

Joy Stick Operation

Two-Axis Stage Controller

SHOT-102

*For Your
Safety*

User's Manual





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For Your Safety

- Before using this product, read this manual and all warnings or cautions in the documentation provided.
- Only Factory Authorized Personnel should be changes and/or adjust the parts of controller.

The Symbols Used in This Manual


 WARNING	 CAUTION
This symbol marks warnings that should be read and used to prevent serious injury or death.	This symbol indicates where caution should be used to avoid possible injury to yourself or others, or damage to property.

The above indications are used together with the following symbols to indicate the exact nature of the warning or caution.

Examples of Symbols Accompanying Warnings and Cautions	
	△ Symbols enclosed in a triangle indicate warnings and cautions. The exact nature of the warning or caution is indicated by the symbol inside (the symbol at left indicates risk of electrocution).
	○ Symbols enclosed in a circle mark indicate prohibitions (actions that must not be performed). The exact nature of the prohibition is indicated by the symbol inside or next to the circle mark (the symbol at left indicates that the product must not be disassembled).
	● Symbols inside a black circle mark actions that must be performed to ensure safety. The exact nature of the action that must be performed is indicated by the symbol inside (the symbol at left is used in cases in which the AC adapter must be unplugged to ensure safety).




Symbols on the product

The symbol mark on the product calls your attention. Please refer to the manual, in the case that you operate the part of the symbol mark on the product.

	This symbol labeled on the portion calls your attention.
---	--

Symbols Used in This Manual

The following symbols are used in this manual.

	This symbol is used to indicate cross-references to relevant information in this manual or other documentation.
	This symbol marks items that should be confirmed before an operation (or action) is performed.
	This symbol marks definitions of terms and other useful information.
(Note)	This symbol marks supplementary information.

Disclaimer of Liability

- ① SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product or the inability to use this product.
- ② SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product that deviates from that described in the manual.
- ③ SIGMAKOKI CO., LTD. does not accept liability for damages resulting from the use of this product in extraordinary conditions, including fire, earthquakes, and other acts of God, action by any third party, other accidents, and deliberate or accidental misuse.
- ④ If the equipment is used in a manner not specified by the SIGMAKOKI CO., LTD., the protection provided by the equipment may be impaired.

WARNING

- Do not use this product in the presence of flammable gas, explosives, or corrosive substances, in areas exposed to high levels of moisture or humidity, in poorly ventilated areas, or near flammable materials.
- Do not connect or check the product while the power is on.
- Installation and connection should be performed only by a qualified technician.
- Do not bend, pull, damage, or modify the power or connecting cables.
- Do not touch the products internal parts.
- Connect the earth terminal to ground.
- Should the product overheat, or should you notice an unusual smell, heat, or unusual noises coming from the product, turn off the power immediately.
- Do not turn on the power in the event that it has received a strong physical shock as the result of a fall or other accident.
- Do not touch the stage while operation.
- Use dry clothes only for cleaning the equipment.

CAUTION

- Do not leave the product in an enclosed area or in areas in which it would be exposed to direct sunlight or vibration.
- Do not touch the product when your hands are wet.
- When unplugging the product, pull on the plug rather than the cord.
- Because some electrical charge remains after the power has been cut, do not touch the input or output terminals for ten seconds after the product has been turned off.
- When connecting peripherals to the product, adjust the product's initial setting (parameter settings) to suit the peripheral.
- Turn off the power before connecting the product to other devices. Connection should be performed following the connection diagram.
- Before turning the equipment on (or when beginning operations), be sure that you can turn the power off immediately in the event that an abnormality should occur.
- Do not obstruct the product's air vents or other openings.
- For continued protection against risk of fire, replace only with same type and rating fuse. Fuse replacement is done by a qualified technician.

Section 1: Before Using Your SHOT-102

1-1 Check Inside the Package

Before you use this controller, check if your package includes all the items listed below. It is convenient to check in the boxes: If your package does not include all the items, or items are damaged, please contact us.

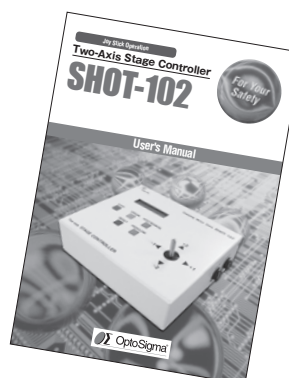
☐ SHOT-102 Stage Controller Unit : 1



☐ AC power cable : 1



☐ User's Manual (This Manual) : 1



1-2 Outline

SHOT-102 is a twin-axis stage controller featuring stepping motor drivers.

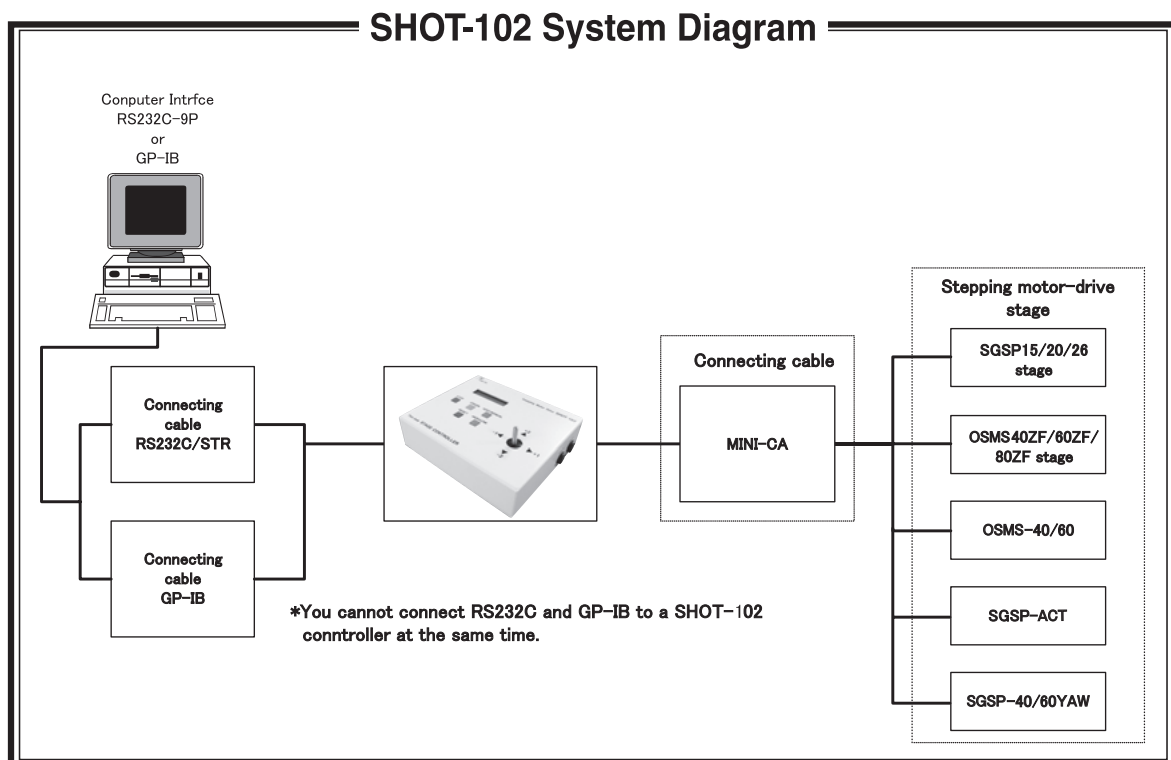
Keeping compatibility with existing models, SHOT-102 features versatility that can support wide variety of your needs at a delightfully low price.

Connect the unit to your standard PC via RS-232C or GP-IB interface, and you can send simple commands from PC for moving motorized stages precisely to target positions and configure a controlling system of considerable scale comfortably.

This also allows you to operate the stage with a joystick.

1-3 SHOT-102 System Diagram

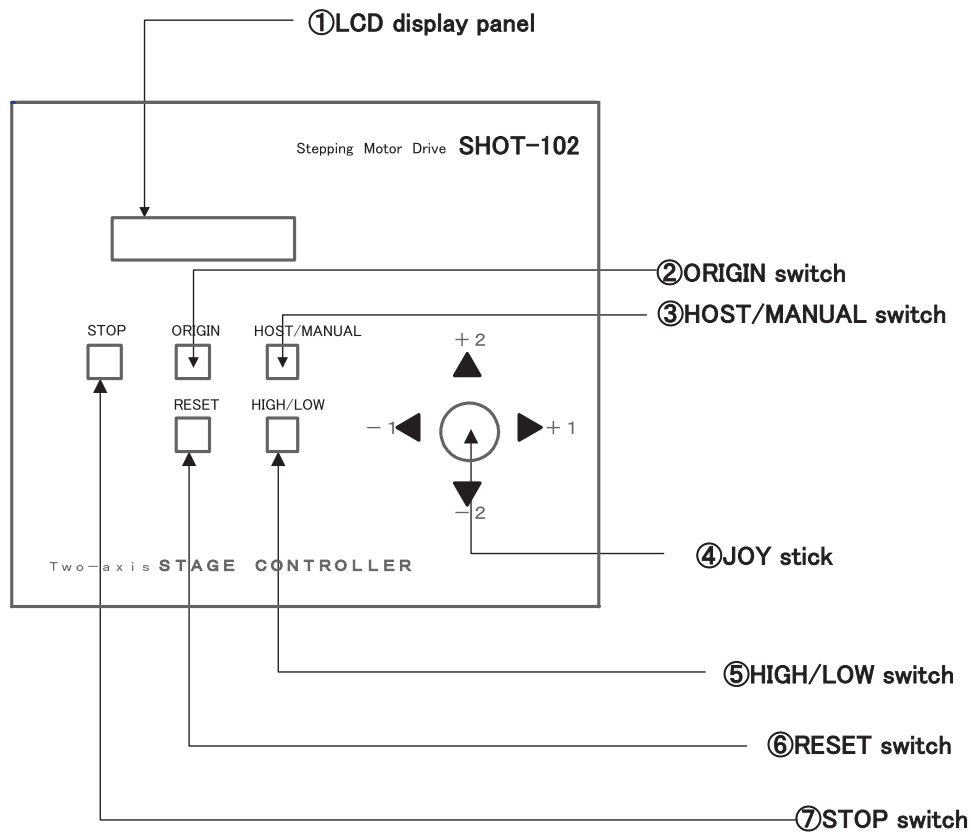
SHOT-102 incorporates stepping motor drivers, which enables you to design a low cost, space-efficient system with our SGSP series or other motorized stages driven by stepping motors, using standard cables for the connection.



Applicable cables and drive current values are depending on the specifications of stages you want to use. Check if your controller matches to desired devices satisfactorily before forming a system.

1-4 Names and Functions of Parts

Upper Panel

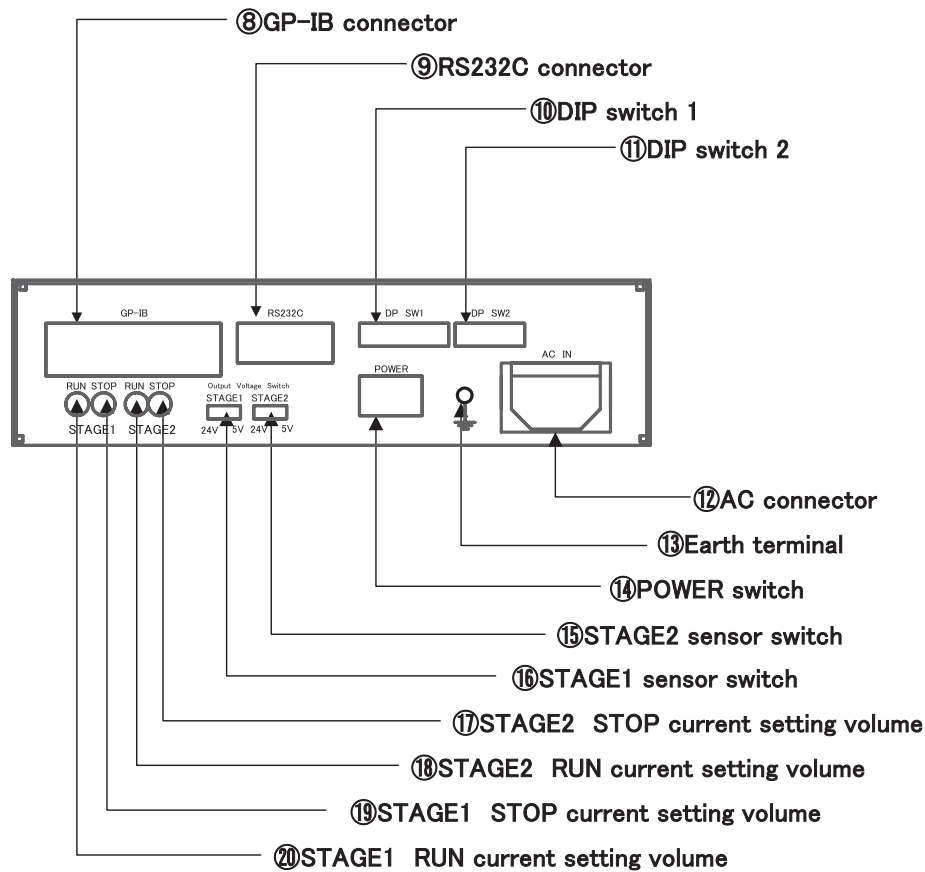


Functions

- ① Indicates each axis coordinate value, controller's motion mode and so on.
- ② Moves the stage to its machine home position in manual mode. The LED indicator lights up when both axes are at the home position.
- ③ Switches host and manual modes. The LED built-in the button lights up during host mode. Host mode is selected immediately after power ON.
- ④ Operates each stage in manual mode.
- ⑤ Selects HIGH/LOW for the stage traveling speed in manual mode. The LED in the button lights up in HIGH state.
- ⑥ Zeroclears the indicated coordinates to set the position as home.
- ⑦ Stops the stage in both host/manual modes. However, this is not the Emergency Stop button. Manual mode is selected after the stage halts.

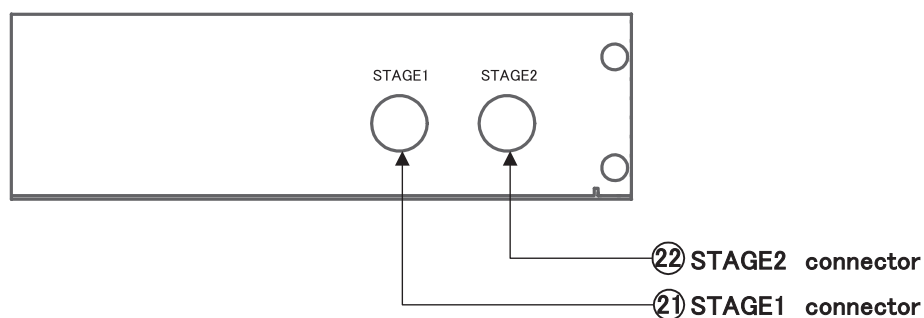
⚠ The controller radiates heat generated inside the enclosure. Though you may feel the enclosure warmed up, that is not necessarily failure.

Rear Panel



- ⑧ Connect the cable when using your PC for controlling via the GP-IB interface.
- ⑨ Connect the cable when using your PC for controlling via RS-232C interface.
- ⑩ Makes basic settings for your SHOT-102.
- ⑪ Makes basic settings for your SHOT-102.
- ⑫ Insert the attached power cord to supply AC power.
- ⑬ Should be grounded properly in your environment.
- ⑭ Power switch. Turn ON to indicate mode, interface, etc on the display.
- ⑮ Changes voltages supplied to the stage 2 sensor.
- ⑯ Changes voltages supplied to the stage 1 sensor.
- ⑰ Volume control adjusting the STOP current output through the stage drive connector (Axis 2).
- ⑱ Volume control adjusting the RUN current output through the stage drive connector (Axis 2).
- ⑲ Volume control adjusting the STOP current output through the stage drive connector (Axis 1).
- ⑳ Volume control adjusting the RUN current output through the stage drive connector (Axis 1).

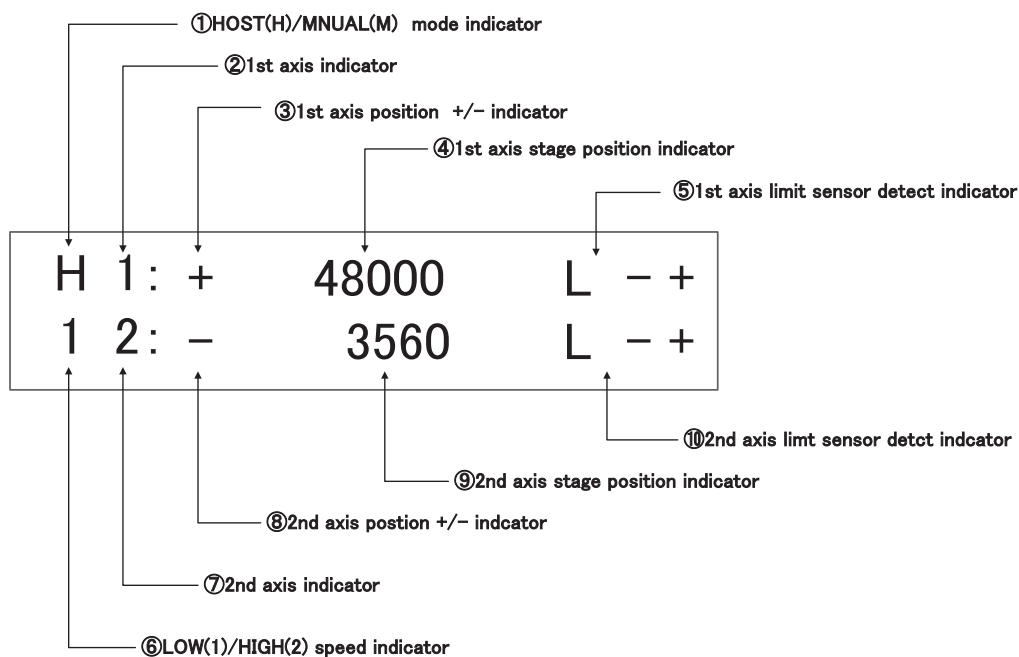
Right Side Panel



②① Connect the stage used as Axis 1.

②② Connect the stage used as Axis 2.

Display (example display for explanations and not representing actual operational status)



- ① Displays either of host (displayed as "H")/manual ("M") modes.
- ② and ⑦ For Axis 1 and Axis 2.
- ③ and ⑧ Displays stage positions as positive (+)/negative (-) from the home position for each axis.
- ④ and ⑨ Displays the stage positions for each axis.
- ⑤ and ⑩ Displays when the limit sensor for each axis is activated.
- ⑥ Displays mode as LOW ("1") or HIGH ("2").

Section 2: Basic Operations

2-1 Initialize SHOT-102

Initialize your SHOT-102 to match to the target stages and host environment (your PC, etc). The initialization includes DIP switch settings and current adjustments (RUN/STOP) for each axis motor.

2-2 Set Parameters with DIP Switch

Make basic settings of your SHOT-102 by setting switches on the DIP switches to ON/OFF. The side marked with " • " is switch 1.

Parameter assignment in DIP Switch 1

DIP switch No.	Items	Parameters
1,2	Delimiter	CR+LF(EOI)/CR(EOI)/LF(EOI)/EOI*
3	Interface	GP-IB/RS232C
4,5	Baud rate	38400/19200/9600/4800
6,7	GP-IB address	8/9/10/11
8	Control axis	First axis only/ Both axis
9,10	Speed	Speed select

* Note: EOI is effective only when GP-IB interface is used.

Parameter assignment in DIP Switch 2

DIP switch No.	Items	Parameters
1,2	Stage1 unit	0.5μm/1μm /2μm /pulse
3,4	Stage2 unit	0.5μm/1μm /2μm /pulse
5	Stage1 origin detection	Enabled/Disabled
6	Stage2 origin detection	Enabled/Disabled
7	Mode	SHOT-102/MINI-5P
8	Divide	Full step/Half step

Setting Voltage Selection Switches for Sensors

SW Indication	Applicable Stage	Setting Item
24V	SGSP Series	+24V output via 1.1k ohm
5V	MINI Series	+5V output via 100 ohm




Make sure to set the supply voltage for Axis 1 and 2 matching to the stages you want to use.

Shaded areas in the list show our factory settings. Wrong settings may damage the controller. Take care to handle those very small DIP switches so as to avoid giving damage to them during the settings.

List of DIP Switch Settings (Set to ON by turning to the number-marked side on the switch body)


DIP Switch 1

Items	DIP switch No.		Descriptions		
Delimiter	SW2	SW1			
	ON	ON	CR+LF(EOI)		
	ON	OFF	CR(EOI)		
	OFF	ON	LF(EOI)		
	OFF	OFF	EOI		
Interface	SW3				
	ON		GP-IB		
	OFF		RS232C		
Baud rate	SW5	SW4			
	ON	ON	38400		
	ON	OFF	19200		
	OFF	ON	9600		
	OFF	OFF	4800		
GP-IB address	SW7	SW6			
	ON	ON	8		
	ON	OFF	9		
	OFF	ON	10		
	OFF	OFF	11		
Control axis	SW8				
	ON		First axis only		
	OFF		Both axis		
Speed	SW10	SW9	F	S	R
	ON	ON	10 k	1 k	200
	ON	OFF	5 k	500	200
	OFF	ON	500	50	0
	OFF	OFF	50	5	0

 Note: Shaded areas in the list show our factory settings. Take care to handle those very small DIP switches so as to avoid giving damage to them during the settings. Use appropriate tools such as sharp tweezers for setting each switches on the DIP switches.

DIP Switch 2

Stage1 unit	SW2	SW1	Descriptions		
	ON	ON	Pulse		
	ON	OFF	2μ m /pulse		
	OFF	ON	1μ m /pulse		
	OFF	OFF	0.5μ m /pulse		
Stage2 unit	SW4	SW3			
	ON	ON	Pulse		
	ON	OFF	2μ m /pulse		
	OFF	ON	1μ m /pulse		
	OFF	OFF	0.5μ m /pulse		
Stage1 origin detection	SW5				
	ON		Enabled		
	OFF		Disabled		
Stage2 origin detection	SW6				
	ON		Enabled		
	OFF		Disabled		
Mode	SW7				
	ON		SHOT-102		
	OFF		MINI-5P		
Divide	SW8				
	ON		Full step		
	OFF		Half step		

 Note: Shaded areas in the list show our factory settings. Take care to handle those very small DIP switches so as to avoid giving damage to them during the settings. Use appropriate tools such as sharp tweezers for setting each switches on the DIP switches

Differences between SHOT-102/MINI-5P modes

SHOT-102 can select SHOT-102 or MINI-5P mode by DIP switch settings.
Operations and commands/parameters vary depending on modes.

SHOT-102 mode (factory settings)

- On turning ON the power, "SHOT" is displayed on the LCD.
- H/M (Host/Manual) and "LOW (1)/HIGHT (2)" (manual speed) are displayed on the LCD.
- The speed in homing is the value set by switches 9 and 10 on DIP switch 1, or the D command.
- Against a command sent from the host, the controller returns OK/NG to the host.
- The speed settings for Axis 1 only, Axis 2 only or both axes can be made by the D command.
- The format of the G command is "G:"

MINI-5P mode

- On turning ON the power, "MINI" is displayed on the LCD.
- Only the coordinate value and limit sensors for each axis are displayed on the LCD.
- Against a command sent from the host, the controller does not return OK/NG to the host.
- The speed in homing is fixed to (S)500(F)5000(R)200 and can not be changed.
- With the D command, speeds should be set for both axes at once. When you want to use only one of the axes, set dummy parameters for the other axis.
- The format of the G command is "G" (colon ":" is not necessary).

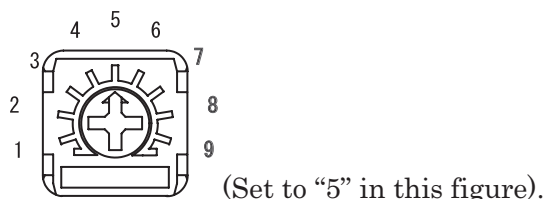
2-3 Adjust Drive (RUN, STOP) Current

Set current values supplied from SHOT-102 to the stages. Turn the RUN volume being provided on the rear side of the unit to adjust the RUN current matching to the stage you want to use. Then Use a STOP Volume to set a ratio to the RUN current according to your conditions for the case where the current down function works. You can make each current adjustment for Axis 1 or Axis 2 independently. Turn the volumes clockwise to increase the current values.

Note that for the STOP current, adjustment is available not for current values, but for a ratio (%) to the RUN current.

Note: Generally the ratio of the STOP current to the RUN current is approx. 50 %.

(Example) Volume setting



Driving current settings (RUN)

Volume No.	0	1	2	3	4	5	6	7	8	9	10
Amperage [A]	0.17	0.25	0.33	0.40	0.47	0.54	0.61	0.67	0.73	0.79	0.85

Stop current settings (Stop current setting to 50% for RUN current)

RUN volume No.	0	1	2	3	4	5	6	7	8	9	10
STOP volume No.	0	1	1	1	1	1	2	2	2	2	2

Note: Each value cited in the above table is a guide to adjust the current without instruments, and may fluctuate within an allowable range. Shaded values in the list are factory settings.

2-4 Connection between SHOT-102 and Motorized Stage

Connect SHOT-102 and motorized stages.

Procedure:

- ① First, make sure that the power plug of SHOT-102 is removed from the receptacle, and its power switch is turned OFF. Follow this step exactly to avoid possible electric shocks or damage to your unit.
 - ② Connect the cable to motorized stages. Select cables correctly matching to your SHOT-102 and stages. MINI-CA or MINIS-CA series cables are applicable to SHOT-102.
 - ③ Connect the cable from the stage for Axis 1 to STAGE 1 connector on SHOT-102. Connect the cable from the Axis 2 stage to STAGE 2.
- If you want to use only one axis, use STAGE 1.

2-5 Manual Operation of Stage with SHOT-102

Operate a stage manually through the SHOT-102 operation buttons or joystick. Complete any settings and the connections for SHOT-102 with the stages to use and the operation conditions before turning ON the power to move the stages.

Procedure:

- ① Turn ON the power switch (turn to "I" mark):

Typical display of SHOT mode

```
SHOT RS232C 9600
DELIMITER = CR+LF
```

Typical display of MINI-5P mode

```
MINI RS232C 9600
DELIMITER = CR+LF
```

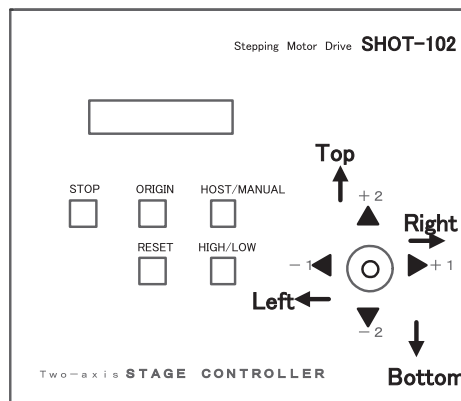
SHOT-102 is turned ON and the opening message like above is displayed on the LCD for about three seconds (the contents of the message vary depending on the settings). Then the LEDs of the HOST/MANUAL and ORIGIN switches light up and the coordinate values of the Stage 1 and 2, etc. are displayed on the LCD.

- ② Press the HOST/MANUAL switch to select manual mode. The LED turns off and the switch joystick on the panel is enabled. While you are using this button, do not operate the other operation buttons and joysticks.

When the controller status is "B" (busy), switching operations cannot be accepted.

- ③ The joystick corresponds with each axis as follows:

Axis No.	Turning Direction of Stick
Stage 1	Left (-)/Right (+) direction
Stage 2	Top (+)/Bottom (-) direction



One move of the stick (for 0.5 sec or shorter) moves the stage by one pulse. A move of the stick for longer than 0.5 sec moves the stage continuously and releasing the stick stops the movement. The stage moves constantly at the minimum speed set by switches 9 and 10 on DIP switch 1 (it does not accelerate/decelerate).

- ④ Press the HIGH/LOW switch and operate the joystick with the LED lit. The stage makes acceleration/ deceleration drive at the maximum speed set by switches 9 and 10 on DIP switch 1. Setting at the host side using the "D" command enables changing the minimum and maximum speeds.
- ⑤ Pressing the ORIGIN switch turns OFF the LED and starts to detect the machine home position. In SHOT-102 mode, traveling speeds to detect depend on the speed settings by the DIP switch and the D command, and the settings of HIGH/LOW switch. In MINI-5P mode, the speed is fixed to the home return speed (S)500(F)5000(R)200 and cannot be changed. The operation is the same as that of "H:W" when "CCW-" is instructed by the H command.

- ⑥ Operate the RESET switch to reset the coordinate to and light up the ORIGIN switch LED. The motion is the same as that of "R:W" of the R command.
- ⑦ The STOP switch is not the Emergency Stop switch. Turn OFF the power switch in an emergency.

(Note 1) Do not send any commands from your PC during manual operation.

Otherwise, the controller and/or stage may malfunction.

(Note 2) Carry out single step (pulse-by-pulse) operation per axis.

(Note 3) The traveling speeds with the joystick can be changed through the "D" command. Immediately after power ON, the stage moves at the speed set with switches 9 and 10 on the DIP switch.

2-6 Connection between SHOT-102 and Host (PC, etc) and Control

Connect SHOT-102 to Host (PC, etc) that sends/receives controlling commands. The applicable communications interfaces are RS232C and GP-IB.

Procedure (RS232C):

- ① Use a genuine cable RS232C/STR, or a 9-pin, D-SUB straight cable with male/female ends using inch screw threads.
- ② Make sure the power is turned OFF on both PC and SHOT-102.
- ③ Set the baud rate interface (selecting RS232C for this explanation) and delimiter (selecting CR+LF(EOL) for this explanation) by DIP switch 1 on the body.
- ④ Insert the male connector of the communications cable into the RS232C terminal on the SHOT-102.
- ⑤ Insert the female end into the serial port on your PC.

Procedure (GP-IB):

- ① Use a genuine cable GP-IB or a standard cable.
- ② Make sure the power is turned OFF on both PC and SHOT-102.
- ③ Set the baud rate interface (selecting GP-IB for this explanation) and delimiter address by DIP switch 1 on the body.
- ④ Connect the GP-IB terminal on the SHOT-102 and your PC with the communications cable.

2-7 Environment Settings of Host

This describes how to connect with your PC using the RS232C interface.

Configure communications environment on the host for communicating with SHOT-102.

Set Communications Environment:

Items	Descriptions
Baud rate	Baud rate set with DIP switch
Data bit	8 bits
Parity	None
Stop bit	1bit
Flow control	Hardware
Delimiter	CR+LF

2-8 Power ON

When you have completed procedures above, connect firmly the power cord attached to SHOT-102, and insert the power plug into the receptacle. Turn ON the power switch (turn to “I” mark). SHOT-102 turns ON and the opening message is displayed on the LCD for about three seconds.


Section 3: Commands for SHOT-102

3-1 Command List

Listed below are all the commands used with SHOT-102:

Some commands have several formats and parameters to be selected depending on the operation mode. See Differences between MINI-5P/SHOT-102 in 2-2.

Command	String	Details
Return to mechanical origin	H :	Detect mechanical origin
Set electronic(logical)origin	R :	Set the electronic(logical)origin to the current position
Speed settings	D :	Set S, F, and R
Set number of pulses for relative movement	M :	Axis of movement, direction, number of pulses
Set number of pulses for absolute movement	A :	Absolute coordinates
Absolute coordinates	J :	Move at minimum speed (S)
Drive command	G : *	Start
Stop	L :	Stop or reduce speed
Free motor	C :	Excitation ON/OFF
Status1	Q :	Return current position etc.
Status2	! :	Return B (Busy)/R (Ready)
Internal information	? :	Check internal information

 : Note that in MINI-5P mode, only the "G" command does not have a colon (":") at the end.

3-2 Function and Format of Command

SHOT-102 uses upper-case, one-byte characters. Some commands need parameters. Some have several formats and parameters to be selected depending on mode selection.

1) Control (drive system) Command 1

(1) H Command: Machine Home Return Command

Function: Detects the machine zero on the stage, and define the position as the home position. Detection of a machine zero sets the display to "0."

In SHOT-102 mode, axis traveling speed is depending on the speed settings by switches 9 and 10 on DIP Switch 1 and the "D" command. In MINI-5P mode, each axis moves at the following constant conditions: minimum speed (S): 500 pps, maximum speed (F): 5000 pps, acceleration/deceleration time (R): 200 ms. In both modes, axes to home depend on the DIP switch settings.

Format: H: [Axis number to home][Direction of the Axis] : Returns only one axis to home position.
H:W[Specifies direction of LS to use] : Returns both axes to home position.

Use parameters "1" or "2" to specify each axis. For both axes, write "W." Use "+" or "-" as direction parameters. Do not insert a space, etc. between parameters.

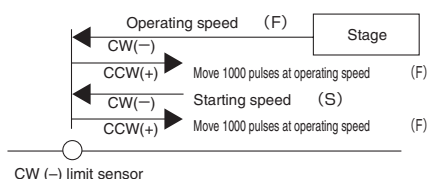
[Example 1] H:1+ : Detects machine zero for Axis 1 in the positive direction.
[Example 2] H:1- : Detects machine zero for Axis 1 in the negative direction.
[Example 3] H:2+ : Detects machine zero for Axis 2 in the positive direction.
[Example 4] H:2- : Detects machine zero for Axis 2 in the negative direction.
[Example 5] H:W+ : Detects machine zero for both axes in the positive direction.
[Example 6] H:W- : Detects machine zero for both axes in the negative direction,

Note: While executing "H:W," sending "L:1" or "L:2" will practically equal to sending an "L:E."

< Detecting the Mechanical Origin >

MINI system

When the command is given to detect the mechanical origin, the stage begins moving clockwise (i.e., in the - direction) at the operating speed (F) specified in the memory switches, stopping when the clockwise (-) limit sensor is detected. It then moves counter-clockwise (i.e., in the + direction) at the operating speed (F) for 1000 pulses. After stopping, it begins moving clockwise (i.e., in the - direction) once more at the starting speed (S), stopping when the clockwise (-) limit sensor is reached. It then moves counter-clockwise (i.e., in the + direction) at the operating speed (F) for 1000 pulses. This position is taken as the mechanical origin (SGSP series).



(2) M Command: Command to Set Relative Move Pulse Count

Function: A command to specify axes to move, moving directions and relative moving distances. After executing this command, make sure to add the driving command, "G." The movement is acceleration/deceleration drive. Set a pulse count for a relative moving distance (a pulse count should be +/- 16777214).

When the H, R, M, A J, L, E or C command is executed before the G command execution, the latest settings specified by the M command immediately before are canceled.

Format: M:[Axis number to move][Direction of move]P[Pulse count for moving] : Moves only one axis.
M:W[Direction of Axis 1]P[moving pulse count for Axis 1][Direction of Axis 2]P[moving pulse count for Axis 2] : Moves both axes.

Note: If you set a pulse count exceeding the movable range of the stage, the stage will be forced to stop once it is detected by the limit sensor. Valid ranges of pulse counts are depending on stage specifications. Check for the specifications of each stage.

- [Example 1] M:1+P1000 : Moves Axis 1 1000-pulse in the positive direction.
G: : Starts driving
- [Example 2] M:2-P9000 : Moves Axis 2 9000-pulse in the negative direction.
G: : Starts driving
- [Example 3] M:W+P500-P200 : Moves Axis 1 500-pulse in the positive direction, and Axis 2 200-pulse in the negative direction.
G: : Starts driving
- [Example 4] M:W+P50-P20 : Moves Axis 1 50-pulse in the positive direction, and Axis 2 20-pulse in the negative direction.
G: : Starts driving

(3) A command: Absolute Value Moving Command

Function: A command that specifies stage movement destination with a coordinate absolute value. After executing this command, make sure to add the driving command, "G." When the H, R, M, A, J, L, E or C command is executed before the G command execution, the latest settings specified by the A command immediately before are canceled.

Format: A:[Axis number to move][Direction of move]P[Coordinate of destination] : Drives only one axis.
A:W[Direction of Axis 1]P[Coordinate of destination][Direction of Axis 2]P[Coordinate of destination] : Drives both axes.

[Example 1] A:1+P1000 : Axis 1 will move to the 1000-pulse coordinate position in the positive direction.
G: : Starts driving
[Example 2] A:2-P9000 : Axis 2 will move to the 9000-pulse coordinate position in the negative direction.
G: : Starts driving
[Example 3] A:W+P5000-P200 : Axis 1 will move to the 500-pulse coordinate position in the positive direction, and
Axis 2 will move to the 200-pulse coordinate position in the negative direction.
G: : Starts driving
[Example 4] A:W+P50-P20 : Axis 1 will move to the 50-pulse coordinate position in the positive direction, and
Axis 2 will move to the 20-pulse coordinate position in the negative direction.
G: : Starts driving

(4) J command: Jogging Command

Function: A command that moves stages in continuous (constant speed) driving mode at the minimum speed (S). After executing this command, make sure to add the driving command, "G." The stage will stop by an L command. For MINI-5P mode, the command is "G."

Format: J:[Axis number to move][Direction of move] : Drives only one axis in jogging mode.
J:W[Direction of Axis 1][Direction of Axis 2] : Drives both axes in jogging mode.

[Example 1] J:1+ : Axis 1 will jog in the positive direction.
G: : Starts driving
[Example 2] J:2- : Axis 2 will jog in the negative direction.
G: : Starts driving
[Example 3] J:W+ : Axis 1 will jog in the negative direction, and Axis 2 will jog in the positive direction.
G: : Starts driving

(5) G Command: Driving Command

Function: Executing a driving command starts stages, which will stop after moving a preset pulses. An M, A or J command should be followed by a G command. A colon (":") is not necessary for a G command in MINI-5P mode.

G: : Starts to drive stages.

(6) R command: Electronic (Logical) Zero Return

Function: Set the stopping position as the origin of the coordinate system. On turning ON the power, the position then will become the origin (displayed "0"). Executing this command will set the display value to "0."

R:1 : Sets Electronic (logical) zero for Axis 1.
R:2 : Sets Electronic (logical) zero for Axis 2.
R:W : Sets Electronic (logical) zero for both Axes 1 and 2.

(7) L Command: Slow Stop Command

Function: Executing the L command will decelerate and stop stages. Deceleration time is the acceleration/deceleration time being set by switches 9 and 10 on DIP Switch 1, or by the "D" command.

L:1 : Decelerates and stops Axis 1.
L:2 : Decelerates and stops Axis 2.
L:W : Decelerates and stops both Axes 1 and 2.

Note: While executing the H: command, sending "L:1" or "L:2" will practically equal to sending an "L:E."

(8) L: E: Emergency Stop Command

Function: Stops stages in any states. The stopped stage position does not coincide with the coordinate value being displayed.

L:E : Terminates the movement of both Axes 1 and 2 in emergency stop mode.

(9) D Command: Command to Set Speed

Function: On turning ON the power, SHOT-102 will default a minimum speed (S), maximum speed (F), and acceleration/deceleration time (R), all set by switches 9 and 10 on DIP Switch 1 for each speed range. If you want to change these initial settings, use the D command. The methods of parameter settings vary depending on mode selection.

Effective parameter ranges are as follows:

Minimum speed (S)	1-20000 pps
Maximum speed (F)	1-20000 pps
Acceleration/Deceleration time (R)	0-5000 ms

Note: The maximum speed (F) setting should be equal to or greater than the minimum speed (S). If the (S) is greater than the (F), an error occurs and you can not change parameters. If the minimum speed is set to equals to the maximum or the acceleration/deceleration time is set to zero, stages will move at a constant speed without performing acceleration/deceleration logically. When the minimum speed (S) is smaller than 50 pps and the maximum speed (F) is equal to or greater than 200 pps, the starting speed is set to 50 pps forcibly.

In MINI5P mode

Format: D:[Dummy] S [Minimum speed] F [Maximum speed] R [Acceleration/Deceleration time] S [Minimum speed for Axis 2]
 |----- Axis 1 parameters -----|-----
 F [Maximum speed] R [Acceleration/Deceleration time]
 ----- Axis 2 parameters -----|

If you want to use Axis 1 only, input parameters for Axis 2 as dummy data.

In MINI-5P mode, input dummy parameter of "1" or "2" (Refer to [Example 1]) after "D:" to set each parameter.

[Example 1] D:1S100F1000R200S100F1000R200 : Sets speeds for Axes 1 and 2 in MINI-5P mode.
 (1 : Dummy data, Axis 1: S = 100 pps/ F = 1000 pps/ R = 200 ms, Axis 2: 2S = 100 pps/F=1000 pps/R = 200 ms)

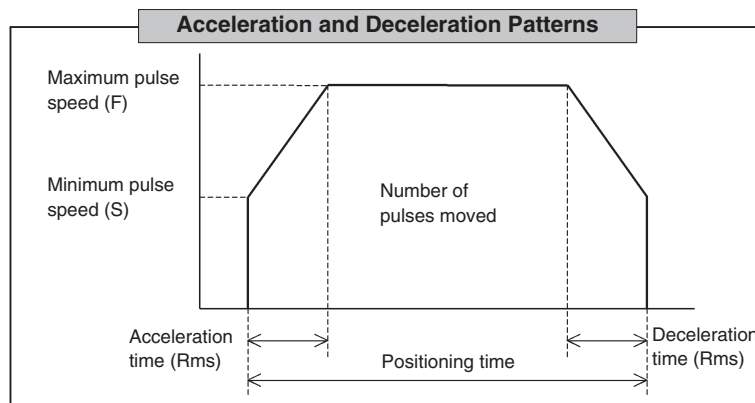
In SHOT-102 mode

Format: D:[Specified Axis] S [Minimum speed] F [Maximum speed] R [Acceleration/Deceleration time] S [Minimum speed for Axis 2]
 |----- Axis 1 parameters -----|-----
 F [Maximum speed] R [Acceleration/Deceleration time]
 ----- Axis 2 parameters -----|

[Example 1] D:1S100F1000R200 : Sets speeds for Axis 1 in SHOT-102 mode.
 (Axis 1: S = 100 pps/F = 1000 pps/ R = 200 ms)

[Example 2] D:2S100F1000R200 : Sets speeds for Axis 2 in SHOT-102 mode.
 (Axis 2: S = 100 pps/F = 1000 pps/ R = 200 ms)

[Example 3] D:WS100F1000R200S100F1000R200 : Sets speeds for Axes 1 and 2 in SHOT-102 mode.
 (Axis 1: S = 100 pps/F = 1000 pps/ R = 200 ms, Axis 2: 2S = 100 pps/F=1000 pps/R = 200 ms)



(10) C Command: Motor Free/Hold (Deenergize/Energize) Command

Function: Deenergizes (motor free) or Energizes (hold) the motor.

Execute this command to move (rotate) stages manually. Once executed, the actual stage position does not coincide with the coordinate value being displayed. For proper positioning, perform zero return and make the stage position consistent with the coordinate value being displayed.

Format: C:[Axis number][Deenergize/Energize]

Parameters are "1" or "2" for each axis, "W" for both axes, and "0/1" to deenergize/energize (free/hold) the motor.

[Example 1]	C:10	: Sets the Axis 1 motor to free state.
[Example 2]	C:11	: Energizes the Axis 1 motor (hold state).
[Example 3]	C:20	: Sets the Axis 2 motor to free state.
[Example 4]	C:21	: Energizes the Axis 2 motor (hold state).
[Example 5]	C:W0	: Sets both the Axis 1 and 2 motors to free state.
[Example 6]	C:W1	: Energizes both the Axis 1 and 2 motors (hold state).

2) Checking Command

(1) Q Command: Status 1 Command

Function: A command to check the validity of an immediately preceding command, and request a controller to return the state of stage operations, coordinates of axes, etc.

Format: Q:

Return data format:

<div>—</div> 100	<div>—</div> 200	ACK1	ACK2	ACK3
Axis 1 coordinate/pulse	Axis 2 coordinate/pulse	Alphabetical data		

Coordinate of Axis 1 : 10-digit data including a sign (if positive, insert a space)

Coordinate of Axis 2 : 10-digit data including a sign (if positive, insert a space)

Alphabetical data

ACK1	X	: Command or parameter error
	K	: Received a command successfully
ACK2	L	: Axis 1 is stopped by LS
	M	: Axis 2 is stopped by LS
	W	: Both axes are stopped by LS
	K	: Normal stop
ACK3	B	: Unable to receive H, R, D, M, J or C commands (Busy)
	R	: Able to receive all commands (Ready)

[Example] 9170,- 7078,K,K,R :Position of Axis 1 is +9170, Axis 2 is -7078, command received successfully, normal stop, able to receive all commands (Ready)

(2) ! Command: Status 2 Command

Function: If you execute this command, the controller will return "B" if the operation status of the stage is Busy.

Format: !:

[Example]	B	: Busy. Only the L, E, Q, ! or ? commands are acceptable.
	R	: Ready. Able to accept all commands.

(3) ? Command: Command to Acquire Internal ROM Version

Function: The command to request an internal ROM version from the controller.

Format: ? :V

[Example]	V2.00	: Internal ROM version 2.00
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Section 4: Specifications

4-1 General Specifications

Power Source	: 100 VAC, 50/60 Hz, 50VA
Operating Temperature	: 5 to 40 °C
Ambient Humidity	: 20 to 85% RH (without condensation)
Storage Temperature	: -20 to 60 °C
Outer Dimensions	: 200 W x 52 H x 172 D (in mm) ※ Excluding protrusions
Weight	: 2.0 kg
Installation Category	: II
Pollution degree	: 2

Driver Specifications

Applicable Motor	: 5-phase stepping motor
Driving Method	: Half/Full step drive
Driving (RUN) Current	: 0.17-0.85 A/phase
Stopping (STOP) Current	: 0.09 (at 0.17A RUN current)-0.69 (at 0.85A RUN current) A/phase
Current Down Function	: Automatic current down
Motor Free Function	: Switchable motor state (Hold/Free) with C command
Power Output for Sensor	: Switchable
	: DC+24 V (inserted 1.1 k ohm resistor in series)
	: or
	: DC+5 V (inserted 100 ohm resistor in series)
Output Current for Sensor	: For 24 V : 20 mA
	: For 5 V : 50 mA
	: Output voltage for Axis 1/2 can be set independently by switch.

Interfacing Specifications

RS232C Interface

Connector	: 9-pin, D-Sub, female connector (inch screw threads)
Baud Rate	: 4800/9600/19200/38400 (Set with switches 4/5 on DIP switch)
Data Length	: 8 bits
Parity	: None
Stop Bit	: 1 bit
Delimiter	: CR+LF (EOI)/CR (EOI)/LF (EOI)
Flow control	: By hardware (via RTS/CTS)

GP-IB Interface

Available Address	: 8/9/10/11	Set by switches 6/7 on DIP switch
Delimiter	: CR+LF (EOI)/CR (EOI)/LF (EOI)/EOI	

Details of RS232C Connector

Pin No.	Name
1	NC
2	TXD
3	RXD
4	DSR
5	SG
6	DTR
7	CTS
8	RTS
9	NC

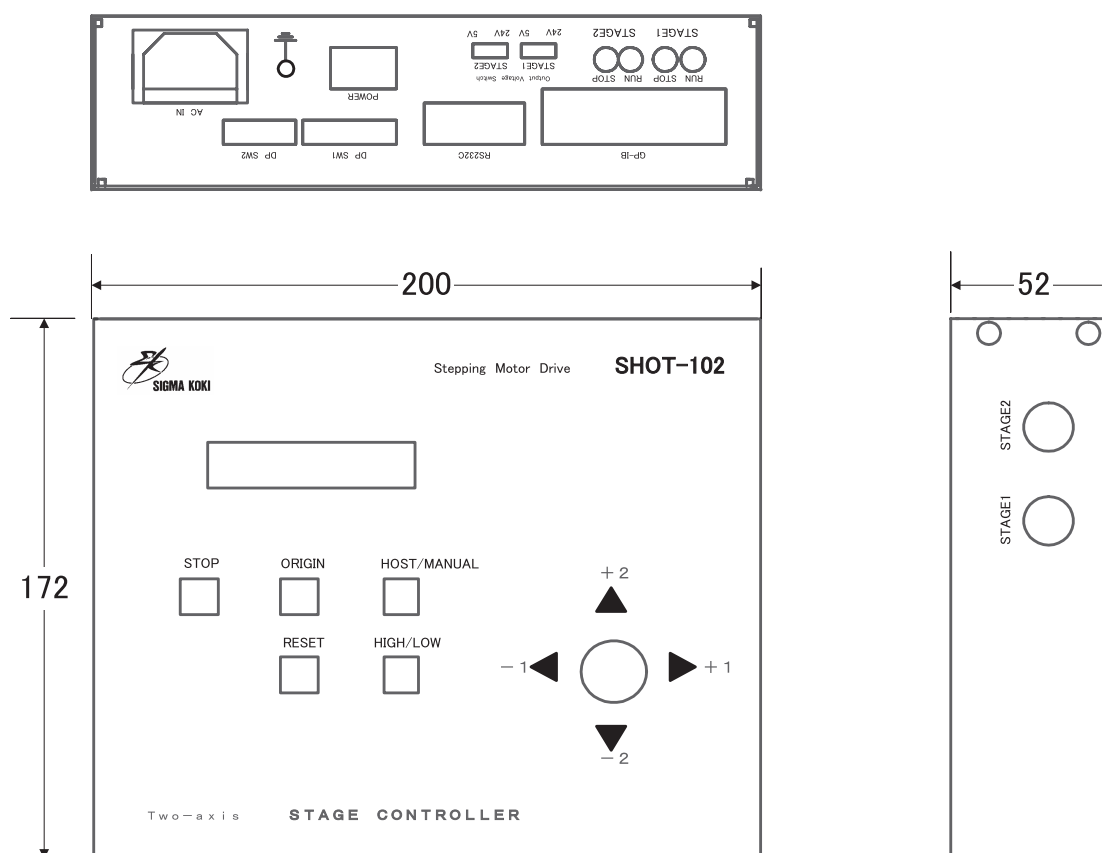
Connector Type: 9-pin,D-SUB female connector (inch screw threads)

4-2 Performance Specifications

Number of Controllable Axes	: 2 axes (maximum)
Coordinate setting Range	: +/- 16777124 pulses
Maximum Display Range	: 8-digit (including sign/decimal point) x 2 lines
Minimum Driving Frequency	: 1 pps
Maximum Driving Frequency	: 20 kpps
Acceleration/deceleration time	: 0-5000 ms
Sensor input	: CCW(+) limit sensor (motor side) : CW(-) limit sensor
Sensor Logic	: Normal Close
Homing Method	: MINI method
Axis to Home	: Effectiveness is selectable with switches 5/6 on DIP switch 2.

4-3 SHOT-102 Case Drawing

※ Excluding protrusions



Weight : 2.0 k g

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