User's Manual

Two-axis Stage Controller

SHOT-702H

HOURS
www.hours-shop.com

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Contents

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.

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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.

Chapter 1: Before you begin

1. Package contents

Purchasers of the Stage Controller should find that the package contains the items listed below. Check the package contents using the following checklist. Contact your retailer as soon as possible, if any item is missing or damaged.

☐SHOT-702H Stage Controller :1

☐User's Manual (This Manual) :1

☐Dedicated AC adaptor :1

About the setting of the Memory Switch of this controller, you can set it by sample software.

Sample software (SG Sample) are available for download our website.

WEB **https://jp.optosigma.com/en_jp/software__sample**

2. Overview

This controller is two axes stage controller, which has drivers for five-phase stepping motor.

Because this controller has a micro-step driver built-in, the smooth movement in high resolving power is possible.

When the SHOT-702H is connected to an ordinary personal computer via an RS232C, USB (Virtual COM) interface, the stage can be accurately moved to the desired position by simple commands sent from the PC.

In addition, manual operation is possible facility by connecting JOYSTICK / DIAL / BUTTON (an optional product) and so.

3. The SHOT-702H system

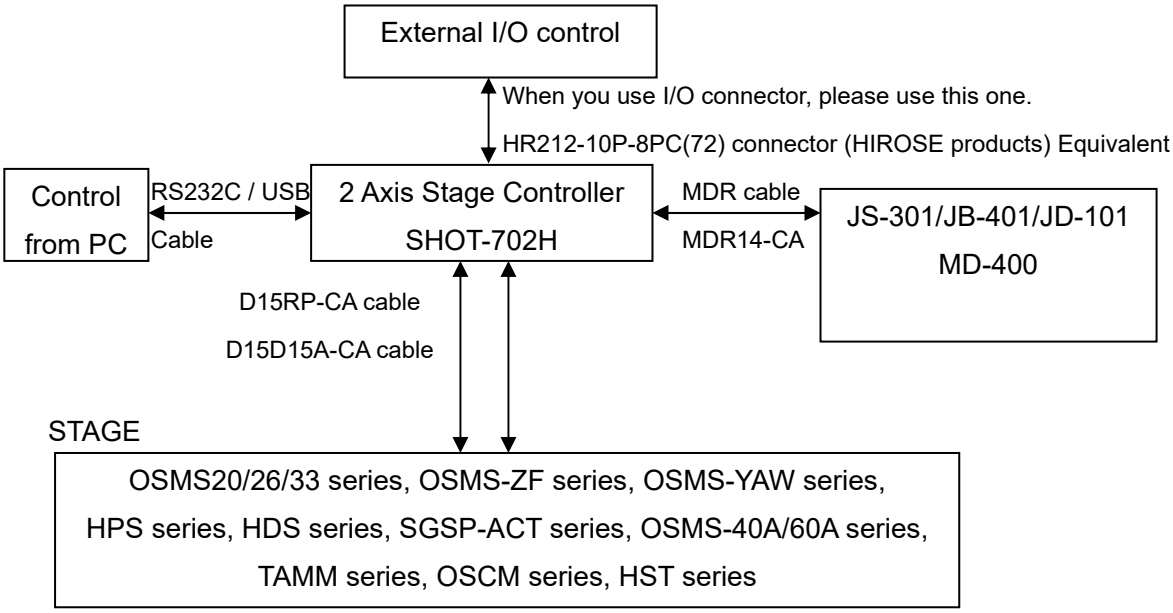


Figure 3-1：The SHOT-702H system

4. Parts of the SHOT-702H

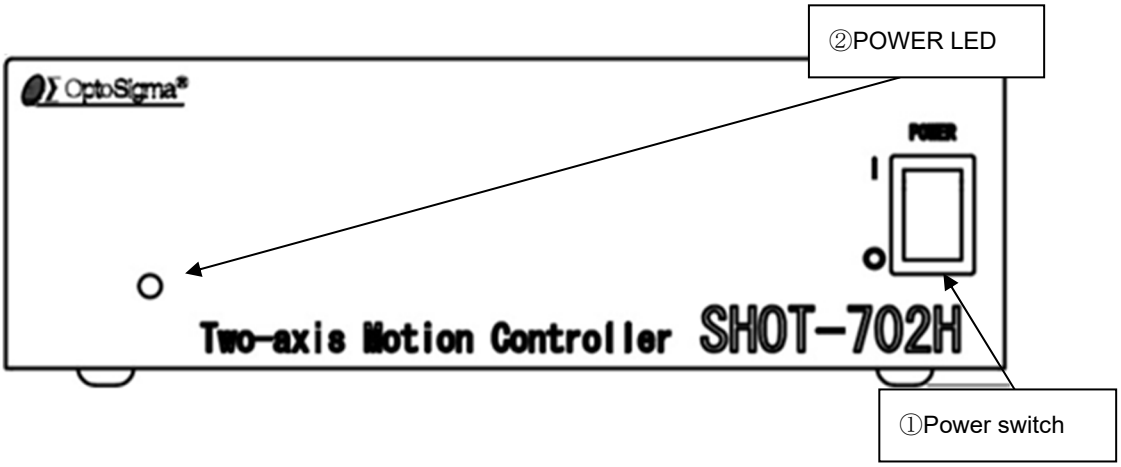


Figure 4-1：SHOT-702H front panel

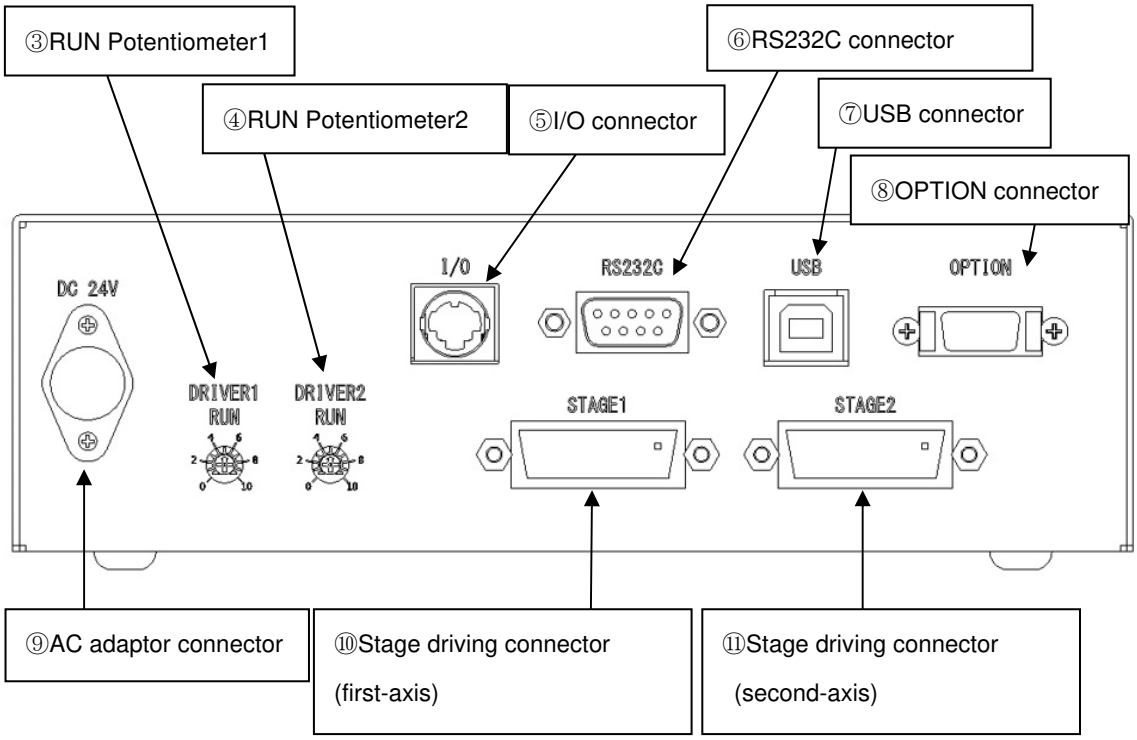


Figure 4-2：SHOT-702H rear panel

Functions:

① Power switch: The product is on when the switch is set to ON. Set the switch to OFF to turn the product off.

② POWER LED: Lights up when powered.

③ ,④RUN Potentiometer: The current delivered when the motor is moving can be set by adjusting RUN potentiometer.

⑤ I/O connector: The connector accepts a cable for sending and receiving I/O and control signals to form an external device.

⑥ RS232C connector: This connector is used when the device is controlled from the computer via an RS232C interface.

⑦ USB connector: When control by USB (Virtual COM) Interface trough PC, please use USB cable.

⑧ OPTION connector: This connector is used to connect JS-301 or JB-401 or JD-101 or MD-400. (peripheral device)

⑨ AC adaptor connector: connect for AC adaptor

⑩ ⑪Stage driving connector: Connect to the motorized stage of your choice. Supports up to two axes.

Chapter 2: Basic Operations

5. SHOT-702H connection procedure

5-1. Connecting to motorized stages

First, connect SHOT-702H to the motorized stages.

①Please confirm the power switch of the SHOT-702H is turning off.

②Connect a standard cable (D15RP-CA / D15D15A-CA) to the connector of the motorized stage.

③Connect the stage to be controlled as the first-axis to the STAGE1 connector of the SHOT-702H controller. Also connect the stage controlled as the second-axis to the STAGE2 connector.

5-2. Connecting to PC and peripheral device

Connect SHOT-702H to PC and peripherals (JS-301 / JB-401 / JD-101 / MD-400).

RS232C or USB interface and is used for the connection between the PC and SHOT-702H.

① Please confirm the power switch of the SHOT-702H is turning off.

② Use a genuine cable RS232C/STR, or 9-pin, D-SUB straight cable with male/female ends using inch screw threads.

(Genuine cable：RS232C/STR)

When you use USB cable, use Type-A (male)– Type-B(male) cable.

(Genuine cable：USB)

③ (1) RS232C connector

Connect the male connector of communications cable into the RS232C connector on the SHOT-702H. Connect the female end into the serial port on your PC.

(2) USB connector

When you use USB cable, connect the male of Type-B on the SHOT-702H USB connecter and connect the male of Type-A with USB connecter on PC.

When you control with PC by USB cable, it needs driver installation.

First, please download the driver from FTDI's website (VCP Drivers) (see figure 5-1).

Then, perform the installation of the driver by this .exe file.

Finally, once the installation is performed, please check the com port in windows device manager.

The FTDI website https://ftdichip.com/drivers/vcp-drivers/

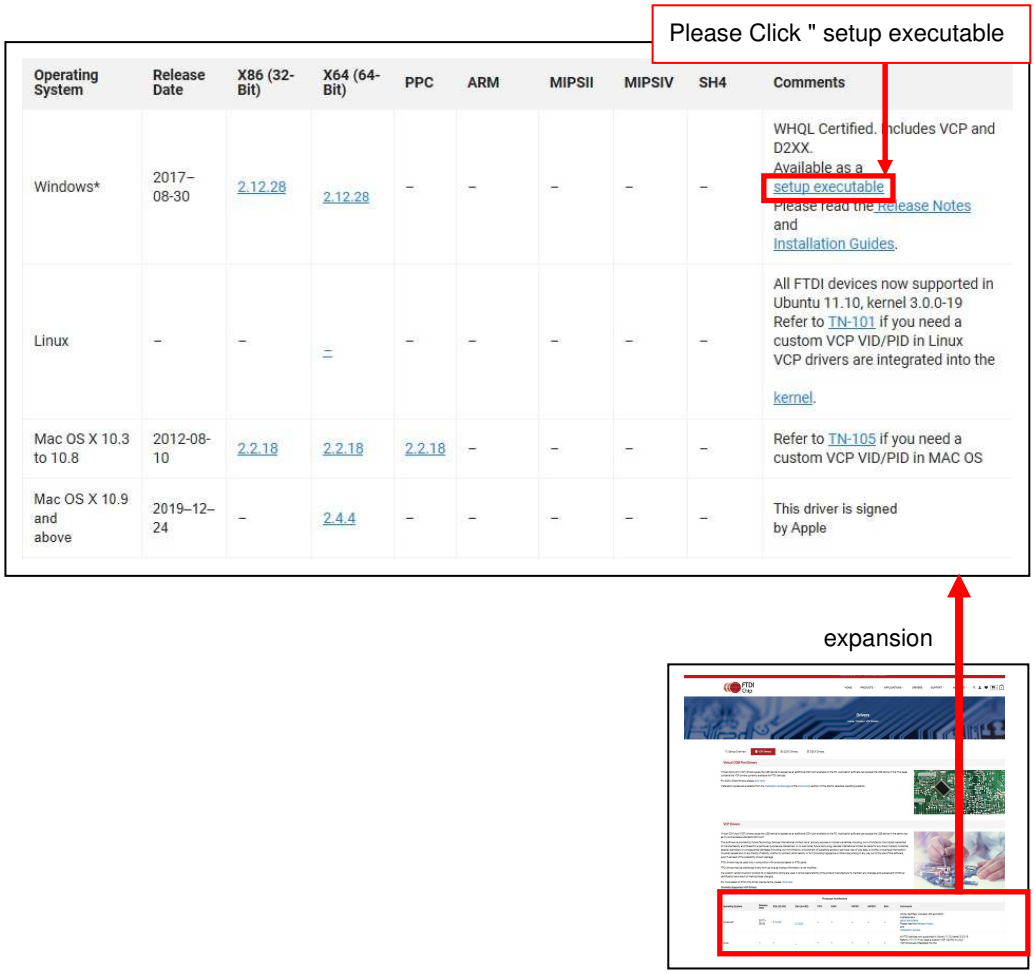


Figure 5-1 : download

Please connect peripheral device according to the procedure from ④ to ⑤ if you use it.

④ Please use a special cable MDR14-CA for the connection of peripheral device.

⑤ The one side of MDR14-CA is connected with the connector of the peripheral device.
The connector on the other side of MDR14-CA is connected with the OPTION connector of SHOT-702H.

5-3. Connecting power cable

Connect the AC adaptor to the AC adaptor connector on the rear panel of SHOT-702H and connect plug of the AC adaptor connector AC cable into an outlet. (Ensure that it is grounded.)

6. SHOT-702H setting

Adjust the drive RUN current and memory switch of controller for each of the connected motorized stages.

The STOP current is 50[%] of the RUN current.

6-1. Setting the drive current

Set current values supplied from SHOT-702H to stages. Turn a RUN current volume, on the rear panel of the unit, to adjust RUN current corresponding to the stages to use.

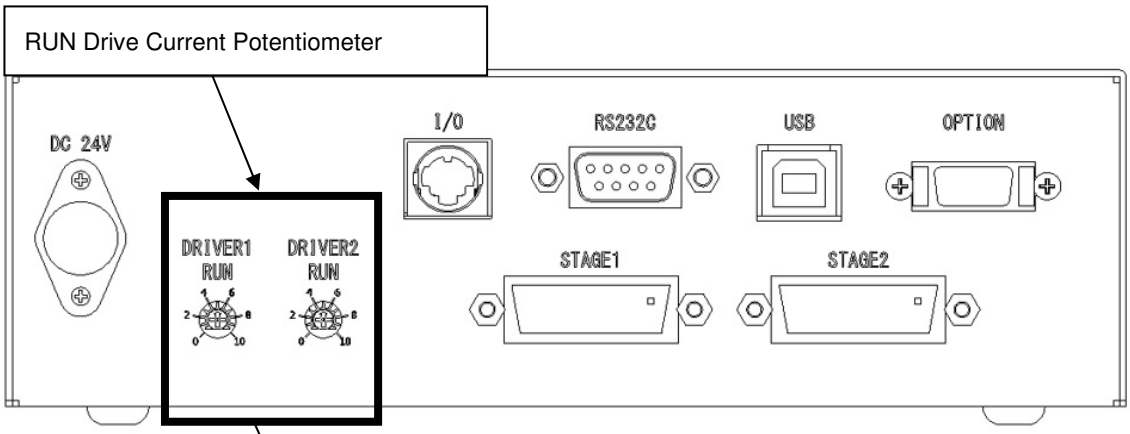


Figure 6-1-1：SHOT-702H rear panel

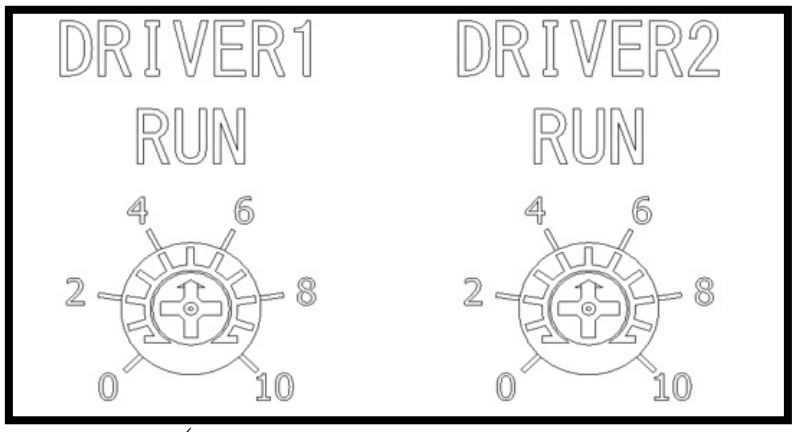


Figure 6-1-2：RUN Drive Current Potentiometer

Driving current settings (RUN current)

Driving current can be set with RUN potentiometer. Its factory default is set to 0.75[A/Phase].

Table 6-1：Driving current settings

Pot. Scale	0	1	2	3	4	5	6	7	8	9	10
RUN current [A/Phase]	0.25	0.27	0.3	0.35	0.55	0.75	0.95	1.1	1.25	1.3	1.4

Note: The STOP current is 50[%] of the RUN current.

6-2. Setting Memory Switch

The Memory Switches store the controller settings.

When changing Memory Switch settings use the Sample software (SG Sample), which can be downloaded from **https://jp.optosigma.com/en_jp/software__sample**

Memory Switch able to set by the (JS-301 / JB-401 / MD-400) without PC with (SG Sample).

Please check each other Manual.

6-3. Memory Switch list

The memory switch has 46 setting items in all. Please set a necessary item.

Table 6-3-1 : Memory Switch list

No	Memory switch setting	Range/ options	Default value
1	SPD SEL	1～4	1
2	SPD1 S	1～500000	100
3	SPD1 F	1～500000	1000
4	SPD1 R	1～1000	200
5	SPD2 S	1～500000	500
6	SPD2 F	1～500000	5000
7	SPD2 R	1～1000	200
8	SPD3 S	1～500000	750
9	SPD3 F	1～500000	7500
10	SPD3 R	1～1000	200
11	SPD4 S	1～500000	1000
12	SPD4 F	1～500000	10000
13	SPD4 R	1～1000	200
14	COM/ACK	MAIN/SUB	MAIN
15	STG UT1	PULSE/MICRO/DEG	PULSE
16	STG UT2	PULSE/MICRO/DEG	PULSE
17	DIVIDE1	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	2
18	DIVIDE2	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	2
19	B RATE1	1～1000	20
20	B RATE2	1～1000	20
21	LS LVL1	NM OPEN/NM CLOSE	NM CLOSE
22	LS LVL2	NM OPEN/NM CLOSE	NM CLOSE
23	OS LVL1	NM OPEN/NM CLOSE	NM OPEN
24	OS LVL2	NM OPEN/NM CLOSE	NM OPEN
25	NS LVL1	NM OPEN/NM CLOSE	NM OPEN

No	Memory switch setting	Range/ options	Default value
26	NS LVL2	NM OPEN/NM CLOSE	NM OPEN
27	MOVE1	POS/NEG	POS
28	MOVE2	POS/NEG	POS
29	ORG1SEL	MINI/MARK/NORM/CENTER/OFF	MINI
30	ORG2SEL	MINI/MARK/NORM/CENTER/OFF	MINI
31	OSPD1 S	1～500000	500
32	OSPD1 F	1～500000	5000
33	OSPD1 R	1～1000	200
34	OSPD2 S	1～500000	500
35	OSPD2 F	1～500000	5000
36	OSPD2 R	1～1000	200
37	ORG OP1	0～32000	0
38	ORG OP2	0～32000	0
39	ACC CN1	LINEAR /S CURVE	LINEAR
40	ACC CN2	LINEAR /S CURVE	LINEAR
41	EMG EX1	ON/OFF	ON
42	EMG EX2	ON/OFF	ON
43	OUT LVL	NM LOW / NM HIGH	NM HIGH
44	FLW CTL	ON/OFF	ON
45	INTFACE	RS232C/USB	RS232C
46	EB OUT	ON/OFF	OFF

NOTE：Baud rate fixed 38400[bps]. Delimiter fixed CR+LF.

6-4. Memory Switch settings in detail

The numbers in each heading indicate the number of the memory switch setting item for the SHOT-702H.

1) SPD SEL: Speed selection

Choose the initial speed setting used at power on.

[Options] 1 ～ 4

2~13) SPD1～4 (S) (F) (R): Speed settings

Operating speed with peripheral device after power turned on is according to the SPEED SEL memory switches. (JS-301 / JB-401 / JD-101 / MD-400)

Set the travel speed of stage (minimum S, maximum F, and acceleration/deceleration time R)

[Options] S: 1 to 500000 [PPS]

F: 1 to 500000 [PPS]

R: 1 to 1000 [ms]

Note: The minimum speed (S) must be less than or equal to the maximum speed (F).

14) COM/ACK: Choose the communication protocol used when communicating with the computer.

Specify whether the controller will return OK/NG in response to command signals sent from the computer in HOST (COMPUTER) mode.

[Options] MAIN: Return OK/NG when using interface

SUB: Do not return OK/NG when using interface (GSC-02 Compatible)

15) STG UT1: Select the units used for display (first-axis)

16) STG UT2: Select the units used for display (second-axis)

Choose the units used to display position coordinates of peripheral device (JS-301 / JB-401 / MD400).

No need to set the units in case that there is no using of peripheral device

[Options] PULSE: Displays number of pulses

MICRO: Displays number of micro [μm]

DEG: Display number of degree [°]

17) DIVIDE1: Select number of steps for 1

18) DIVIDE2: Select number of steps for 2

[Options] 1,2,4,5,8,10,20,25,40,50,80,100,125,200,250

Number of steps = Divide = BASE RATE (in 0.1[μm] steps)/ (10 X travel per pulse (in [μm]))

19) B RATE1: Travel per pulse at the base (full) step for the first-axis

20) B RATE2: Travel per pulse at the base (full) step for the second-axis

Input the travel per pulse at the base (full) step for each-axis. (MICRO: in 0.1-[μm] steps, DEG: in 0.001-[degree] steps)

[Options] At a setting of PULSE: Disabled

At a setting of MICRO: 1 to 1000 (0.1 [μm] to 100 [μm])

At a setting of DEG: 1 to 1000 (0.001 [degrees] to 1 [degree])

<Settings example> B RATE = 40 for a directly motorized stage with screw lead of 2[mm]

Table 6-3-2 : B RATE

Stage	XYZ linear stage					Rotation stage
Screw lead	0.5[mm]	1[mm]	2[mm]	6[mm]	10[mm]	-
Base step angles	0.72[°]					
Travel per pulse at base step	1[μm]	2[μm]	4[μm]	12[μm]	20[μm]	0.005[°]
B RATE	10	20	40	120	200	5

21) LS LVL1: Specify the input logic for the first-axis limit sensor

22) LS LVL2: Specify the input logic for the second-axis limit sensor

Select the conditions (input logic) for the limit sensor for each-axis.

[Options] NM OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

NM CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

Motorized stages that support normal closed method: OSMS / SGSP / TSDM / TAMM / HPS / HDS / OSMS-40A, 60A / HST series .

23) OS LVL1: Specify the input logic for the first-axis ORG sensor

24) OS LVL2: Specify the input logic for the second-axis ORG sensor

Select the conditions (input logic) for the ORG sensor for each-axis.

[Options] NM OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

NM CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

SIGMAKOKI's Motorized stages that support normal open method

25) NS LVL1: Specify the input logic for the first-axis NEAR sensor

26) NS LVL2: Specify the input logic for the second-axis NEAR sensor

Select the conditions (input logic) for the NEAR sensor for each-axis.

[Options] NM OPEN: Normal open (switches ON from default value of OFF when limit sensor is detected)

NM CLOSE: Normal close (switches OFF from the default value of ON when limit sensor is detected)

27) MOVE1: Direction of travel for first-axis

28) MOVE2: Direction of travel for second-axis

Select the + direction for each-axis

[Options] POS: Positive (forward) rotation

NEG: Negative (reverse) rotation

29) ORG1 SEL: Specify method used for return to first-axis origin

30) ORG2 SEL: Specify method used for return to second-axis-origin

[Option] MINI: MINI method

MARK: MARK method

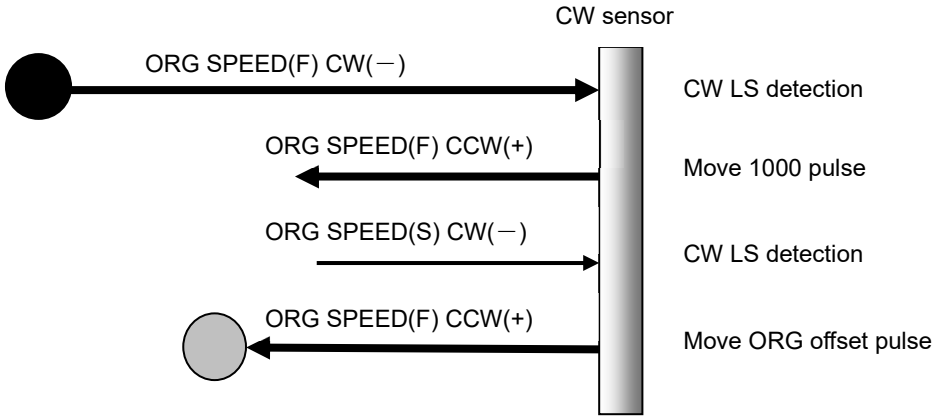
NORMAL: Standard method (NORMAL method)

CENTER: Median point detection method (CENTER method)

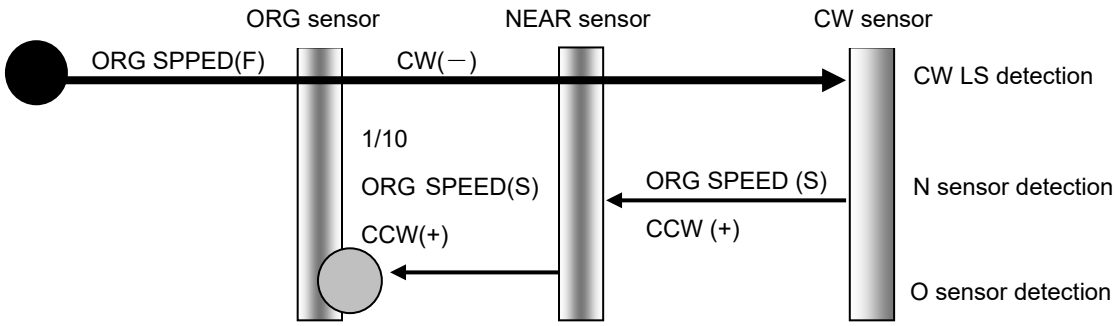
OFF: Not return origin

See the description below.

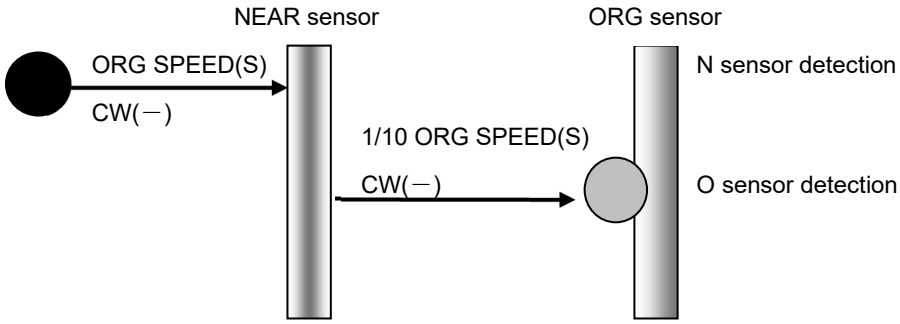
・MINI method



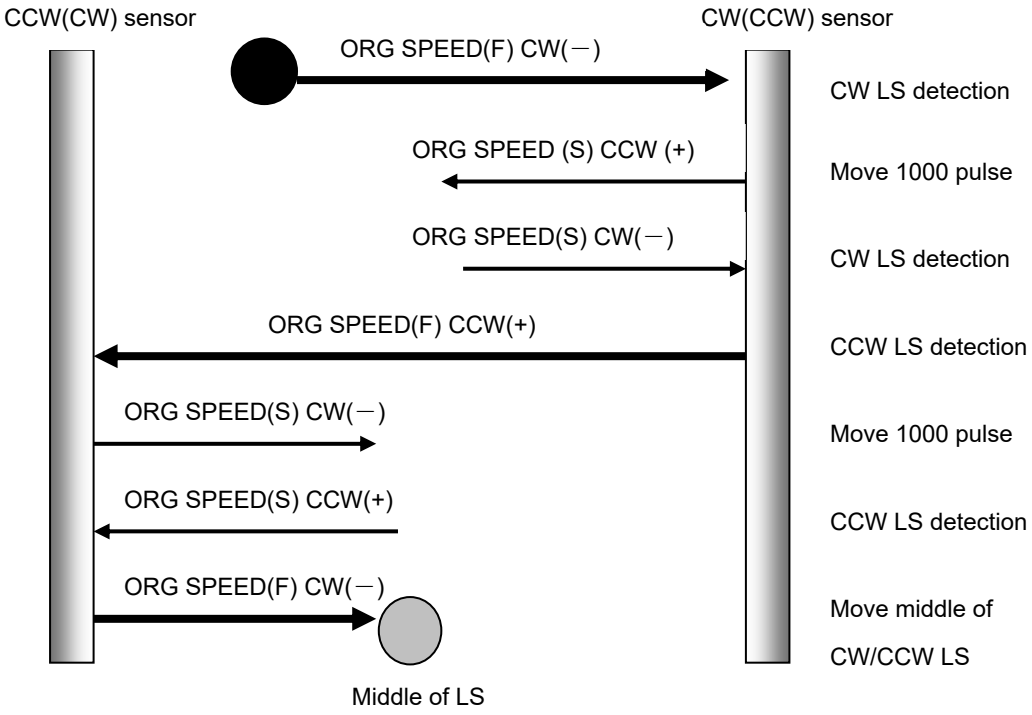
・MARK method



・standard method (NORMAL method)



・**median point detection method (CENTER method)**



31)～36) OSPD1/2 (S)(F)(R): Specify speed when returning to origin

Set the travel speed of stage (minimum S, maximum F, and acceleration/deceleration time R)

When returning to the mechanical origin for the stage on each-axis.

[Options] S: 1 to 500000 [PPS]

F: 1 to 500000 [PPS]

R: 1 to 1000 [ms]

Note: The minimum speed (S) must be less than or equal to the maximum speed (F).

37) ORG OP1: Set ORG offset pulse of the first-axis when MINI method set

38) ORG OP2: Set ORG offset pulse of the second-axis when MINI method set

Set the travel (number of pulses) of ORG offset of each-axis when MINI method set.

Default value is 0. Divide × 500 [pulse] move

[Option] 0 to 32000 (unit:1=100 [pulse])

39) ACC CN1: Set the speed-acceleration profile of the first-axis

40) ACC CN2: Set the speed-acceleration profile of the second-axis

[Options] LINEAR: trapezoidal control

S CURVE: S curve control

41) EMG EX1: Set the excitation ON/OFF of the first-axis when the emergency stop

42) EMG EX2: Set the excitation ON/OFF of the second-axis when the emergency stop

[Options] ON: Excitation

OFF: Free motor

43) OUT LVL: I/O output signal level setting

Set the output signal level of I/O function.

[Option] NM LOW: When outputting signal, it becomes LOW.

NM HIGH: When outputting signal, it becomes HI.

44) FLW CTL: Flow control selection

Specify whether the controller will do flow control in RS232C communication.

[Option] ON: Hardware (RTS/CTS)

OFF: None

45) INTFACE: Interface selection

Specify whether the how to connect with controller communication.

[Option] RS232C: RS232C

USB: USB (Virtual COM)

46) EB_OUT: Set the function ON when you use the Electromagnetic brake.

When you use the Electromagnetic brake, use EB-GND and EB-24V of STAGE Connector.

EB-GND: 0[V]

EB-24V: 24[V]

[Option] ON: enable

OFF: not enable

Chapter 3: Using SHOT-702H to position motorized stages

7. Using Computer to position motorized stages

The controller can be connected to a computer using an RS232C or USB (Virtual COM) interface. Motorized stages can then be precisely controlled by commands (strings) transmitted from the computer. The interface communication parameter of the SHOT-702H is described below. Please set the configurations of the PC side according to the following table.

Table 7：communication setting

Parameter	Descriptions
Baud rate	38400 [bps]
Delimiters	CR+LF
Parity	None
Data bits	8bit
Stop bit	1bit
Flow control	Hardware (RTS/CTS) or none (Default value is Hardware)

7-1. List of commands

The following is a list of available commands:

Table 7-1 : List of commands

Command	String	Details
Return to mechanical origin	H :	Detect mechanical origin
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
Jog command	J :	Move at minimum speed (S)
Drive command	G :	Start
Stop command	L :	Stop
Set electronic (logical) origin	R :	Set the electronic (logical) origin to the current position
Speed settings	D :	Set S, F and R
ORG speed setting	V :	Set S, F and R of ORG
Free motor	C :	Excitation ON/OFF
Switch number of steps	S :	Switch number of steps
Status1	Q :	Return current position etc.
Status2	! :	Return B(busy)/R(ready)
Internal information	? :	Check internal information
Output	O :	Output to I/O connector
Input	I :	Input from I/O connector

NOTE: When stage operating status is Busy, if you send other command of L:, Q:, !:, ?:, O:, I:, command status is NG.

7-2. Command format

The communications protocol used between the controller and the computer depends on the memory switch COMM/ACK.

1. When COMM/ACK is set to MAIN:

A protocol is used in which one response is issued for each command.

Command string …… receive

Response string …… sent

The response string when a command is received normally is “OK,” that when the command was not received, “NG.” In some cases, for example in response to confirmation commands, data will be returned instead of “OK.” Commands should only be sent after checking the internal status of the controller.

2. When COMM/ACK is set to SUB:

A protocol is used in which the controller does not respond to each command. you can't get response OK or NG.

Data will however be returned in response to some commands, such as confirmation commands.

To determine whether or not a command was received normally, use the Q command to check status.

7-3. Command in detail

(1) H command: Return to mechanical origin

Features: This command is used to detect the mechanical origin for a stage and set that position as the origin. Once the mechanical origin has been detected, the value displayed will be 0.

When after power on, the stage will move at the speed specified in the OSPD1/2 (S, F, R) on memory switches.

NOTE: During stage operating status is Busy, the command status is NG.

NOTE: During all of electromagnetic current off by C command, motorized stages can't move and the command status is NG.

・Command format

H: 1 Detect the mechanical origin for the first-axis.

H: 2 Detect the mechanical origin for the second-axis.

H: W Detect the mechanical origin for the first and second-axis.

(2) M command: Set number of pulses for relative travel

Features: This command is to specify the axis of travel, direction, and the travel (number of pulses).

This command must always be followed by a drive (G) command.

Travel is by means of acceleration/deceleration driving. The distance traveled is specified in pulses.

NOTE: During stage operating status is Busy, the command status is NG.

NOTE: During all of electromagnetic current off by C command, motorized stages can't move and the command status is NG.

・Command format

M：nmPx

・parameter

n: 1 or 2 or W 1: first-axis, 2: second-axis, W: both first-axis and second-axis

m: + or - +: + direction, -: - direction

x: Travel [pulse] (0 to 268435455)

Ex) M: 1+P1000 Travel 1000 [pulses] in the + direction on the first-axis
G:

Ex) M: W+P500-P200 Travel 500 [pulses] in the + direction on the first-axis and 200 [pulses] in the -direction on the second-axis
G:

(3) A command: Set number of pulses for absolute travel

Features: This command is to specify the-axis of travel, direction, and the travel (number of pulses). This command must always be followed by a drive (G) command. Travel is by means of acceleration/deceleration driving.

NOTE: During stage operating status is Busy, the command status is NG.

NOTE: During all of electromagnetic current off by C command, motorized stages can't move and the command status is NG.

・Command format

A：nmPx

・parameter

n: 1 or 2 or W	1: first-axis, 2: second-axis, W: both first-axis and second-axis
m: + or -	+: + direction, -: - direction
x:	Travel [pulse] (0 to 268435455)

Ex) A: 1-P2000 Travel to the 2000 [pulse] position in the - direction on the first-axis.
G:

Ex) A: W+P1000-P2000 Travel to the 1000 [pulse] position in the + direction on the first-axis and
G: the 2000 [pulse] position in the - direction on the second-axis

(4) J command: JOG

Features: This command drives stages continuously (at a constant speed) at the starting speed (S). This command must always be followed by a drive (G) command.
L command can stop this move. When nothing L command,until get limit sensor signal continue this moving.

NOTE: During stage operating status is Busy, the command status is NG.

NOTE: During all of electromagnetic current off by C command, motorized stages can't move and the command status is NG.

・Command format

J：nm

・parameter

n: 1 or 2 or W	1: first-axis, 2: second-axis, W: both first-axis and second-axis
m: + or -	+: + direction, -: - direction

Ex) J:1+ move in the + direction on the first-axis.
G:

Ex) J:W-+ move in the - direction on the first-axis and in the + direction on the second-axis
G:

(5) G command: Drive

Features: When a drive command is issued, the stage starts moving, moves the specified number of pulses, and then stops. The G command is used after M, A, and J commands.

NOTE: During stage operating status is Busy, the command status is NG.

NOTE: During all of electromagnetic current off by C command, motorized stages can't move and the command status is NG.

・Command format

G:	Drive
G	Drive

(6) L command: Decelerate and stop

Features: When this command is executed, the stage decelerates and stops.

・Command format

L:1	First-axis decelerates and stops
L:2	Second-axis decelerates and stops
L:W	First- and second-axis decelerate and stop

(7) L: E command: Emergency stop

Features: This command stops all stages immediately, whatever the conditions.

・Command format

L:E	Stop first and second-axis immediately

(8) R command: Set electronic (logical) origin

Features: This command is used to set electronic (logical) origin to the current position of each-axis.

NOTE: During stage operating status is Busy, the command status is NG.

・Command format

R:1	Set the electronic (logical) origin for the first-axis
R:2	Set the electronic (logical) origin for the second-axis
R:W	Set the electronic (logical) origins for the first- and second-axis

(9) D command: Speed settings

Features: The minimum speed (S), maximum speed (F), and acceleration/deceleration time (R) are set according to the SPD SEL memory switches when the power is turned on. This command allows you to change these initial settings.

NOTE: During stage operating status is Busy, the command status is NG.

The following options are available:

・Command format

D：nSspd1Fspd2Rspd3

・parameter

n: 1 or 2 or W 1: first-axis, 2: second-axis, W: both first-axis and second-axis

The following options are available:

spd1: Minimum speed(S) 1 to 500000 [PPS]

spd2: Maximum speed（F） 1 to 500000 [PPS]

spd3: Acceleration/deceleration time（R） 1 to 1000 [mS]

Note that the minimum speed (S) must be less than or equal to the maximum speed (F).

Ex) D:1S100F1000R50 Adjust speed settings for the first-axis（S=100[PPS]／F=1000[PPS]／R=50[ms]）

Ex) D:WS100F1000R50S100F1000R50 Adjust speed settings for the first- and second-axis

First-axis speed settings Second-axis speed settings

(10) V command: ORG speed settings

Features: ORG speed (minimum speed (S), maximum speed (F), and acceleration/deceleration time (R)) is set according to the SPEED SEL memory switches when the power is turned on. This command allows you to change these initial settings.

NOTE: During stage operating status is Busy, the command status is NG.

・Command format

V：nSspd1Fspd2Rspd3

・parameter

n: 1 or 2 or W 1: first-axis, 2: second-axis, W: both first-axis and second-axis

The following options are available:

spd1: Minimum speed(S) 1 to 500000 [PPS]

spd2: Maximum speed（F） 1 to 500000 [PPS]

spd3: Acceleration/deceleration time（R） 1 to 1000 [ms]

Note that the minimum speed (S) must be less than or equal to the maximum speed (F).

Ex) V:1S100F1000R50 Adjust ORG speed settings for the first-axis（S=100[PPS]／F=1000[PPS]／R=50[ms]）

Ex) V:WS100F1000R50S100F1000R50 Adjust ORG speed settings for the first- and second-axis

First-axis speed settings Second-axis speed settings

(11) C command: Free/ hold motor (Excitation ON/OFF)

Features: This command is used to excite the motor or to turn excitation off, making it possible to move (rotate) stages manually.

NOTE: During stage operating status is Busy, the command status is NG.

・Command format

C：nm

・parameter

n: 1 or 2 or W 1: first-axis, 2: second-axis, W: both first-axis and second-axis

m: 0 or 1 0: electromagnetic current off, 1: electromagnetic current on

The options available are 0: free motor, and 1: excitation (hold motor).

Ex) C:10 Free first-axis motor

Ex) C:W1 Excite (hold) both the first- and second-axis motors

(12) S command: Changing the number of steps

Features: Use this command to change motor step angle (number of steps). Select one of the following 15 step angles built into the driver. First specify an axis, then set the value.

When after power on, the stage will move at the Divides in the DIVIDE1/2 on memory switches.

NOTE: During stage operating status is Busy, the command status is NG.

Take care of motor will don't fix during a little bit time, when you change the number of steps.

・Command format

S：nd

・parameter

n: 1 or 2 1: first-axis, 2: second-axis

d: 1/2/4/5/8/10/20/25/40/50/80/100/125/200/250

Ex) S: 120 Divides the step angle of the first-axis into 20 angles.

If the base step (full step) angle is to 0.72 [degrees], the stepping motor makes one full turn every 500 [pulses]. The motor is said to have a minimum resolution of 0.72 [degrees] (if the motor moves 10 [mm] for each turn, minimum resolution=10 [mm] ÷ 500 pulses=20 [μm]). You can change the minimum resolution by dividing the motor step angle (1/2=0.36 [°]).

Table 7-3-1：Step angle

Number of steps	1	2	4	5	8	10	20	25
Step angle [°]	0.72	0.36	0.18	0.144	0.09	0.072	0.036	0.0288
Number of pulses per full turn	500	1000	2000	2500	4000	5000	10000	12500
Number of steps	40	50	80	100	125	200	250	
Step angle [°]	0.018	0.0144	0.009	0.0072	0.00576	0.0036	0.00288	
Number of pulses per full turn	20000	25000	40000	50000	62500	100000	125000	

(13) Q command: Status 1

Features: On receipt of this command, the controller returns the coordinates for each-axis and the current state of each stage.

Q:

— 100, — 200, ACK1, ACK2, ACK3 …… Data returned

First-axis coordinates　Second-axis coordinates　Three-character string data

ACK1 ▪▪▪▪▪▪▪▪▪ X:Command or parameter errors.
K :Command received normally.

ACK2 ▪▪▪▪▪▪▪▪▪ L :First-axis stopped at LS
M:Second-axis stopped at LS
W:First and second axes stopped at LS
K :Normal stop

ACK3 ▪▪▪▪▪▪▪▪▪ B:(BUSY) L, Q, !, ?, O and I commands can be received
R:(READY) all commands can be received

※Coordinate values for each-axis have a fixed length of ten digits, including symbols (Symbols are left-aligned, coordinates values right-aligned).

(Symbol is only at -coordinates and there is no Symbol at + coordinates.)

(14) ! command: Status 2

Features: On receipt of this command, the controller returns the stage operating status.

・Command format

! :

ACK3 ▪▪▪▪▪▪▪▪▪ Data returned

ACK3 ▪▪▪▪▪▪▪▪▪ B:(BUSY) L, Q, ! , ? , O and I commands can be received
R:(READY) all commands can be received

(15) ? command: Request for internal information

Features: This command returns controller settings.

・Command format

? : pn

・parameter

p: Parameter　watch below the table

n: 1 or 2 or W　1: first-axis, 2: second-axis, W: both first-axis and second-axis

When you use (V or -) parameter, N don't need.

Table 7-3-2：List of ? Commands

Parameter	Data returned	Examples
N	Device name	SHOT-702H
V	Version numbers	V1.00
-	Sub version numbers	100
P	Travel per pulse	1.00,1.00
S	Division	2,2
D	Travel speed	S100F1000R200
B	ORG speed	S500F5000R200

(16) O command: Output

Features: This command changes the output status.

・Command format

[Option] O:0 Set the output signal to Normal level (Default value: High)

O:1 Output signal (Default value: Signal will be Low level when outputting signal)

NOTE: The output level is maintained until the next O command is accepted.

(17) I command: Input

Features: This command checks the input status. Signal level is active low.

[Option] I:

0 or 1 …Data returned

0: negative

1: active

8. Using I/O signal

When you use I/O connector, please use this one.

HR212-10P-8PC(72) connector (HIROSE products) Equivalent

SHOT-702H has following I/O signal functions.

Output-1 point

Busy signal output-1 point

Input-1 point (photo-coupler input)

Emergency stop input-1 point (photo-coupler input)

When you use I / O connector, use extra power supply for (pin 6 and 7) that +5 [V].

①Output

This is output port. Output signal can be controlled by O command.

Output logic is switchable by memory switch. Default value is normal HI.

②Busy signal output

Outputting signal when motorized stages moving.

Busy signal level is switchable by memory switch. Default value is normal HI. Output logic is active low.

③Input

This is input port. Input signal can be checked by I command.

Input logic is active low.

When input level is low, photocoupler will get current, after that output will be ON.

④EMG STOP input

EMG STOP is photo-coupler input (Figure:8-2).

EMG STOP turns on when the current passes in photocoupler by EMG STOP terminal being connected to ground. PC or peripheral device can't move Motorized stages when EMG STOP signal turns on.

If EMG STOP signal turn off, motorized stages can move again. However, controller is necessary to turn on the power supply again because it enters the state that cannot be operated due to the communication fault when there are communication statements from PC while EMG STOP turns on.

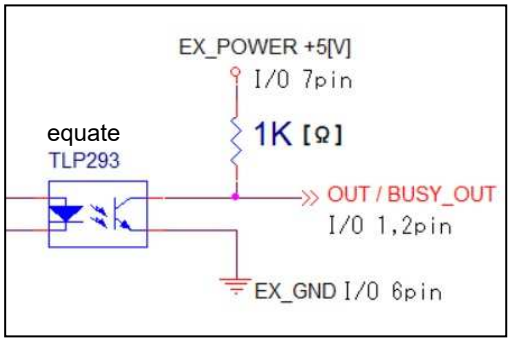


Figure 8-1: OUT/BUSY_OUT circuit

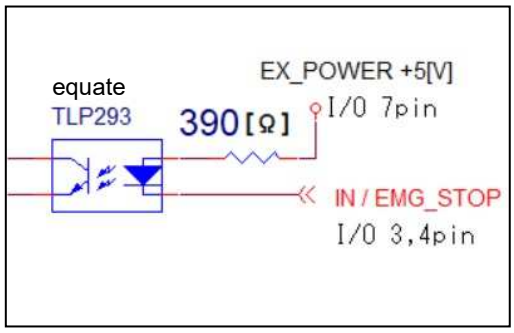


Figure8-2:IN/EMG_STOP

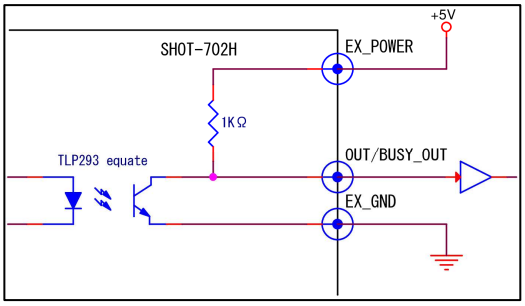


Figure 8-3: OUT/BUSY_OUT example

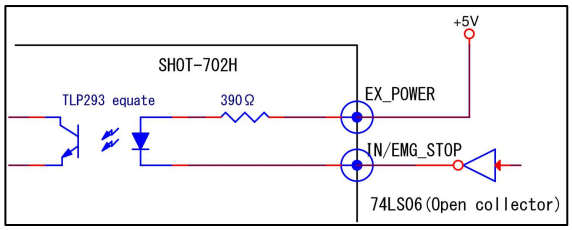


Figure8-4:IN/EMG_STOP example

9. Using peripheral device to position motorized stages

The controller can be connected to a peripheral device (JS-301/JB-401/JD-101/MD-400). Motorized stages can then be manual controlled and displayed the position coordinates for each-axis by peripheral device. For the details, see the User's manual of peripheral device (JS-301/JB-401/JD-101/MD-400).

Chapter 4: Specification

10. Specification

1) General specifications

Power Supply	DC24 [V] / 3.4 [A]
AC adaptor	AC100 to 240[V], 50/60[Hz]
Operating temperature	5 to 40 [℃]
Storage temperature	-20 to 60 [℃]
Ambient humidity	20 to 80 [%RH] (no condensation)
Altitude	up to 2000 [m]
Indoor use only	
Installation category	Ⅱ
Pollution degree	2
External dimensions	180W x119D x55H (excluding projections) [mm]
Weight	1.0 [kg]

(2) Performance

Controlling axis	2 axis
Maximum driving speed (F)	1 to 500000 [PPS]
Minimum driving speed (S)	1 to 500000 [PPS]
Acceleration/deceleration time (R)	1 to 1000 [ms]
Sensor input	Origin sensor/proximity sensor/CW (-) limit/CCW (+) limit (Memory switches can be used to change input logic for sensors.)
Method of return to origin	MINI method/MARK method/Standard method Median point detection method/Not return origin (You can change method of ORG by Memory Switch)
Interface	RS232C / USB (Virtual COM) interface Communication Parameters - Baud rate 38400 [bps] - Data bits 8 bits - Parity None - Stop bit 1 bit - Flow control Hardware - Delimiters CR+LF
I/O	1 input point (photo-coupler input, internal resistance 390 [Ω]) 1 output point (Open-collector output, maximum use conditions DC24 [V] 20 [mA])

Control signals	Emergency stop-1 point
	(photo-coupler input, internal resistance 390[Ω])
	BUSY 1 point
	(Open-collector output, maximum use conditions DC24 [V] 20 [mA])

(3) Driver Specifications

Driver type	Bi-polar pentagon micro-steps system
Driving electric current (output current)	0.25 [A/phase] to 1.4 [A/phase]
Current down (stop current)	STOP current is 50[%] of RUN current.
	STOP current can't alone adjust.
Division (micro-step) settings	1, 2, 4, 5, 8, 10, 20, 25, 40, 50, 80, 100, 125, 200, 250 divisions

(4) Electrical fast transmit/burst immunity EN61000-4-4 (2012) Level2

(5) Electrostatic discharge EN61000-4-2 (2009) Level2.

11. Connector pin numbers and signals

11-1. I/O connector signals

No.	Name	No.	Name
1	OUT	5	-
2	Busy	6	EX_GND
3	IN	7	EX_+5[V]
4	EMG STOP	8	-

HR212-10RA-8SDL (72) (HIROSE products) Equivalent product used

11-2. STAGE1,2 connector

No.	Name	No.	Name
1	Blue: motor wiring	9	EB-GND: Electromagnetic brake
2	Red: motor wiring	10	EB-24V:Electromagnetic brake
3	Orange: motor wiring	11	LS (+): limit detection on +
4	Green: motor wiring	12	LS (-): limit detection on-
5	Black: motor wiring	13	GND: common sensor
6	GND: common sensor	14	NEAR: proximity detection
7	ORG: mechanical origin detection	15	+24[V]: sensor power supply
8	+24[V]: sensor power supply		

XM3B-1522-112 connector (OMRON products) Equivalent product used

11-3. RS232C connector

No.	Name	No.	Name
1	-	6	DTR
2	TxD (OUT)	7	CTS (IN)
3	RxD (IN)	8	RTS (OUT)
4	DSR	9	-
5	SG		

XM3B-0922-132 connector (OMRON products) Equivalent product used

11-4. USB connector

No.	Name	No.	Name
1	-	6	DATA+
2	DATA-	7	GND

XM7B-0442 connector (OMRON products) Equivalent product used

11-5. OPTION connector

No.	Name	No.	Name
1	GND	8	GND
2	+5[V]	9	+5[V]
3	RXD+	10	RXD-
4	TXD+	11	TXD-
5	STOP	12	CONNECT
6	-	13	-
7	-	14	-

10214-52A2PL (3M Japan products) Equivalent product used

11-6. AC adaptor connector

No.	Name	No.	Name
1	GND	3	GND
2	+24V[V]	4	+24[V]

Power DIN jack 4 pin used

12. Exterior dimensions