System configuration

- Host controller → Pulse line position command function setting (CW-P/CCW-P, etc.) → FWD driver → M (Stepping motor)
- Exterior ← Output: Out-of-step detection / Alarm and index signals
- 24V DC power → (Rotary SW)
- Resolution setting

■General specifications

		Driver section	Motor section
Insulation class		—	Equivalent to E class
Insulation resistance		—	500VDC 100MΩ min
Dielectric strength		—	500VAC 50Hz 1min
Working environment	Ambient temperature	0~+50℃	-10~+50℃
	Ambient humidity	0~+50℃	15~85%
Storage environment	Ambient temperature	0~+50℃	-20~+70℃
	Ambient humidity	35~85%	10~85%

■How to identify the types

Driver section

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FWD2B1P15-11
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- Cables 1 : Included 0 : Not included
- Applicable motor classification
- Excitation system function
- Supply voltage P : 24V DC
- Output current 1 : 1A 2 : 2A
- Drive system B : Bi-polar drive
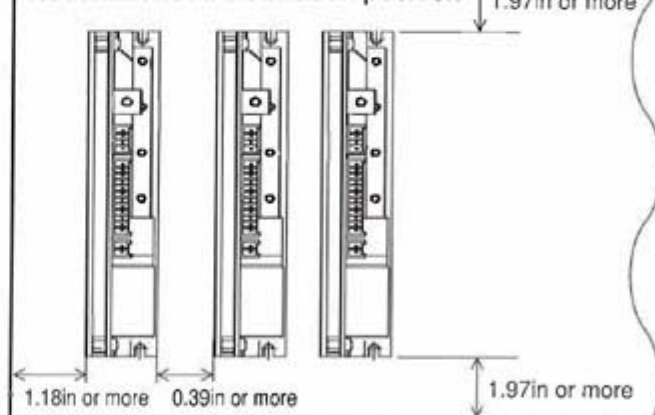- Number of phase 2 : 2-phase
- Series name

Motor section

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KH42HM2-951
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- Coil specifications
- Motor's basic step angle 2 : 1.8°
- Motor type M : Hybrid type
- Motor length (in) H : 34 J : 40-42 K : 47-54 Q : 76
- Outside dimensions (rounded in mm)
- Series name

■Installation location

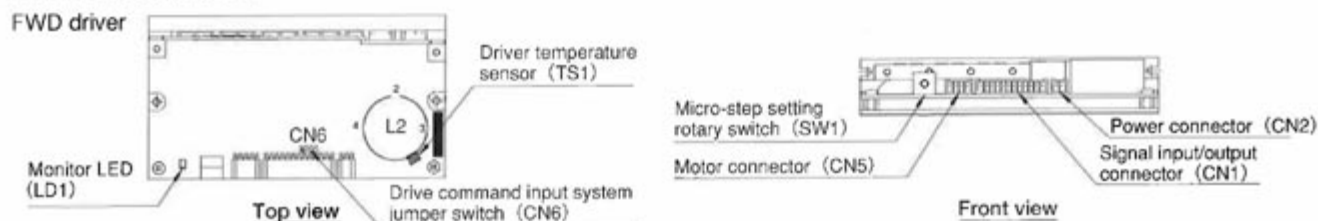| Installation conditions	Precautions for installation
When installed in a control panel	Design the control panel, including the size, driver placement, and cooling method, so that the temperature at the edges of the FWD driver is always 50℃ or less.
When installed near a heating element	Minimize any heat radiated from a heating element and limit temperature increases using convection, so that the temperature at the edges of the FWD driver is always 50℃ or less.
When installed near a source of vibration	Install a vibration damping device on the driver mounting surface, so that no vibration is transmitted to the FWD driver.
When installed in a location where corrosive gas is present	Devise a way to prevent corrosive gas from coming into contact with these devices. Although it will not cause immediate harm to these devices, it may cause failure in equipment related to the contactor.
Other	Do not install the system in places exposed to high temperatures, high humidity, lots of dust or metal powder.

Recommended installation position

1.97in or more
1.18in or more   0.39in or more
1.97in or more

■Specifications

Driver type	Applicable motors	Number of phase	Basic resolution	Excitation system	Rated current (A/phase)	Max. static torque mN·m {oz·in}	Rotor inertia oz·in·S²	Power specifications (DC)	Driver mass lb	Motor mass lb
FWD2B1P15-11	KH42HM2-951	2	0.72°	*Micro step Basic resolution/n (Step)	0.8	169{23.9}	0.54X10⁻³	24V, 2.0A	0.51	0.44
FWD2B1P15-21	KH42JM2-951				0.8	314{44.5}	0.79X10⁻³	24V, 2.0A		0.57
FWD2B1P15-31	KH42KM2-951				1.2	427{60.5}	1.2X10⁻³	24V, 2.5A		0.79
FWD2B2P15-41	KH60JM2-951				2.0	918{130}	3.89X10⁻³	24V, 4.0A		1.32
FWD2B2P15-51	KH60KM2-951				2.0	1360{192}	5.66X10⁻³	24V, 4.0A		1.70
FWD2B2P15-11	KH56JM2-951				2.0	491{69.5}	1.63X10⁻³	24V, 3.0A		0.88
FWD2B2P15-21	KH56KM2-951				2.0	915{130}	2.66X10⁻³	24V, 3.5A		1.43
FWD2B2P15-31	KH56QM2-951				2.0	1510{214}	3.81X10⁻³	24V, 4.0A		2.03

*n=1,2,4,8,10,20,40,80

■Connection method

FWD driver

Driver temperature sensor (TS1)

CN6
L2
Monitor LED (LD1)

Top view

Drive command input system jumper switch (CN6)

Micro-step setting rotary switch (SW1)
Motor connector (CN5)

Power connector (CN2)
Signal input/output connector (CN1)

Front view

■Common specification for drivers

Supply voltage		24V DC±10%
Input signals	TTL input (internally pulled up)	
	CW pulse signal/pulse signal	CW direction operation command pulse signal (jumper switch (CN6) selecting between pins 2 and 3: Operation command pulse signal)
	CCW pulse signal/rotation direction signal	CCW direction operation command pulse signal (jumper switch (CN6) selecting between pins 2 and 3: Rotation direction signal)
	Hold-off signal	H.OFF signal "H": Excitation OFF, "L": Excitation ON
	Automatic current save signal	SAVE signal "H": 50%, "L": 75%
Output signals	Open collector output (+5 - 24V, 10 mA or less)	
	Index signal	Only a single "H" signal is output to the INDEX terminal for a motor rotation angle of 7.2° However, set the drive pulse frequency to 1 kHz or 1
	Alarm output	When any of the abnormalities shown in the separate table occur, an "H" signal will be output on the ALM terminal. When everything is normal: "L"
	Out-of-step detection signal	When the motor gets out-of-step at 500 rpm or more, an "H" signal is output to the PSW terminal. When it is normal: "L". When the driver is restored to normal operation, the signal is cleared.
Micro-step angle selection		Selected in eight steps using the rotary switch.
Cooling system		Natural cooling

■Functional description

Drive command input system	This driver can select two types of the drive command input system. The input system type is selected using a jumper switch (CN6). Changes in this setting only become valid after resetting the power.
Hold-off function	Motor excitation is set to ON or OFF using the H.OFF terminal. The setting can be changed during operation.
Automatic current save function	This function allows the current applied to the motor to be 50% or 75% of the rated value 0.5 seconds after the motor stops. The setting value of this function is set using the SAVE terminal. The setting can be changed during operation.
Motor current value setting	The motor current value is set using the C0 and C1 terminals. The setting can be changed during operation.
Micro-step angle setting	This setting is made with a rotary switch (SW1). It is necessary to reset the power to make the change effective.
Index signal	Only a single "H" signal is output to the INDEX terminal for a motor rotation angle of 7.2° then this signal is used for positioning the origin, set the drive pulse frequency to 1 kHz or less.
Alarm signal	When any of the following abnormalities occur, an "H" signal will be output on the ALM terminal and the motor will enter a no-current state. To clear the alarm, you must reset the power.
Out-of-step detection signal	When the motor does not follow the number of rotation commands normally while being driven, it is regarded as out-of-step and an "H" signal is output on the SYNC_OUT terminal. This function is only valid when the motor revolution speed is 500 rpm or more. When the driver is restored to normal operation, the signal will be cleared. The motor does not enter the no-current state.

■Function setting

Terminal No	Function details		Logic			
	Drive command input system jumper position (CN6)		CW/CCW pulse signal input: between pins 1 and 2	Pulse/rotation direction signal input: between pins 2 and 3		
1	CW rotation		Pulse	—		
2			"H" or open	—		
1	CCW rotation		"H" or open	—		
2			Pulse	—		
1	CW rotation		—	Pulse		
2			—	"H"		
1	CCW rotation		—	Pulse		
2			—	"L"		
3	Hold-off function	Excitation OFF	"H" or open			
		Excitation ON	"L"			
4	Automatic current save function	50%	"H" or open			
		75%	"L"			
	Motor current %		100%	75%		50%
8	Combination setting		"L"	"L"	"H"	"H"
9			"L"	"H"	"L"	"H"
6	Alarm output	Normal operation	"L"			
		Abnormality	"H"			
7	Out-of-step detection function	Normal operation	"L"			
		Out-of-step	"H"			

■List of alarm signal outputs

Abnormalities	Conditions causing the alarm
Overcurrent	When the peak current value of the motor exceeds the value shown in the following table
Overvoltage	When the inverter voltage is 46V or more
Overspeed	When a drive pulse signal of 4000 rpm or higher is input
Dangerous overheating	When the temperature sensor detects a temperature of 70°C or more
CPU abnormal	When the CPU runs away

■Overcurrent value (peak value)

FWD2B1P15—11	FWD2B2P15—11
FWD2B1P15—21	FWD2B2P15—21
FWD2B2P15—31	FWD2B2P15—31
	FWD2B2P15—41
	FWD2B2P15—51
2.5 A/phase or more	5.0 A/phase or more

■Description of the monitor LEDs

Normal operation and abnormalities are indicated by the lighting and/or flashing of the two color LEDs.

	Function	Green LED	Red LED
Lit	Normal operation	○	—
	Hold-off	—	○
Flashing	Overcurrent	Once	Twice
	Overvoltage	Once	Three times
	Overspeed	Once	Four times
	Dangerous overheating	Once	Five times
	Motor out-of-step	Twice	Once
	CPU abnormal	Three times	Once

■Rotary switch setting

Rotary switch position	0·8	1·9	2·A	3·B	4·C	5·D	6·E	7·F
Step angle [°/step]	0.72	0.36	0.18	0.09	0.072	0.036	0.018	0.009

The rotary switch position when shipped from the factory is "0".

■List of connector terminal names

Connector name	Terminal No.	Color	Terminal name	Function
CN1	1	Brown	CW	CW pulse signal or pulse signal input
	2	Red	CCW	CCW pulse signal or rotation direction signal
	3	Orange	H.OFF	Motor excitation ON/OFF signal input
	4	Yellow	SAVE	Automatic current save Change signal input
	5	Green	INDEX	Index signal output
	6	Blue	ALM	Alarm signal output
	7	Purple	SYNC_OUT	Out-of-step detection signal output
	8	Gray	C0	Motor current value setting signal input
	9	White	C1	
	10	Black		
	11	Brown	GND	Signal ground
	12	Red		
CN2	1	Red	VM	Connect to +24V DC.
	2	Black	GND	Power supply ground
CN5	1	Red	A	A-phase output
	2	Blue	Ā	A-phase output
	3	Yellow	B	B-phase output
	4	White	B̄	B-phase output

■Jumper switch setting

| Jumper position	Drive command input system	CW terminal	CCW terminal
Between 1 and 2	CW/CCW pulse signal input	CW pulse signal	CCW pulse signal
Between 2 and 3	Pulse/rotation direction signal input system	Pulse signal	Rotation direction signal

CN6
1 2 3
□ □ □

* Note: The jumper switch setting only becomes effective after resetting the power.

■Input signal circuit

Input terminals (CW, CCW, H.OFF, SAVE, C0, and C1)

User provided recommended circuit / Configuration of the FWD-side input circuit
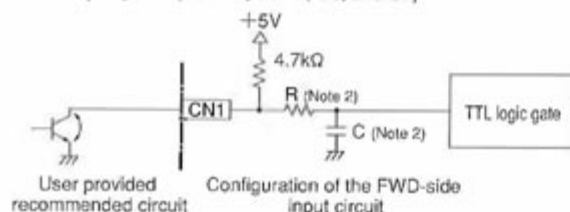
* Note 2: The R and C values are different for each terminal, as shown in the table on the right.

Input circuit constant

Terminal name	R	C
CW, CCW	1kΩ	100pF
H, OFF, SAVE	4.7kΩ	2200pF
C0, C1	560Ω	2200pF

■Output signal circuit

Output terminals (INDEX, ALM, and PSW)

User provided recommended circuit / Configuration of the FWD output circuit
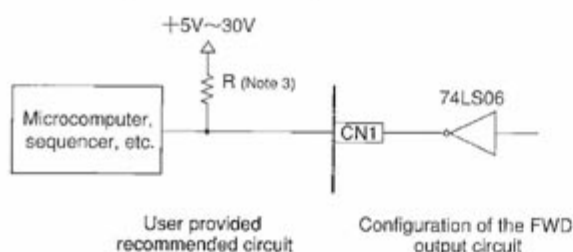
* Note 3: Set the value of pull-up resistor R so that the current draw of the 74S06 is 10 mA or less per terminal when L is output.

■Connector specification

	Driver side	User provided		Manufacturer
	Type	Applicable housing	Applicable contact	
CN1	53426-1210	51103-1200	50752-8000 (link)	
CN2	53426-0210	51103-0200	50752-8100 (random)	MOLEX
CN5	53426-0410	51103-0400		

■Input/output signal standard

Item	Symbol	Standard value	
		MIN	MAX
H level input voltage	Vih (V)	4.2	—
L level input voltage	Vil (V)	—	0.8
H pulse width	Twh (μs)	1.0	—
L pulse width	Twl (μs)	1.0	—
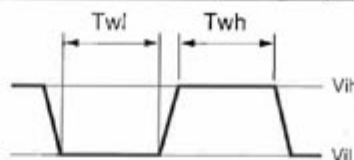
Power specification

Driver supply voltage (VM): 21.6V - 26.4V

Sequence for turning the power on and off
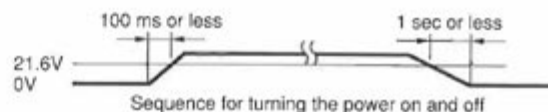
Precautions when turning the power on and off
· Only apply signals after the power has stabilized.
· Allow at least 0.5 seconds between power resets.