (124)	2.0
PK268-02A	PK268-02B	1.8 °	1.35 (187)	2.0
PK296-01AA	PK296-01BA	1.8 °	2.2 (305)	2.0
PK299-01AA	PK299-01BA	1.8 °	4.4 (611)	2.0
PK2913-01AA	PK2913-01BA	1.8 °	6.6 (916)	2.0

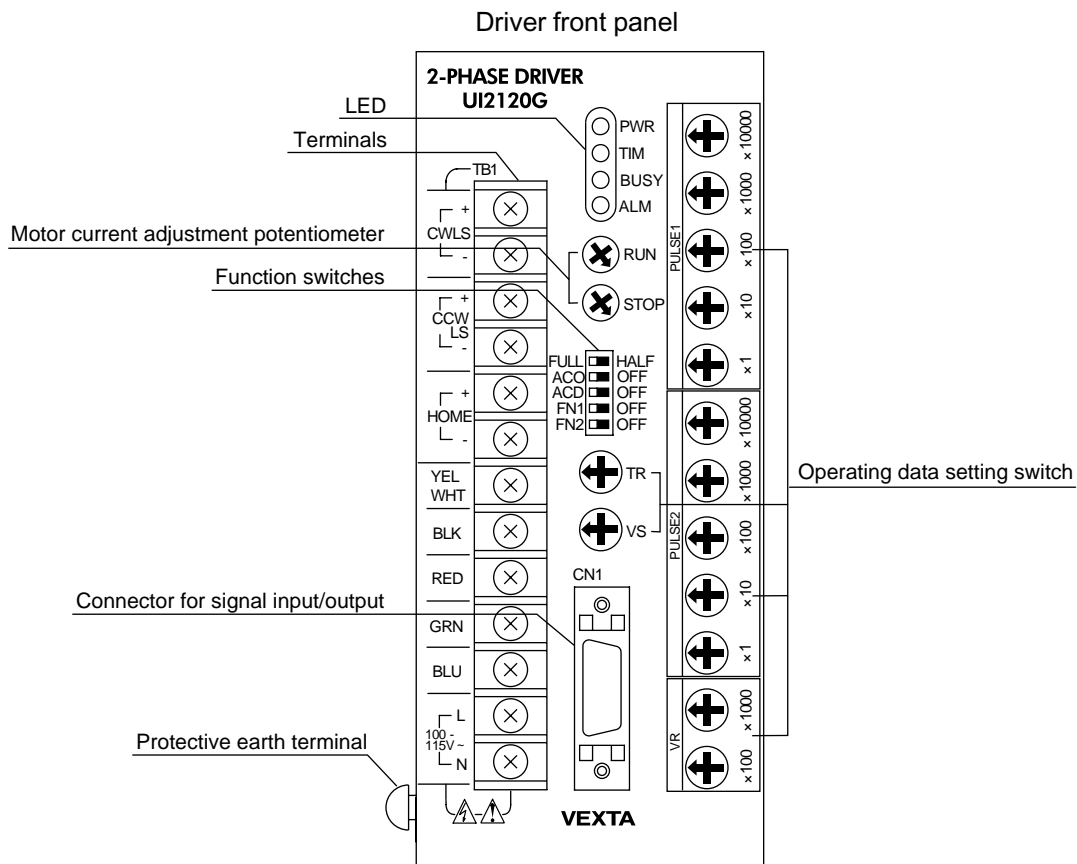
■ PK series high-resolution type

Model		Basic step angle	Maximum holding Torque [N·m (oz-in)]	Rated current [A/phase]
Single shaft	Double shaft			
PK243M-01AA	PK243M-01BA	0.9 °	0.16 (22.2)	0.95
PK244M-01AA	PK244M-01BA	0.9 °	0.26 (36.1)	1.2
PK245M-01AA	PK245M-01BA	0.9 °	0.32 (44.4)	1.2
PK264M-02A	PK264M-02B	0.9 °	0.39 (54.1)	2.0
PK266M-02A	PK266M-02B	0.9 °	0.9 (124)	2.0
PK268M-02A	PK268M-02B	0.9 °	1.35 (187)	2.0

■PK series SH geared type

Model		Basic step angle	Maximum holding Torque [N·m (oz-in)]	Rated current [A/phase]
Single shaft	Double shaft			
PK243A1A-SG3.6	PK243B1A-SG3.6	0.5 °	0.2 (1.73)	0.95
PK243A1A-SG7.2	PK243B1A-SG7.2	0.25 °	0.4 (3.47)	0.95
PK243A1A-SG9	PK243B1A-SG9	0.2 °	0.5 (4.33)	0.95
PK243A1A-SG10	PK243B1A-SG10	0.18 °	0.56 (4.86)	0.95
PK243A1A-SG18	PK243B1A-SG18	0.1 °	0.8 (6.94)	0.95
PK243A1A-SG36	PK243B1A-SG36	0.05 °	0.8 (6.94)	0.95
PK264A2A-SG3.6	PK264B2A-SG3.6	0.5 °	1.0 (8.67)	2.0
PK264A2A-SG7.2	PK264B2A-SG7.2	0.25 °	2.0 (17.3)	2.0
PK264A2A-SG9	PK264B2A-SG9	0.2 °	2.5 (21.6)	2.0
PK264A2A-SG10	PK264B2A-SG10	0.18 °	2.7 (23.4)	2.0
PK264A2A-SG18	PK264B2A-SG18	0.1 °	3.0 (26)	2.0
PK264A2A-SG36	PK264B2A-SG36	0.05 °	4.0 (34.7)	2.0
PK296A1A-SG3.6	PK296B1A-SG3.6	0.5 °	2.5 (21.6)	1.5
PK296A1A-SG7.2	PK296B1A-SG7.2	0.25 °	5.0 (43.3)	1.5
PK296A1A-SG9	PK296B1A-SG9	0.2 °	6.3 (54.6)	1.5
PK296A1A-SG10	PK296B1A-SG10	0.18 °	7.0 (60.7)	1.5
PK296A1A-SG18	PK296B1A-SG18	0.1 °	9.0 (78.1)	1.5
PK296A1A-SG36	PK296B1A-SG36	0.05 °	12.0 (104)	1.5

3. Names and functions of driver parts



3.1 LED

Indication	LED name	Color	Condition when LED ON	Page reference
PWR	Power input LED	Green	Lights up when single phase 100-115V \pm 15% (50/60Hz) is input.	-
TIM	Excitation timing output LED	Green	Lights up when excitation timing signal is output.	Page 23
BUSY	Busy output LED	Green	Lights up when busy signal is output.	Page 23
ALM	Alarm output LED	Red	Lights or flashes when alarm signal is output.	Page 24

3.2 Motor current adjustment potentiometer

Indication	Potentiometer name	Factory setting	Function	Page reference
RUN	RUN potentiometer	Min. value	Adjusts current when the motor operates.	Page 14
STOP	STOP potentiometer	Min. value	Adjust the current reduced by automatic current cutback function at motor standstill.	Page 14


3.3 Function switches

Indication	Switch name	Factory setting	Function	Page reference
FULL /HALF	Step angle switch	FULL	A switch to select the motor step angle of the full or half step.	Page 12
ACO/OFF	Automatic current off function switch	ACO	Has a function to turn off the motor current automatically when the driver internal temperature rises to about 85 (185 F) or more. This switch allows the function to be set and released.	Page 12
ACD/OFF	Automatic current cutback function switch	ACD	Has a function to reduce the motor current automatically at motor standstill. This switch allows the function to be set and released.	Page 13
FN1/OFF	Limit sensor input method switch	FN1	The limit sensor input system connected to the driver is set to the contact A or B. Contact A = Normally Open (NO) Switch Contact B = Normally Closed (NC) Switch	Page 13
FN2/OFF	Rotation direction switch for return to mechanical home operation	FN2	A switch to select the rotation direction when return to mechanical home operation is started. Rotation starts in the clockwise direction when set to the FN2 position, while rotation starts in the counterclockwise direction when set to the OFF position.	Page 13

3.4 Operating data setting switch

Indication	Switch name	Factory setting	Function	Page reference
PULSE1	Travel selector switch 1	All 0	A switch to set the number of the motor operation pulses. Five switches allow setting in the range from 0 to 99999steps.	Page 20
PULSE2	Travel selector switch 2	All 0	A switch to set the number of the motor operation pulses. Five switches allow setting in the range from 0 to 99999steps.	Page 20
VR	Operating pulse rate setting switch	All 0	A switch to set the output pulse rate of the built-in generator. The motor speed depends on the output pulse rate.	Page 20
TR	Acceleration/deceleration rate setting switch	0	A switch to set the operation pulse acceleration and deceleration rates. Acceleration/deceleration rate is higher as the switch indication is smaller. When the switch is set to 0, operation is performed without acceleration or deceleration.	Page 21
VS	Startup pulse rate setting switch	0	A switch to set the first pulse rate when pulse generation starts. Motion is started at the VS set value until VR is reached. Slowdown is started at the VR set value to reach the VS set value.	Page 21

3.5 Protective earth terminal

Indication	Terminal name	Function	Page reference
	Protective earth terminal	This terminal is connected to the driver casing. (M4 screw size)	Page 31

3.6 I/O signal connector

Pin No.	Signal type	Terminal name	Function	Page reference	
1	Input signal	Start signal input terminal	A signal to start operations in each mode.	Page 22	
2		Slowdown stop input terminal	A signal to slowdown the motor during operation and to stop it. In the continuous operation mode, the speed is reduced down to VS to continue operation at a constant speed. This is disabled in the return to mechanical home mode.	Page 22	
3		Emergency stop signal input terminal	A signal to stop operations in the process of running.	Page 22	
4		Rotation direction switching signal input terminal	A switch to select the rotation direction in each operation mode (except for return to mechanical home mode and return operation).	Page 22	
5		Travel switching signal input terminal	A signal to select the travel in positioning.	Page 22	
6,7,8		Operation mode switching signal input terminal	A signal input to select the operation mode.	Page 23	
9	Output signal	Output current off signal input terminal	A signal to stop the supply to current to the motor. When this signal is being input, the motor is not driven even if you input the start signal.	Page 23	
10		GND	Ground terminal	A ground terminal for signal input.	-
11		Excitation timing signal output terminal	A signal to show that the motor excitation sequence is at step 0. This signal is output when the motor excitation (winding where current flows) is in the initial state.	Page 23	
12	Busy signal output terminal	A signal to be output when the motor is running or the driver cannot accept the start signal.	Page 23		
13	Alarm signal output terminal	A signal to be output when the temperature within the driver has risen to 85 (185 F) or the limit switch during operation has tripped.	Page 24		
20	COM	Common terminal	A common terminal for output signals.	-	

3.7 Terminals

Pin No.	Indication	Terminal name	Function	Page reference
1	CWLS	+ CW limit sensor input terminal	A terminal to connect the limit sensor in the clockwise direction	Page 28
2		-		
3	CCWLS	+ CCW limit sensor input terminal	A terminal to connect the limit sensor in the counterclockwise direction	Page 28
4		-		
5	HOME	+ Home position sensor input terminal	A terminal to connect the mechanical home position sensor	Page 28
6		-		
7	YEL WHT	Yellow/white motor lead connection terminal	A terminal to connect the yellow/white motor lead wire	Page 28
8	BLK	Black motor lead connection terminal	A terminal to connect the black motor lead wire	Page 28
9	RED	Red motor lead connection terminal	A terminal to connect the red motor lead wire	Page 28
10	GRN	Green motor lead connection terminal	A terminal to connect the green motor lead wire	Page 28
11	BLU	Blue motor lead connection terminal	A terminal to connect the blue motor lead wire	Page 28
12	100 - 115V ~	L	A terminal to connect the single-phase 100-115V ± 15% (50/60Hz) power source	Page 28, 31
13		N		

4. Installation

- ⚠ Warning** Do not use the product in an explosive, flammable, corrosive or atmosphere to avoid possible fire, an electric shock or personal injury. Do not use it where it may be splashed with water, or near the combustible substances.
- Only qualified installers should be assigned to the work of installation, connection, running, operation, inspection and trouble diagnosis. This is intended to prevent fire, an electric shock and injury.
- Do not move, install, connect, inspect, or set the functions of the product when power is applied. Turn off power before starting such work. This caution is to prevent possible an electric shock. Install the driver and motor inside a cabinet. This is to prevent an electric shock and injury.
-

- ⚠ Caution** Do not place combustibles around the driver and motor. Otherwise, fire may occur or you may be burnt.
- Do not place around the driver and motor any obstacle which may interfere with ventilation. Otherwise, the equipment may be damaged.
- The driver should be firmly secured on the metallic plate in order to prevent personal injury or the equipment may be damaged.
-

4.1 Installation site

The driver is designed and manufactured to be incorporated into the equipment.

To ensure effective ventilation and easy inspection, install it in the following site.

In the indoor housing (where a ventilation port must be provided)

Ambient temperature: 0 to +40 (+32 F to +104 F) (non-freezing)

Ambient humidity: 85% or less (non condensing)

Not in the explosive atmosphere with hazardous gas or liquid

Not exposed to sunlight

Not at the site exposed to much dust or metallic particles

Not at the place splashed with water (rain or water drop), oil (oil drop) or other liquid

Not at the site containing a high concentration of salt

Not subjected to continuous vibration or excessive shock

Not at the position exposed to much electromagnetic noise (caused by welder and power driven equipment)

Not at the site near radiation, magnetic field or vacuum environment

4.2 Installation method

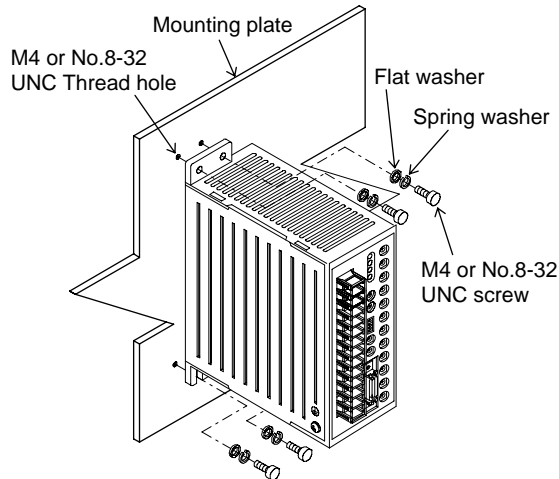
The driver is designed to discharge heat by natural convection. Be sure to install it upright, as illustrated below.

Prepare the following to install the driver (The customer is requested to supply them).

- Four M4 or No. 8-32UNC screws
- Four M4 or No.8 flat washers
- Four M4 or No.8 spring washers

Fix the driver on the equipment installation plate using four screws.

Use an installation plate made of iron or aluminum having a excellent heat conductivity with a thickness of 2mm (0.079 in.) or more.

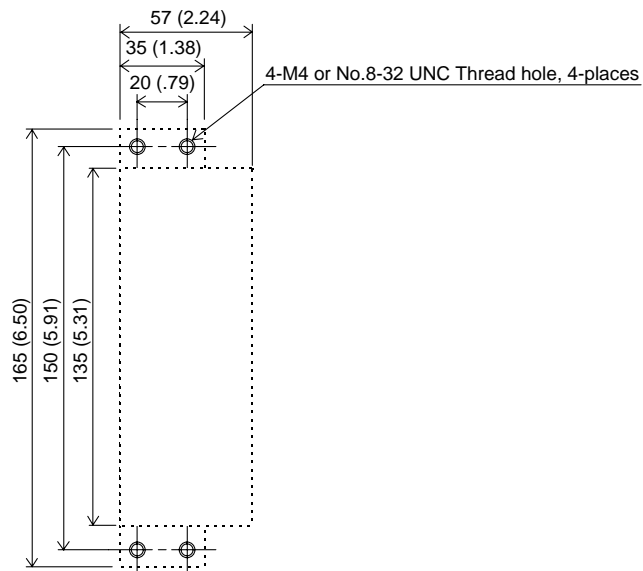


Note

- Install it only in the illustrated direction. This caution is to prevent the driver from being damaged due to temperature rise inside the driver.
- If there is any big noise source (such as high frequency induction welding machine and large-sized electromagnetic switch) close to the driver, take counter-noise measures such as insertion of a noise filter or connection to a separate power line. This cautions is to prevent possible operation error of the motor.
- For installation, a space of 25mm (0.98in.) or more is essential between the driver and other equipment or structure on each surface. When you want to use multiple drivers, a space of 20mm (0.79in.) or more must be provided between them. This cautions is to prevent a possible rise of ambient temperature due to driver heat generation; the driver may be damaged by temperatures excess of the specified ambient temperature range.
- If the driver ambient temperature has exceeded 40 (104 F), review the ventilation conditions.

4.3 Mounting plate dimensions

[Unit: mm (inch)]



5. Making preparations before operation startup

5.1 Setting the function

When you want to use the driver, use the function selector switch to select the functions required for operation in advance.

⚠ Warning Do not move, install, connect, inspect, or set the functions of the product when power is applied. Turn off power before starting such work. This caution is to prevent possible an electric shock.
Start the work 30sec. or more after turning off driver power. This caution is to prevent possible an electric shock.

5.1.1 Selecting the step angle (FULL/HALF)

The driver provides a full step drive mode to drive the motor in the basic step and a half step drive mode to drive it in half the basic step angle. Use the step angle switch (FULL/HALF) to select the step angle.

When the step is set to the FULL side, the motor is driven at the basic step angle.

1.8 7step for standard type 2-phase stepping motor

0.9 7step for high resolution type 2-phase stepping motor

When the step is set to the HALF side, the motor is driven at half the basic step angle.

0.9 7step for standard type 2-phase stepping motor

0.45 7step for high resolution type 2-phase stepping motor

Note

The state of the switch is read when the power is turned on. The step angle does not change even if the switch is operated while power is turned on.

5.1.2 Selecting the automatic current off function (ACO/OFF)

⚠ Warning Take position holding measures for movable parts when the automatic current off function is set to ACO (Enabled) position. If the driver overheat preventing function has activated, the motor will be stopped and holding force will be lost. This caution is to prevent possible personal injury or equipment damage. This function is set to ACO (Enabled) position at the time of shipment.
When you have set the automatic current off function to OFF (Disabled), monitor the driver alarm output and stop the motor if an alarm is signaled. This caution is to prevent possible fire hazards.

What is automatic current off function?

The driver produces alarm signal when the temperature inside the driver has reached is 85 (185  ) (overheated), and the alarm output LED lights up. In this case, this function cuts off current supplied to the motor automatically and stops the motor, thereby preventing the drive from being damaged. Use the automatic current off function switch (ACO/OFF) to enable or disable the automatic current off function.

Setting the switch to ACO position enables the automatic current off function.

Setting it to OFF position disables the automatic current off function.

Note

Alarm output resulting from overheating can be released only when you turn on power again.

5.1.3 Selecting the automatic current cutback function (ACD/OFF)

What is automatic current cutback function?

The current supplied to the motor at motor standstill is automatically reduced to the preset level by this function. The function serves to reduce the heat generated by the motor and driver. When the current is reduced, the current is adjusted by the current adjustment potentiometer at motor standstill (STOP). The automatic current cutback function switch (ACD/OFF) is used to enable or disable the automatic current cutback function.

Setting the switch to ACD position enables the automatic current cutback function.

Normally, use under this condition

Setting it to OFF position disables the automatic current off function.

Use this position when you want to adjust the operation current. Normally, use this function at the ACD position.

5.1.4 Selecting the limit sensor input method (FN1/OFF)

The driver allows return to mechanical home and emergency stop to be performed by connection of the limit sensor. Select the limit sensor input method switch (FN1/OFF) in conformity to the type of the limit sensor (in contact with the driver contact A or B).

Setting the switch to FN1 position enables the contact A type to be used.

If you do not use the limit sensor, select the FN1 position.

Setting it to OFF position enables the contact B type to be used.

Note

The state of the switch is read when the power is turned on. The setting does not change even if the switch is operated while power is turned on.

5.1.5 Selecting the rotation direction for return to mechanical home position (FN2/OFF)

Select the direction of starting movement to detect the home position for return to mechanical home operation, using the switch to select the rotation direction for return to mechanical home position (FN2/OFF).

Setting the switch to the FN2 position causes operation to be started in the clockwise direction.

Setting the switch to the OFF position causes operation to be started in the counterclockwise direction.

For the details of the return to mechanical home operation, see page 17 to 19.

5.2 Setting the motor current

When you want to use the driver, adjust the output current in conformity to the motor to be used.

Adjust the current quickly in conformity to the following steps.

⚠ Warning Only qualified installers should be assigned to the work of installation, connection, running, operation, inspection and trouble diagnosis. This is intended to prevent fire, an electric shock and injury.

Do not move, install, connect, inspect, or set the functions of the product when power is applied. Turn off power before starting such work. This caution is to prevent possible an electric shock.

Do not touch the motor and driver with a bare hand or provide grounding in order to prevent possible an electric shock when you want to install them on the equipment.

⚠ Caution Remove the CN1 to adjust motor current. If a wrong signal is input, the motor will make a sudden start, resulting in possible personal injury or damage of the equipment.

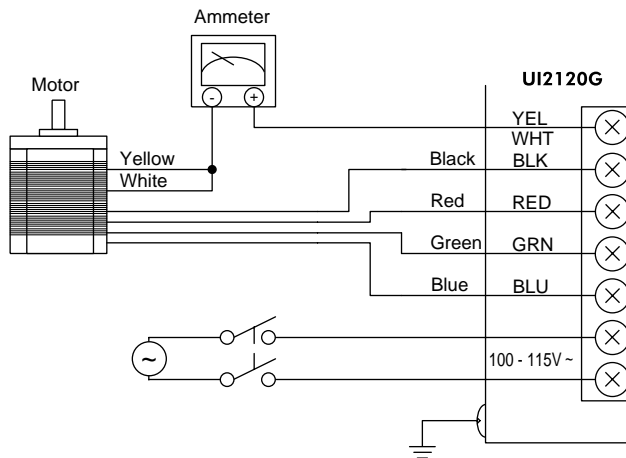
Adjust the driver current adjustment potentiometer with an insulated screwdriver. This caution is to prevent an electric shock.

5.2.1 Connecting the ammeter and motor

Prepare the ammeter and motor in addition to the driver to adjust the current. The following shows how to make connection:

Do not allow other terminals and connectors to be connected.

Do not turn on power source until the specified step.



5.2.2 Setting the motor operation current

Set the step angle switch (FULL/HALF) to the FULL position.

Set the automatic current cutback function switch (ACD/OFF) to the OFF position.

Turn on power.

Control the current using the RUN potentiometer so that the ammeter indicator will indicate " twice " the phase current of the motor to be used.

Current is increased by turning the RUN potentiometer in the clockwise direction.

Set to the minimum value at the time of shipment.

After adjustment, turn off power.

Set the automatic current cutback function switch (ACD/OFF) to ACD position.

(Normally, use this function at the ACD position.)

Set the current at motor standstill.

5.2.3 Setting the current at motor standstill

After making sure that the power is off, set the automatic current cutback function switch (ACD/OFF) to ACD position.

In this case, set the step angle switch (FULL/HALF) to FULL position.

Turn on power.

Adjust the current using the STOP potentiometer.

It must be set so that the ammeter will indicate " twice " the current to be set at standstill.

Current flowing to the motor is increased by turning the STOP potentiometer in the clockwise direction. The minimum value is set at the time of shipment. The current adjusting range at motor standstill is generally 0.3 to 0.9A/phase although it may differ according to the motor type.

Turn off power after adjustment.

After making sure that power is turned off, turn the function switch to the required value.

Note

Do not use the motor at the current in excess of the rated current. This may damage the motor.

6. Description of operation mode

The driver has six motor operation modes. They can be used by switching the operation mode switching signal input as required.

Travel, speed and acceleration/deceleration rate required for operation can be set from the operation data setting switch.

Input control signals for operation start/stop, etc. from the signal input/output connector (CN1), and start operation.

⚠ Warning Turn off drive power in the event of power interruption. When the power is restored, the motor may start up suddenly and cause injuries or damage to the equipment.

Take position holding measures for movable parts when the automatic current off function is set to ACO (Enabled) position. If the driver overheat preventing function has activated, the motor will be stopped and holding force will be lost. This caution is to prevent possible personal injury or equipment damage. This function is set to ACO (Enabled) position at the time of shipment.

When you have set the automatic current off function to OFF (Disabled), monitor the driver alarm output and stop the motor if an alarm is signaled. This caution is to prevent possible fire hazards.

Do not turn ON the output current off input during motor operation. The motor will be stopped and holding force will be lost. This caution is to prevent the movable parts from being dropped, thereby causing personal injury or equipment damage.

⚠ Caution Use the driver and motor in its specified combination. This is to prevent fire or the equipment may be damaged.

Start running after making sure that the emergency stop can be used whenever required. Otherwise, injury may occur.

Set all driver signal inputs to off before turning on the driver. If not, the motor will start up to cause personal injury and equipment damage.

Make sure that the output power off input of the driver is turned on if you want to move the motor shaft directly (e.g. for manual positioning). This caution is to prevent personal injury. Immediately when trouble has occurred, stop running and turn off the driver power. This is intended to prevent fire, an electric shock and injury.

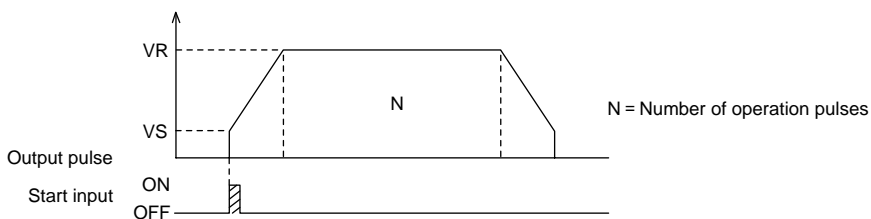
Set the acceleration and deceleration time in conformity to load and avoid sudden changes in load. This caution is to prevent possible personal injury or equipment damage because of the motor getting out of synchronism and the movable parts moving in an unexpected direction.

During running and for some time after stopping the equipment, do not touch the driver and motor. You may be burnt by high temperature on the surfaces of the driver and motor.

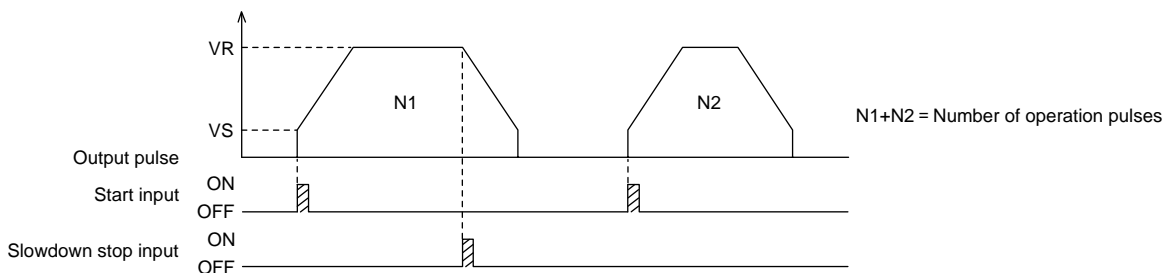
Immediately after the protection function has been activated, turn off the power and remove the cause. Then turn on power again. If the motor operation is continued without removing the cause, the driver and motor may operate incorrectly and cause personal injury and equipment damage.

6.1 Positioning mode

This is the mode where operation is performed automatically by the number of operation pulses set on the travel setting switch (PULSE 1 or PULSE 2) of the operation data setting switch, and is stopped after that. Operation is performed at the speed set on the switch.



If slowdown stop signals are input during positioning operation, the motor will stop after slowdown. If you input the start signal again, the motor rotates by the remaining number of the set pulses for operation.



Data required for positioning and signal

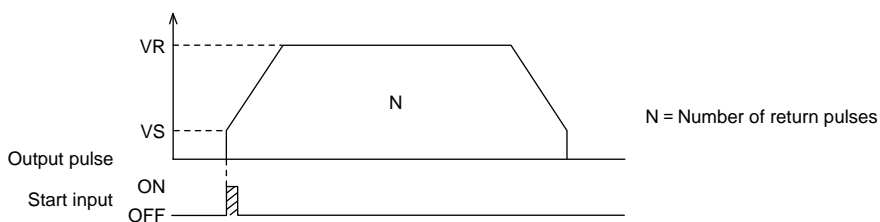
Name	Switch indication	Remarks
Travel	PULSE 1 or PULSE 2	Either is selected by travel switching input.
Operation pulse rate	VR	Rotates at a constant speed at the VR speed TR is 0.
Startup pulse rate	VS	
Acceleration/deceleration rate	TR	If it is set to 0, acceleration/deceleration is not performed.
Rotation direction		Selected by rotation direction switching input.

6.2 Return operation mode

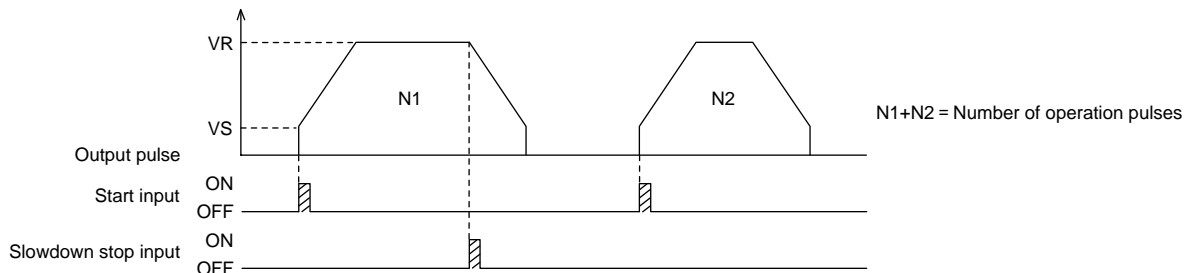
In this mode, the travel is calculated between the current position and the start point (electric home position) where positioning is started, and return is made automatically to the start point.

(Automatic calculation is possible when the total of travel is within ± 16777215 pulses. If this range is exceeded, you cannot go back to the start position.)

When emergency stop is input, the input position becomes a new start point.



When the slowdown stop signal is input during the return operation, the motor stops after slowdown. If a start signal is input, the motor restarts return operation to move to the electric home position.



Data for return operation

Name	Switch indication	Remarks
Operation pulse rate	VR	Rotation is performed at the constant speed of the VR when the TR is 0.
Startup pulse rate	VS	
Acceleration/deceleration rate	TR	Acceleration/deceleration operation is not performed if set to 0.

6.3 Return to mechanical home operation mode

The mechanical home position refers to the reference position of the equipment set by the home sensor. This is the operation mode where the CW and CCW limit sensors mounted on the equipment are used to perform rotation automatically to reach the home position (mechanical home position) where rotation stops. Return to the home position is possible from any position according to the specified sequence while checking the current positions by three sensors. You can change the direction of starting the operation using the selector switch (FN2/OFF) of the rotation direction for return to mechanical home position.

Operation example: The startup point between the CCWLS and HOME

(When the switch to select the rotation direction in return to mechanical home position is FN2)

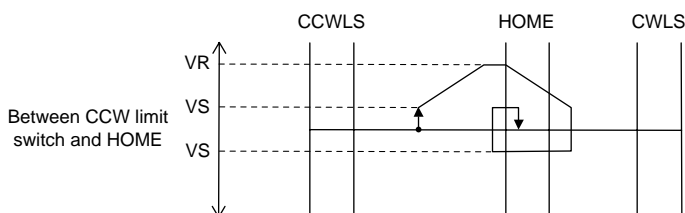
Operation is started in the clockwise direction by the input of start signals.

When the home position has been detected, operation starts at the VS in the reverse direction after slowdown stop.

When the home position is detected again and is turned off, operation starts at the VS in the reverse direction.

When HOME is input, the motor stops.

Home position detection operation startup direction
CW



Data required for return to mechanical home operation

Name	Switch indication	Remarks
Operation pulse speed	VR	Rotation is performed at the constant speed of the VR or VS according to motor position when TR is 0.
Startup pulse rate	VS	
Acceleration/deceleration rate	TR	Acceleration/deceleration operation is not performed if set to 0.
Startup rotary direction	FN2/OFF	CW direction when FN2 is selected, and CCW when OFF is selected.

Note

- Return to mechanical home operation is different in movement according to the motor position when start signal is input. See " 6.7 Operation pattern in return to mechanical home operation "
- After return to mechanical home operation, the mechanical home position will become an electrical home position.

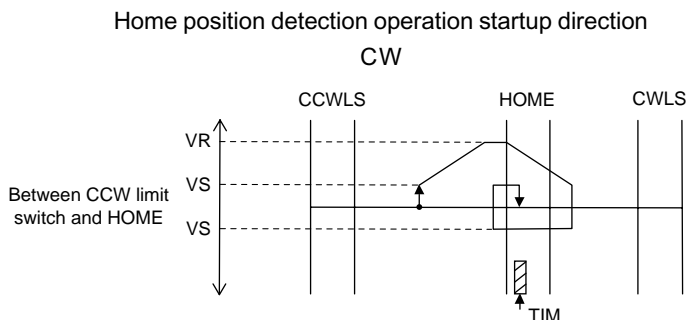
6.4 Return to mechanical home operation based on timing signal synchronization

For the return to mechanical home operation using only the home position sensor, the home position may be deviated or varied due to the home position sensor error or installation error. In this case, you can maintain accuracy by AND-ing of the timing signal produced by the driver and the signal of home position sensor.

Use of the timing synchronization function allows the home position detecting accuracy to be kept within ± 1 pulse of the motor.

Return to mechanical home operation based on timing signal synchronization is the return to mechanical home operation AND-ed automatically with timing signal inside the driver. The operation is the same as that of normal return to mechanical home operation.

- The home position sensor position must be adjusted to the position where the driver timing signal is generated.



Note

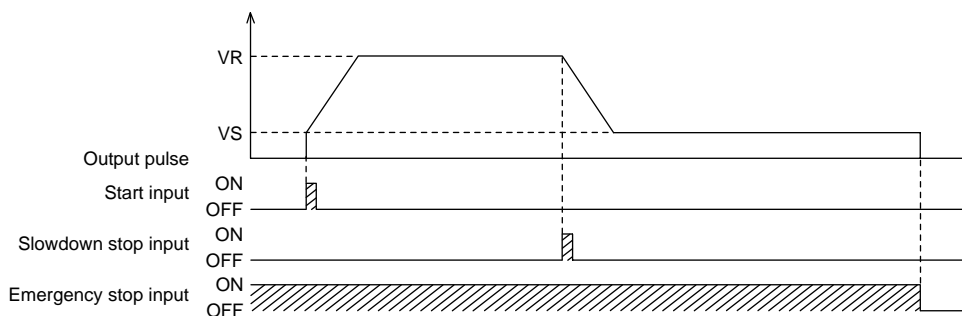
Return to mechanical home operation based on timing signal synchronization is different in movement according to the motor position when start signal is input.

See " 6.7 Operation pattern in return to mechanical home operation ".

6.5 Continuous operation mode

In this mode, operation is continued without a travel amount being set until emergency stop signal is input.

If the slowdown stop signal is input during the operation, the speed is reduced down to the startup pulse speed (VS); then rotation is carried out at a constant speed.



Data required for continuous operation

Name	Switch indication	Remarks
Operation pulse speed	VR	Rotation is performed at the constant speed of the VR according to motor position when TR is 0.
Startup pulse rate	VS	
Acceleration/deceleration rate	TR	Acceleration/deceleration operation is not performed if set to 0.
Rotation direction		Selected by rotation direction switching input

6.6 Jog operation mode

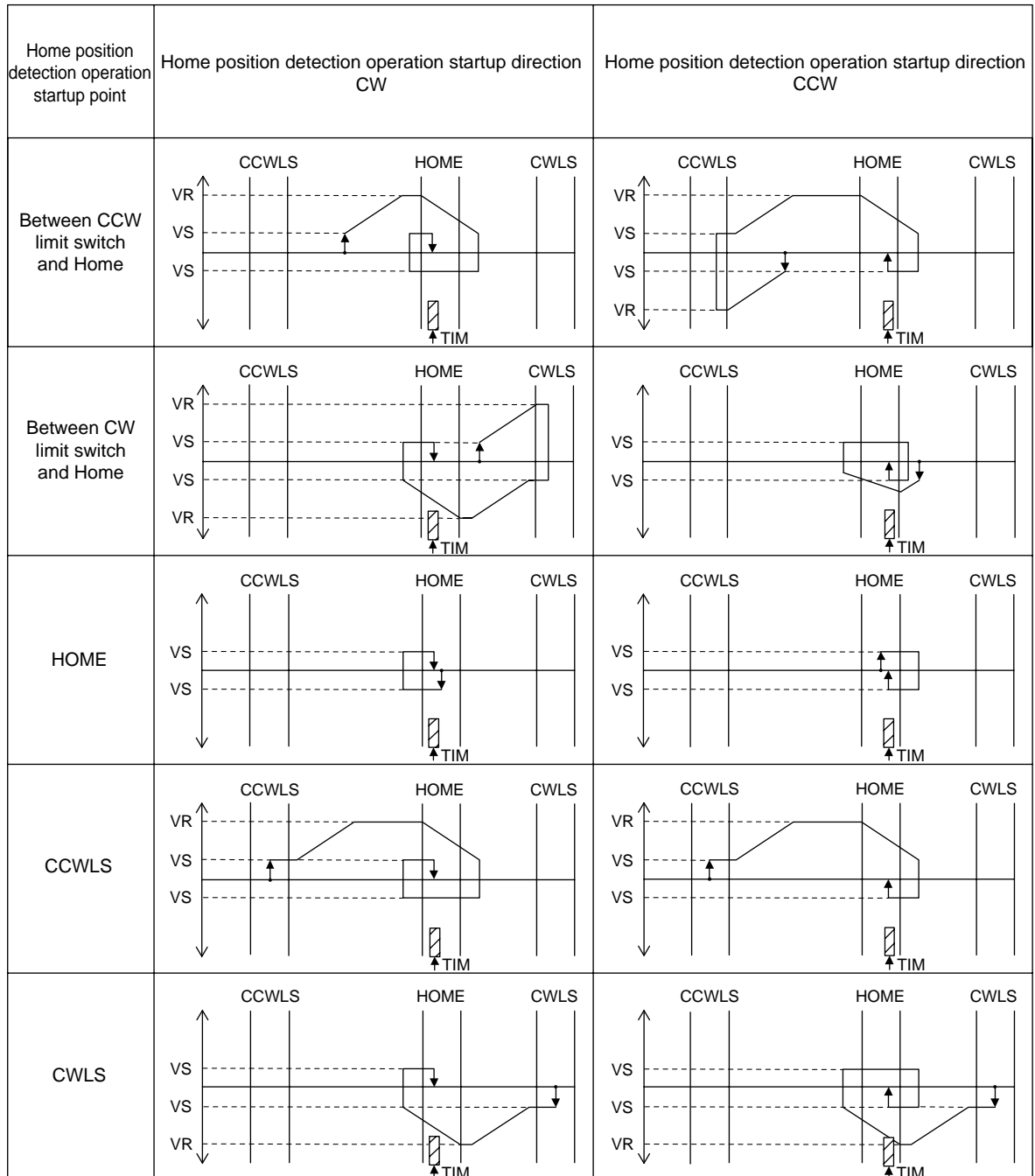
This is a pulse-by-pulse operation mode convenient for fine tuning of the stepping motor shaft. When the startup signal is input, the motor moves only one step. If startup signal input is continued for one second or more in the jog operation mode, continuous operation will be started at 30Hz and the motor is also stopped when the start signal input is stopped.

6.7 Operation pattern in return to mechanical home operation

The following shows the operation pattern in the return to mechanical home operation mode and operation pattern in the return to mechanical home operation mode based on timing signal synchronization when the home position is detected by the CW and CCW limit sensors and home position sensor.

In the return to mechanical home operation mode based on timing signal synchronization, operation stops when the home position sensor and timing signal are synchronized with each other.

For return to mechanical home operation mode, there is no timing signal (TIM).



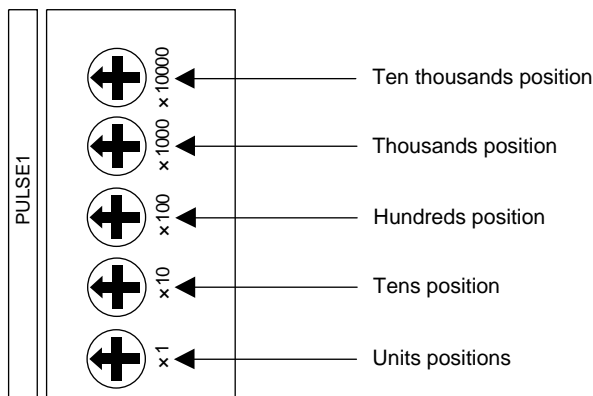
If travel distance is short, slowdown may start before VR is reached.

7. Operation mode setting procedures

The driver provides six motor operation modes. They can be selected and used by the signal input, as required. The travel and acceleration/deceleration rate required for these operations are set by the operation data setup switch on the front panel.

7.1 Setting the travel

The travel used in the positioning mode can be set by the travel setting switch 1 (PULSE 1) and travel setting switch 2 (PULSE 2).



Set the graduation of the travel setting switch 1 or 2 to the number of the steps of the motor which you want to operate.

The number of settable steps ranges from 0 to 99999.

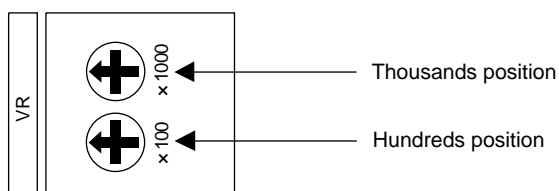
7.2 Setting the operation pulse rate

This is to set the motor drive speed.

The operation pulse rate set here provides the speed of all operation modes (except for jog operation mode).

The following expression shows the relationship between the operation rate speed and motor shaft drive speed:

$$\text{Drive speed (r/min)} = \frac{\text{Operation pulse rate [Hz]} \times \text{motor step angle [°]} \times 60}{360}$$



The graduation of the operation pulse rate setting switch (VR) is equal to the pulse rate. The pulse rates which can be set are 50 and 100 to 9900Hz.

Note: 50Hz is selected when the switch is set to 00.

[Unit: Hz]

$\times 10^2$ \ / \ $\times 10^3$	0	1	2	3	4	5	6	7	8	9
0	50	100	200	300	400	500	600	700	800	900
1	1000	1100	1200	1300	1400	1500	1600	1700	1800	1900
2	2000	2100	2200	2300	2400	2500	2600	2700	2800	2900
3	3000	3100	3200	3300	3400	3500	3600	3700	3800	3900
4	4000	4100	4200	4300	4400	4500	4600	4700	4800	4900
5	5000	5100	5200	5300	5400	5500	5600	5700	5800	5900
6	6000	6100	6200	6300	6400	6500	6600	6700	6800	6900
7	7000	7100	7200	7300	7400	7500	7600	7700	7800	7900
8	8000	8100	8200	8300	8400	8500	8600	8700	8800	8900
9	9000	9100	9200	9300	9400	9500	9600	9700	9800	9900

Note

If the operation pulse rate (VR) is smaller than the set startup pulse rate (VS), operation is performed at the constant speed of the startup pulse rate (VS).

7.3 Setting the acceleration/deceleration rate

Set the time ratio (ms/kHz) which provides the slowup and slowdown of the operation pulse rate.

Set the graduation of the acceleration/deceleration rate setting switch (TR) according to the following table until the required acceleration/deceleration rate is obtained.

The acceleration/deceleration set here is used for all the operation modes (except for jog operation mode).

Acceleration/deceleration rate
setting switch

[Unit: ms/kHz]



Switch setting	0	1	2	3	4	5	6	7	8	9
Acceleration/ deceleration rate	0	10	20	30	40	50	60	70	80	90

7.4 Setting the startup pulse rate

This is the pulse rate where the built-in pulse generator starts to produce pulses. The motor also starts to rotate at this pulse rate. When the speed is reduced, deceleration stops when this pulse rate has been reached.

Set the graduation of the startup pulse rate setting switch (VS) according to the following table until the required startup pulse rate is reached.

The startup pulse rate set here provides the speed of all operation modes (except for jog operation mode).

Startup pulse rate
setting switch

[Unit: Hz]



Switch setting	0	1	2	3	4	5	6	7	8	9
Initial set speed	50	100	200	300	400	500	600	700	800	900

Note

When the acceleration/deceleration setting switch (TR) is " 0 ", operation is performed at the constant speed of the operation pulse rate (VR), independently of the setting of the startup pulse rate (VS). If the setting of the startup pulse rate (VS) is higher than that of the operation pulse rate (VR), operation is performed at the constant speed of the startup pulse rate (VS).

8. How to use input/output signal

When you have set the operation data, the control signal is used to control the start and stop of the operation, and other functions. Signal input/output connector (CN1) is used for control signal input/output.

Note

- When the input terminal for input signal is connected to the GND (photocoupler ON), this state is described “ ON ” .
- If the emergency stop signal is turned off, the driver does not operate. Use it in the “ ON ” (normal closed) state.

8.1 Description of input signals

8.1.1 Start signal (Pin No.1)

This is a signal to start operations in each mode. Operations are enabled when the signal is on.

Role of start signal

- Start in each operation mode
- Restart of positioning and return operation at the slowdown stop halfway through the operation
- If the input or signal is kept on, the next operation will be disabled. Turn it off once, then the next start signal input will be enabled.
- If the start signal is turned on for one second or more in the jog operation mode, continuous operation starts at 30Hz while it is on.

8.1.2 Slowdown stop signal (Pin No.2)

This is a signal to slowdown and stop the running motor. When the signal is on, the operation is enabled. After input of the slowdown and stop signal, the speed is reduced according to the set value of the acceleration/deceleration rate (TR), and the operation stops when the startup pulse rate (VS) is reached.

- Slowdown stop signal cannot be used for return to mechanical home operation. The input will be ignored.
- In the continuous operation, the speed is reduced down to the VS, and operation is performed at the constant speed.

8.1.3 Emergency stop signal (Pin No.3)

This is a signal to stop the operation being performed. The operation is enabled when the signal is off. Use it in normal closed state. If the emergency stop signal is input during the operation, the operation will be forcibly stopped, and the motor will stop without slowdown. Even if the start signal is input, the suspended operation cannot be continued.

The point where the emergency stop signal is input will be an electrical home position

- Forced stop of each operation mode
- Setting of electrical home position

8.1.4 Rotation direction switching signal (Pin No.4)

This is a signal to select the rotation direction in each operation mode (except for return to mechanical home operation and return operation).

- Rotation is performed in the clockwise direction when the signal is off.
- Rotation is performed in the counterclockwise direction when the signal is on.
- The rotation direction switching signal enables state when the startup signal is input. Hold the desired state until the startup signal is input.
- The rotation direction during the operation is not changed even when the rotation direction switching signal is switched during the operation.

8.1.5 Travel distance switching signal (Pin No.5)

This is a signal to select the travel distance in positioning. Select PULSE 1 or PULSE 2 of the travel setting switch on the front panel.

- The travel of the PULSE 1 is selected when the signal is off.
- The travel of the PULSE 2 is selected when the signal is on.
- The travel switching signal enables state when the start signal is input. Hold the desired state until the start signal is input.
- The travel during the operation is not changed even when the travel switching signal is switched during the operation.

8.1.6 Operation mode switching signal (Pins Nos. 6, 7 and 8)

This is a signal to select the operation mode. Set each operation mode in a combination of three signals.

- The operation mode switching signal enables state when the startup signal is input. Hold the desired state until the start signal is input.
- The mode during the operation is not changed even when operation mode switching signal is switched during the operation.

Operation mode switching signal input			Operation mode
Pin No.6	Pin No.7	Pin No.8	
OFF	OFF	OFF	Positioning
ON	OFF	OFF	Return operation
OFF	ON	OFF	Return to mechanical home operation
ON	ON	OFF	Return to mechanical home operation based on timing signal synchronization
OFF	OFF	ON	Continuous operation
ON	OFF	ON	Jog operation

Any combination not in the above table is ignored and operation is not performed even if the startup signal is input.

8.1.7 Output current off signal (Pin No. 9)

⚠ Warning Do not turn ON the output current off input during motor operation. The motor will be stopped and holding force will be lost. This caution is to prevent the movable parts from being dropped, thereby causing personal injury or equipment damage.

This is a signal to stop the current supply to the motor. You can use it when you want to control motor heat generation. When the signal is on, the output current is zero.

8.2 Description of output signals

8.2.1 Excitation timing signal (Pin No. 11)

The excitation timing signal shows that the motor excitation sequence is step 0.

The excitation timing output LED on the front panel lights up during the excitation timing signal output.

The excitation sequence provides one cycle in 4 steps in the case of the full step.

It provides one cycle in 8 steps in the case of the half step.

8.2.2 BUSY signal (Pin No. 12)

This is a signal to be output during the motor operation or when the driver cannot accept the startup signal.

The BUSY output LED on the front panel lights up while the BUSY signal is output.

- The emergency stop signal, slowdown stop signal, limit sensors (CWLS and CCWLS) and output current off signal are enabled even when the BUSY signal is output.
- BUSY signals are continuously produced during the pause in the positioning and return operation mode. However, the startup signal is accepted, and continuous operation is possible.

8.2.3 Alarm signal (Pin No. 13)

This is a signal to be issued when the normal operation of the driver fails.

While the alarm signal is produced, the alarm output LED on the front panel will light up or flash.

The following shows the conditions where normal operation fails:

- When the signal from clockwise or counterclockwise limit sensor is input: (LED flashes)
 - When overheating occurs due to driver internal temperature exceeding 85 (185 °F): (LED flashes)
- Restrictions will be imposed on driver operation when the alarm signal output. The following shows the operations which are enabled:

When the clockwise or counterclockwise limit switch signal is input:

You can get out of the restriction of the limit sensor by return to mechanical home operation, continuous operation and jog operation.

In the case of continuous operation and jog operation, operation is carried out in the direction opposite to that of the activated limit sensor, independently of the state of the rotation direction switching input.

Example: Rotation only in the counterclockwise direction when the clockwise limit sensor is on.

When Overheated:

When overheated, you can release the alarm state only by turning off the power.

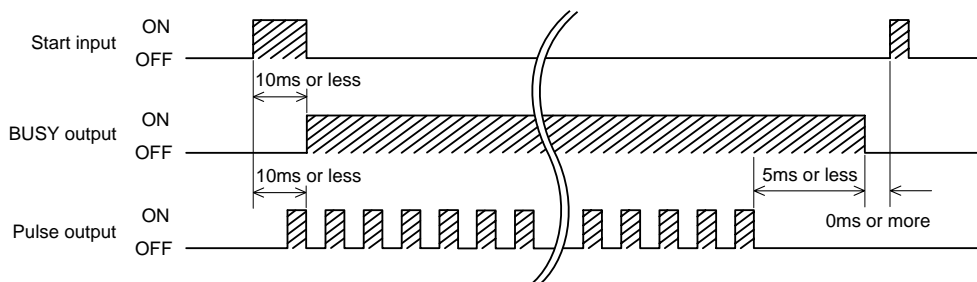
Turn off power and remove the cause for heat generation.

When the automatic current off function is turned on, the automatic current off function operates automatically to cut off power supply to the motor, thereby stopping the motor.

8.3 Signal timing chart

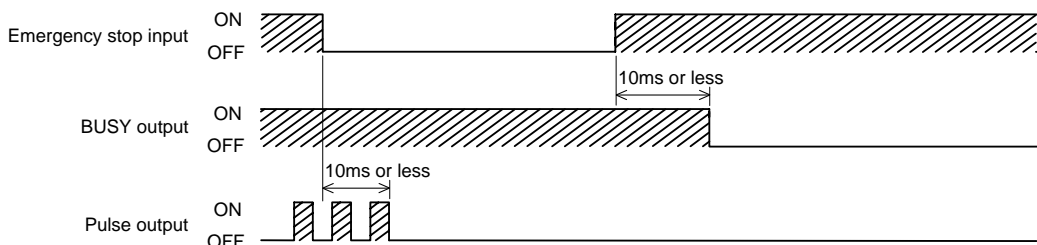
8.3.1 General operation

The following shows the relationships between the start input, pulse output and the BUSY output. These relationships are common to the various operational modes.



8.3.2 Emergency stop

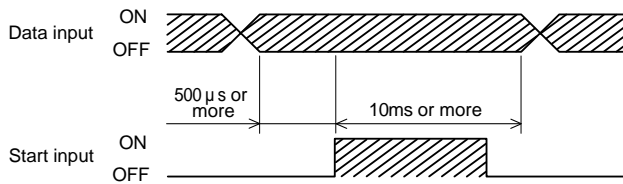
The following shows the relationship between the emergency stop input and BUSY output. If emergency stop is input during the operation, pulse generation will be suspended within 10ms.



8.3.3 Data set

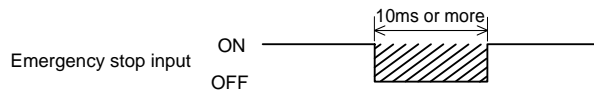
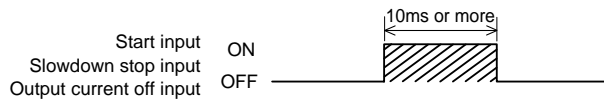
The driver reads the data required for each operation (operation mode switching, travel switching and rotation direction switching) at the time of start input. Be sure to confirm the data.

After start input, keep the state for 10ms or more.





8.3.4 Input signal width

If start input, slowdown stop input, emergency stop input or output current off input is turned off, keep the state for 10ms or more.



9. Connection

- ⚠ Warning** Only qualified installers should be assigned to the work of installation, connection, running, operation, inspection and trouble diagnosis. This is intended to prevent fire, an electric shock and injury.
- Do not move, install, connect, inspect, or set the functions of the product when power is applied. Turn off power before starting such work. This caution is to prevent possible an electric shock.
- Do not touch the marked positions when power is turned on. Marks  and  on the driver front panel indicate the terminal where high voltage is applied. This is prevent fire and an electric shock.
- The driver power input voltage should be within the rated range. Otherwise, fire and an electric shock may occur.
- Electrical connections must be made in strict accordance with the connection diagram. Otherwise, fire and an electric shock may occur.
- Do not bend or pull the electrical cable and motor lead wire. Do not force them into other parts. This is to prevent fire and an electric shock.
- Do not touch the motor and driver with a bare hand or provide grounding in order to prevent possible an electric shock when you want to install them on the equipment.
-

- ⚠ Caution** Do not use the driver and motor in excess of ratings. Otherwise, you may get an electric shock, injury or the equipment may be damaged.
- Do not put your finger and other objects into the driver opening. This is to prevent possible fire, an electric shock or personal injury.
- Mount the terminal cover of the driver terminal after connection. This is to prevent possible an electric shock.
-

Use the following steps to make electrical connection according to the wiring diagram:

1. Connect between the motor and driver.
2. Connect the CW and CCW limit sensors and home position sensor to the driver.
3. Connect between the driver and controller.
4. Ground the motor, driver and controller.
5. Connect between the driver and power source.

Turn on the power source after all electrical connection has been completed.

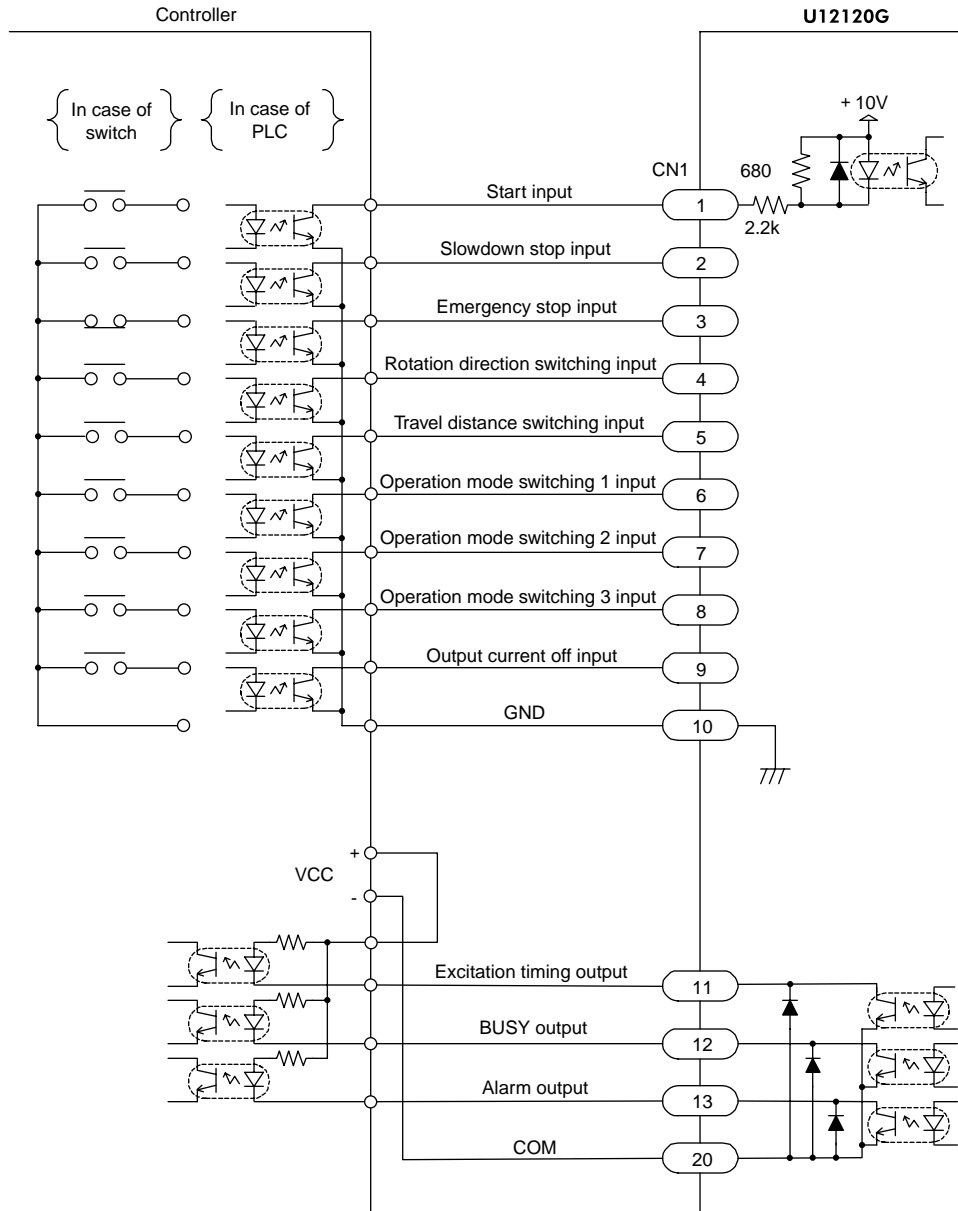
9.1 Connection diagrams

9.1.1 Connection example of driver and controller (CN1)

Note

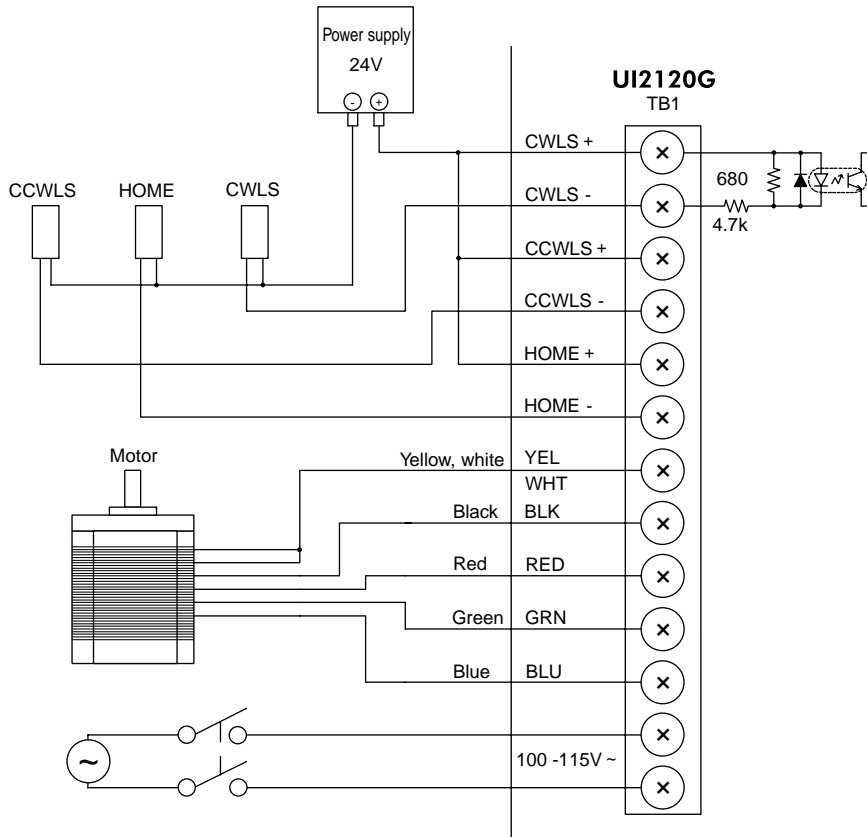
If the emergency stop signal is turned off, the driver does not operate.

Use it in the “ ON ” (normal closed) state in which the input terminal is connected to the GND.



The VCC voltage is required to be 24V DC or less.

9.1.2 Connection example of sensor, motor and driver



9.2 Connecting the motor and driver (See page 28 9.1.2)

Use the terminal block (TB) when connect the motor to the driver.

1. Remove the terminal cover.
2. Attach crimp terminals to the motor lead wires.
3. Loosen the terminal screws (M3), connect the motor lead crimp terminals to the driver terminals, and then tighten the terminal screws.

Screw tightening torque: 0.5N·m (70.8oz-in)

Connect the power source (See page 31).

4. Reattach the terminal cover.

- When extending the motor lead wires use wire of AWG20 (0.5mm²) or greater.

9.3 Connecting the limit sensor and driver (See page 28 9.1.2)

Use the terminal block (TB) when connect the limit sensor and driver.

1. Remove the terminal cover.
2. Attach crimp terminals to the sensor lead wires.
3. Loosen the terminal screws (M3), connect the sensor lead crimp terminals to the driver terminals, and then tighten the terminal screws.

Screw tightening torque: 0.5N·m (70.8oz-in)

4. Reattach the terminal cover.

- A power supply must be provided to actuate the limit sensor. The customer is requested to provide the power supply.

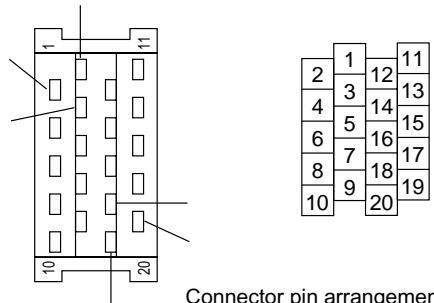
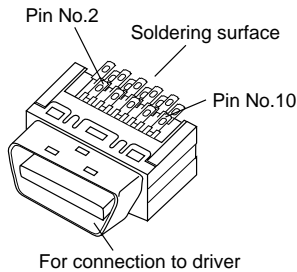
9.4 Connecting the driver and controller (See page 27 9.1.1)

Connect the driver to the controller. Confirm the following when making the connections.

- For signal lines, use twisted pair wire of AWG24 (0.2mm²) or greater, and 2m (6.56ft.) or less in length.
 - Separate the signal lines from the power lines and motor lead wires by at least 10cm (4in.). Do not band the wires together.
 - This is to prevent noise interference from entering the signal lines and subsequent erratic motor operation.
 - Use an open collector transistor (sink type) for the controller signal output.
- If electrical noise generated by other equipment causes operational errors, shield the signal lines with conductive tape or wire mesh etc. (not supplied).
- Connect the shield material to the driver's protective earth terminal for grounding.

9.4.1 Preparing the I/O signal connector

Refer to the pin No. of I/O signal connector (page 9) and solder the signal lines to the relevant pin numbers. After soldering, assemble the I/O signal connector and connect it to the driver connector CN1.



Connector pin arrangement
(As seen from side to be soldered)

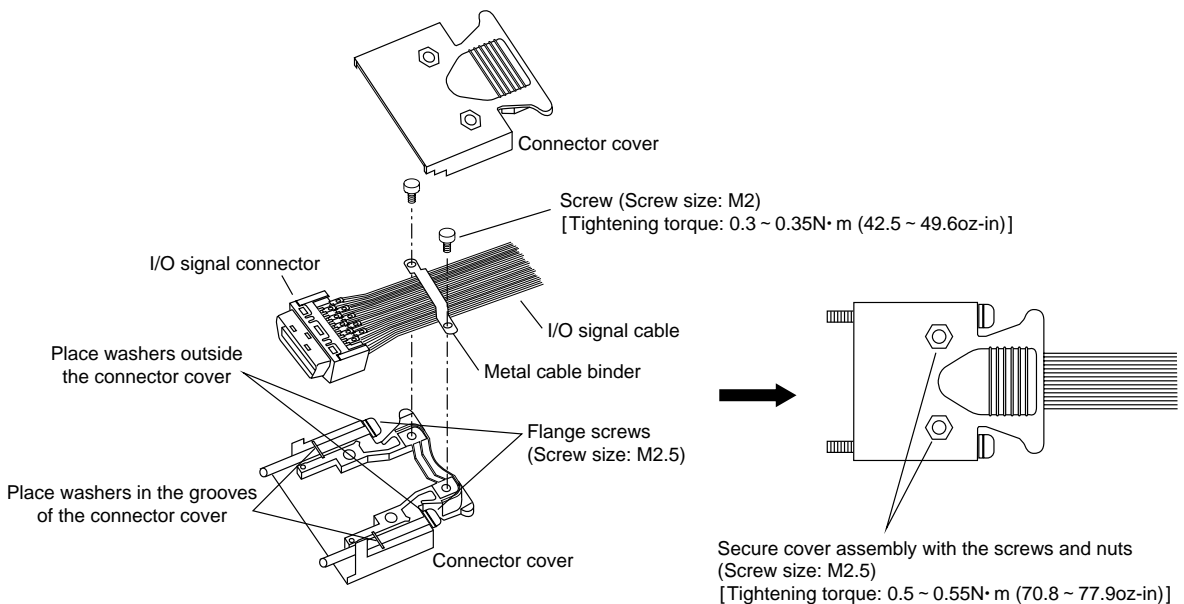
I/O signal connector (Accessory)
Connector: 54306-2011 (MOLEX)
Connector cover: 54331-1201 (MOLEX)

Equivalent product
Connector: 10120-3000VE (Sumitomo 3M)
Connector cover: 10320-52A0-008 (Sumitomo 3M)

9.4.2 Connector cover assembly and connection to the driver

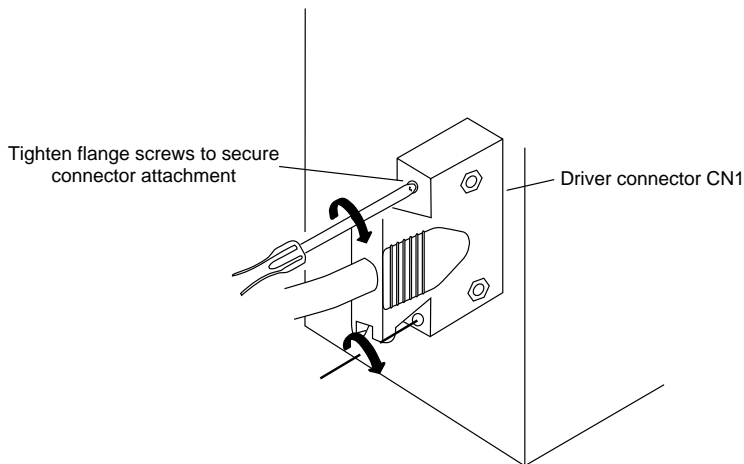
After soldering the signal lines to the I/O connector, attach the connector cover.

- (1) Place the I/O signal cable and flange screws in the connector cover. Place the washers as shown in the diagram below. Place the I/O signal cable on the connector cover, hold it by the metal binder and secure the metal binder with the screws. Connect both sides of the connector cover and secure the assembly with the screws and nuts.



(2) Plug the I/O connector into driver connector CN1, then tighten the flange screws to secure the connector to the driver.

[Screw tightening torque: 0.3 ~ 0.35N·m (42.5 ~ 49.6oz-in)]



9.5 Grounding

⚠ Warning Do not touch the motor and driver with a bare hand or provide grounding in order to prevent possible an electric shock when you want to install them on the equipment.

9.5.1 Grounding the motor and controller

The motor is designed in a Class structure based only on basic insulation. Be sure to ground the motor connected with the driver.

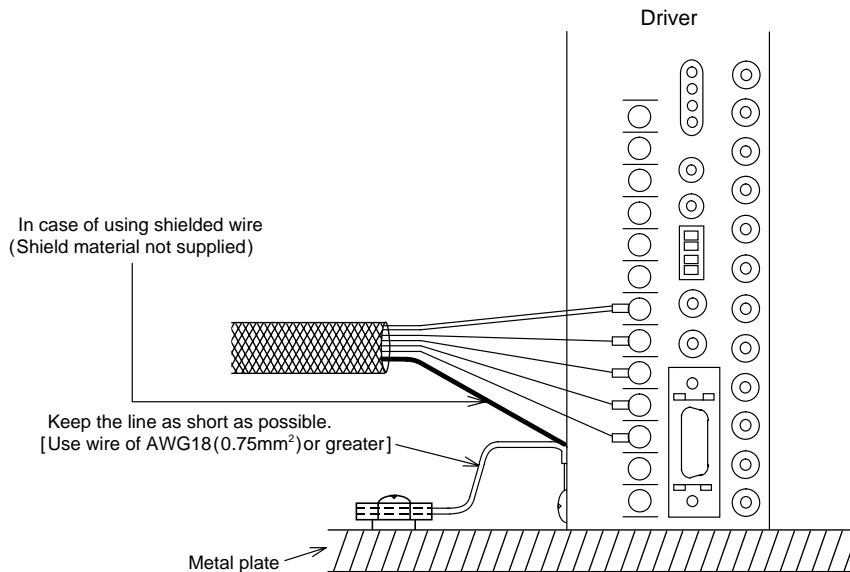
The driver signal input/output connector is provided with reinforced insulation for the driver. To ensure safety, ground the controller connected to the driver. Also observe the following cautions:

- Install the motor inside the enclosure so that the motor cannot be touched directly by the operator.
- If the operator must touch the motor by hand, be sure to apply protective ground. For grounding, use the ground wire with a diameter equivalent to AWG18 (0.75mm²) or more. The length of the ground wire should be minimized whenever possible.
- Use the motor and controller according to the operating manuals.

9.5.2 Grounding the driver

The driver is designed in a class II structure based only on basic insulation.

- For the driver, pull out the ground wire from the protective ground terminal, and connect it to the ground. Use the ground wire with a diameter equivalent to AWG18 (0.75mm²) or more. The length of the ground wire should be minimized whenever possible.
- Connect the protective ground terminal to the protective conductor.



9.6 Connecting the power source

Connect to a power source of single phase 100-115V \pm 15% 50/60Hz.

Use a power source which will supply sufficient input current.

The current value for input power as indicated in the specifications on page 35 is the maximum value.

The current value will vary according to the motor and pulse frequency. Refer to the speed-torque characteristics in the product guide or the general catalog for the relationship between the input current and pulse frequency.

1. Remove the terminal cover.
2. Attach crimp terminals to the power lines.
3. Loosen the terminal screws (M3), connect the power line crimp terminals to the driver terminals, and then tighten the terminal screws.
Screw tightening torque: 0.5N·m (70.8oz-in)
4. Reattach the terminal cover.

Note

- For power lines, use wire type AWG18 (0.75 mm²) or greater.
- If the current capacity of the power supply is insufficient, the transformer may be damaged or the motor torque may be reduced. In this case, normal rotation may be prohibited.

10. Troubleshooting

⚠ Warning Only qualified installers should be assigned to the work of installation, connection, running, operation, inspection and trouble diagnosis. This is intended to prevent fire, an electric shock and injury.

Do not touch the driver connection terminal immediately (within 30sec.) after turning off driver power. This caution is to prevent possible an electric shock due to residual voltage.

Do not disassemble or modify the driver. Otherwise you may get an electric shock or injury.

When internal inspection and repair must be made, contact your local sales office.

⚠ Caution During running and for some time after stopping the equipment, do not touch the driver and motor. You may be burnt by high temperature on the surfaces of the driver and motor.

When testing the insulation resistance or dielectric strength, do not touch the terminal.

Otherwise, an electric shock may occur.

When scrapping the driver, scrap it as industrial waste.

Consult the following chart if the motor is not functioning properly. If the motor is still not functioning properly after confirming the checkpoints below, contact your nearest sales office as listed at the back of this manual.

Problem	Check points	Measures
No excitation in the motor. (The motor holding torque is insufficient, and the motor is not driven by signal input.)	1. Is the driver power LED on? (If on, condition is normal.)	If the power LED is not on, check if the power source is properly connected. Verify that single phase 100V-115V \pm 15% 50/60Hz is input correctly.
	2. Is the output current off signal being input to the driver?	When the output current off signal is input the motor will lose all excitation (no holding torque). Return the output current off signal to off.
	3. Is the driver alarm output LED off? (If off, condition is normal.)	When alarm signal is output and alarm output LED is lit, the driver is overheated. If the automatic current off function switch is set to ACO position in this case, the motor will be in a non-excitation state (The holding torque will be lost). Adjust the output current and check for driver ventilation so that the overheat signal is not output. Take approximate measures.
	4. Are the motor and driver correctly connected?	Check the connection terminal of the driver to see if the motor and driver are connected firmly or not. If the motor lead wire is extended, check the connected portion as well.
	5. Are the RUN potentiometer or STOP potentiometer set too low?	These adjustment potentiometers control the output current to the motor. Recheck current control (See page 14).
	Note : If the motor still has no torque after checking the above conditions, the driver is probably defective. After reconfirming that the current voltage and connections are correct, contact your nearest sales office for service.	
The motor does not rotate.	First check the 5 items above.	
	6. Is the operation mode correctly set?	When the operation mode switching signal is set outside the specified values, operation is not performed even if you input the starter signal. Correctly set it according to the description on page 23.

Problem	Check points	Measures
The motor does not rotate.	7. Is the emergency stop signal off?	The emergency stop signal input terminal is enabled when it is off. When the terminal is open, the emergency stop signal is kept input at all times. This will result in the start signal not being accepted. So the motor is not driven. Use it in a normally closed state.
	8. Is the limit sensor actuated? Is the limit sensor input method switch of the driver set in conformity to the type of the limit sensor?	If the limit sensor signal is input, the motor will stop and alarm signal will be output. In this case, the alarm output LED will flash. If settings between the limit sensor contact type and limit sensor input method switch do not agree with each other, then the limit sensor signal is input at all times. So the motor cannot be rotated. Check for settings according to the description on page 13.
	9. Is the travel set?	The motor does not move if all the travel data setting switches 1 and 2 are set to " 0 " in the case of positioning (These switches are set to " 0 " at the time of shipment).
	10. Is the control signal correctly input? Is the signal width 10ms or more?	If the signal width is smaller than the specified value, the driver may not recognize the signal. Make adjustment to ensure that the signal width meets the specified value.
Motor rotation is erratic.	First check items 4 and 5	
Motor start up is unstable.	11. Are the motor shaft and load properly aligned? Is the load too heavy for the motor?	Make sure the motor shaft and load are securely attached and properly aligned. Recheck the operating conditions, and if necessary lighten the load.
The motor rotates too far or not far enough.	12. Does the step angle required by your equipment match the step angle of the stepping motor?	Check the setting of the step angle switch located on the driver.
	13. Does the travel setting conform to motor movement?	Check for the setting of the travel data setting switch. Also check for the state of travel data selection signal.
The motor loses synchronization during acceleration or while running.	14. Is the alarm output LED off? (If off, condition is normal.)	When the alarm signal is issued and alarm output LED is lit, the driver is overheated. If the automatic current off function switch is set to ACO position in this case, the motor will be in a non-excitation state (The holding torque will be lost). Check for the output current and the ventilation so that the overheat signal is not output, and take approximate measures.
	15. Is the starting pulse frequency too high?	Check this by decreasing the frequency.
	16. Is the acceleration/deceleration time too short?	Increase the setting of the acceleration/deceleration rate and make sure of the effect.
	17. Is the motor being affected by noise interference?	Check this by running the motor while the machine suspected of producing the noise interference is off.
Motor vibration is very high.	18. Is the output torque too high?	Try reducing the motor running current with the current adjustment potentiometer " RUN " .
	19. Decrease the size of the step angle (increase the resolution) using the driver step angle switches.	Reducing the size of the step angle will reduce vibration.
	20. Try changing the pulse frequency.	If the vibration decreases after the pulse frequency has been adjusted, this means the motor is resonating. Either adjust the frequency or change the step angle. Also try installing the optional (sold separately) clean damper (for double shaft model only).

Problem	Check points	Measures
Motor temperature is very high.	21. Is the motor running time too long?	Shorten the running time or increase the resting time (The temperature of the motor may rise considerably depending on the operating conditions. During high speeds and depending on the duty drive cycle, the motor could be susceptible to heat damage. Allow for sufficient heat dissipation from the motor.) . For UL and CSA standards, insulation is Class A [105 (221 F)]. [Keep the temperature of the motor case below 75 (167 F)] For other standards insulation is Class B [130 (266 F)]. [Keep the temperature of the motor case below 100 (212 F).]

Alarm state type and countermeasures

When alarm signal is issued, check for the alarm output LED, and make sure to take approximate measures.

Alarm output LED state	Alarm name	Alarm description	How to release alarm
When lit:	Overheated	Issued when the driver internal temperature has exceeded 85 (185 F).	Alarm can be released only by turning off power. Before turning on power again, check for temperature around the driver, output current setting, and state of installation. Remove the causes for temperature rise. Use the fan to provide forced cooling, if required.
When flashing:	Detected by limit sensor	If the limit sensor signal is input during the drive, the driver will be emergency-stopped, and alarm will be issued.	You can release the alarm by turning off power or by getting out of the restriction of the limit sensor. 1. Turning off the power After turning off power, take some means to get out of the restriction of the limit sensor. If you turn on power without getting out of it, alarm will be issued again. 2. How to get out of the restriction of the limit sensor You can get out of the restriction of the limit sensor either by performing return to mechanical home operation or by inputting the start signal in the continuous mode or jog mode. When you use the method of return to mechanical home operation, you can go back to the mechanical home position after alarm has been released. When you use the continuous mode or jog mode, rotation is carried out in the direction reverse to the detected sensor when the operation is started, independently of the state of rotation direction switching signal input. Rotation stops when you get out of the restriction of the limit sensor. (Example: Rotation is performed in the CCW direction when the CW limit has been detected)
	Failure in return to mechanical home operation	Alarm is issued if return to mechanical home operation does not complete.	You can release the alarm by using the instructure listed above, in the detected by limit sensor section. Failure in return to mechanical home position occurs due to simultaneous input of CW and CCW limit signals when distance between the limit sensor and home position sensor is insufficient. Correct the limit switch layout.

Note: Exception to the operation of getting out of the limit switch restriction

1. When emergency stop has occurred after overrunning the limit switch:

If the operation speed is too high, the stopped position may be beyond the limit sensor position due overrunning, even if emergency stop is caused by the limit sensor. The state of alarm is maintained in this case, as well. To release the alarm, it is necessary to perform operations of getting out of the restriction of the limit sensor. Since the stopped position is beyond the limit sensor, you will get into the domain of the limit switch again, and alarm occurs when you use the continuous mode or jog mode to get out of it. If this occurs, repeat operations of getting out of the restriction of the limit sensor in this state. This also applies to the case of returning to the mechanical home position.

2. Emergency stop before limit sensor

Emergency stop may occur before limit sensor if emergency stop is applied by the limit sensor when used in the Z-axis direction or during rotation accompanied by vibration. Alarm state is maintained in this case as well. Consequently, to release alarm, it is necessary to perform operations of getting out of the restriction of the limit sensor. If you want to use the continuous mode or jog mode to get out of it, movement will be made to the limit sensor on the opposite side, and alarm will occur again. If this occurs, repeat operations of getting out of the restriction of the limit sensor in this state. In the case of returning to the mechanical home position, alarm is released in one return, and you are back at the home position.

11. Specifications

Model number		UI2120G	
Maximum holding torque		Single phase 100-115V ± 15% 50/60Hz 3.0A	
Drive system		Unipolar constant current drive	
Drive capacity		2.0A/phase or less	
Excitation mode		2 phase excitation (Full step) 1-2 phase excitation (Half step)	
Control method		Point to point	
Pulse generator	Operation function	Signal-based operation mode switching method, a total of six operation types Positioning, Return operation, Return to mechanical home operation, Return to mechanical home operation based on timing signal synchronization, Continuous operation, Jog operation	
	Pulse generating capacity	Operation pulse rate range	Switch setting 100steps 50 and 100 to 9900Hz
		Startup pulse rate range	Switch setting 10steps 50 to 900Hz
		Acceleration/deceleration rate range	Switch setting 10steps 0 to 90ms/kHz
Travel setting range	Switch setting 2 systems 0 to 99999pulses		
Max. return pulse count	± 16777215pulses		
I/O signals	Input signal circuit	Start signal Slowdown stop signal Emergency stop signal Rotation direction switching signal Travel switching signal Operation mode switching signal Output current off signal	Photocoupler input Internal pull-up +DC10V, 2.2k , source current 4.5mA TYP
		Limit sensor signal	Photocoupler input Input resistance 4.7k , DC24V maximum, input current 5mA maximum
	Output signal circuit	Excitation timing signal BUSY signal Alarm signal	Photocoupler, Open collector output (emitter common) External use condition DC24V maximum, 10mA maximum
Functions	Step angle switch, Automatic current off, Automatic current cutback Limit sensor input method switch, Rotation direction switch for return to mechanical home operation		
	Alarm output function	Overheat detection, Limit sensor detection, Failure in return to mechanical home position	
Indicators (LED)		Power input, Excitation timing output, BUSY output, Alarm output	
Cooling method (Driver)		Convection	
Mass		0.8kg (1.76lb.)	
Insulation resistance		100M minimum under normal temperature and humidity, when measured by a DC500V megger between the following places: <ul style="list-style-type: none"> • Power input terminal - protective earth terminal • Motor output terminal - protective earth terminal • Signal input / output terminals - power input terminal • Signal input / output terminals - motor output terminal 	
Dielectric strength		Sufficient to withstand the following for one minute, under normal temperature and humidity. <ul style="list-style-type: none"> • Power input terminal - protective earth terminal AC0.8kV 50Hz • Motor output terminal - protective earth terminal AC0.8kV 50Hz • Signal input / output terminals - power input terminal AC1.3kV 50Hz • Signal input / output terminals - motor output terminal AC1.3kV 50Hz 	
Ambient temperature range		0 ~ +40 (+32 F ~ +104 F)	

• Power supply input current value is the maximum input current value of the driver. It differs according to the motor to be used, current setting and operation pulse rate.

Note

Do not test the insulation resistance or withstand voltage when the motor and driver are connected.

Model		UI2120G
Degree of protection		IP00
Operation environment	Ambient temperature	0 ~ +40 (+32 F ~ +104 F) (non-freezing)
	Altitude	85% max. (non-condensing)
	Surrounding atmosphere	Up to 1000m (3280ft.) above sea level
	Humidity	No corrosive gas, dust, water or oil
Storage environment	Ambient temperature	-25 ~ +70 (-13 F ~ +158 F)
	Altitude	85% max. (non-condensing)
	Surrounding atmosphere	Up to 3000m (9840ft.) above sea level
	Humidity	No corrosive gas, dust, water or oil
Shipping environment	Ambient temperature	-25 ~ +70 (-13 F ~ +158 F)
	Altitude	85% max. (non-condensing)
	Surrounding atmosphere	Up to 3000m (9840ft.) above sea level
	Humidity	No corrosive gas, dust, water or oil
Applicable standards	EN standards	EN50178
Installation conditions		Built-in type Class equipment Overvoltage category: Pollution degree: Class 2

- This driver is not measured individually for EMC. Perform the EMC test when products are incorporated into the final equipment.
- Voluntary display of the CE mark conforming to the Low Voltage Directives.

- Please contact your nearest Oriental Motor office for further information.

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