SC12205-K10-15002 1st

User's Manual

Three-axis Stage Controller

HSC-103

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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 indicates 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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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.

Chapter 1: Before You Begin

1-1.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 in the event that you should find that any item is missing or damaged.

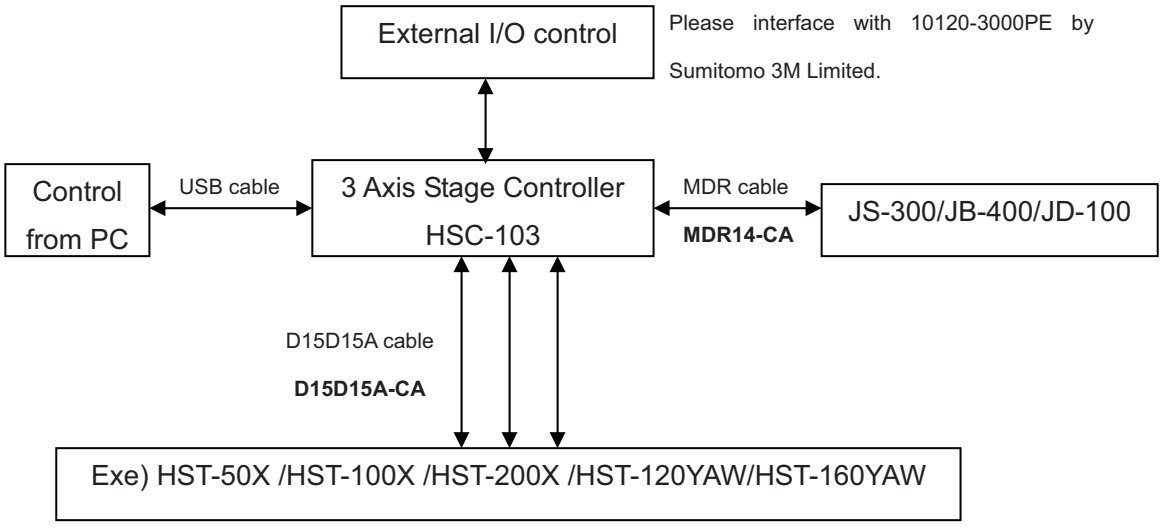
□HSC-103 Stage Controller :1
□User's Manual (This Manual) :1
□AC Power Cable :1

About the setting of the Memory Switch of this controller, you can set it by sample software.
You can download sample programs from our web page.
For the details of the samples, see the manual of each program.
View our home page **http://www.global-optosigma.com/en_jp/software/sample_en.html**

1-2. Overview

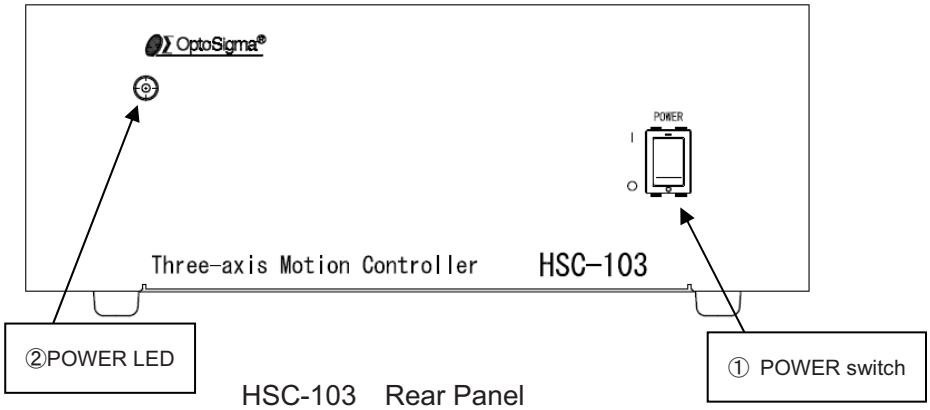
This controller is three axes stage controller, which has drivers for five-phase stepping motor.
Because this controller has a microstep driver built-in, the smooth movement in high resolving power is possible.
When the HST-103 is connected to an ordinary personal computer via an USB interface, the stage 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 (an optional product).

1-3.The HSC-103 System

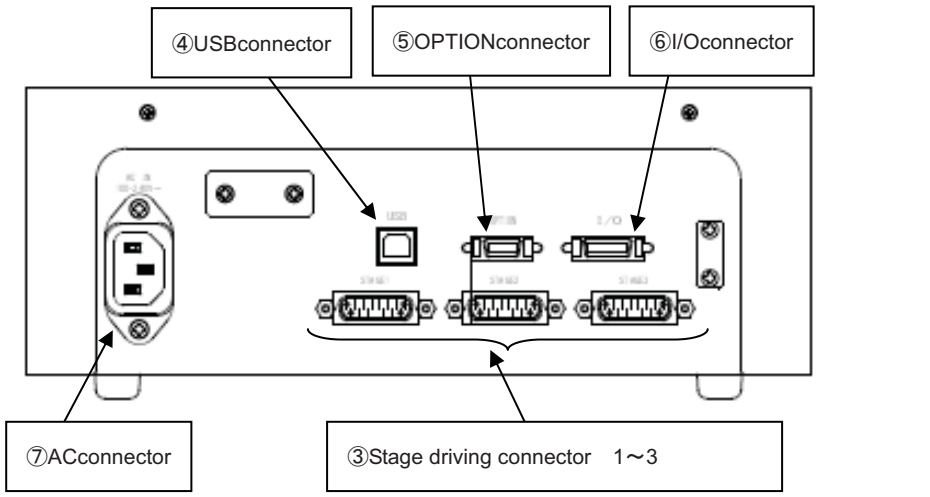


1-4. Parts and Functions

HSC-103 Front Panel



HSC-103 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 Stage driving connector : Connect to the motorized stage of your choice. Supports up to three axes.

④ USB connector : This connector is used when the device is controlled from the computer via an USBinterface.

⑤ OPTION Connector : When control by JS-300/ JB-400 or JD-100.
※)About the usage of OPTION(JS-300/JB-400/JD-100), confirm various User's manual

⑥ I/O Connector : The connector accepts a cable for sending and receiving I/O and control signals to form an external device. and it can connect an input and output signal and a stop signal to external equipment.

⑦ AC connector : This is where you connect the supplied 2.3meter power cable.

● USABLE DETACHABLE POWER CORDS

Type	Connecter	Cord	Attachment plug cap
AC100-120V	Use the detachable power cord set attached to the product only.		
AC200-240V	IEC C-22 Rated 7A, 250V UL, CSA Approved	Type SJT, No16 AWG Min. 3-Conductors (Single phased;2-current carrying & ground) UL, CSA Approved	NEMA6-15P Tandem blade Rated 7A,250V UL, CSA Approved

Cable length of above Power Supply cord shall be shorter than 4.5m.

For your own safety, make sure POWER is OFF before connecting every cable.

Chapter 2: Basic Operations

2-1.HSC-103 Connection procedure

First, connect HSC-103 to the motorized stages.

① Please confirm the power switch of the HSC-103 is turning off.

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

③ Connect the stage to be controlled as the first axis to the STAGE1 connector of the HSC-103 controller. Also connect the stage controlled as the second axis to the STAGE2 connector. Also connect the stage controlled as the third axis to the STAGE3 connector.

2-2. Connecting to PC and peripheral device

Connect HSC-103 to PC and peripherals (JS-300/JB-400/JD-100).

USB interface is used for the connection between the PC and HSC-103.

The USB interface communication parameter at the time of default Value is described below. Please set the configurations of the PC side according to the following table.

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

① Please confirm the power switch of the HSC-103 is turning off.

② Use a genuine USB cable,

③ Insert of USB cable to the USB connector on the HSC-103.

Please connect peripheral device according to the procedure from ④ to ⑥ 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.

⑥ The connector on the other side of MDR14-CA is connected with the OPTION connector of HSC-103.

2-3. Connecting Power Cable

Connect the supplied power cable to the AC connector on the rear panel of HSC-103 to plug the cable into an outlet. (Ensure that it is grounded.)

2-4.USB Driver installation Method

please use after the installation of the USB-driver in the following content.

(In the case of Windows 7/ Windows 8/ Windows 8.1)

While the Internet is connected, when connected toHSC-103, the installation of an automatic driver will start.

***) If unconnected to the Internet, from FTDI's website on a PC connected to the Internet, please go to download the driver (VCP Drivers). Then move the driver that download to PC to connect the HSC-103. Please then perform the installation of the driver.**

The FTDI website (http://www.ftdichip.com/index.html)

Chapter 3: Settings

3-1.Memory Switch settings

The Memory Switches store the controller settings.

When changing Memory Switch settings use the Sample software (SGSample), which can be downloaded from http://www.global-optosigma.com/en_jp/software/sample_en.html

***) After changing Memory Switch, be sure to reboot the power HSC-103.**

3-2. Memory Switch contents list and detailed settings

3-2-1 General

No	Memory Switch contents	Setting Range / Select items	Default Value
1	SPD SEL	1～4	1
2	SPD 1 S	1～999999999	10000
3	SPD 1 F	1～999999999	100000
4	SPD 1 R	1～1000	200
5	SPD 2 S	1～999999999	30000
6	SPD 2 F	1～999999999	300000
7	SPD 2 R	1～1000	200
8	SPD 3 S	1～999999999	70000
9	SPD 3 F	1～999999999	700000
10	SPD 3 R	1～1000	200
11	SPD 4 S	1～999999999	100000
12	SPD 4 F	1～999999999	1000000
13	SPD 4 R	1～1000	200
14	IO_LVL	ACT HIGH/ACT LOW	ACT HIGH

1) SPD SEL：Speed selection at Power ON

Select the initial setting Speed No. at Power ON.

[Setting Range] 1 ~ 4

2)～13) Speed 1～4(S)(F)(R)：Speed Setting

Set 4 kinds of travel stage Speed (minimum S, maximum F, and acceleration/deceleration time R) at Power ON. When JS-300(Option) operation and during the internal program behavior, work in this movement speed setting.

[Setting Range] S：1～999999999 (Unit：0.01μm/s)

F：1～999999999 (Unit：0.01μm/s)

R：1～1000 (Unit：ms)

***) Minimum S values should be set smaller than maximum F at Speed Setting.**

14) IO_LVL：I/O Output signal logic Setting

Select Logic (Voltage level) for I/O output signal.

[Select item] ACT HIGH：Lo level (Active High) normally

ACT LOW：Hi level (Active low) normally

3-2-2 INTERFACE

No	Memory Switch contents	Setting Range / Select items	Default Value
1	BAUDRATE	9600/38400/57600	38400

1) BAUDRATE：Baudrate setting

Set the data communication speed for the USB (Serial communication) Interface.

[Select item] 9600：9600bps

38400：38400bps

57600：57600bps

3-2-3 Axis

No	Memory Switch contents	Setting Range / Select items	Default Value
1	STG UT1	PULSE/MICRO/DEGREE	MICRO
2	STG UT2	PULSE/MICRO/DEGREE	MICRO
3	STG UT3	PULSE/MICRO/DEGREE	MICRO
4	PLS_RATE1	1～1000000	1000
5	PLS_RATE2	1～1000000	1000
6	PLS_RATE3	1～1000000	1000
7	MOVE1	POS/NEG	POS
8	MOVE2	POS/NEG	POS
9	MOVE3	POS/NEG	POS
10	ORG1 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
11	ORG2 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
12	ORG3 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
13	ORG OFFSET1	0～999999999	0
14	ORG OFFSET2	0～999999999	0
15	ORG OFFSET3	0～999999999	0
16	CONFIG1	ON/OFF	ON
17	CONFIG2	ON/OFF	ON
18	CONFIG3	ON/OFF	ON

1～3) STG_UT1～3：Select the units for display

Set the units used to display position coordinates of OPTION_unit (JS-300, JB-400).

[Select item] PULSE：Number of pulses

MICRO：Micron m units

DEGREE：Degrees units

4～6) PLS_RATE1～3：Pulse Rate setting(1～3axes))

Set the travel distance per 1 pulse for each axis.

The divisions of the driver set at 40. If the setting is not right, right positioning movement is not possible.

***) Otherwise, it is not able to position correctly. (Setting Unit：0.1nm) *1)**

[Setting range] 1～1000000 (0.1nm～100μm) *1)

***1) If "STG_UT1~4" setting is "DEGREE", please setting Unit: 0.000001°.**

7～9) MOVE1～3：Travel direction setting 1~3axis

Set + travel direction for each axis.

[Select item] POS： Positive rotation

NEG： Negative rotation

10～12) ORG1 SEL～ORG3 SEL：Origin reset method setting

Set Origin reset method for each axis.

[Select item] OFF：Origin reset OFF (ORG0)

MINI：ORG1

CENTER：ORG2

ORGS：ORG3

NORM：ORG4

ZPM：ORG5

ZPP：ORG6

*) Regarding each method, please refer to "Origin Reset Method".

13～15) ORG OFFSET1～3：ORG offset setting

Set ORG offset value for each axis (ORG1、ORG5、ORG6) at the ORG reset.

[Setting range] 0～999999999 (Unit：0.01μm)

*) When Setting range is set [0], ORG offset value is 0.5mm.

16～18) CONFIG1～3：Select Auto-Config mode.

Set Auto-Config mode for each axis.

[Select item] ON：effect

OFF：no effect

『Origin Reset Method』

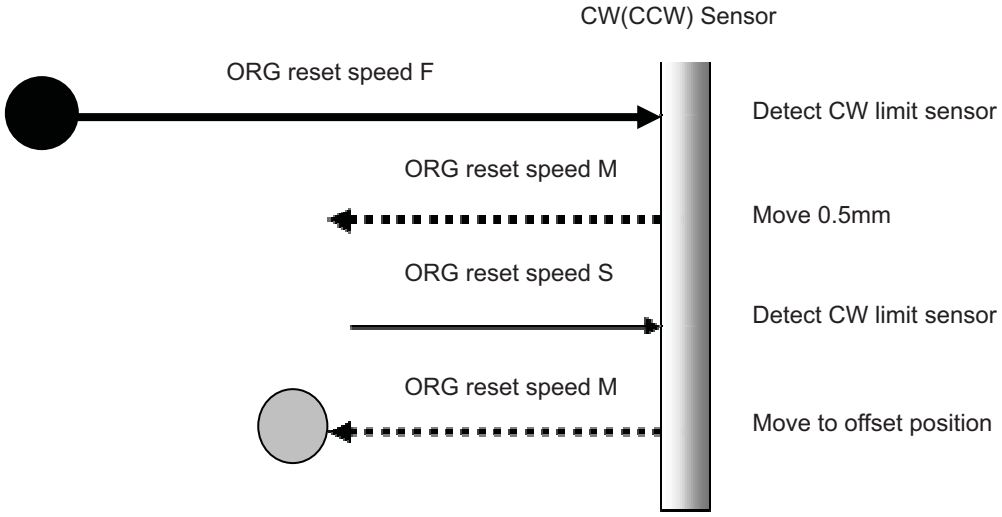
There are six types in Origin Reset setting. Please select optimal Origin Reset setting for stage in use depending upon software.

There are two parameters to do with Origin Reset, which are Origin Reset Speed (S, F, R, M) and Origin offset (ORG OFFSET). Parameters of each axis can be individually set. Please select the optimum value according to the software.

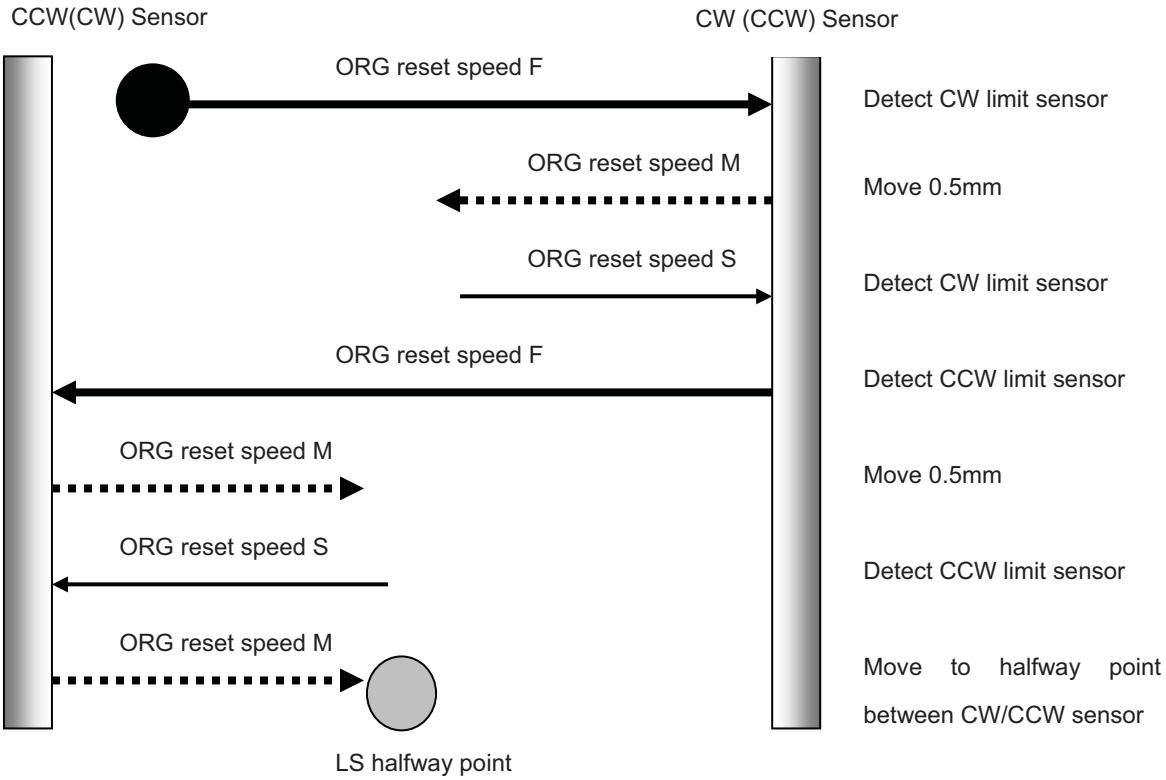
In case of when PGO (Z pulse) is used as an Origin sensor, (ORG5 or ORG6), Origin sensor is not in need at stage since Excitation Reset of motor driver is used.

1, ORG0 Not reset ORGIN position.

2, ORG1 (MINI method compatible, however stage moves to ORG offset value)
ORG OFFSET default value: 0.5mm.

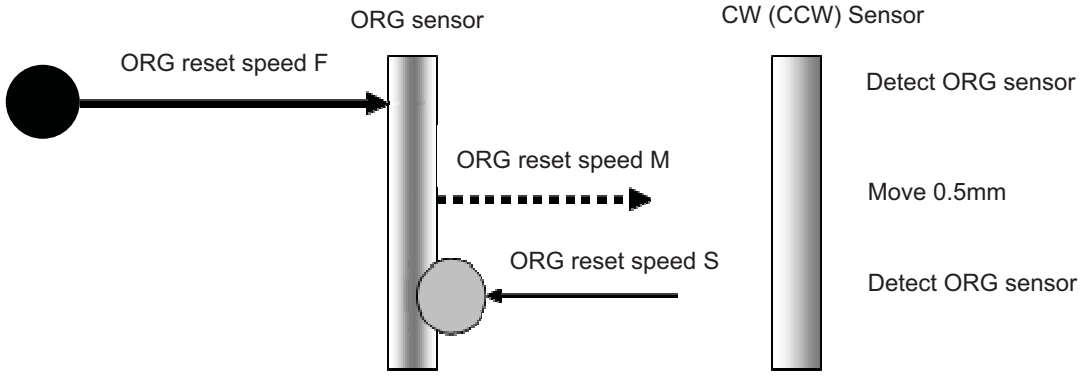


3, ORG2 (CENTER method)

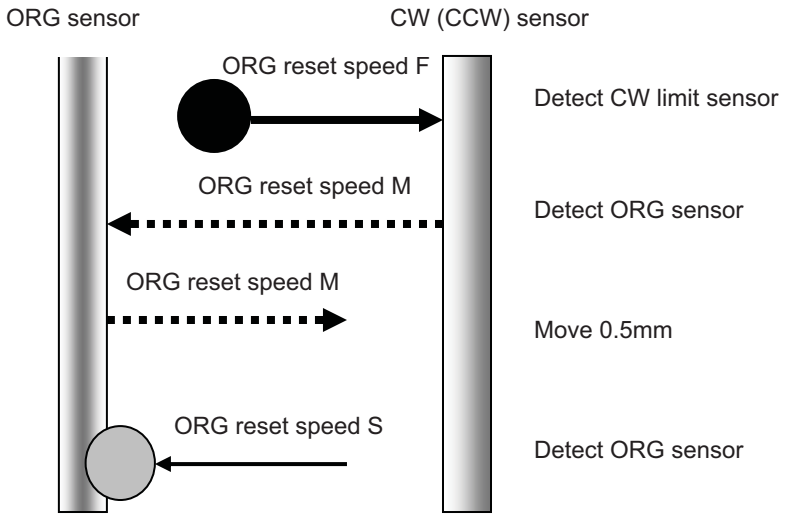


4, ORG3 (for 3 sensor use (LS + ORG))

4-1) In case that ORG sensor is set on the inside of CW(CCW) sensor



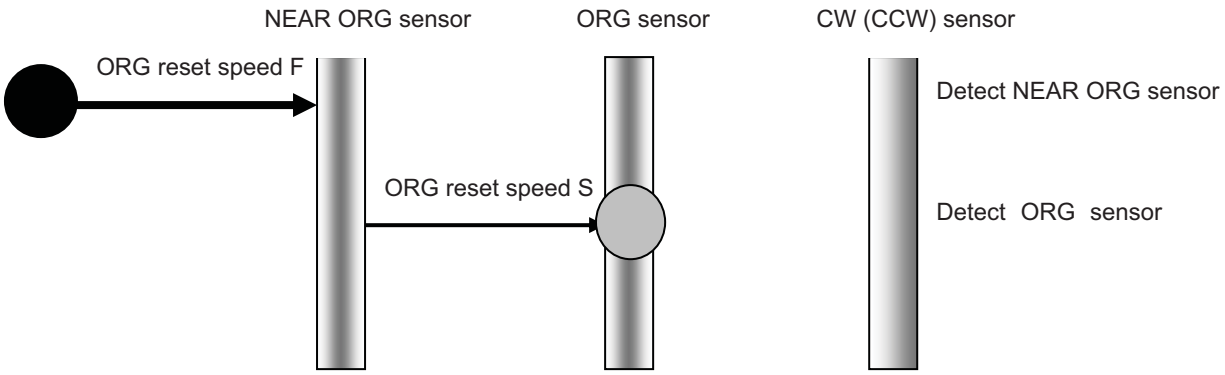
4-2) In case that ORG sensor is set beyond limit SW toward CW direction.



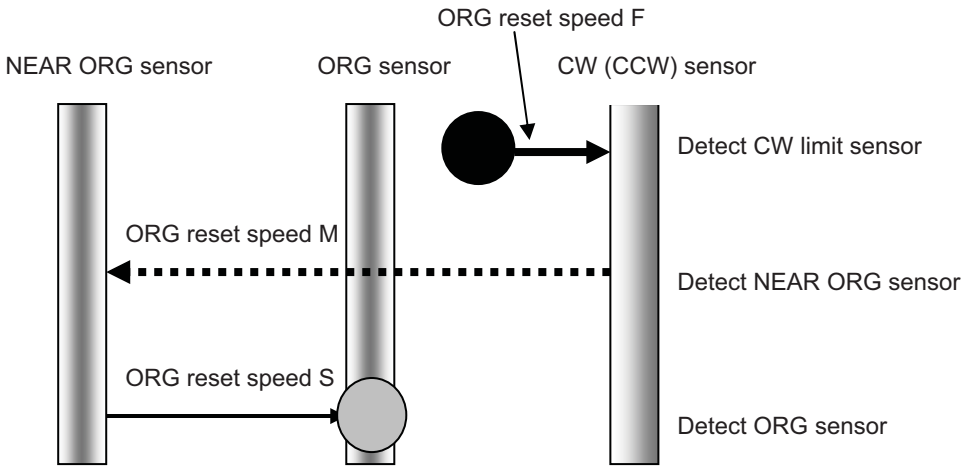
Caution1) In case that after detect CW (CCW) sensor, stage move toward CCW direction and then can not detect ORG sensor (in case of no ORG sensor), stage stop at CCW (CW) sensor position.

5, ORG4 (for 4 sensor (LS+SD+ORG) use.)

5-1) In case that NEAR ORG sensor is on the inside of CW(CCW) sensor.



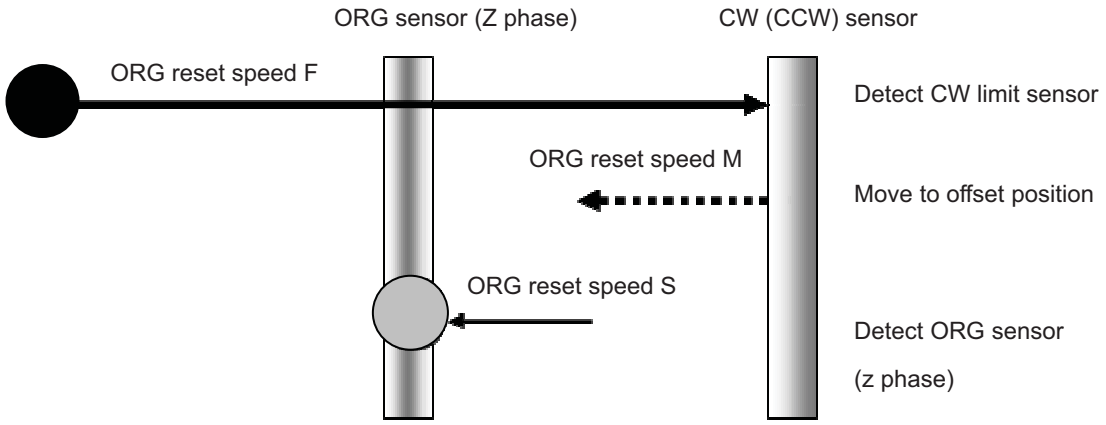
5-2) In case that ORG sensor is beyond NEAR ORG sensor toward CW(CCW) direction.



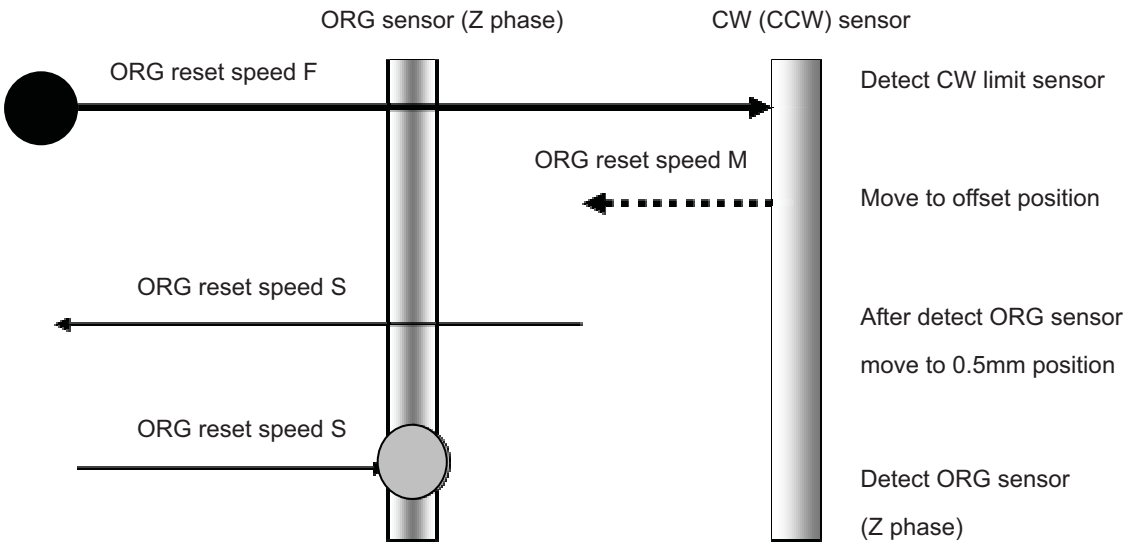
Caution1) In case that after detect CW (CCW) sensor, stage move toward CCW direction and then can not detect NEAR ORG sensor (in case of no NEAR ORG sensor), stage stop at CCW (CW) sensor position.

Caution 2) In case that after detect NEAR ORG sensor, stage move toward CW direction and then can not detect ORG sensor (in case of no ORG sensor), stage stop at CW (CCW) sensor position.

6, ORG5 (for 3 sensor use (LS+ORG(Z phase)))



7, ORG6 (for 3 sensor use (LS+ORG(Z phase)))



3-2-4 Sensor

No	Memory Switch contents	Setting Range / Select items	Default Value
1	LS LVL1	NM OPEN/NM CLOSE	NM CLOSE
2	LS LVL2	NM OPEN/NM CLOSE	NM CLOSE
3	LS LVL3	NM OPEN/NM CLOSE	NM CLOSE
4	OS LVL1	NM OPEN/NM CLOSE	NM OPEN
5	OS LVL2	NM OPEN/NM CLOSE	NM OPEN
6	OS LVL3	NM OPEN/NM CLOSE	NM OPEN
7	NS LVL1	NM OPEN/NM CLOSE	NM OPEN
8	NS LVL2	NM OPEN/NM CLOSE	NM OPEN
9	NS LVL3	NM OPEN/NM CLOSE	NM OPEN

1～3) LS LVL 1～3: Limit sensor input logoc level setting (1～3axis)

Select limit sensor detecting level (Input logic level) for each axis

[Select item] NM Open : (Normally switch ON by detecting limit sensor from SW OFF condition)

NM Close : (Normally switch OFF by detecting limit sensor from SW ON condition)

4～6) OS LVL 1～3: ORG sensor input logic level setting (1～3axis)

Select ORG sensor detecting level (Input logic level) for each axis.

[Select item] NM Open : (Normally switch ON by detecting ORG sensor from OFF condition)

NM Close : (Normally switch OFF by detecting ORG sensor from ON condition)

7～9) NS LVL 1～3: NEAR ORG sensor input logic level setting (1～3axis)

Select NEAR ORG sensor detecting level (Input logic level) for each axis

[Select item] NM Open : (Normally switch ON by detecting NEAR ORG sensor from OFF condition)

NM Close : (Normally switch OFF by detecting NEAR ORG sensor from ON condition)

3-2-5 Speed

No	Memory Switch contents	Setting Range / Select items	Default Value
1	ORG1 SPD S	1～999999999	50000
2	ORG1 SPD F	1～999999999	500000
3	ORG1 SPD R	1～1000	200
4	ORG2 SPD S	1～999999999	50000
5	ORG2 SPD F	1～999999999	500000
6	ORG2 SPD R	1～1000	200
7	ORG3 SPD S	1～999999999	50000
8	ORG3 SPD F	1～999999999	500000
9	ORG3 SPD R	1～1000	200
10	ORG1 SPD M	1～999999999	250000
11	ORG2 SPD M	1～999999999	250000
12	ORG3 SPD M	1～999999999	250000

1～12) ORG1～3 SPD(S)(F)(R)(M): ORG reset speed setting

Set mechanical ORG reset speed (minimum speed S, maximum speed F, acceleration time, ORG-reset speed M) for each axis.

[Setting Range] S：1～999999999(Unit：0.01μm/s)

F：1～999999999(Unit：0.01μm/s)

R：1～1000(Unit：ms)

M：1～999999999(Unit：0.01μm/s)

***) Regarding Speed setting, minimum speed S should be set smaller than maximum speed F and ORG-reset speed M.**

Chapter 4: Using HSC-103 to position Motorized Stages

4-1. Feature

The controller can be connected to a computer using an USB interface. Motorized stages can then be precisely controlled by commands (strings) transmitted from the computer.

And command format of HSC-103, will be compatible with our controller (HIT-M/PGC).

The USB interface communication parameter at the time of default Value is described below. Please set the configurations of the PC side according to the following table.

Parameter	Descriptions
Baud rate	38400bps
Delimiters	CR+LF
Parity	None
Data bits	8bit
Stop bit	1bit
Flow control	Hardware (RTS/CTS)

4-2.Command

4-2-1 Format of command

General format is shown below. Some formats are different depending on type of command. Please refer to each command explanation for details.

code：p1,p2,p3

code　Use a string to represent a command.

:　Command separation (Colon(：))

p1～p3　Use(,)command to separate and assign number of slave unit 1-3. Only integer values can be used as parameter values.

A decimal number is an incorrect command and will be response by NG.

+ sign can be abbreviated. +1000 or 1000 is treated as the same command.

A travel or distance parameter of 1 is equal to 0.01μm.

Parameter is abbreviated when NOP (No Operation) needs to be set to the designated slave unit number.

Note: (,)cannot be abbreviated.

（Ex） ,p2　Parameter of 1 and 3-axis is abbreviated.

p1,,p3　Parameter of 2-axis is abbreviated.

Capital or lower case characters can be used. Example: h and H are both valid for the Home command. Backspace is effective to delete a prior string.

Command string must not have leading or trailing spaces. Otherwise, the command string will not be accepted and NG will be returned as a command error.

Immediate movement will be made in case when activation commands such as H, M, A, E, K, and J commands are accepted normally. Unlike the SHOT-Controller, the activation command (G) is not needed in HSC-103. Activation command (G) is treated as an incorrect command In HSC-103.

When issuing Q, ?, !, or I command, its status will be responded. In case which other commands are issued, 'OK' or 'NG' sign will be responded. 'OK' and 'NG' signs hereby mean 'normal acceptance' and 'acceptance refused for an incorrect command' respectively. When other commands except Q, ?, L, !, I, O commands are issued to an engaged slave in busy condition, 'NG' sign will be responded for incorrect commands, which will result in the whole command not being executed.

▪ 4-2-2 Command list

Command	Movement	Detail
H	Return to mechanical origin	Detect mechanical origin
M	Set number of pulses for relative movement	Setting of Axis of movement, direction, number of pulses with relative coordinate
A	Set number of pulses for absolute movement	Setting of Axis of movement, direction, number of pulses with absolute coordinate
E	Settings of rotary movement	Circular interpolation (Move at minimum speed (S))
K	Settings of linear interpolation movement	Linear interpolation (Move at minimum speed (S))
J	Jog command	Move by minimum speed (S)
L	Stop	Stop or reduce speed
R	Set electronic (logical) origin	Set the electronic (logical) origin to the current position
D	Speed settings	Set S, F, and R of M and A command
B	Setting of returning origin speed	Setting of returning origin command (S, F, R and M)
C	Free motor	Excitation ON/OFF
Q	Status1	Return current position etc.
!	Status2	Return 1(Busy) or 0 (READY)
?	Internal information	Return by internal information
O	I/O output command	Output data to OUT terminal of I/O connector
I	I/O input check	Return data to IN terminal of I/O connector
P	Program control	Internal program command

4-2-3 H command (Return to mechanical origin command)

(1) Function

This command indicates detect the mechanical origin for a stage and set the position as the origin.

Coordinate value is cleared by 0.

When the designated axis number with parameter is 1, the mechanical origin will be operated. No operation to 0 or abbreviated axis.

(2) Example

H:1,1,0 means to operate the mechanical origin to axis number 1 and 2

4-2-4 M command (Relative movement command)

(1) Function

This command indicates relative movement with pulse number.

Travel is a length and indicates by (0.01μm unit)

***) Controller enables to output number of pulse (-134217728 to +134217727). In case of the over number, NG will be returned and stage will not move.**

(Note: The above limitation is conflicted when a high microstep is set.)

(2) Example

M:100000,-20000,30000 means to move from current position 1mm, -0.2mm and 0.3mm to axis number 1, 2 and 3 respectively.

4-2-5 A command (Absolute movement command)

(1) Function

This command indicates Relative movement with pulse number.

Travel is a length and indicates by (0.01μm unit)

***) Controller enables to output number of pulse (-134217728 to +134217727). In case of the over number, NG will be returned and stage will not move. Actual length of travel is calculated automatically by controller from a specified absolute movement length value.**

(Note: The above limitation is conflicted when a high microstep is set.)

(2) Example

A:0,-20000,30000 means to return to origin (0), -0.2mm and 0.3mm of absolute position to axis number 1,2 and 3 respectively.

4-2-6 E command (Arc interpolation movement command)

(1) Function

This command for arc interpolation movement enables to specify operation axis and rotation direction. 3 different modes of parameter are available to operate the arc interpolation movement with arbitrary 2 axes. When this command is sent under condition of busy and unconnected of axis, it will be response by NG as a command error and all command will stop to operate.

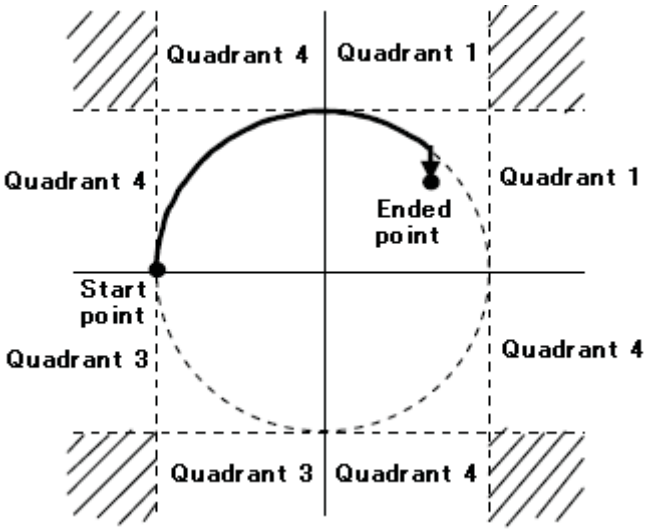
To operate an interpolation with this command, pulse speed and travel per pulse (PLS_RATE) must be identical for both axes.

Otherwise, an interpolation movement will be unable to operate due to an incorrect setting.

Note: if there is a difference in PLS_RATE between axis, apparent speed ([S, F, R value] and [Microstep] and [Acceleration and Deceleration] pattern (Trapezoidal shape or S shape)) is same, pulse speed and travel per pulse are different. However the speed when operates the arc interpolation movement is minimum speed (S).

Coordinate of arc movement is specified based on the relative travel from current position (0.01μm unit).

E：0 command (Arc interpolation movement command 0) is a setting for the end of Coordinate. In order to move out from a circular line as shown by the image right hand side, the end movement of one axis when it reaches to a specified position in a quadrant and stop the interpolation function. Then, another axis move to reach the end point.



Note: the specified end point as ended coordinate of arc interpolation inside the area of diagonal line, the stage will move non-stop and arc interpolation movement is effective without end.

Due to operation by calculation, there is a calculation error to the ended point of **E：1 command** (Arc interpolation movement command 1) and **E：2command** (Arc interpolation movement command 2). Please check the actual stage.

4-2-6-1 E:0 command (Arc interpolation movement command 0)

(1) Function

This command indicates a designation of ended point and center point in order to operate the arc movement.

(2) Example

E：0,axis1,axis2,d,e1,e2,c1,c2

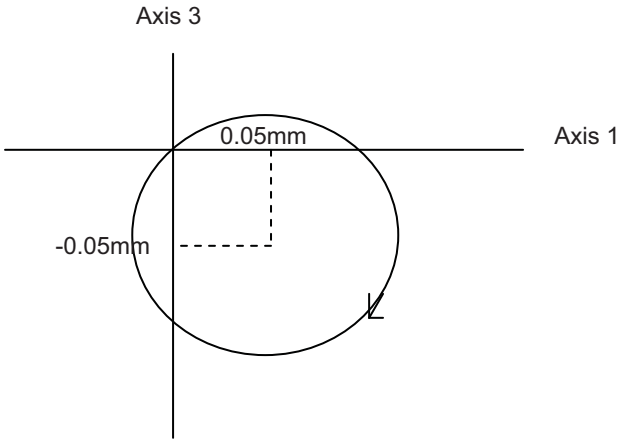
Axis1, axis2：1～3 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnect is prohibited.
Axis 1 represents X axis and axis 2 represents Y axis.

d：0 or 1 0 is CW rotation (Clockwise), 1 is CCW rotation (Counterclockwise)

e：Ended point coordinate (e1 axi1 setting value、e2 axis2 setting value) (unit of setting 0.01μm unit)

c：Center point coordinate (c1 axis1 setting value、c2 axis2 setting value) (unit of setting 0.01μm unit)

E：0,1,3,0,0,0,5000,-5000 A center point coordinate is based on a relative coordinate of the current position (0.05mm,-0.05mm) and move stages of axis No1, axis No3 one round clockwise until the current position.



4-2-6-2 E：1 command　(Arc interpolation movement command 1)

(1) Function

This command indicates a designation of center point and degree of ended point in order to operate the arc movement

(2) Example

E：1, axis1,axis2,d,c1,c2,ae

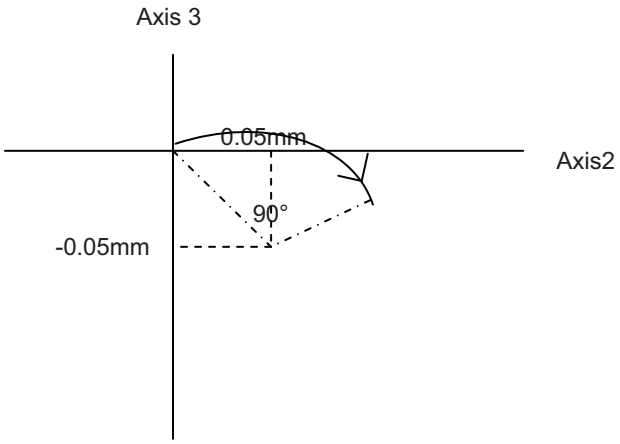
axis1, axis2：1～3 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnect is prohibited. Axis1 represents X axis and axis2 represents Y axis.

d：0 or 1 0 is CW rotation(Clockwise). 1 is CCW rotation (Counterclockwise).

c：Center point coordinate (c1 axis1 setting value、c2 axis2 setting value)
(unit of setting 0.01μm unit)

ae：Degree of ended point (deg) (Setting range：integer of 0°<ae≦360° The other degree than mentioned is NG.)

E：1,2,3,0,5000,-5000,90 A center point coordinate is based on a relative coordinate of the current position (0.05mm,-0.05mm) and move stages of axis No2、axis No3 90°from current position to degree of ended point position clockwise.



4-2-6-3 E：2 command　(Arc interpolation movement command 2)

(1) Function

This command indicates a designation of pass point coordinate and ended point's coordinate in order to operate the arc interpolation movement. Note: if 3 points (current position, pass point coordinate and ended point coordinate) lay on the same straight line, it is unable to make an arc movement.

(2) Example

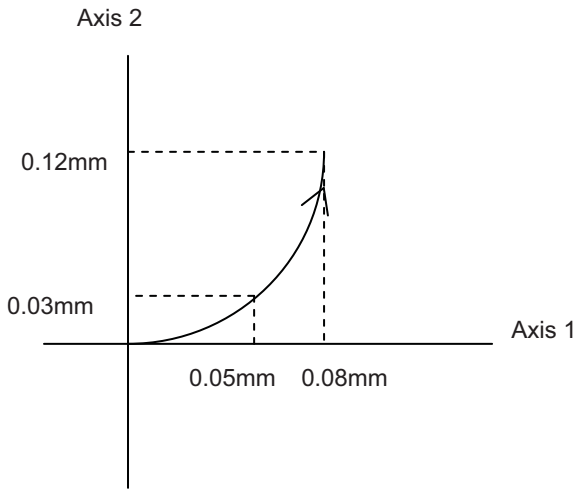
E：2, axis1,axis2,p1,p2,e1,e2

axis1, axis2：1～3 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnected is prohibited. Axis 1 represents X axis and axis 2 represents Y axis.

p：Pass point coordinate (p1 axis1 setting value、p2 axis2 setting value)
(unit of setting 0.01μm unit)

e：Ended point coordinate (e1 axis1 setting value、e2 axis2 setting value)
(unit of setting 0.01μm unit)

E：2,1,2,5000,3000,8000,12000 Pass point coordinate and ended point coordinate are based on a relative coordinate of the current position (+0.05mm, +0.03mm) and (+0.08mm, +0.12mm). Then, stages of axis No1、axis No2 move circularly.



4-2-7 K command (Linear interpolation movement command)

(1) Function

This command indicates a designation of axis of movement and a designation of relative movement in order to operate linear interpolation movement. Operation of linear interpolation movement is able to designate up to arbitrary 3 axes.

When this command is sent under condition of busy and unconnected of axis, it will be responsed by NG as a command error and all command will stop to operate.

To operate an interpolation with this command, pulse speed and travel per pulse(PLS RATE) must be identical for both axes.

Otherwise, an interpolation movement will be unable to operate due to an incorrect setting.

Note: if there is a difference in PLS RATE between axis, apparent speed ([S, F, R value] and [Microstep] and Acceleration and Deceleration pattern is same, pulse speed and travel per pulse are different.

Coordinate of linear movement is specified based on the relative travel from current position (0.01μm unit).

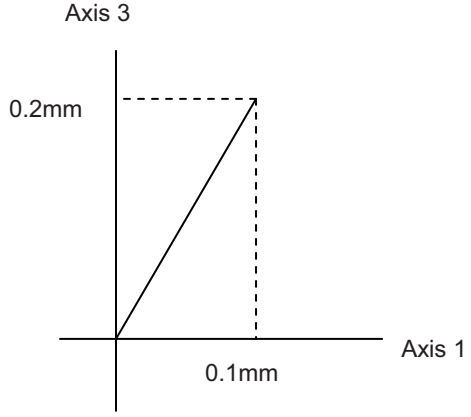
(2) Example

K：axis1,axis2, axis3,e1,e2,e3

axis1,axis2,axis3：1～3 means to designate the number of axis to operate linear interpolation movement. Same number of axis or unconnected is prohibited. To operate linear interpolation movement by 2 axes, please abbreviate axis2.

e:Ended point coordinate (e1 axis1 setting value、e2 axis2 setting value、e3 axis3 setting value) To operate linear interpolation movement by 2 axes, please abbreviate axis2. (unit of setting 0.01μm unit)

K：1,3,,+10000,20000 Ended point coordinate is based on a relative coordinate of the current position (+0.1mm, +0.2mm) and move stages of axis No1、axis No3 linearly.



4-2-8 J command　(Jog command)

(1) Function

This command indicates to drives stages continuously (at a constant speed) at the minimum pulse speed (S). During command operation, stage will move non-stop until the detection of limit sensor or receipt of Stop command (L command).

(2) Example

J：s1,s2,s3

s：+,- or abbreviated　+ is + direction, - is - direction、abbreviated is NOP(No Operation).

J：,+,-　Jog movement to axis No2 is + direction, axis No3 is － direction. No movement to axis No1.

4-2-9 L command　(Decelerate and stop command)

(1) Function

Deceleration and stop stage

(2) Example

L：p1,p2,p3

p：0,1 or abbreviated　1 is to decelerate and stop stage of the axis number.　0 or abbreviated are NOP(No Operation).

L：,,1　To decelerate and stop stage of the axis No3.

4-2-10 L:E command　(Emergency stop (Immediate stop) command)

(1) Function

This command indicates to stop stages of all axis immediately.

(2) Example

L：E　means to stop stages of all axis immediately.

4-2-11 R command (Return to logical origin command)

(1) Function

This command indicates a setting of logical origin (coordinate value 0) to the stage of the designated axis number based on the current position.

When this command is sent under condition of busy and unconnected of axis, it will be responsed by NG as a command error and all command will stop to operate.

(2) Example

R : p1,p2,p3

p : 0,1 or abbreviated 1 is to set the logical origin to the stage of the axis number. 0 or abbreviated are NOP(No Operation)

R : 0,1,1 means to set the logical origin (coordinate value 0) to the stage of the axis number 2 and 3.

4-2-12 D command (Speed setting command)

(1) Function

This command indicates a speed setting to the designated axis number. It is unable to set the multiple number of axes at the same time.

When this command is sent under busy condition of axis, it will be responsed by NG as a command error and all command will stop to operate.

(2) Example

D : axis,s,f,r

axis :	axis number 1～3	
s :	Start-up speed (Initial speed)	range of setting: 1～999999999 (unit : 0.01μm/s)
f :	Maximum speed	range of setting: 1～999999999 (unit : 0.01μm/s)
r :	Acceleration / deceleration time	range of setting:1～1000 (unit : ms)

Note : the condition of s<=f

*) Maximum speed (calculated by pulse) is 4000000(pulse/s). In case of over speed setting (travel : 0.01μm/s unit), OK will be returned, but it will be treated as speed of 4000000(pulse/s).

D : 3,20000,200000,200 means Start-up speed : 0.2mm/s, 2mm/s : Maximum speed, 200ms : Acceleration / deceleration time to axis No3.

4-2-13 B command (Setting of returning origin speed command)

(1) Function

This command indicates the setting of returning origin speed to the designated axis number. It is unable to set the multiple number of axis at the same time. When this command is sent under condition of busy and unconnected of axis, it will be responsed by NG as a command error and all command will stop to operate. When the power is turned on, it will be the setting speed of the memory switch.

(2) Example

B : axis,s,f,r,m

axis : axis No.1～3

s : Start-up speed (Initial speed) range of setting: 1-999999999 (unit : 0.01μm/s)

f : Maximum speed range of setting: 1-999999999 (unit : 0.01μm/s)

r : Acceleration/deceleration time range of setting:1-1000 (unit : ms)

m : ORG reset speed range of setting: 1-999999999 (unit : 0.01μm/s)

Note : the condition of s≦m≦f

*) Maximum speed (calculated by pulse) is 4000000(pulse/s). In case of over speed setting (travel : 0.01μm/s unit), OK will be returned, but it will be treated as speed of 4000000(pulse/s).

B:3,10000,200000,200,100000 Setting start-up speed by 0.1mm/s, Maximum speed by 2mm/s, Acceleration/deceleration time by 200m and ORG reset speed by 1mm/s to axis No3.

4-2-14 C command (Excitation On/OFF command)

(1) Function

This command indicates an Excitation On/OFF of motor. The stage is able to move (rotate) manually when the excitation OFF of motor.

When this command is sent under busy condition of slave unit, it will be responsed by NG as a command error and all command will stop to operate.

(2) Example

C : p1,p2,p3

p : 0,1 or abbreviated 1 is an Excitation ON to the stage of the axis number. 0 is an Excitation OFF to the stage of the axis number. The abbreviation is NOP（No Operation）

C : 0,0,1 Excitation ON to the motor of the axis No3, and OFF to motor of axis No1,2.

4-2-15 Q command (Reading current position command)

(1) Function

This command indicates to return the current position information of 3 tages of axis.unit No 1-3(0.01μm unit). In the case of pulse specified in memory SW, return the number of pulses. The returned current position data is separated by (,) -mark represents when the current position is minus. Maximum 10 digit including marking by left-align display. Driver Alarm because the coordinate values when the on is undetermined comma (,) only will be returned.

(2) Example

Q :

-1000,1000,0 Return data : current position of axis No1 is -0.01mm, 0.01mm to axis No2, and 0mm to axis No3.

4-2-16 Q:S command (Reading status command)

(1) Function

This command indicates to return the status information of controller and axis No1-3

The returned data is separated by (,).

(2) Example

Q : S

stm,sts1,sts2,sts3

stm 00 : Controller accepted the received command.

01 : Controller rejected the received command due to wrong command.

sts 00～FF : Return the status of the axis No with hexadecimal number and 2 digit. Each bit of Hexadecimal number and status are shown as table below. A bit represented by 0 means undetected and 1 means detected.

7	6	5	4	3	2	1	0
-	DRV alarm	Reserve	Z limit	Near	ORG	+LS	-LS
0	0 or 1	0	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

Example of returned data

00,01,02,40 means controller accepted the received command. Detect –LS by axis No1 , detect +LS by axis No2 and detect Driver-alarm by axis No3.

4-2-17 ! command (Reading status command)

(1) Function

This command indicates to return the status (Busy/Ready) of each axis.

(2) Example

! :

sts1, sts2 ,sts3 Returned data

sts 0 means the ready status of the axis. 1 represents the busy status of the axis. Abbreviation represents Driver alarm.

Example of returned data

1,0,0 means the ready status of axis No2 and 3, Busy status of axis No1.

4-2-18 ? command （Reading internal information command）

(1) Feature

This command indicates to return controller information.

(2) Example

? : Paxis

P above represents by string parameter is shown as table below.

axis above represents axis number. Note: axis No1-3 must be written only when D or B string parameter is applied.

String parameter	Returned data	Example of returned data
N	Device name	HSC-103
V	Version	V1.00-001
D	Travel speed [μm/s]	100,1000,200
B	Returning origin speed [μm/s]	500,5000,200,2500
L	Status of program operation	ProgNo、ProgRun、LineNo、Count of remaining Loop (Example)2,1,13,4 13 row of program No.2 is running and count of remaining Loop is 4.
P	Travel per pulse [μm or degree]	0.0100,0.0100,0.0100

4-2-19 O command （Output data command）

(1) Function

This command indicates output the data to the output terminal of I/O connector (4 bit).

Output	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
OUT1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
OUT2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
OUT3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
OUT4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON

(2) Example O：14 out2,3,4 out pot.

4-2-20 I command （Input data command）

(1) Function

This command indicates input the data to the input terminal of I/O connector (4 bit).

Data	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
IN1	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON	OFF	ON
IN2	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON	OFF	OFF	ON	ON
IN3	OFF	OFF	OFF	OFF	ON	ON	ON	ON	OFF	OFF	OFF	OFF	ON	ON	ON	ON
IN4	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	ON	ON	ON	ON	ON	ON	ON	ON

(2) Example

I : Returned data **14**

4-2-21 P command （Internal program control command）

(1) Function

This command indicates program number selection of internal program and Operate/Stop. Please refer to the detail of program feature from “4-2 program feature”.

(2) Example

P：p

p：P, S, E, U0, U1

P：Pn n represents program number which can be selected 0-9. The others than mentioned will be responsed by NG as a command error. It is 0 when power on. **(Example) P:P2** Program No.2 is selected.

S： Start operation of the program. Start operation of the selecting program. **(Example) P：S**

E： Finish program operation. When the finish command is accepted, it will finish the under operating in the current Line No. **（Example）P：E**

U0： Stop program temporarily. When the the command is accepted, it will temporarily stop after the under operating program in the current Line No. **(Example)P：U0**

U1： Restart program. The temporary stop of program can be restarted by P：U0. **(Example)P:U1**

4-3. Program functions

10 kinds of program, numbered 0 to 9, can be stored in HSC-103 controller. These programs are stored in unerasable memory, which means they will not be erased even when POWER goes OFF. Maximum capacity for each program is 1024 lines. Please use tool software by SigmaKoki when composing, editing, loading and saving programs.

Please set distance modulus (unit 0.01μm) as positioning parameter.

Please be aware of that abnormal positioning may occur when PLS_RATE value on Memory Switch has been misset. Speed No. appointed with Memory Switch is used for travel speed.

4-3-1 Program data format

There is a command in a line in this program. Each command consists of up to 16 fields and each field is distinguished by a comma. Different fields are needed depending on type of movement command.

①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
No	Command	Parameter								Speed				out	wait

①：Line No. Any number between 1 and 1024 can be used but it should be a consecutive number of the previous one.

②：Command code

M：Relative travel positioning (unit : 0.01μm)

A：Absolute travel positioning (unit : 0.01μm)

H：Origin return

K：Linear Interpolation movement (capable of up to 3 axes)

E：Circular Interpolation movement

?：IO terminal input confirmation

C：Continuous operation

F：Setup repeating No. (1 – 2,147,483,647 can be input)

N：Stop repeating movement

Y：Exit program

Continuous operation (C), please be careful about the following points.

- Please do not change the movement axis in the Continuous operation ranges.
- The possible instructions are only four kinds of M,A,K,E
- Divide a continuous operation into M, and A, and K, and E, and order it
- OUT, and Wait, are effective only for the last instructions of continuous operation ranges.
- ?:n command number given back in ?:n is only the last number of continuous operation.

Y should be used for command code for last line in program. Repeated loop nesting between F and N is not applicable.

③～⑤：Travel distance of axis 1 to 3

In case of M/A/H/K/E, it is equal to command specification. Please set distance modulus (unit 0.01μm) as positioning parameter. Please be aware of that when PLS_RATE in Memory Switch is unset, it may interfere with correct positioning.

In case of ? / F, and C please set 3 only and omit 4 to 5.

In case of N/Y, please omit 3 to 5.

⑥～⑩：Interpolation indicated value

In case of K/E, it is equal to command specification. Please set distance modulus (unit 0.01μm) as positioning parameter. Please be aware of that when PLS_RATE in Memory Switch is unset, it may interfere with correct positioning.

In case of K, please set 6 to 7 and omit 9 to 10.

In case of M/A/H/?/C/F/N/Y, please omit 6 to 10.

⑪～⑬：Speed settings for axis 1 to 3

Please select one from 4 types of SPD_SEL on Memory Switch. In case of K/E, please set 11 only and omit 12 to 13. For command K and E, PULSE speed can be calculated from speed 11, and parameter (in PLS_RATE) of axis with the smallest No. among those in operation. It applies to speed for all interpolation object axes.

In case of H/?/F/N/Y, please omit 11 to 13.

⑭：OUT signal output instructions

Appoint 0 to15. In case of F/N/Y, it will be omitted. When they are not appointed, previous condition remains

⑮：Waiting time

Any number from 0 to 32767 can be input. (Unit：0.1S)

In case of F/N/Y, it will be omitted.

Please refer to table below regarding whether or not each parameter by command code can be omitted. ◎ indicates ‘cannot be omitted’, ○‘omittable in circumstances’, and ー ‘be omitted at all times’in table below.

②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮
M	○	○	○	—	—	—	—	—	○	○	○	○	○
A	○	○	○	—	—	—	—	—	○	○	○	○	○
H	○	○	○	—	—	—	—	—	—	—	—	○	○
K	◎	◎	○	◎	◎	○	—	—	◎	—	—	○	○
E	◎	◎	◎	◎	◎	◎	◎	○	◎	—	—	○	○
?	◎	—	—	—	—	—	—	—	—	—	—	○	○
C	◎	—	—	—	—	—	—	—	—	—	—	—	—
F	◎	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—	—
Y	—	—	—	—	—	—	—	—	—	—	—	—	—

4-3-2 Program Examples

```
1,M,1000,-1000,,,,,,,1,2,,,15,100
2,H,1,1,1,,,,,,,,,,5,100
3,A,200000,200000,,,,,,,3,3,,,10,5
4,K,1,2,3,10000,20000,30000,,,3,,,,1,500
5,E,0,1,2,1,0,0,0,100000,4,,,,5
6,?,3
7,F,1000
8,M,100,,,,,,,1
9,N
10,C,2
11, A,1000000, ,,,,,,,2
12, A,0, ,,,,,,,2,,,,5,10
13,Y
```

1. Travel 10 microns in the +direction at speed 1 on the 1st axis, 10 microns in the –direction at speed 2 on the 2nd axis, output out 15 with waiting 10seconds after completion of positioning.
2. Execute ORIGIN return of 1st, 2nd and 3rd axis, and output OUT5 then 10seconds wait. (* ORIGIN return speed is set by each axis.)
3. Travel +2mm in the +direction at speed 3 on the 1st axis, +2mm in the +direction at speed 3 on the 2nd axis, output OUT10 with waiting 0.5second after completion of positioning.

4. Execute 3axies linear travel (linear interpolation) at speed 3on 1st, 2nd, 3rd axis move 100 microns, 200 microns, 300 microns (moving speed of the long side of the rectangle), output OUT1 with waiting 50 seconds after completion of positioning .
5. Execute circular interpolation movement linear travel at speed 4 on 2nd, 3rd axis, and move 180 degrees from the current position in CW direction with keeping OUT1 and waiting 0.5seconds after completion of circular interporation.
6. Wating input signal, if INPUT is 3 execute next step.
7.
8. } Repeating 1000 times 1 micron move at speed 1 at 1st axis with keeping OUT1.
9.
10. Continuous operation start instructions
11. Travel 10 millimeter in the +direction at speed 2 on the 1st axis,
12. Travel 10 millimeter in the -direction at speed 2 on the 1st axis, and output OUT5 then 1seconds wait.
13. Quit.

4-3-3 Issuing command in program execution

Issuable commands when program is running are as below.

Status ▪ Read series : Command **Q**, Command **!**, Command **?**

Stopping command : Command **L**

Program control command : Command **P** (**P:E** and **P:U0**)

Commands unmentioned above will be treated as fault commands. If they are issued, NG will show.

4-4 About the use of peripheral equipment

JS-300/JB-400 or JD-100 can be used in HSC-103.

Manual manipulation and the Count level, can be indicated by using JS-300/JB-400.

※)About the usage of OPTION(JS-300/JB-400/JD-100), confirm various User's manuals.

Chapter 5: Rotation Stage

Mainly listed it to a foregoing chapter about a Translation stage, but list it in this chapter about an item peculiar to a rotaion stage.

Appoint movement distance by A command and the M command of the Translation stage.
On the other hand, in the case of as rotation stage such as HST-120YAW and HST-160YAW, it is necessary to set it at a rotary angle not movement distance.

5-1 Setting item

STG_UT (Memory-SW) : Set the display position units to “DEGREE” for each axis.

PLS_RATE (Memory-SW) : Set the travel Rotaly angle per 1 step pulse for each axis. (Setting Unit: 0.000001°)

Case of sigmakoki’s rotation stage:

ORG_OFFSET (Memory-SW) : Set the ORG offset value to “25000(2.5°)” for each axis.

*) In the case of HST-120YAW / HST-160YAW

The following items are automatic, and, in the case of ON, memory switch 16~18 is set.

STG UT1~3 :DEGREE

PLS RATE1~3 :125

ORG_OFFSET1~3 :25000

ORG SPD1~3 :S10000 F100000 R200 M50000

*) Rotation stage changes only the connected axis.

5-2 Command/ Status

A command, M command: Set a rotary angle with the integer of the 0.0001 degrees unit.

The positional information that is sent back by Q command: send back a position at an angle of a 0.0001 degrees unit now.

[Example] When turn 45 degrees by M command, set it with M:450000.

When it is sent back with 450000 by Q command, a position shows that it is 45.0000 degrees now.

5-3 Speed

Speed setting with memory switch in the case of a rotation stage or the speed to set by D command and B command a rotary angle (set it in 0.0001 degrees unit) / second.

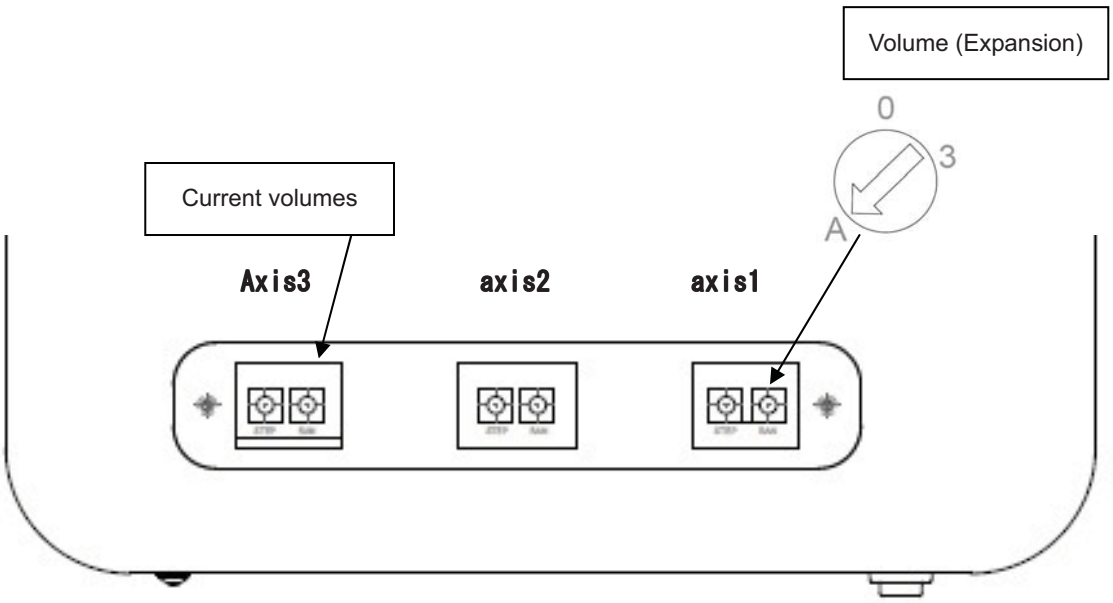
[Example] In the case of 300000, F speed shows 300,000 × 0.0001 degree = 30 degrees/s.

Chapter 6: RUN current setting

Adjust the drive (RUN) current of controller for each of the connected motorized stages.

6-1. Setting the drive current.

Set current values supplied from HSC-103 to stages. Turn a RUN current volume, 3 or A, to adjust RUN current corresponding to the stages to use.



Top Panel

Volume No.	0	3	**A (Default Value)**
Run current [A/phase]	0.45	0.75	**1.4**

Chapter 7: Specifications

7-1.Specifications

1. General Specifications

Power source	AC100-240V 50/60Hz
Consumption	200VA
Operating temperature	5～40℃
Storage temperature	-20～60℃
Altitude	up to 2000m
Indoor use only	
Installation category	Ⅱ
Pollution degree	2
Ambient humidity	20 to 80%RH (no condensation)
External dimensions	260W×260D×95H(excluding projections)
Weight	3.3kg

2. Performance

Controlling axis	3 axis
Maximum driving speed (F)	0.01～9999999.99μm/s (1～4000000PPS)
Minimum driving speed (S)	0.01～9999999.99μm/s (1～4000000PPS)
Maximum No.of travel pulse	-134217728 (Pulse) ~ +134217727 (Pulse)
Acceleration/deceleration time (R)	1~ 1000ms
Sensor Input	Origin sensor / Proximity sensor / CW (-) Limit / CCW (+) Limit (Memory switches can be used to change input logic for sensors.)
Interface	USB Interface (Serial communication) Communication Parameters ・Baud Rate 9600/38400/57600 bps ・Data Bits 8bit ・Parity None ・Stop Bit 1bit ・Flow Control Hardware ・Delimiters CR+LF
I/O	Input 4-pin (Photo-coupler Input, Internal Resistance 2.2kΩ) Output 4-pin (Open-collector Output Maximum Use Conditions DC24V 20mA)

Control signals	Return-to-origin -1 point (photo-coupler input, internal resistance 2.2kΩ)
	Emergency stop-1 point (photo-coupler input, internal resistance 2.2kΩ)
	Rotation-3 point (photo-coupler input, internal resistance 2.2kΩ)
	Reverse rotation-3 point (photo-coupler input, internal resistance 2.2kΩ)

3. Driver Specifications

Driver type	Bi-polar pentagon micro-steps system
Driving electric current (output current)	1.4 A/phase (0.75 A/phase)
Current down (stop current)	0.7 A/phase (0.375 A/phase)
Division (micro-step) settings	40 divisions

7-2 Connector Pin Assignments

・7-2-1. I/O Connector

No.	Description	No.	Description
1	24V_EX	11	JOGY-
2	GND_EX	12	-
3	JOGY+	13	JOGX+
4	-	14	JOGX-
5	STOP	15	ORG
6	IN1	16	IN2
7	IN3	17	IN4
8	JPGZ+	18	JPGZ-
9	OUT1	19	OUT2
10	OUT3	20	OUT4

Connector 10220-52A2PL (by Sumitomo 3M Limited) used

***) When using the I / O signal, please supply the 24V_EX (pin 1) and GND_EX (pin 2) than external.**

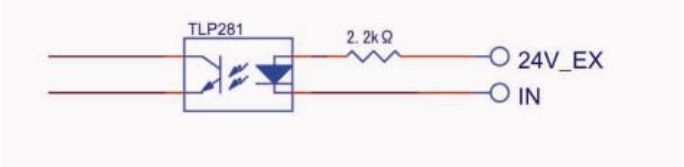


Figure 6-2-1：IN1～4,jpgX-Y-Z,ORG,STOP Input Circuit Diagram

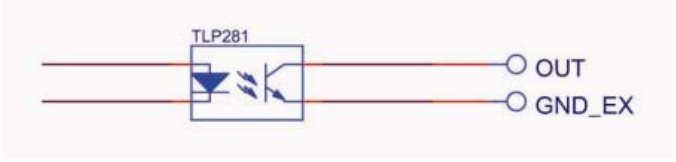


Figure 6-2-2：OUT1～4 Output Circuit Diagram

▪ 7-2-2. STAGE1,2 Connector

No.	Description	No.	Description
1	Blue: motor wiring	9	Autoconfig
2	Red: motor wiring	10	-
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	+24V: sensor power supply
8	+24V: sensor power supply		

Female XM3B-1522 connector (OMRON products) used

▪ 7-2-3. USB Connector

No.	Description	No.	Description
1	-	3	DATA+
2	DATA-	4	GND

Connector XM7B-0442 (By Omron) used

▪ 7-2-4. OPTION Connector

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

Connector 10214-52A2PL (by Sumitomo 3M Limited) used

7-3. Outlines