Intelligent Driver

Two-Axis Stage Controller

GSC-02

For Your Safety

User's Manual

OptoSigma

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Contents

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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 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.

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.

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

□GSC-02 Stage Controller: 1

□SCT-602 Terminal Cap: 1

□User's Manual (This Manual): 1

You can download sample software from our web page.
Web http://www.global-optosigma.com/en-jp/software/sample_en.html

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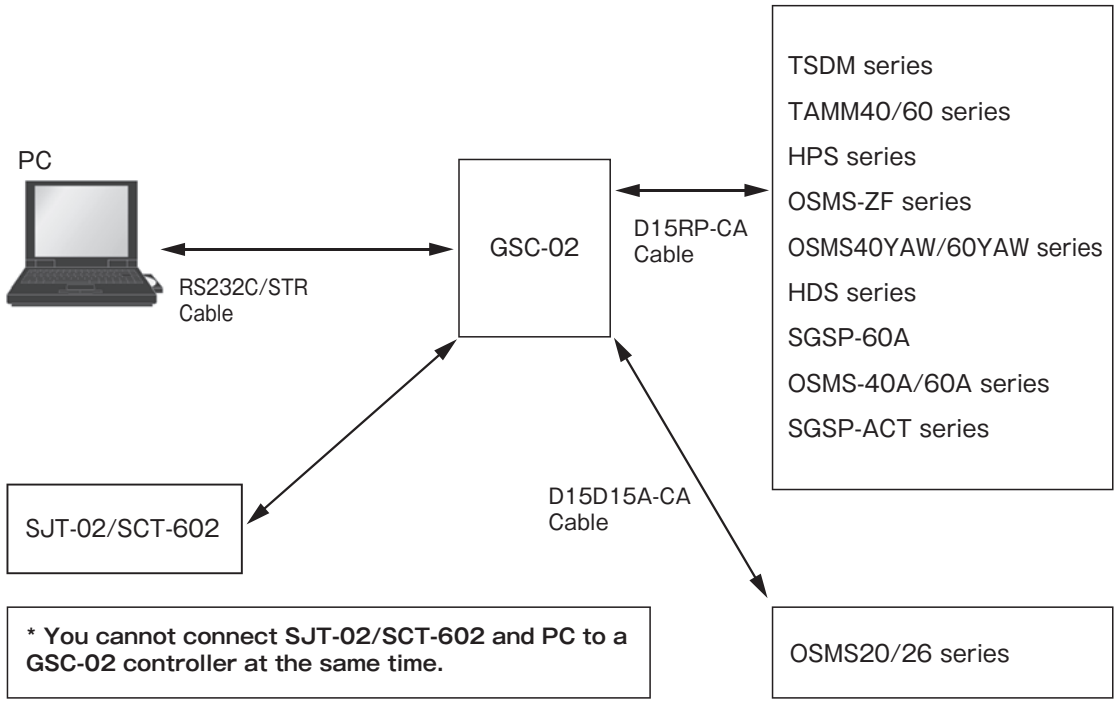
2. Overview

This controller is two axes stage controller featuring stepping motor drivers.
When the GSC-02 is connected to an ordinary personal computer via an RS232C interface, the stage can be accurately moved to the desired position by simple commands sent from the PC.

3. The GSC-02 System



⚠ Note that applicable cables and drive current values are depending on the specifications of stages used. Check if your controller can adequately control desired devices before forming a system.

⚠ You cannot connect SJT-02/SCT-602 and PC to a GSC-02 controller at the same time. If you connect them in parallel, GSC-02, SJT-02/SCT-602, and/or PC may be damaged.

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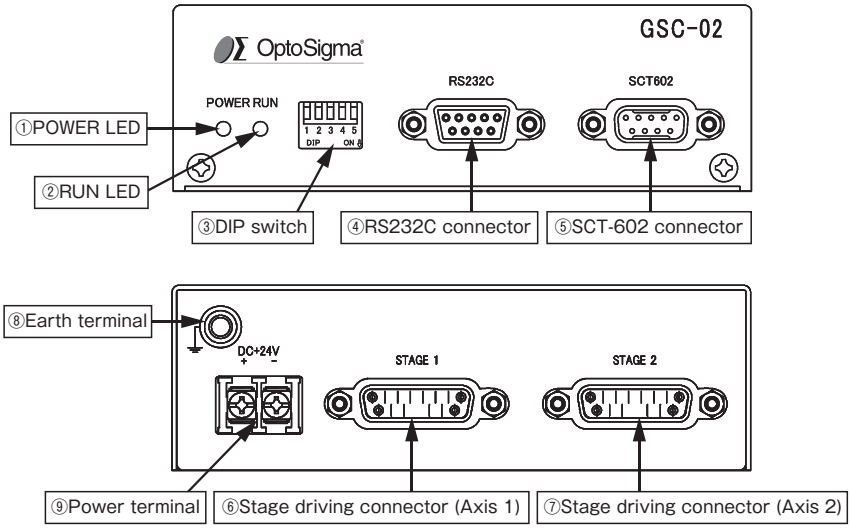
4. Parts of the GSC-02

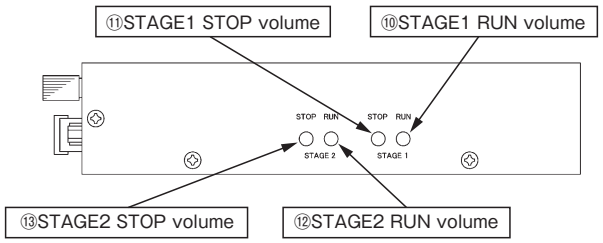


Functions:

①POWER LED	:	Lights up in green when powered.
②RUN LED	:	Lights up in red while driving stages.
③DIP switch	:	Makes basic settings for GSC-02.
④RS232C connector	:	This connector is used when the device is controlled from the computer via an RS232C interface.
⑤SCT-602 connector	:	This connector is used when controlling with the SJT-02/SCT-602.
⑥,⑦Stage driving connector	:	Connect to the motorized stage of your choice. Supports up to two axes
⑧Earth terminal	:	Should be grounded properly in your environment.
⑨Power terminal	:	Connect to the power source (+24V, 2A).

⚠ Turn off a power supply in the case of the connector connection for security.

⚠ Make sure to set up and wire the cable supplying DC+24V and GND to the GSC-02 so that the maximum length of cable is not longer than 2m.



⑩STAGE1 RUN volume : Volume control adjusting the RUN current output through the stage drive connector. (Axis 1)
⑪STAGE1 STOP volume : Volume control adjusting the STOP current output through the stage drive connector. (Axis 1)
⑫STAGE2 RUN volume : Volume control adjusting the RUN current output through the stage drive connector. (Axis 2)
⑬STAGE2 STOP volume : Volume control adjusting the STOP current output through the stage drive connector. (Axis 2)

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Chapter 2: Basic Operations

5. GSC-02 Connection procedure

5-1. Connecting to Motorized Stages

First, connect GSC-02 to the motorized stages.

① Please confirm the power source 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 GSC-02 controller. Also connect the stage controlled as the second axis to the STAGE2 connector.

5-2. Connecting to PC and peripheral device

Connect GSC-02 to PC and peripherals (SJT-02/SCT-602).

RS232C interface is used for the connection between the PC and GSC-02.

The following descriptions premise the RS232C interface.

① Please confirm the power source 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.

③ Insert the male connector of communications cable in to the RS232C connector on the GSC-02. Insert the female end into the serial port on your PC.

6. GSC-02 Setting

Initialize your GSC-02 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.

6-1. Set parameters with DIP Switch

Initialize your GSC-02 by setting each switch to ON/OFF as follows:

Parameter Assignment in the DIP Switch:

DIP Switch No.	Items	Parameters
1,2	Baud rate	2400/4800/9600/19200
3	Detecting the mechanical origin	MARK method/MINI method
4	Input logic for the limit sensor	Normal open/ Normal close
5	Specify whether to return mechanical origin for each axis	First axis only/ Both axis

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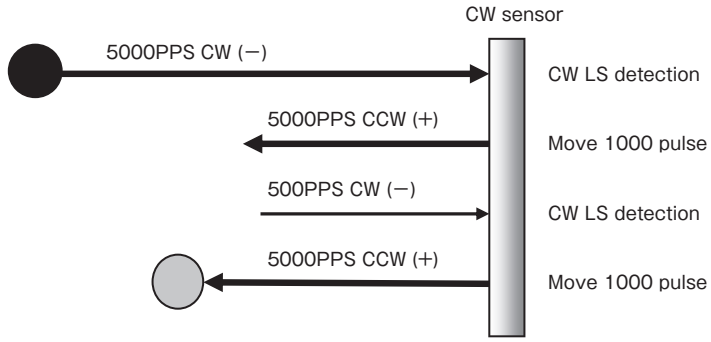
Switch settings and Corresponding Parameters (Set to ON by turning to the down side)

Items	Dip Switch No.		Descriptions
Baud rate	SW No.2	SW No.1	
	ON	ON	2400bps
	ON	OFF	4800bps
	OFF	ON	9600bps
	OFF	OFF	19200bps
Detecting the mechanical origin	SW No.3		
	ON		MARK method
	OFF		MINI method
Input logic for the limit sensor	SW No.4		
	ON		Normal open
	OFF		Normal close
Specify whether to return mechanical origin for each axis	SW No.5		
	ON		First axis only
	OFF		Both axis

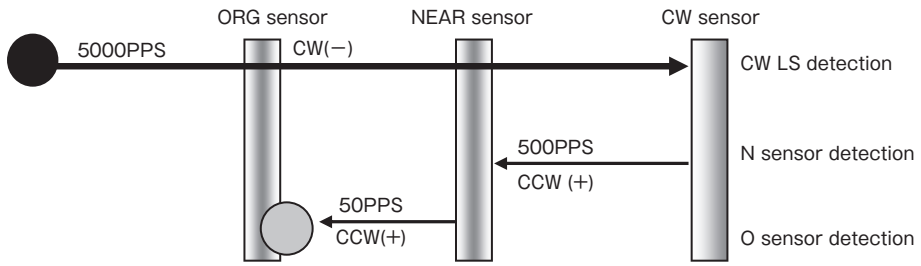
(Note) Shaded areas in the list show our factory settings. Tale care to handle the very small DIP Switch so as to avoid giving damage to them during the settings. Use appropriate tools such as sharp tweezers for setting switches on the DIP Switch. For our SGSP series stages, select Normal close for the limit sensor logic and MINI for the homing method.

Detecting the Mechanical Origin:

MINI method



MARK method



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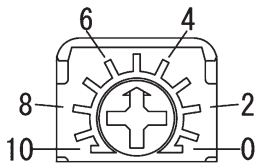
6-2.Setting the drive current

Set current values supplied from GSC-02 to stages. Turn a RUN current volume, provided on the side of the unit, to adjust RUN current corresponding to the stages to use. Use a STOP current volume to set a ratio to 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.

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%.



Volume

Driving current settings (RUN)

Factory-set to 0.35A/Phase

Volume No.	0	1	2	3	4	5	6	7	8	9	10
RUN current (A/phase)	0.3	0.31	0.32	0.33	0.4	0.5	0.6	0.68	0.75	0.79	0.8

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

Factory-set to volume No.0

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

Note) Each value cited in the above table is a guide to adjust the current without instrument, and may fluctuate within an allowable range.

6-3.Power ON

When you have completed procedures above, connect the power source. GSC-02 is power ON and the green power LED lights up.

Now the setup has been done, and your GSC-02 is ready to use. For the details of commands applicable to GSC-02, see Chapter 3.

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Chapter 3: Using GSC-02 to position Motorized Stages

7. Using Computer to position Motorized Stages

The controller can be connected to a computer using an RS232C interface. Motorized stages can then be precisely controlled by commands (strings) transmitted from the computer.
The RS232C interface communication parameter of the GSC-02 is described below. Please set the configurations of the PC side according to the following table.

Items	Descriptions
Baud rate	Baud rate set with DIP Switch
Delimit	CR+LF
Parity	Non
Data bit	8bit
Stop bit	1bit
Flow control	Hardware (RTS/CTS)

7-1. List of Commands

The following is a list of available 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
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
Free motor	C :	Excitation ON/OFF
Status1	Q :	Return current position etc.
Status2	! :	Return B(busy)/R(ready)
Internal information	? :	Check internal information

7-2. Command Format

Except for some status check commands (Q:, !:, ?:), no response will be returned to a command input. To determine whether or not a command was received normally, use the Q command to check status.
All commands are in single-byte characters.

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7-3. Commamd 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. Each axis moves at the following constant conditions: Minimum speed (S): 500PPS, Maximum speed (F): 5000PPS, Acceleration/ Deceleration time (R): 200mS. Axes to home are depending on the DIP Switch settings.

Format:

H: 1+	Detects mechanical origin for Axis 1 in the positive direction.
H: 1-	Detects mechanical origin for Axis 1 in the negative direction.
H: 2+	Detects mechanical origin for Axis 2 in the positive direction.
H: 2-	Detects mechanical origin for Axis 2 in the negative direction.
H: W++	Detects mechanical origin for Axis 1 in the positive direction, and Axis 2 in the positive direction.
H: W+-	Detects mechanical origin for Axis 1 in the positive direction, and Axis 2 in the negative direction.
H: W-+	Detects mechanical origin for Axis 1 in the negative direction, and Axis 2 in the positive direction.
H: W--	Detects mechanical origin for Axis 1 in the negative direction, and Axis 2 in the negative direction.

(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.

Format:

M: nmPx

Parameter:

n: 1 or 2 or W	Axis number	1 or 2: Moves only one axis, W: Moves both axes.
m: + or -	Direction of move	+: + direction move, -: - direction move
x: moving pulse count		0 - 16777214.
Example:	M: W+P500-P200	Travel 500 pulses in the + direction on the first axis and 200 pulses in the -
G	direction on the second axis	

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(3) 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. The stage will stop by an L command.

Format:

J: nm

Parameter:

n : 1 or 2 or W	Axis number	1 or 2: Moves only one axis, W: Moves both axes.
m : + or −	Direction of move	+: + direction move, −: − direction move

Example:

J : W−+ G — Move in the − direction on the first axis and in the + direction on the second axis

(4) 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 and J commands.

Format:

G — Drive

(5) L command: Decelerate and stop

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

Format:

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

Note) Stage does not stop even if "L:1", "L:2" at the time "H:". Stop in "L:W" or "L:E".

(6) L: E command: Emergency stop

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

Format:

L: E — Stop first and second axes immediately

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

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

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

(8) D command: Speed settings

Features: The minimum speed (S), maximum speed (F), and acceleration/deceleration time (R) are set according to the initialize settings when the power is turned on. This command allows you to change these initial settings. The initialize setting is (S): 500PPS, (F): 5000PPS, (R): 200mS.

Format:

D: rSspd11Fspd21Rspd31Sspd12Fspd22Rspd32

Parameter:

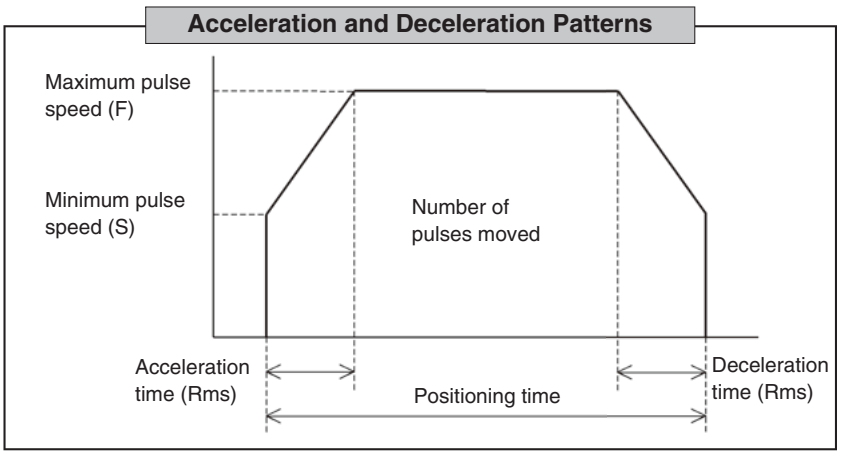
r: 1 or 2	Speed range	1: Low speed range, 2: High speed range
spd1	Minimum speed(S)	1 – 200PPS (Low range), 50 – 20000PPS (High range)
spd2	Maximum speed(F)	1 – 200PPS (Low range), 50 – 20000PPS (High range)
spd3	Acceleration/ Deceleration time (R)	0 – 1000mS (for both High/Low range)

Note) The maximum speed(F) setting should be equal or greater than the minimum speed. 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.

Example:

D: 2S100F1000R200S100F1000R200

Sets speeds for Axes1 and 2: Axis1: S = 100PPS, F = 1000PPS, R = 200mS, Axis2: S = 100PPS, F = 1000PPS, R = 200mS.



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(9) 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.

Format:
C: nm

Parameter:

n: 1 or 2 or W	Axis number	1 or 2: only one axis, W: both axes.
m: 0 or 1		0: motor free, 1: motor hold
Example: C: 10		Free first-axis motor

(10) 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.

Format:
Q: Return data: — 100, — 200, ACK1, ACK2, ACK3

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 ,and ! commands can be received
R: (READY) all commands can be received

※Coordinate values for each axis have a fixed length of ten digits, including sign (Sign is left-aligned, coordinates values right-aligned).

(11) ! command: Status 2

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

Format:

!:	Return data:	B	(BUSY) L, Q and ! commands can be received
		R	(READY) all commands can be received

(12) ? command: Request for internal information

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

Format:
?: V

Return data example: V2.00 Internal ROM version 2.00
1: active

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Chapter 4 : Specification

8. Specification

(1) General specifications

Power source	DC+24V
Rating current	2A
Operating temperature	5 to 40℃
Storage temperature	-20 to 60℃
Altitude	up to 2000m
Indoor use only	
Installation category	Ⅱ
Pollution degree	2
Ambient humidity	20 to 80%RH (no condensation)
External dimensions	180W x125D x40H (excluding projections)
Weight	0.7kg

(2) Performance

Controlling axis	2 axis
Maximum driving speed (F)	1 to 20kPPS
Minimum driving speed (S)	1 to 20kPPS
Acceleration/deceleration time (R)	0 to 1000ms
Sensor input	Origin sensor/proximity sensor/CW (-) limit/CCW (+) limit
	(Limit sensor logic can be changed with the settings of switch 4 on the DIP Switch.)
Method of return to origin	MINI method/MARK method
	(Set with switch 3 on the DIP Switch.)
Axes to Home	Axis1/ both axis (1axis and 2axis)
	(Set with switch 5 on the DIP Switch.)
Interface	RS232C interface
	Communication Parameters
	- Baud rate 2400/4800/9600/19200
	(Set with switches 1/2 on the DIP Switch.)
	- Data bits 8 bits
	- Parity None
	- Stop bit 1bit
	- Flow control Hardware (RTS/CTS)
	- Delimiters CR+LF

(3) Driver Specifications

Driver Mode	Half step driving
Driving (RUN) current	0.3A/phase to 0.8A/phase
Current down function	Automatic current down

(4) Electrical fast transmit/burst immunity

EN61000-4-4 (2012) Level2

(5) Electrostatic discharge

EN61000-4-2 (2009) Level2.

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9. Connector Pin Numbers and Signals

9-1. STAGE1, 2 Connector

No.	Name	No.	Name
1	Blue: motor wiring	9	GND: for Brake
2	Red: motor wiring	10	+24V: for 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	+24V: sensor power supply
8	+24V: sensor power supply		

Connector Type　D-sub 15pin female connector (mm screw threads)

9-2. RS232C Connector

No.	Name	No.	Name
1	—	6	DTR
2	TxD	7	CTS
3	RxD	8	RTS
4	DSR	9	—
5	SG		

Connector Type　D-sub 9pin female connector (inch screw threads)

9-3. SCT602 Connector

No.	Name	No.	Name
1	+24V	6	DTR
2	TxD	7	CTS
3	RxD	8	RTS
4	DSR	9	Reserved
5	SG		

Connector Type　D-sub 9pin male connector (mm screw threads)

⚠ Do not connect any other devices to the SCT602 connector to avoid possible damage.
You cannot connect to the SCT602 connector and RS232C connector at the same time.

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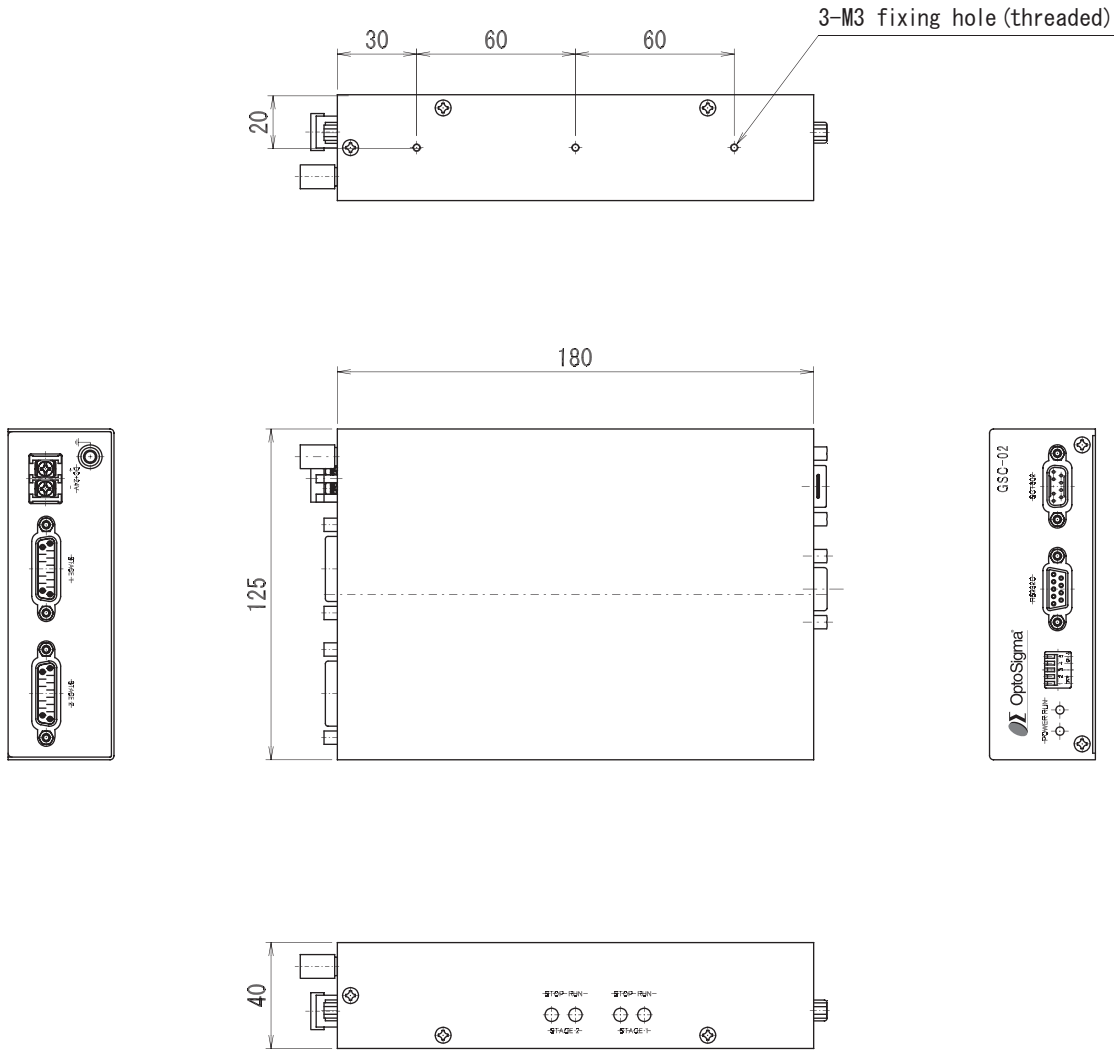
10. Exterior Dimensions



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