Autonics

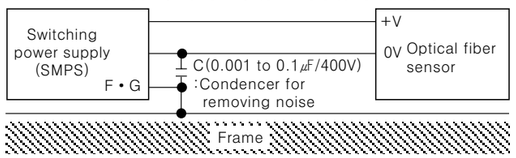
OPTICAL FIBER SENSOR
BF4R SERIES
M A N U A L

Thank you very much for selecting Autonics products.
Please read this manual carefully before you use this unit.

▣ Caution

This unit is not designed for safety, therefore when this unit is applied at dangerous application such as serious human injury, serious property damage, be sure to install fail-safe device.

1. Do not scratch the section of optical fiber cable.
2. Intercept a strong light as like sunlight, spotlight under triangulation range of optical fiber cable.
3. Do not apply a strong tensile force to optical fiber cable.
4. In case of install the optical fiber cable, be sure not to curve the optical fiber cable over tolerance that mentioned in our catalogue.
5. When a high voltage or power line pass through near the Amp. cable, be sure to use seperated conduit to prevent a sensor from surge or noise.
6. Avoid to install the unit as following place.
   Corrosive gas, oil or dust, strong flux, noise, sunny, strong alkali, acid.
7. In case of connecting inductive load such as DC relay at load, use shielded cable, diode and varistor in order to remove noise.
8. The Amp. cable must be used shortly, because it might be occurred malfunction by noise through the long cable.
9. When it is stained by dirt at a detecting part of the optical fiber cable, please clean the detecting part with dry cloth softly. But don't use an organic materials such as alkali acid, chromic acid.
10. When the unit is supplied switching power supply unit, as a power source please earth Frame ground(F.G) terminal, and connect condencer between 0V and F.G terminals to remove noise.



※Above cautions must be kept because malfunction of unit can be occurred.

▣ Ordering information

BF 4 R P – E

	Standard type
E	External synchronization input type
R	Remote sensitivity setting type
	NPN O • C output
P	PNP O • C output
R	Light source(R:Red LED)
4	Series name
BF	Fiber sensor

※The above specifications are changeable without any notice of anytime.

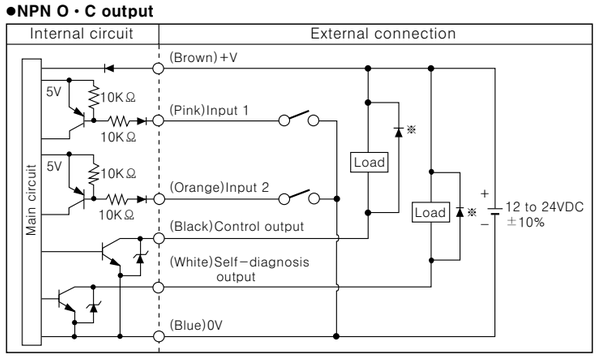
▣ Specification

Model	BF4R (Standard type)	BF4R-E (External synchroni-zation input type)	BF4R-R (Remote sensitivity setting type)	BF4RP (Standard type)
Power voltage	12 to 24VDC ±10%, Ripple p-p:Max. 10%			
Power consumption	Max. 45mA			
Control output	NPN o • c output			PNP o • c output
	Load current:Max. 100mA Applied voltage:Max. 30VDC Residual voltage:Max. 1V(at 100mA load current), Max. 0.4V(at 16mA load current)			Load current :Max. 100mA, Applied voltage :Max. 30VDC Output voltage Min. power supply -2.5V
Self-diagnosis output	ON state under unstable sensing(When the target stays for 300ms in unstable area) or ON state when control output short-circuit			
	Load current:Max. 50mA Applied voltage:Max. 30VDC Residual voltage:Max. 1V(at 50mA load current), Max. 0.4V(at 16mA load current)			Load current :Max. 50mA, Applied voltage :Max. 30VDC Output voltage Min. power supply -2.5V
Operating mode	Setting the sensitivity in front of unit with ON/OFF button			
Protection circuit	Built-in short-circuit protection, Reverse polarity protection device			
Light source	Red LED(Modulated)			
Response time	Max. 0.5ms(Note*1)			
Control output indicator(OUT)	Red LED			
Stable indicator(STAB)	Green LED flickers when the target stays in stable sensing area			
Emission disable input	———	Built in	———	———
External synchroni-zation function		Built in (Gate/Trigger)		
Remote sensitivity setting function		———	Built in	
Interference prevention function	Built-in selectable FREQ.1 or FREQ.2 by ON/OFF button			
Timer function (Selectable)	Off delay timer (Approx. 40ms fixed)	———	Off delay timer(Approx. 40ms fixed)	
Ambient operating illumination	Sunlight : Max. 11,000Lux, Incandescent lamp : Max. 3,000Lux			
Noise	±240V the square wave noise (pulse width:1㎲) by the noise simulator			
Dielectric strength	1000VAC 50/60Hz for 1 minute between all terminals and enclosure			
Insulation resistance	Min. 20MΩ(at 500VDC) between all terminals and enclosure			
Vibration	1.5mm amplitude at frequency of 10 to 55Hz in each of X, Y, Z directions for 2hour			
Shock	500m/S² (50G) X, Y, Z direction for 3 times			
Ambient operating temperature	-10 to 50℃(at non-freezing state)			
Ambient storage temperature	-20 to 70℃(at non-freezing state)			
Ambient humidity	35 to 85%RH			
Material	Case : Heat-resistant ABS, Case cover : Polycarbonate			
Cable	ø4, 4P, Length:2m	ø4, 6P, Length : 2m		ø4, 4P, Length:2m
Weight	About 65g			
Approval	CE			

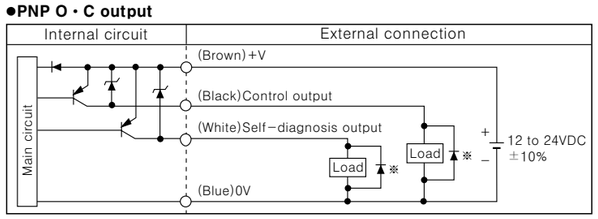
※(Note1)Frequency 1(Normal mode):Max. 0.5ms, Frequency 2:Max. 0.7ms
※The weight of above chart is net weight.

▣ Control output

●NPN O • C output



●PNP O • C output

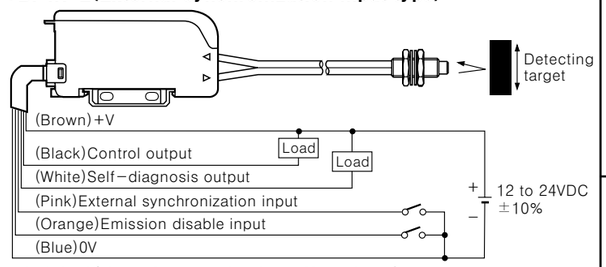


Model / Input cable	BF4R (Standard type)	BF4R-E (External synchronization input type)	BF4R-R (Remote sensitivity setting type)
Input 1	———	External synchronization input	ON input of external sensitivity setting
Input 2	———	Emission disable input	OFF input of external sensitivity setting

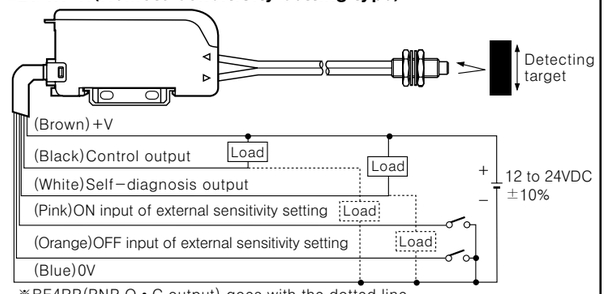
※Connect Diode at external terminal for inductive load.

▣ Connection

●BF4R-E(External synchronization input type)



●BF4R-R(Remote sensitivity setting type)



※BF4RP(PNP O • C output) goes with the dotted line.
※There are no pink & orange wires at **Standard type(BF4R/BF4RP).**
※Connection of the through-beam type is the same as above connection.

▣ Dimension

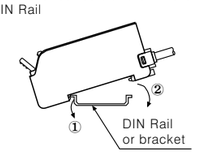
(Note1)**BF4R/BF4RP** cable spec. : ø4, 4P, 2M
BF4R-E/BF4R-R cable spec. : ø4, 6P, 2M

(Unit:mm)

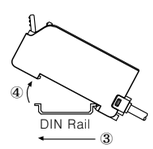
▣ Mounting

1. Mounting of the amplifier

●When mounting the Amp.
①Hook the amp on the front of DIN Rail(or Bracket)
②Press the rear part of the Amp on DIN Rail

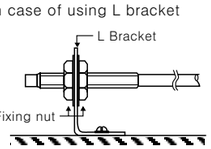


●In case of seperating Amp push the back of Amp toward ③ and lift the hole for fiber toward ④ up then simply take it out without tools.

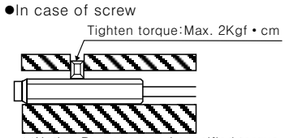


2. Installation of fiber cable

●In case of using L bracket

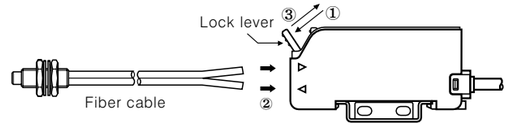


●In case of screw



※Notice:Do not exceed specified torque rating, because of the damage.

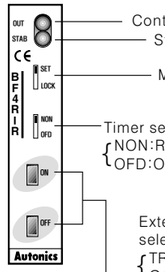
3. Connection of optical fiber cable & Amp.



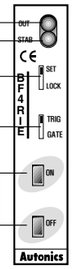
①Open the Lock lever to "↙" direction.
②Insert the optical fiber cable in the Amp. slowly. (Depth:10mm)
③Close the Lock lever to "↗" direction.

▣ Part names

●Standard type(BF4R/BF4RP) /Remote sensitivity setting type(BF4R-R)



●External synchronization input type(BF4R-E)



Control output indicator(Red)
Stable indicator(Green)
Mode selection switch
Timer selection switch
{NON:Removal of timer function
{OFD:Off Delay timer function
External synchronization selection switch
{TRIG:Trigger synchronization
{GATE:Gate synchronization
Sensitivity setting button

▣ Accessories

Model	Features	Application model	Dimension
FTH-410	Protection pipe (Shock, vibration)	FT-420-10 FTS-420-10	
FDH-610	Protection pipe (Shock, vibration)	FD-620-10 FDS-620-10	

▣ Optical fiber cable(Standard model)

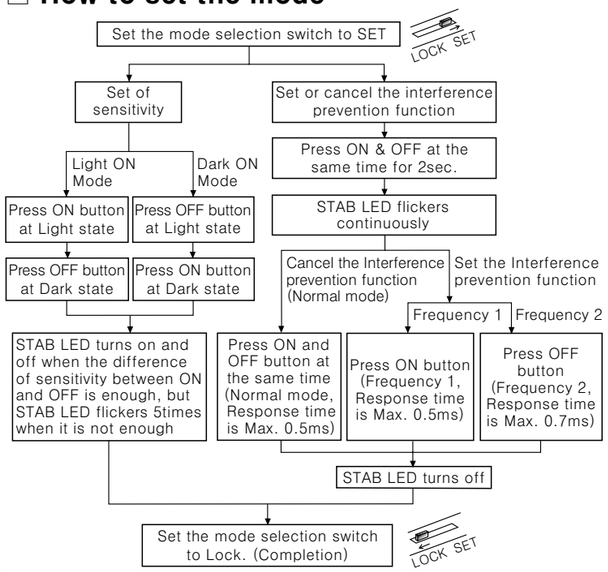
◎ **Fiber cable model name(All models)**

●FD-320-05	●FDP-320-10	●FD-620-F2	●FTC-220-05	●FTS-420-10
●FD-420-05	●FDS-320-05	●FD-620-10H	●FTC-320-10	●FTS1-320-05
●FD-620-10	●FDS-420-05	●FD-620-15H1	●FTCS-220-05	●FT-420-10H
●FD-620-10C	●FDS-620-10	●FT-320-05	●FTP-320-10	●FT-420-10H1
●FDC-320-05	●FD-320-F	●FT-420-10	●FTR-420-10	●GT-420-14H2
●FDCS-320-05	●FD-320-F1	●FT-420-10C	●FTS-320-05	

Detec-ting type	Model	Allowing band radius	Min. detecting object	Detecting distance (mm)	Dimension
Through-beam type	FT-320-05	15R	ø0.5	150	
	FT-420-10	30R	ø1	500	
Diffuse reflective type	FD-320-05	15R	ø0.03	40	
	FD-620-10	30R	ø0.03	120	

※Specification of other models is indicated in our general catalogue.

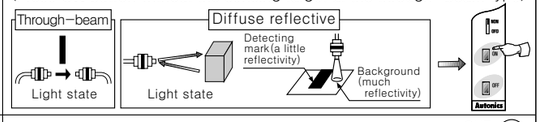
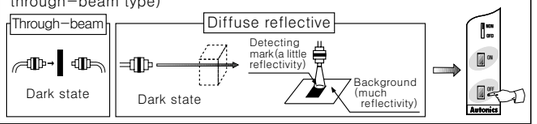
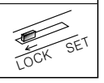
▣ How to set the mode



▣ Function

◎ Adjustment of sensitivity

●Adjustment by the sensitivity setting button(All models)
-Light ON Mode

Order	Setting method
①	Mount the fiber cable within detecting distance.
②	Set the mode selection switch to SET. 
③	Press **ON** button in state of the installed the sensing target. (Press **ON** button without the sensing target at the through-beam type) 
④	The stable indicator flickers at ON state. (Detect the target position) 
⑤	Press **OFF** button in state of the removed sensing target. (Press **OFF** button at state of the installed the sensing target at the through-beam type) 
⑥	• When there is enough sensitivity differential between ON state and OFF state, the stable indicator turns on and off one time only at stable sensing area. • When there is not enough sensitivity differential between ON state and OFF state, the stable indicator turns on and off five times at unstable sensing area. (Note) 
⑦	Set the mode selection switch to LOCK, even though somebody touches the sensitivity setting button, setting sensitivity shall be not changed. 

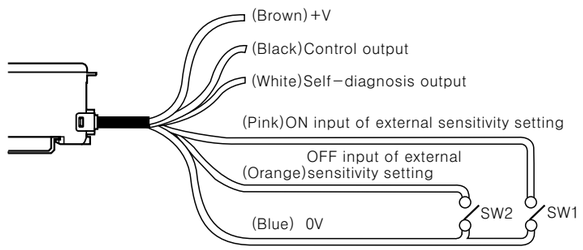
(Note) The sensitivity can be set at unstable sensing area.
※Setting sensitivity is memorized when power turns off.
※Don't touch the Fiber cable after adjusting the sensitivity.

-Dark ON Mode(Diffuse reflective type)
Most of adjustments except ③ & ⑤ are same as Light ON mode.
• Press ON button without the sensing target. (③ state)
• Press OFF button with the sensing target. (⑤ state)

• Light ON Mode : Output turns on at Light state and turns off at Dark state. • Dark ON Mode : Output turns off at Light state and turns on at Dark state.

-In case of setting as Max. sensitivity
①Set the mode selection switch to SET mode.
② • **In case of Light ON mode :** Press ON/OFF button **from ON to OFF** without the sensing target. (Or set ON input for remote sensitivity setting to LOW level, and then set OFF input for remote sensitivity setting to LOW level)
③ • **In case of Dark ON mode :** Press ON/OFF button **from OFF to ON** without the sensing target. (Or set OFF input for remote sensitivity setting to LOW level, and then set ON input for remote sensitivity setting to LOW level)
③Set the mode selection switch to LOCK mode.
〈 Application〉
• In case of extend detecting distance as the diffusive reflection type.
• In case of use the through-beam type at bad environment.

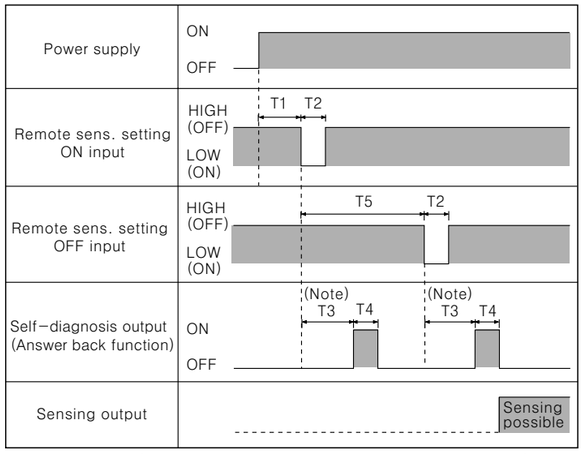
●Remote adjustment of sensitivity(BF4R-R only)
BF4R-R type can adjust the sensitivity with input signal lines in regardless to the mode selection switch as follow diagram;



-Adjustment at Light ON Mode
①SW1(On input of external sensitivity setting):SW1 turns on and then turns off instead of ③ method by the sensitivity setting button.
②SW2(Off input of external sensitivity setting):SW2 turns on and then turns off instead of ⑤ method by the sensitivity setting button.
-Adjustment at Dark ON Mode
①SW2(OFF input of external sensitivity setting):SW2 turns on and then turns off instead of ⑤ method by the sensitivity setting button.
②SW1(ON input of external sensitivity setting):SW1 turns on and then turns off instead of ③ method by the sensitivity setting button.

●Answer Back function(BF4R-R only)
When ON or OFF input of external sensitivity setting is applied, after 300ms, self-diagnosis output turns on for 40ms and then the sensor keeps normal detecting state. (Notice:Time chart)
-Self-diagnosis output does not turn on if there is no difference of sensitivity between ON input and OFF input and stable sensing is not achieved, but stable sensing operates after 340ms.

〈 Time Chart:Light ON Mode〉



1. T1≥1,000ms(After the power turns on, it can be set after 1s)
2. T2≥5ms(ON or OFF input time of external sensitivity setting must be Min. 5ms)
3. T3≒300ms(When ON or OFF input of external sensitivity setting is applied, self-diagnosis output turns on after 300ms)
4. T4≒40ms(ON time of self-diagnosis output)
5. T5≥500ms(When ON input of external sensitivity setting is applied and then apply OFF input of external sensitivity setting after 500ms)

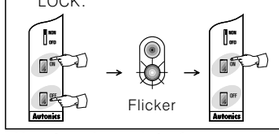
(Note)During period T3(Approx. 300ms), do not change the incident light intensity by moving the object, etc.

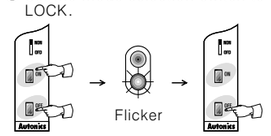
◎ Interference prevention function(All models)

BF4R series have a built-in interference prevention function, two fiber cables can be mounted very closely by setting different emission frequencies.

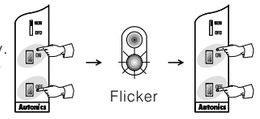
●How to set interference prevention function(Operation of different wave mode)

First sensor-FREQ.1 (Response time:0.5ms)	Second sensor-FREQ.2 (Response time:0.7ms)
① Set the mode selection switch to SET. ② Press ON & OFF buttons for 2 second at the same time. ③ The stable indicator flickers continuously. ④ **Press ON button** ⑤ The stable indicator turns off. ⑥ Set the mode selection switch to LOCK.	① Set the mode selection switch to SET. ② Press ON & OFF buttons for 2 second at the same time. ③ The stable indicator flickers continuously. ④ **Press OFF button** ⑤ The stable indicator turns off. ⑥ Set the mode selection switch to LOCK.



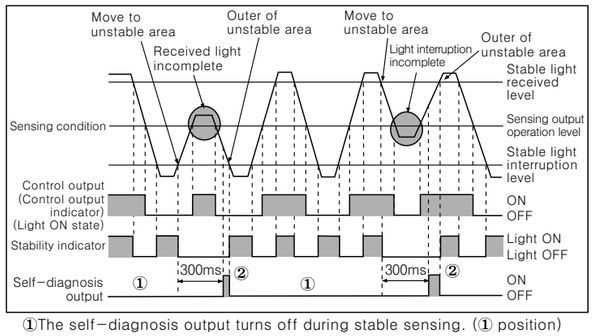


●How to release interference prevention function (Operation of normal mode)-Response time:0.5ms
① Set the mode selection switch to SET.
② Press ON & OFF buttons for 2 second at the same time.
③ The stable indicator flickers continuously.
④ **Press ON & OFF buttons at the same time**.
⑤ The stable indicator turns off.
⑥ Set the mode selection switch to LOCK.
※In case of using interference prevention function, hysteresis & response time will be longer than normal operation.



◎ Self-diagnosis function(All models)

●When Fiber hood is soiled by dust, malfunction of the Emitter, reducing received light source, self-diagnosis function is to operate alarm output.

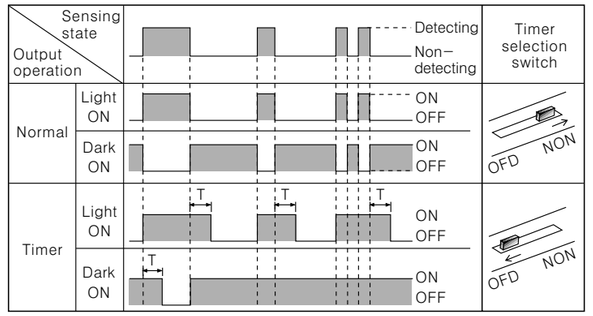


①The self-diagnosis output turns off during stable sensing. (① position)
②When detecting state keeps for 300ms at unstable area between stable light interruption level and stable light received level, self-diagnosis output turns on, self-diagnosis output turns off at lower than stable light interruption level and upper than stable light received level. (② position)
●Under the control output turns on, if the over-current supplied in control output, then self-diagnosis output turns on.

◎ OFF Delay timer function(BF4R/BF4RP/BF4R-R only)

Standard type(BF4R/BF4RP) and Remote sensitivity setting type(BF4R-R) built-in an Approx. 40ms fixed off-delay timer function.
The timer works when the timer selection switch is set to 'OFD'.
The output turns off after turnning on for 40ms at off position of the sensing output. It is useful when the response time of the connecting device is slow or when the sensing signal from a tiny object is too short.

〈 Time Chart〉 T≒40ms



◎ External synchronization input function(BF4R-E)

By using external synchronization function, the timing for making detection can be specified by External synchronization.
Trigger synchronization and gate synchronization are available.

	Trigger synchronization	Gate synchronization
(Note) Sensing signal	ON / OFF	ON / OFF
External synchroni-zation input	HIGH / LOW, T	HIGH / LOW, T
Control output	ON / OFF, 40ms Approx. ※Output for differential synchroni-zation is fixed as 40ms.	ON / OFF
External synchroni-zation selection switch	GATE TRIG : TRIG	GATE TRIG : GATE

※T≥0.5ms(When using interference prevention function:T≥0.7ms)

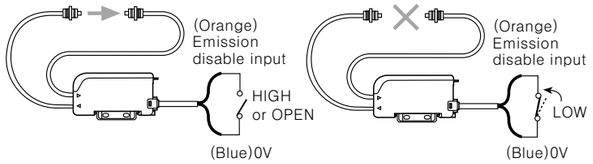
〈 Input signal condition for External synchronization〉

State	Signal condition
HIGH	4.5 to 30VDC or OPEN
LOW	0 to 1VDC

※(Note)Inner signal state before sending as control output for detecting signal which the sensor detects.

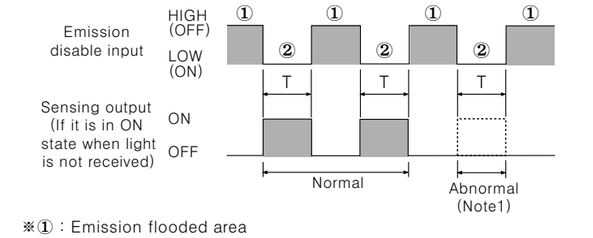
◎ Emission disable function(BF4R-E) -Operation Test

●Below test is available under Light ON state only.
●If Emission disable input is at Low state, Emission light does not flood.
●It can check normal or abnormal state of the sensor without moving the target.



[If Emission disable input is at High or Open state, Emission light floods]

[If Emission disable input is at Low state, Emission light does not flood]



※① : Emission flooded area
※② : Emission stopped area
※(Note1)If Emission stops, control output must turn on, but if control output does not turn on, it seems that sensor has some problems.
※T≥0.5ms(When using interference prevention function T≥0.7ms)

〈 Input signal condition for Emission disable〉

State	Signal condition
HIGH	4.5 to 30VDC or OPEN
LOW	0 to 1VDC

▣ Main products

■COUNTER ■TIMER ■TEMPERATURE CONTROLLER ■PANEL METER ■TACHOMETER
■LINE SPEED METER ■DISPLAY UNIT ■PROXIMITY SWITCH ■PHOTOELECTRIC SENSOR
■OPTICAL FIBER SENSOR ■ROTARY ENCODER ■SENSOR CONTROLLER
■POWER CONTROLLER ■STEPPING MOTOR & DRIVER & CONTROLLER

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