

Pulse-Generating Controller

PGC-04-U



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For Your Safety

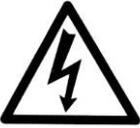
Before using this product, read this manual and all warnings or cautions in the documentation provided.

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.
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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.



- 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 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.

PGC-04-U <input type="checkbox"/> PGC-04-U Controller <input type="checkbox"/> User's Manual (This Manual)
Option <input type="checkbox"/> PAT-POW (DC24V Power Supply)

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

Sample software are available for download our website.

WEB http://www.global-optosigma.com/en_ip/software/sample_en.html

1-2.Overview

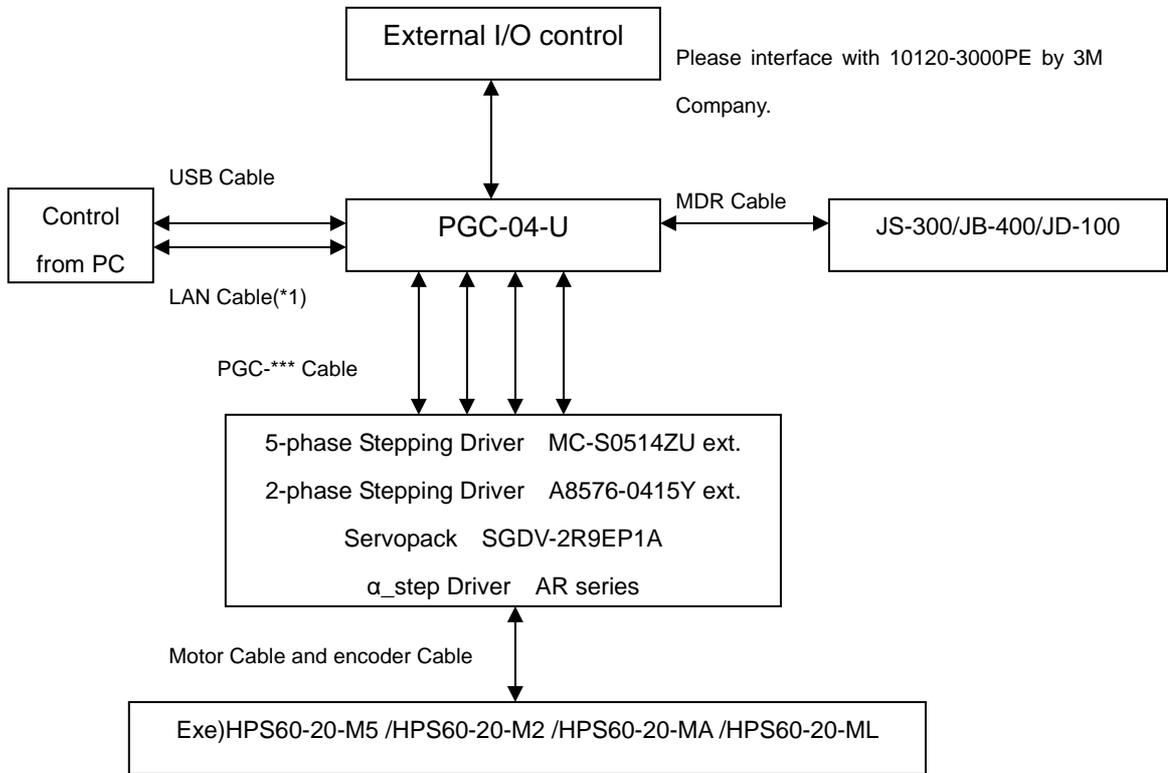
This controller (below PGC-04-U) is a Pulse-generator type 4-axis Controller.

PGC-04-U can be connected to the various motor drivers.

When PGC-04-U connected to an ordinary personal computer via an USB, LAN interface, the stage can be accurately moved to the desired position by simple commands sent from the PC.

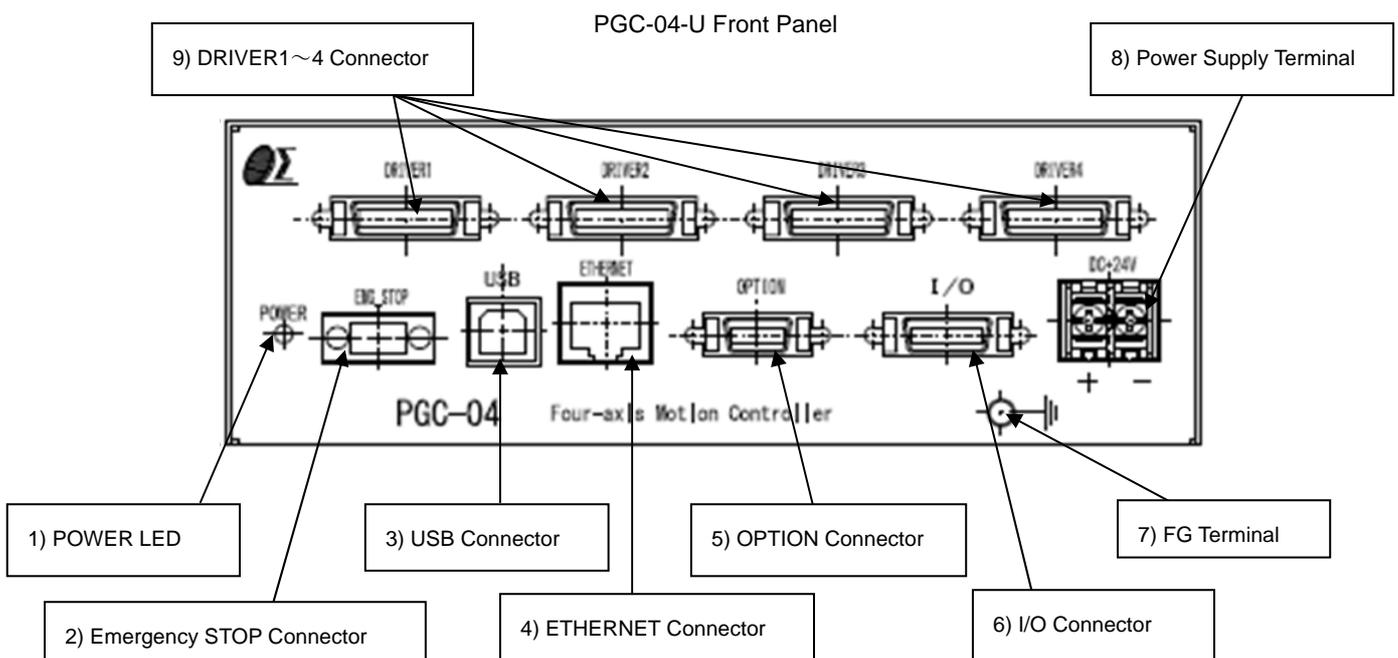
Can be manually operated by a Handy Terminal (JS-300, JB-400, JD-100).

1-3.PGC-04-U System Diagram



*1) In case of connection between PC and PGC-04-U directly please use cross cable, and in case of connection through HUB please use straight cable.

1-4.Parts and Functions



- 1) POWER LED : Lights up when powered.
- 2) Emergency Stop Connector : It connects with Emergency Stop Switch. Please refer to 「4-3 Emergency STOP」 for further details.
- 3) USB Connector : When control by USB Interface(Serial) through PC, please use USB.
- 4) ETHERNET Connector : In case of connection through Ethernet from PC, connect with using straight or cross LAN cable.
- 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 manuals.
- 6) I/O Connector : It interfaces with input/output signal for external devices.
- 7) FG Terminal : It is Terminal for Frame Ground. Please connect to Earth in the actual environment.
- 8) Power Supply Terminal : Supply Power (DC +24V 1.4A)
- 9) DRIVER Connector 1～4 : Connects to the cable attached to the Driver/ Servo-pack in use.



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



Make sure to set up and wire the cable supplying DC+24V and FG_GND to the PGC-04-U so that the maximum length of cable is not longer than 2m.



Power supply, use a DC power supply with primary side and the secondary side is reinforced insulation.

In addition, wire the power supply separate from the motor drivers and servo -pack.

Chapter 2: Connection Flow

2-1.Connection setup various drivers, the SERVO-PACK

When shipped from the factory, because it is a stepping motor driver setting, when connecting the α _step driver and servo-pack(SGDV series), Please change the settings to the following procedure.

When connecting a 2-phase stepping motor driver and 5-phase, the setting of this item is unnecessary.

- ① Remove the cover on top of the PGC-04-U. (Remove M2.6 dish bis x 8)
 - ※) When removing the top cover, a power supply, Please carry it out in a state of power supply OFF by all means.
- ② Replace jumper pin of following Fig.2-1 in the AM side (α _step motor and AC servo motor side) from the SP side (stepping motor side). AX1,2,3,4 shows the AXIS1,2,3,4 respectively. Therefore, change the setting of the axis you want to change.

JP for AXIS1 setting : JP11,12 , JP for AXIS2 setting : JP13,14

JP for AXIS3 setting : JP15,16 , JP for AXIS4 setting : JP17,18.

※) Setting the jumper pin except theabove is unnecessary. Do not change it.

Example) When changing AXIS1 to the AC servo setting, it becomes like Fig.2-2.

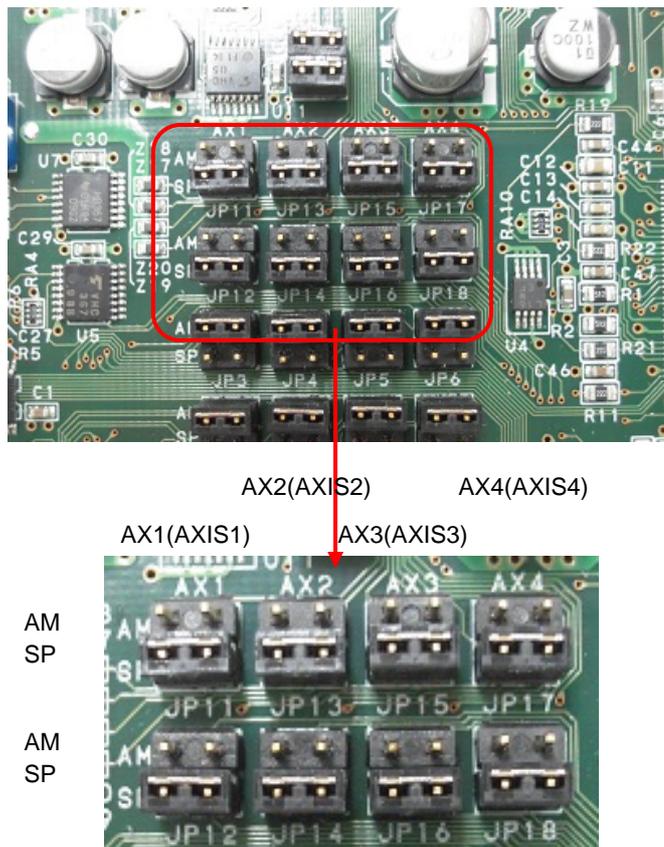


Fig.2-1 for setting the jumper pin

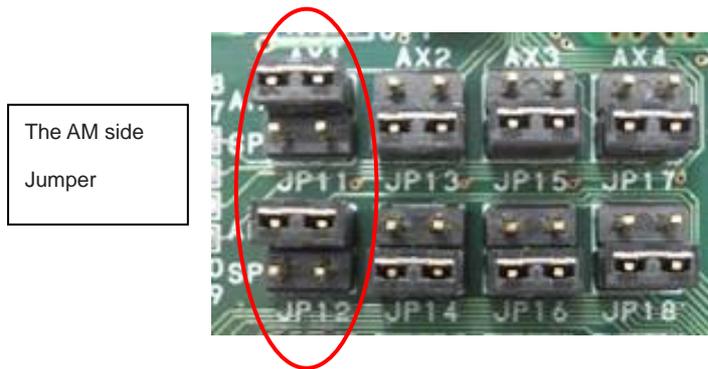


Fig.2-2 example) 1 Axis AC servo jumper pin setting (Set to the AM side of the JP11, 12)

- ③ Setting of ② After finishing, please attach the upper cover removed in ①

2-2.Connection with various drivers

Connecting PGC-04-U and various drivers, please use a “DRIVER1 - 4” connector. Please refer to the following list for the pin assignment of the “DRIVER1 - 4” connector.

No.	Description	Function
1	PP+	+pulse output
2	PP-	
3	PM+	-pulse output
4	PM-	
5	CLR (ERC)	Clear-signal output (AC_SRV and ALPHA setting)
6	Servo_ON/STEP4	Servo_ON-signal output (AC_SRV/ALPHAsetting) / STEP4-signal output (STEPNG setting)
7	P_Reset/STEP3	P_Reset-signal output (ALPHA setting) / STEP3-signal output (STEPNG setting)
8	ALM_RST/STEP2	ALM_Reset-signal output (AC_SRV setting) / STEP2-signal output (STEPNG setting)
9	CCM/STEP1	CCM-signal output (ALPHA setting) / STEP1-signal output (STEPNG setting)
10	FREE/H.O	FREE-signal output (ALPHA setting) / H.O-signal output (STEPNG setting)
11	#RES	Power_ON_Reset-signal output
12	Auto_Config	Auto_Config-signal input output (for only sigmakoki products.)
13	ALARM_IN(Driver)	ALARM-signal input

14	INP	Positioning completion signal input (COIN/END-signal input)
15	TIM+ (Z_P+)	TIM(PCO)/Z phase-signal input ※1
16	TIM- (Z_P-)	
17	LS+	+LS(+Limit Sensor) input
18	LS-	-LS(-Limit Sensor) input
19	ORG	ORG(Origin sensor) input
20	NEAR	NEAR(Near Org sensor) input
21	24V	DC24V output
22	24V	
23	5V	DV5V output
24	5V_ with 180Ω	DV5V with 180Ω
25	GND	GND
26	GND	

※1) About the TIM/Z_P-signal, refer to “2-1 Connection setup various drivers, the SERVO-PACK”. It becomes the line-driver tray setting in AM side setting, photo-coupler tray setting in SP side setting. At the use of SGD_V and α _step, AM setting. At the use of MC-S0514ZU, SP setting.

When you connect various drivers, please use a standard cable (option) or please connect various driver connection of P12 – P14 after reference.



Coution Use a shield-cable for a connection cable.



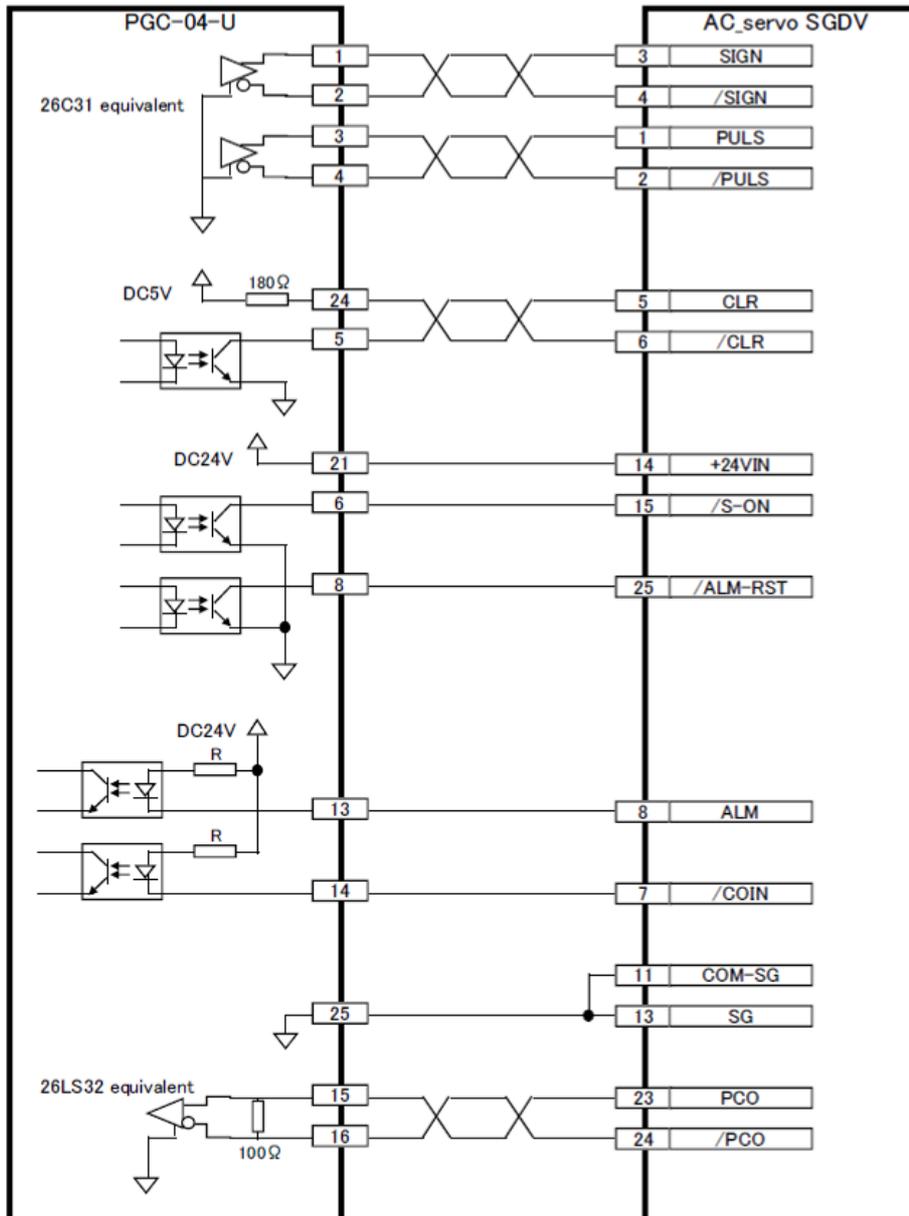
Coution Use less than 2m of connection cable. In addition, wire it to become as short as possible.

1) When it connects with the AC servo pack SGD series (product made in Yaskawa Electric Corporation)

When you connect with the AC servo pack SGD series, please connect using standard cable (PGC-ACS), or, please connect the following connection after reference.

※) When use an AC servo pack, AM side setting, please while referring to a 2-1 clause.

※)When use an AC servo pack, please make setting of the memory switch(Axis:29 - 32) AC SRV setting.

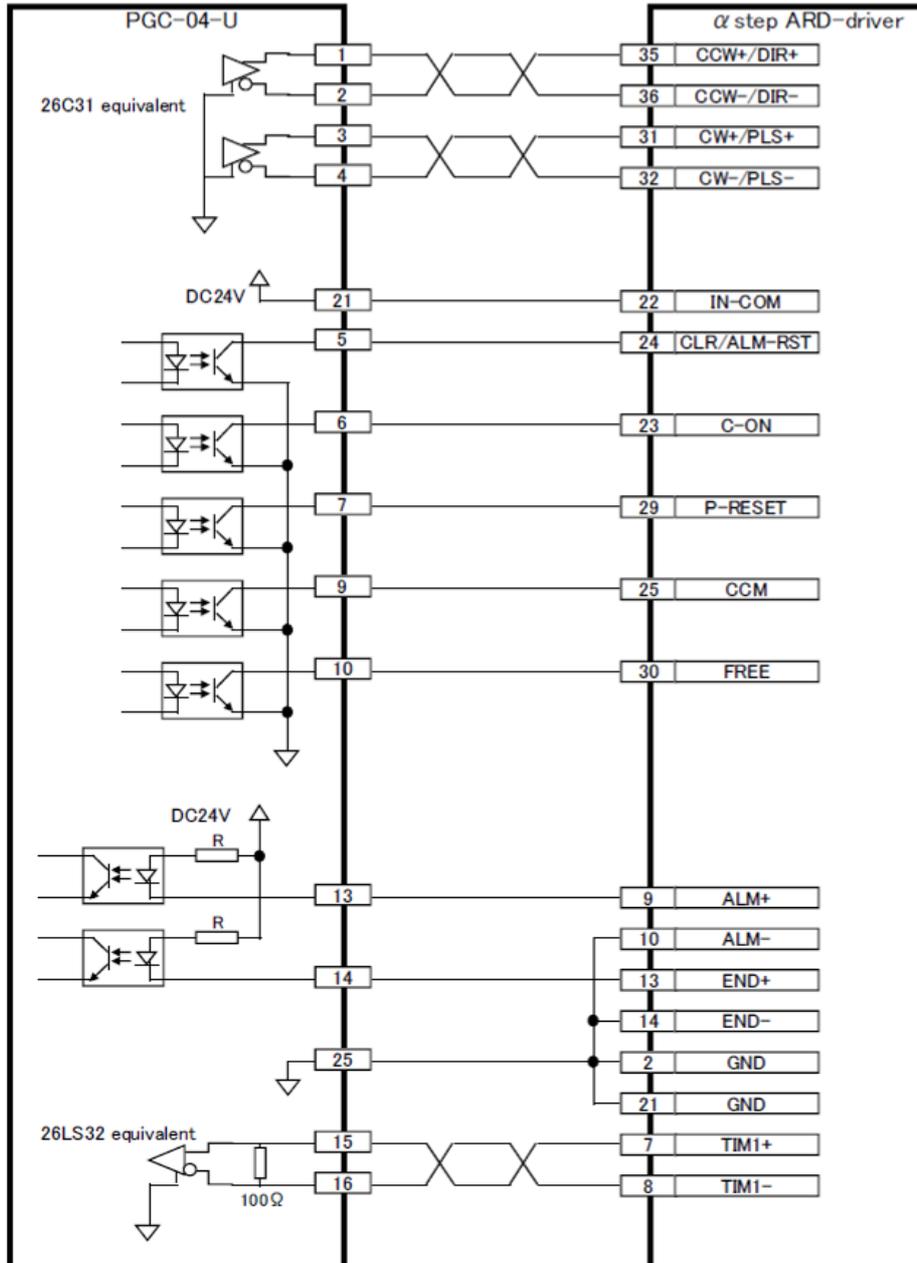


2) When it connects with the α _STEP AR series (product made in OrientalMotor)

When you connect with the α _STEP AR series, please connect using standard cable (PGC-ARD), or, please connect the following connection after reference.

※) When use an α _STEP, AM side setting, please while referring to a 2-1 clause.

※) When use an α _STEP, please make setting of the memory switch(Axis:29 - 32) ALPHA setting.

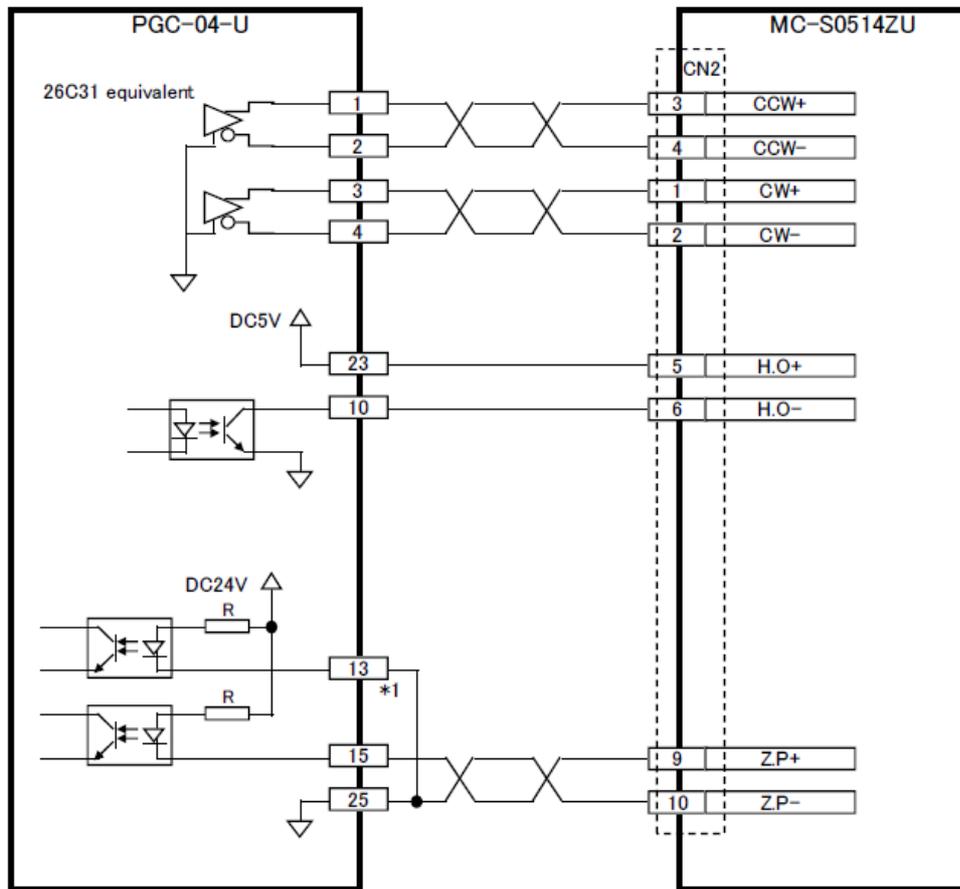


3) When it connects with the Five phase stepping motor driver MC-S0514ZU (product made in SIGMAKOKI)

When you connect with the MC-S0514ZU, please connect using standard cable (PGC-S0514ZU), or, please connect the following connection after reference.

※) When use an MC-S0514ZU, SP side setting, please while referring to a 2-1 clause.

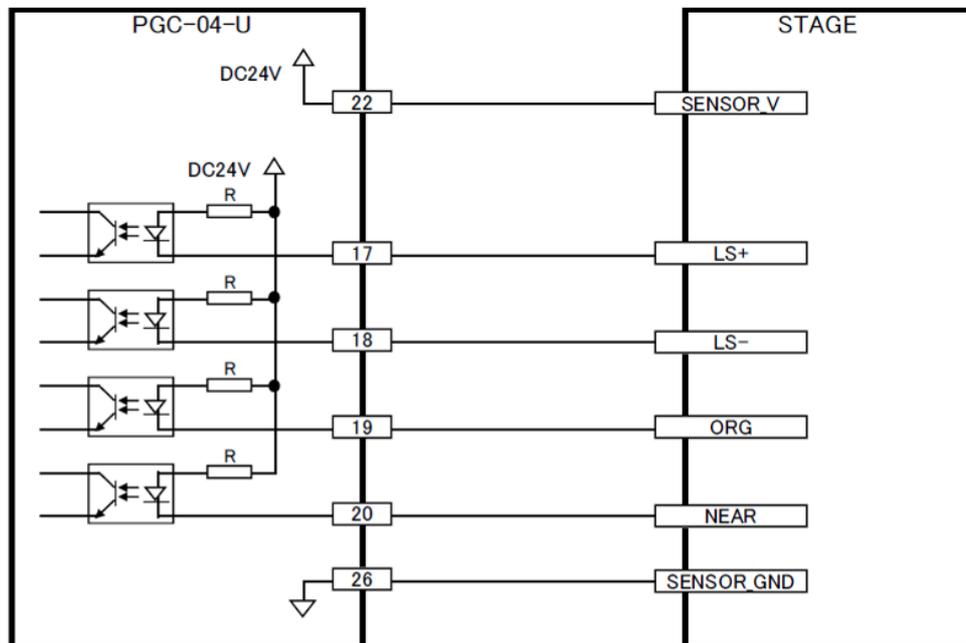
※) When use an MC-S0514ZU, please make setting of the memory switch(Axis:29 - 32)STEPNG setting.



*1) PGC-04-U 13pin is ALARM_IN, so when using MC-S0514ZU, please be sure to connect with GND. When being open, it'll be a driver alarm.

2-3.Connection between PGC-04-U and stage's sensor

When connecting various stage sensors (LS+, LS-, ORG, NEAR), please use standard cable (option) or connect according to the following circuit diagram.



※) Please set input logic(polarity (NORMAL OPEN/NORMAL CLOSE)) of each sensor by a memory switch (Sensor:1-12), according to the sensor you use.

※) Please use a limit sensor(LS+, LS-) of each axis by identical logic. It isn't possible to use LS+, LS- by different logic (polarity).

2-4.Setting of drivers and servopack

The following setting is needed to connect PGC-04-U and various driver, servopack.

① AC servopack SGDV series (YASKAWA Electric Corporation) setting

1) Setting change preparations of SGDV series

When changing the setting of a SGDV series, exclusive software Sigma Win+ is used.

Please download Sigma Win+ from YASKAWA Electric Corporation HP

(<http://www.e-mechatronics.com/download/tool/servo/sgmwinpls/index.html>)

2) Connect PC and Servopack

Please connect a PC in which Sigma Win+ is installed and a servopack.

Please connect by a USB cable (the servopack side: Micro-B type).

And, please connect a servopack and a servomotor (stage).

(A SIGMAKOKI's standard motor is SGMMV-A1E2A21. A SIGMAKOKI's standard servopack is SGDV-2R9EP1A.)

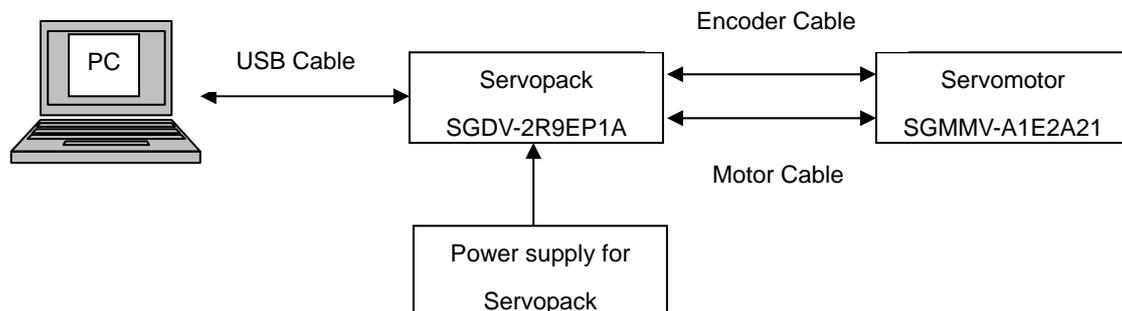


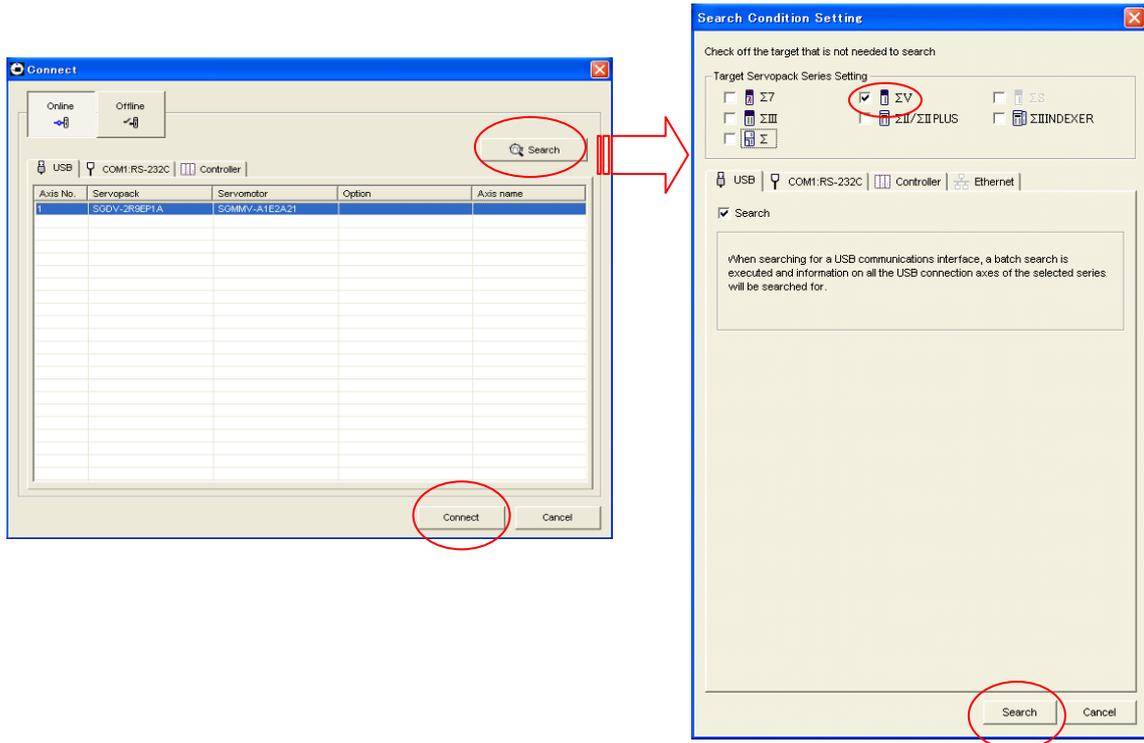
Fig2-3 Connection composition

3) Servopack settings

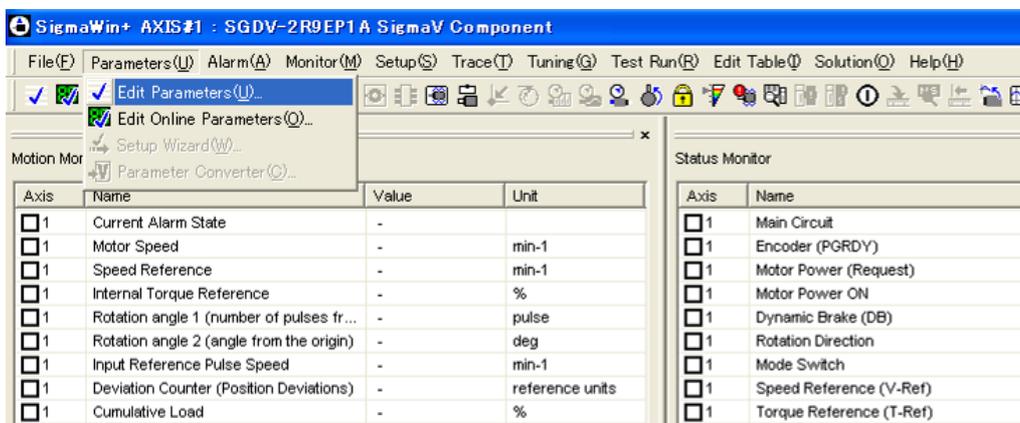
After a connection, please supply a servo pack with electricity. After supplying electricity, please start Sigma Win+. When connecting for the first time, please confirm the connection of a servo pack in "Search".

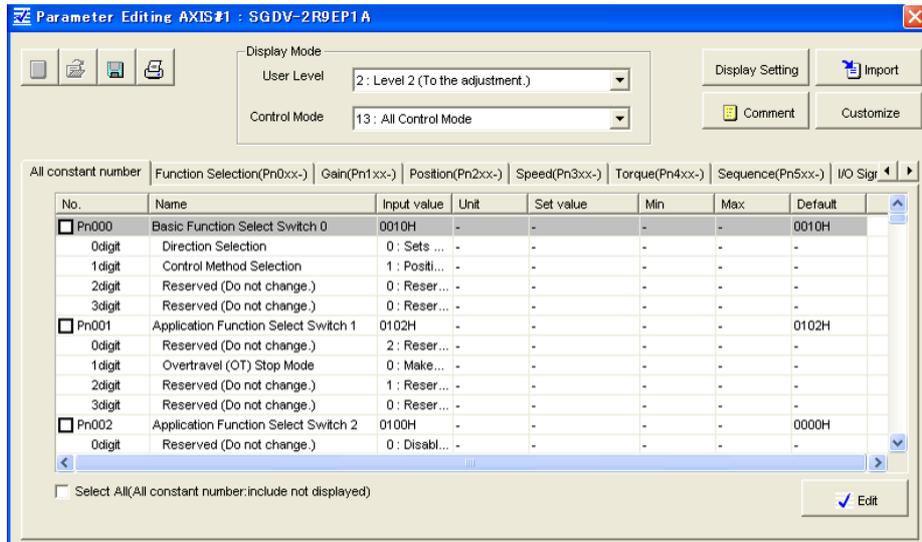
When the connection is confirmed, connected servo pack and servomotor are indicated.

After choosing the servo pack you'd like to set, please click "Connect".



Next, please choose "Edit Parameters(U)" in Sigma Win+ screen. A parameter editing screen is indicated.

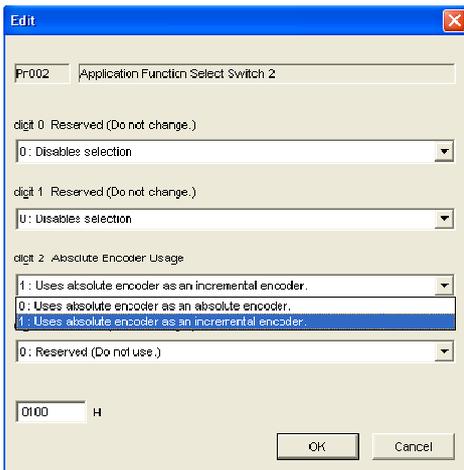




Please set the following parameter in parameter edit.

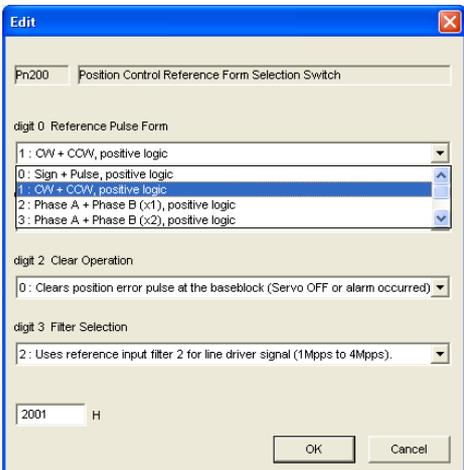
○Pn002 : Default(0000H) ⇒ Change(0100H)

Uses absolute encoder as an incremental encoder.



○Pn200 : Default(0000H) ⇒ Change(2001H)

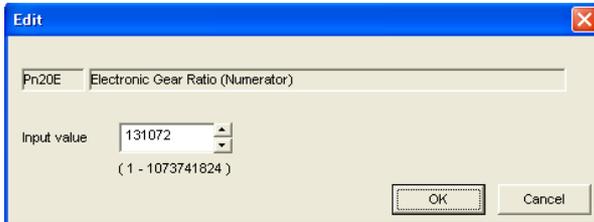
Input filter(~4Mpps)and order pulse form are CW+CCW、positive logic.



○Pn20E : Default(4) ⇒ Change(131072)

Electronic Gear Ratio (Numerator) Encoder resolution of SGMMV-A1E2A21 Set value 131072

※But, when the reduction gear ratio isn't 1/1, please set a figure which matches the reduction gear ratio.



○Pn210 : Electronic Gear Ratio (Denominator)

First the amount of transfer of 1 pulse is decided.

In case of X stage of reduction gear ratio: 1/1, please calculate as follows and input.

Screw lead : p(mm), The amount of transfer per 1 pulse : u(um)

Electronic Gear Ratio (Denominator) = (p×1000)/u

(※Please make electronic gear ratio an integer.)

example) When SGMV26-100(screw lead:2mm) made of SIGMAKOKI is set as amount of transfer 0.1µm per pulse.

$$\begin{aligned} \text{Electronic Gear Ratio (Denominator)} &= (2 \times 1000) / 0.1 \\ &= 20000 \end{aligned}$$

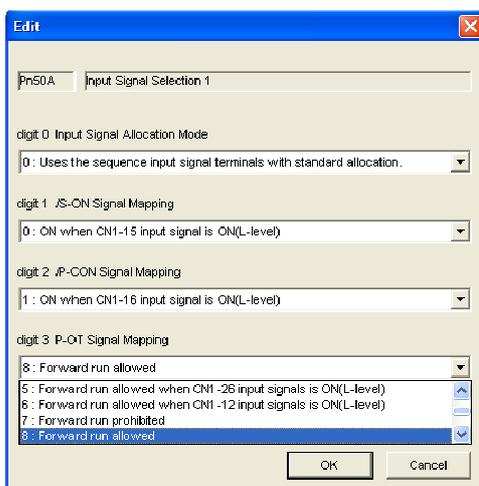
※) Please set electronic gear ratio in $4000 \geq \text{Pn20E} / \text{Pn210} \geq 0.001$ area

When exceeding this area, 『Parameter Setting Error』 occurs.

※) Please set memory switch (axis: 9-12) PLS_RATE of PGC-04-U according to the above.

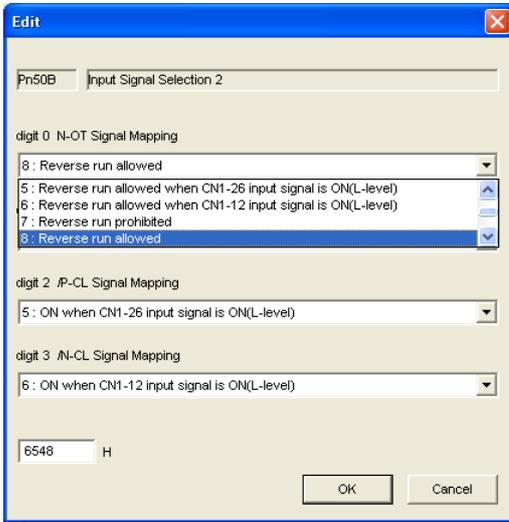
○Pn50A : Default(2100H) ⇒ Change(8100H)

P-OT Signal Mapping is changed.



○Pn50B : Default (6543H) ⇒ Change (6548H)

N-OT Signal Mapping is changed.



The parameter to which setting is necessary is as mentioned above.

Please change other parameters as the need arises.

Please confirm details of a servo pack by manual,etc.from YASKAWA Electric Corporation WEB(<http://www.e-mechatronics.com/product/servo/index.html>).

② α_STEP AR series (product made in OrientalMotor) setting

1) ARD-K(α_STEP driver)setting

The setting is changed by the front switch of driver.

○Resolution

Please set resolution per motor 1 round by SW1-No.3/No.4

SW3	SW4	Resolution
OFF	ON	500 P/R
OFF	OFF	1000 P/R
ON	ON	5000 P/R
ON	OFF	10000 P/R

Default (1000 P/R)

※) Please set memory switch (axis: 9-12) PLS_RATE according to the above.

○Please use pulse input system by default:2 pulse input system.

Please confirm details of α_STEP driver by manual,etc.from ORIENTAL MOTOR Co. , Ltd. WEB(http://www.orientalmotor.co.jp/products/stepping/ar_dc/features/).

③ MC-S0514ZU (five phase stepping motor driver)setting

1) MC-S0514ZU setting

Please change the setting with dip switch and digital switch of driver.

○Devide

Please change the setting with divide setting from digital switch M1 of driver.

The contents of divide setting by driver's digital switch M1 are written by a driver instruction manual .Please refer to that.

※) Please set memory switch (axis: 9-12) PLS_RATE according to the above.

○Please use pulse input system by default:2 pulse input system.

Please confirm other detail of MC-S0514ZU by driver manual.

④ Other five phase stepping motor driver / two phase stepping motor driver setting

○Resolution/Devide

Please set it with setting of each driver.

※) Please set memory switch (axis: 9-12) PLS_RATE according to the above.

○Pulse input system

Pulse output of PGC-04-U is 2pulse system. Please set it as 2 pulsed system by each driver.

2-5.Connection between PGC-04-U and motoried stage/ Driver

First, please connect PGC-04-U and various driver, motorized stage.

The example which connects motorized stage (SGMV series : made by SIGMAKOKI) and servopack(SGDV:made by YASKAWA Electric Corporation) with 1Axis of PGC-04-U is indicated here.

- ① A standard cable (PGC-ACS-1) is connected to "DRIVER1" connector in the front panel of PGC-04-U.Please connect the connector(D-sub9P : male) in which 2cable are included).
- ② Please connect limit sensor connector(D-sub9P : male) of SGMV saries and the other connector(one of two, D-sub9P : male)of the cable that connected by ①.
- ③ Please connect CN1 connector of SGMV saries and the other connector(one of two, square type and 26Pin) of the cable that connected by ① .

2-6.Connection between driver and motorized stage (at the time of standard cable use)

Please connect various driver and motorized stage.

The example which connects motorized stage (SGMV series) with servo pack (SGDV) is indicated here.

- ① A standard motor cable(JZSP-CF1M00 : Yaskawa Electric Corp.) is connected to CN4 connector of SGD.V.
- ② Please connect motor cable of SGMV series and the other connector of the cable that connected by ①.
- ③ A standard encoder cable (JZSP-CMP10: Yaskawa Electric Corp.) is connected to CN2 connector of SGD.V.
- ④ Please connect encoder cable of SGMV series and the other connector of the cable that connected by ③.

2-7.Interface with PC

(1) USB Connection

Please connect by using USB (USB-1 / USB-2) cable. In this case, please set the memory switch (Interface) to USB. Default setting is USB.

PGC-04-U performs USB serial conversion using FT232 by FTDI. For PC control, driver should be installed in PC. For information about how to install the driver, please install after referring to 「2-8.Driver Installation Method」 .

(2) LAN connection

Please connect by using LAN crossover cable (LAN-CA). However, please use straight LAN cable when connecting via HUB. Then, set Memory Switch (INTERFACE) to Ethernet.

[192.168.0.1] and [255.255.255.0] are set as default value for IP address of PGC-04-U and Subnet Mask respectively. Please set IP address for PC to [192.168.0.X] (X can be any number from 0 to 255.) and Subnet Mask [255.255.255.0] in order for PC to be able to communicate with PGC-04-U.

With regard to LAN settings for PGC-04-U, please refer to 「3-3.LAN Settings」 .

Caution) Default setting is USB. In the case of LAN connection, change the Memory Switch or send the command “?:N” at the start communication.

2-8.Driver installation Method

If using a USB interface in the PGC-04-U, please use after the installation of the USB-driver in the following content.

(In the case of Windows 7/ Windows 8/ Windows 8.1/ Windows10)

While the Internet is connected, when connected to PGC-04-U, 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 PGC-04-U. Please then perform the installation of the driver.**

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

2-9.Power Supply

Power supply should be done as instructed below. Use DC24V for PGC-04-U.

1. First, switch External Driver on.
2. Next, switch PGC-04-U on. Power LED on PGC-04-U will show.

*Note) They can also be switched on at the same time.

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 PGC-04-U.

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

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	STG UT4	PULSE/MICRO/DEGREE	MICRO
5	DIVIDE1	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	20
6	DIVIDE2	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	20
7	DIVIDE3	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	20
8	DIVIDE4	1/2/4/5/8/10/20/25/40/50/80/100/125/200/250	20
9	PLS_RATE1	1~1000000	1000
10	PLS_RATE2	1~1000000	1000
11	PLS_RATE3	1~1000000	1000
12	PLS_RATE4	1~1000000	1000
13	MOVE1	POS/NEG	POS
14	MOVE2	POS/NEG	POS
15	MOVE3	POS/NEG	POS
16	MOVE4	POS/NEG	POS
17	ORG1 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
18	ORG2 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
19	ORG3 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
20	ORG4 SEL	OFF/MINI/CENTER/ORGS/NORM/ZPM/ZPP	MINI
21	ORG OFFSET1	0~999999999	0
22	ORG OFFSET2	0~999999999	0
23	ORG OFFSET3	0~999999999	0
24	ORG OFFSET4	0~999999999	0
25	EMG EXT1	ON/OFF	ON
26	EMG EXT2	ON/OFF	ON
27	EMG EXT3	ON/OFF	ON
28	EMG EXT4	ON/OFF	ON
29	DRIVER1	STEPNG/ALPHA/AC SRV/LINEAR/EZI_STEP	STEPNG
30	DRIVER2	STEPNG/ALPHA/AC SRV/LINEAR/EZI_STEP	STEPNG
31	DRIVER3	STEPNG/ALPHA/AC SRV/LINEAR/EZI_STEP	STEPNG
32	DRIVER4	STEPNG/ALPHA/AC SRV/LINEAR/EZI_STEP	STEPNG

1~4) STG_UT1~4 : 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

5~8) DIVIDE1~4 : Divide setting for SG-55M

Set Divide for each axis. (For SG-55M).

***) With regard to the Driver and Servo-pack of non-SG-55M, set the number of divisions in the Driver and Servo-pack.**

[Select item] 1/2/4/5/8/10/20/25/40/50/80/100/125/200/250

9~12) PLS_RATE1~4 : Pulse Rate setting(1~4axes)

Set the travel distance per 1 pulse for each axis.

***) 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° .**

13~16) MOVE1~4 : Travel direction setting 1~4axis

Set + travel direction for each axis.

[Select item] POS: Positive rotation
 NEG: Negative rotation

17~20) ORG1 SEL~ORG4 SEL : Origin reset method setting

Set Origin reset method for each axis.

[Select item] OFF: Origin reset OFF
 MINI: ORG1
 CENTER: ORG2
 ORGS: ORG3
 NORM: ORG4
 ZPM: ORG5
 ZPP: ORG6

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

21~24) ORG OFFSET1~4 : ORG offset setting

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

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

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

25~28) EMG EXT1~4 : Motor Excitation setting at Emergency STOP

Set Motor Excitation ON or OFF for each axis at at Emergency STOP.

[Select item] ON: Excitation ON

OFF: Excitation OFF

29~32) DRIVER1~4 : Connection Driver setting

Select connection Driver.

[Select item] STEPNG : 5-phase Stepping motor Driver (Equivalent MC-S0514ZU)

2-phase Stepping motor Driver (Equivalent A8576-0415Y)

ALPHA : α _step Driver (ORIENTAL MOTOR Co.,Ltd.)

AC SRV : AC ServoPack (SGDV series : YASUKAWA ELECTRIC CORPORATION)

LINEAR : Linear Servo-Driver (SGDV series : YASUKAWA ELECTRIC CORPORATION)

EZI_STEP : Ezi Step (2-phase Stepping motor) Driver (Fastech Co., Ltd.)

『Origin Reset Method』

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

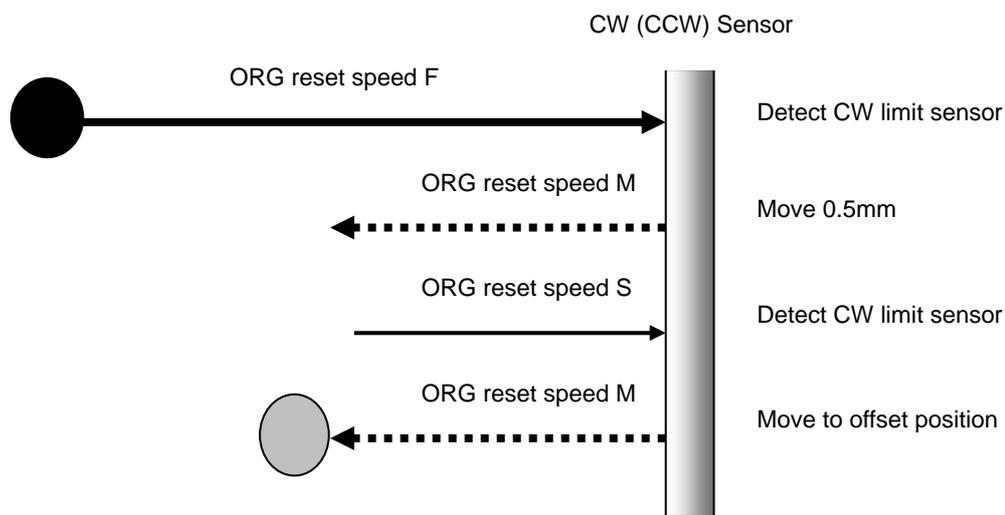
There are two parameters to do with Origin Reset, which are Origin Reset Speed (S, F, R, M) and Origin offset (ORG OFFSET). Parameters of each axis can be individually set. Please select the optimum value according to the software.

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.

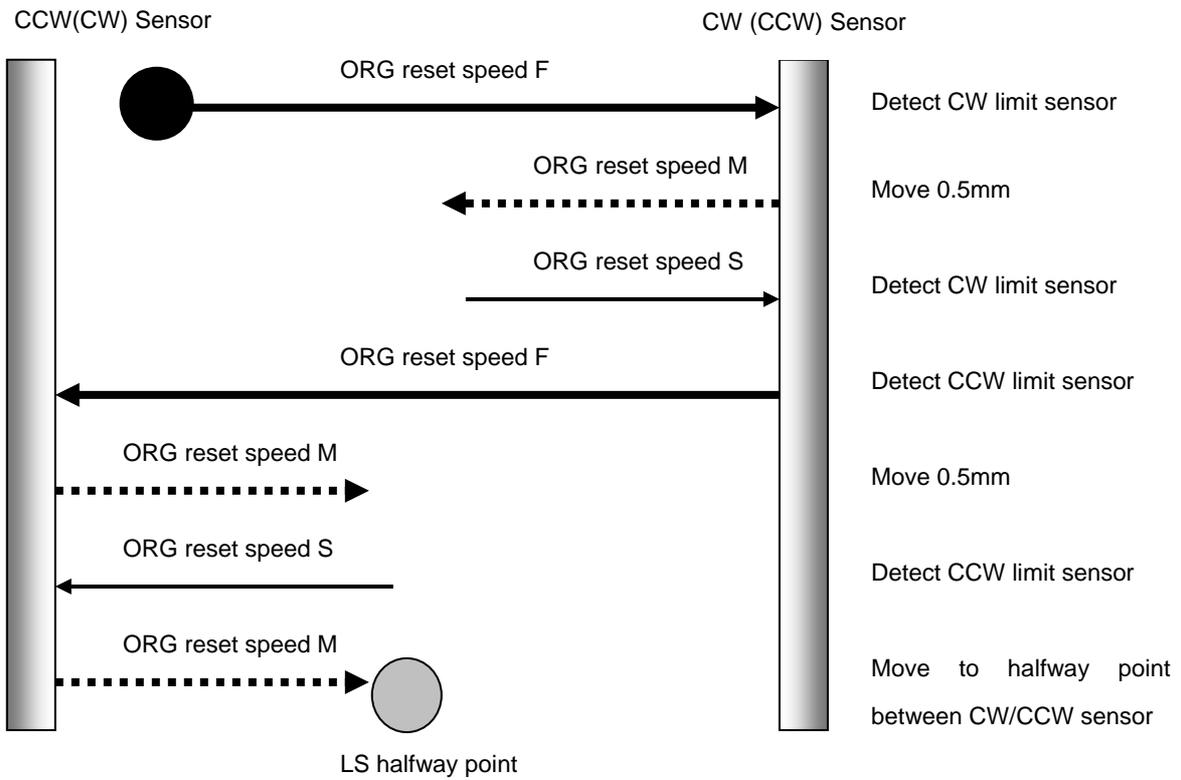
1, ORG0 Not reset ORGIN position.

2, ORG1 (MINI method compatible, however stage moves to ORG offset value)

ORG OFFSET default value: 0.5mm.

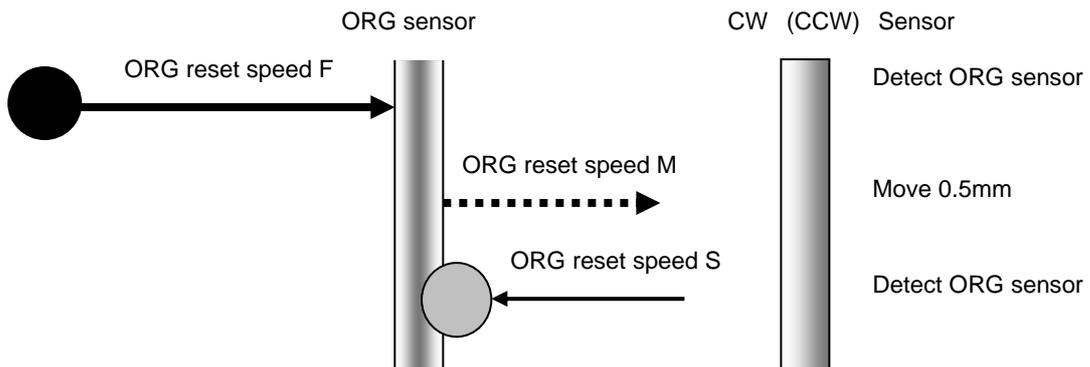


3, ORG2 (CENTER method)

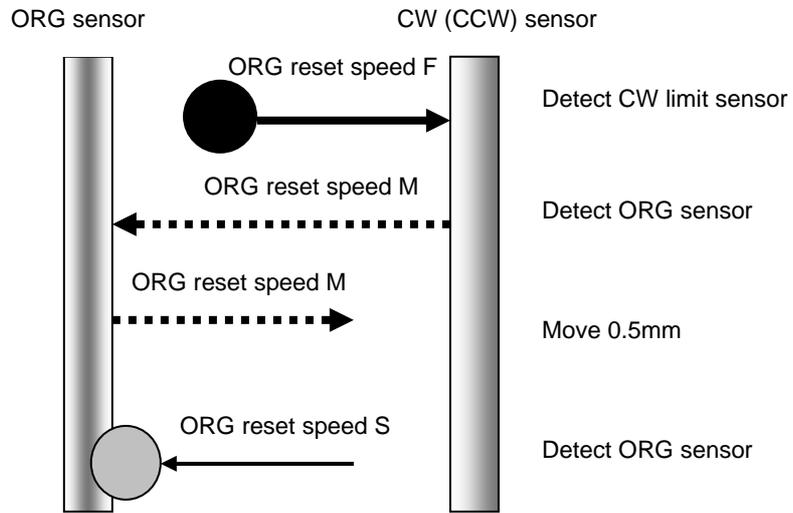


4, ORG3 (for 3 sensor use (LS + ORG))

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



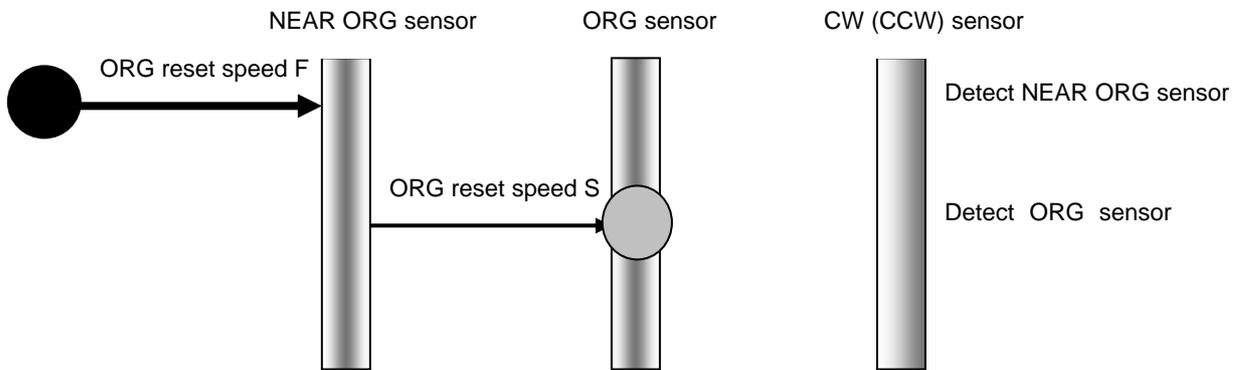
4-2) In case that ORG sensor is set beyond limit SW toward CW direction.



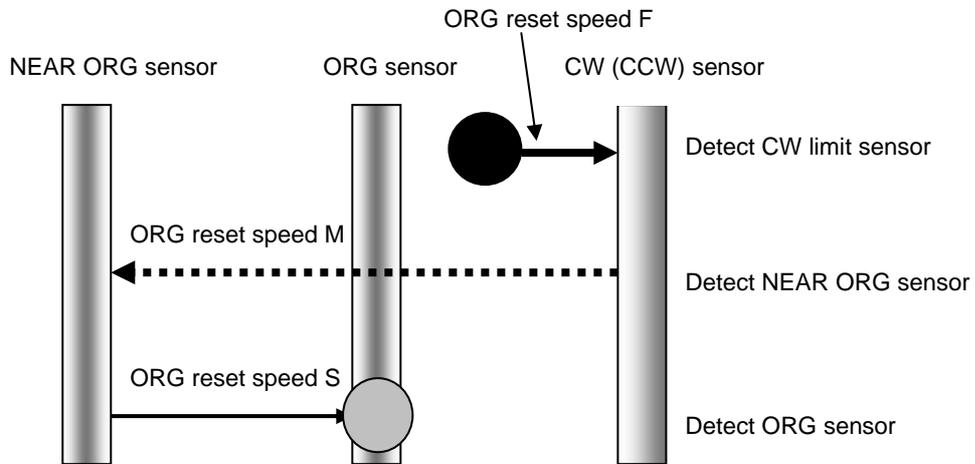
Caution1) In case that after detect CW (CCW) sensor, stage move toward CCW direction and then can not detect ORG sensor (in case of no ORG sensor), stage stop at CCW (CW) sensor position.

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.



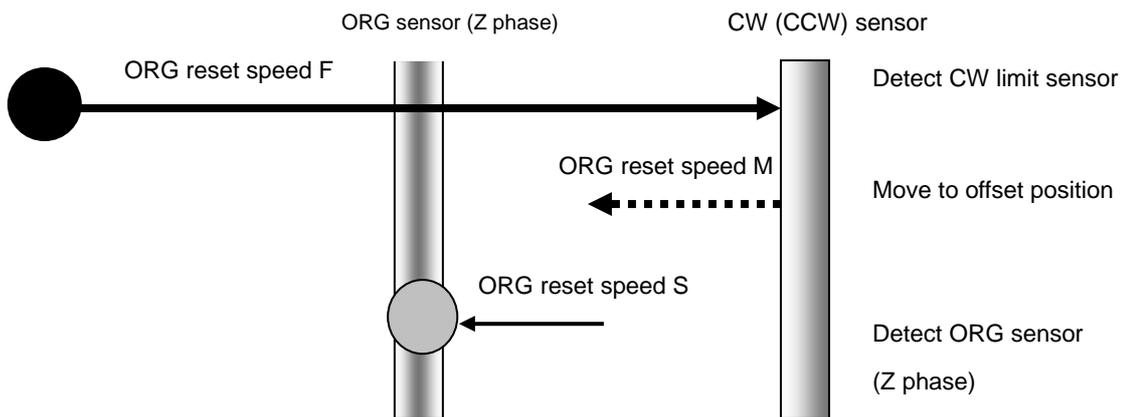
5-2) In case that ORG sensor is beyond NEAR ORG sensor toward CW(CCW) direction.



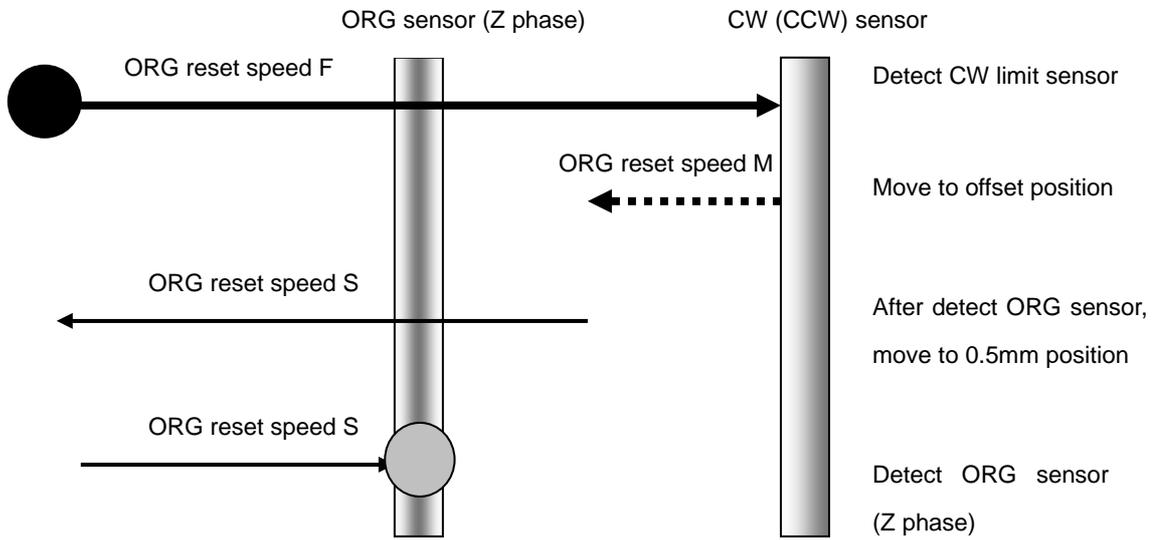
Caution1) In case that after detect CW (CCW) sensor, stage move toward CCW direction and then can not detect NEAR ORG sensor (in case of no NEAR ORG sensor), stage stop at CCW (CW) sensor position.

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	LS LVL4	NM OPEN/NM CLOSE	NM CLOSE
5	OS LVL1	NM OPEN/NM CLOSE	NM OPEN
6	OS LVL2	NM OPEN/NM CLOSE	NM OPEN
7	OS LVL3	NM OPEN/NM CLOSE	NM OPEN
8	OS LVL4	NM OPEN/NM CLOSE	NM OPEN
9	NS LVL1	NM OPEN/NM CLOSE	NM OPEN
10	NS LVL2	NM OPEN/NM CLOSE	NM OPEN
11	NS LVL3	NM OPEN/NM CLOSE	NM OPEN
12	NS LVL4	NM OPEN/NM CLOSE	NM OPEN

1~4) LS LVL 1~4: Limit sensor input logic level setting (1~4axis)

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)

5~8) OS LVL 1~4: ORG sensor input logic level setting (1~4axis)

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)

9~12) NS LVL 1~4: NEAR ORG sensor input logic level setting (1~4axis)

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	ORG4 SPD S	1~999999999	50000
11	ORG4 SPD F	1~999999999	500000
12	ORG4 SPD R	1~1000	200
13	ORG1 SPD M	1~999999999	250000
14	ORG2 SPD M	1~999999999	250000
15	ORG3 SPD M	1~999999999	250000
16	ORG4 SPD M	1~999999999	250000
17	ACC CNT1	LINEAR/S CURVE	LINEAR
18	ACC CNT2	LINEAR/S CURVE	LINEAR
19	ACC CNT3	LINEAR/S CURVE	LINEAR
20	ACC CNT4	LINEAR/S CURVE	LINEAR

1~16) ORG1~4 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:0.01 μ m/s)
 F: 1~999999999(Unit:0.01 μ m/s)
 R: 1~1000(Unit:ms)
 M: 1~999999999(Unit:0.01 μ m/s)

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

17~20) ACC CNT1~4: Speed –acceleration profile setting

Set speed –acceleration profile for each axis

[Select item] LINEAR: Trapezoidal control
 S CURVE: S curve control

3-3.LAN settings

LAN settings for PGC-04-U

1. Connect PC and PGC-04-U using LAN.

Regarding interface between PC and LAN, please refer to 「2-7 Interface with PC」.

2. Activate SGSample, and select“PGC-04-U”in“Controller Choose”.

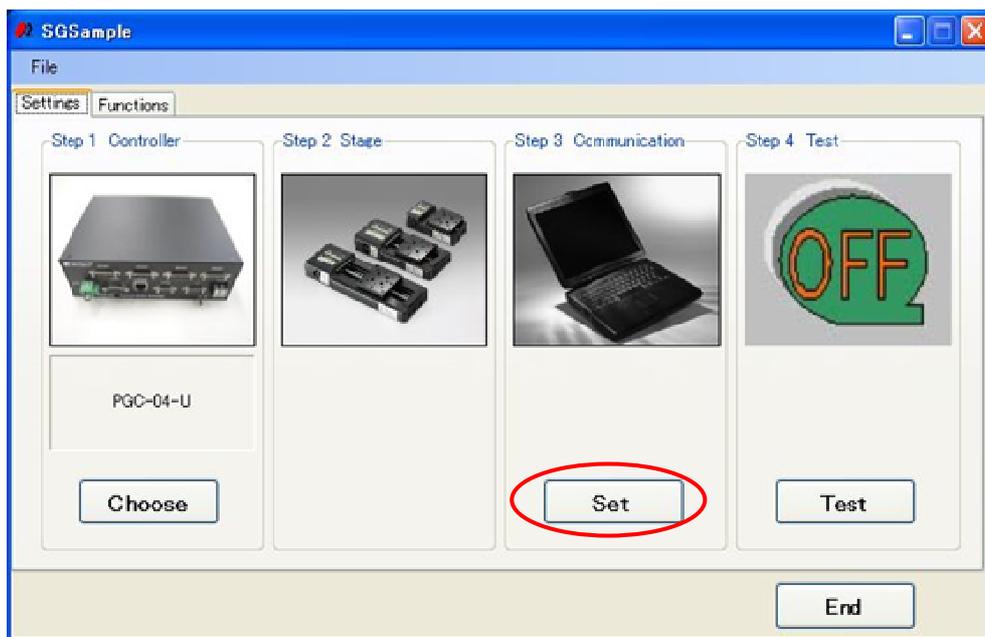


Figure 3-1 : Sample software (SGSample)

3. Please click “Set” tab according to Fig.3-1 and select LAN in interface of communication setting.
(Fig.3-2)



Fig.3-2 Communication setting screen

4. Please open communication setting screen (Fig.3-3) from Fig.3-2“Communication”.

Please adjust the host name and a port to setting of PGC-04-U connected at present.Please make the host name and the port setting PGC-04-U setting connected at present.

Factory default is host name(IP adress) : 192.168.0.1 port : 9004.

5. LAN settings (Figure 3-4) will pop up by clicking "Settings" on Communication settings (Figure 3-3).

6. Click OK after setting IP address on Figure 3-4 LAN settings in accordance with PC condition.

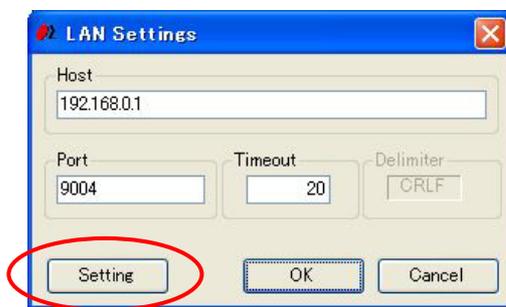


Fig.3-3 : Communication settings

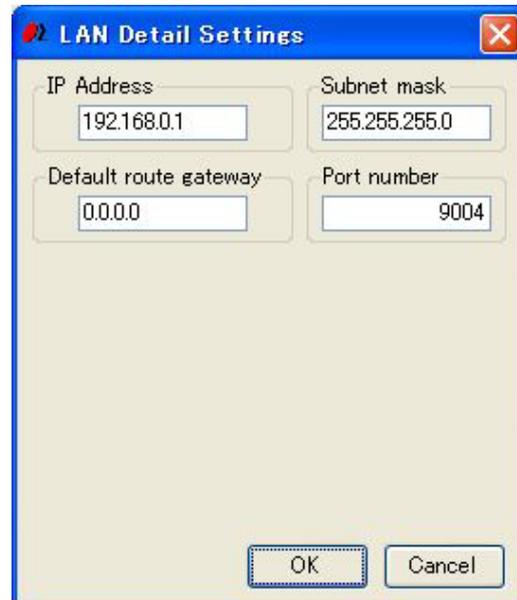


Fig.3-4 : LAN settings

*) Redo PC settings according to new LAN settings when any changes have been made in settings.

Chapter 4: Feature

Command format of PGC-04-U, will be compatible with our controller (HIT-M).

4-1.Command

4-1-1 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,p4

code Use a string to represent a command.

: Command separation (Colon(:))

P1~p4 Use(,)command to separate and assign number of slave unit 1-4. Only integer values can be used as parameter values.

A decimal number is an incorrect command and will be responded 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 0.01 μ m.

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

Note: (,)cannot be abbreviated.

(Ex) .,p2,p3,p4	Parameter of 1-axis is abbreviated.
p1.,p3,p4	Parameter of 2-axis is abbreviated.
p1,p2	Parameter of 3 and 4-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 PGC-04-U. Activation command (G) is treated as an incorrect command in PGC-04-U.

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.

4.1.1 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
Y	Position override	Update moving 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
U	Alarm reset	Driver alarm reset
P	Program control	Internal program command

4-1-2 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

4-1-3 M command (Relative movement command)

(1) Function

This command indicates relative movement with pulse number.

Travel is a length and indicates by (0.01 μ m 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 4 respectively.

4-1-4 A command (Absolute movement command)

(1) Function

This command indicates Relative movement with pulse number.

Travel is a length and indicates by (0.01 μ m 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 2,3 and 4 respectively.

4-1-5 Y command (Update moving coordinate command)

(1) Function

With respect to the axis of the move, it is commanded to change the positioning completion position.

Travel is a length and indicates by (0.01 μ m unit)

Only one axis can be directive, instruction with respect to the axis in interpolation operation to return the NG, can not change position. For details about this command, it will be effective only with respect to the axis of the move (Busy state). Therefore, it becomes NG If you have issues a command to the axis of the Ready state. In addition, the specified position (coordinates) will be absolute position coordinates from the movement start position.

(2) Example

Y : n,my

- n : 1~4 Position specifies the axis to override.
- m : + or - + : + coordinate setting, and - : - is coordinate setting. (If there is no sign + assume.)
- y : Position coordinate value Specifies the positioning complete position you want to change.
(Unit 0.01 μ m)

Y:1,-200000 Change to move the positioning completion position of the first axis of the move to the position of -2mm.

4-1-6 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 responded by NG as a command error and all command will stop to operate.

To operate an interpolation with this command, a designation of (S-Curve / Linear-Curve) and pulse speed and travel per pulse (PLS_RATE) must be identical for both axes.

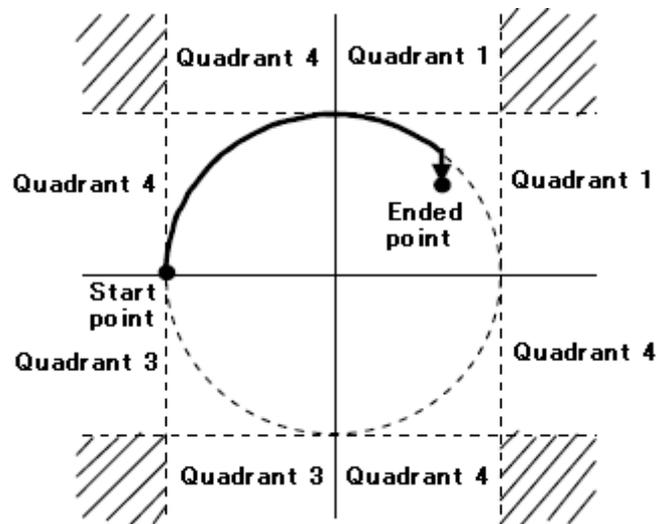
Otherwise, an interpolation movement will be unable to operate due to an incorrect setting.

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 (0.01 μ m 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.

4-1-6-1 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 : 1~4 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnect is prohibited.

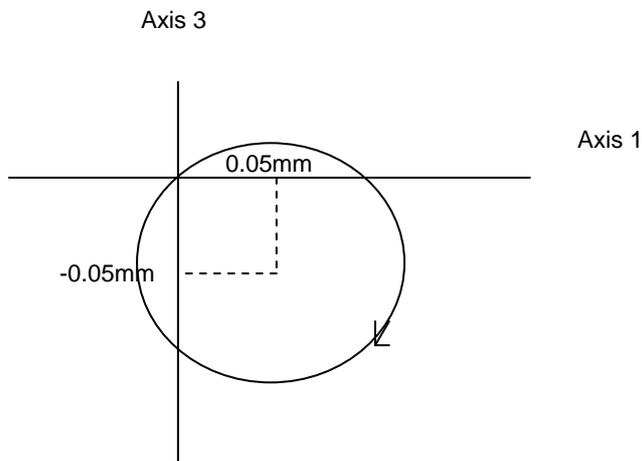
Axis 1 represents X axis and axis 2 represents Y axis.

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

e : Ended point coordinate (e1 axis1 setting value, e2 axis2 setting value) (unit of setting 0.01 μ m unit)

c : Center point coordinate (c1 axis1 setting value, c2 axis2 setting value) (unit of setting 0.01 μ m 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.



4-1-6-2 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

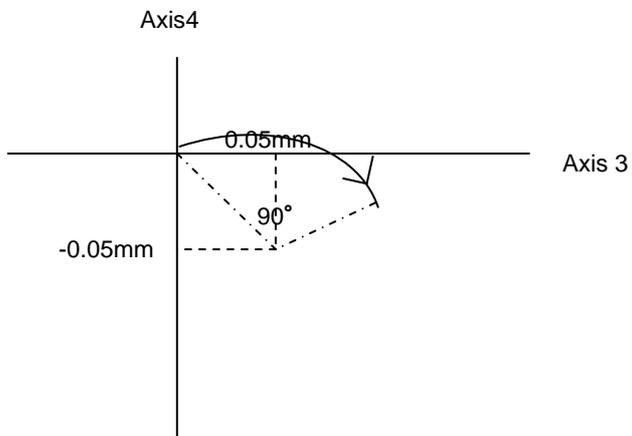
axis1, axis2 : 1~4 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnect is prohibited. Axis1 represents X axis and axis2 represents Y axis.

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 0.01 μ m unit)

ae : Degree of ended point (deg) (Setting range : integer of $0^\circ < ae \leq 360^\circ$ The other degree than mentioned is NG.)

E : 1,3,4,0,5000,-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 No3、 axis No4 90°from current position to degree of ended point position clockwise.



4-1-6-3 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

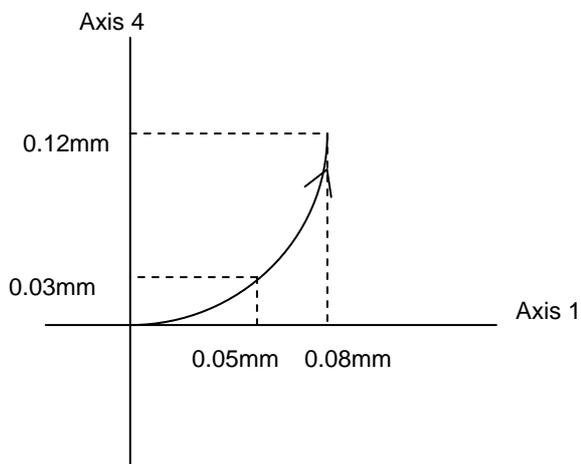
axis1, axis2 : 1~4 means to designate the number of axis to operate arc interpolation movement. Same number of axis or unconnect is prohibited. Axis 1 represents X axis and axis 2 represents Y axis.

p : Pass point coordinate (p1 axis1 setting value, p2 axis2 setting value)
(unit of setting 0.01 μ m unit)

e : Ended point coordinate (e1 axis1 setting value, e2 axis2 setting value)
(unit of setting 0.01 μ m unit)

E : 2,1,4,5000,3000,8000,12000

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 No4 move circularly.



4-1-7 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 responded by NG as a command error and all command will stop to operate.

To operate an interpolation with this command, a designation of (S-Curve / Linear-Curve) and 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 (Linear-Curve or S-Curve)) 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 : 1~4

means to designate the number of axis to operate linear interpolation movement. Same number of axis or unconnect is prohibited. To operate linear interpolation movement by 2 axes, please abbreviate axis2.

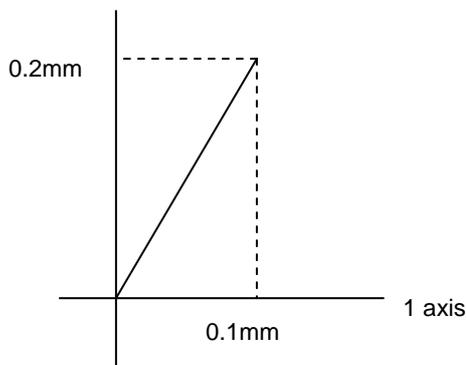
e:Ended point coordinate

(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 : 1,4,,+10000,20000

4 axis

Ended point coordinate is based on a relative coordinate of the current position (+0.1mm, +0.2mm) and move stages of axis No1、axis No4 linearly.



4-1-8 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,s4

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

J : ,+,- Jog movement to axis No2 is + direction, axis No4 is - direction. No movement to axis No1, 3.

4-1-9 L command (Decelerate and stop command)**(1) Function**

Deceleration and stop stage

(2) Example

L : p1,p2,p3,p4

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

L : ,,1,1 To decelerate and stop stage of the axis No3 and 4.

4-1-10 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.

4-1-11 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 responded by NG as a command error and all command will stop to operate.

(2) Example

R : p1,p2,p3,p4

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.

4-1-12 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 responded by NG as a command error and all command will stop to operate.

(2) Example

D : axis,s,f,r

axis : axis number 1~4

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 : 3,10000,200000,200 means Start-up speed : 0.1mm/s, 2mm/s : Maximum speed, 200ms : Acceleration / deceleration time to axis No3.

4-1-12-2 D:D command (Speed override command)

(1) Function

This command is change the speed of the moving axis to the specified speed. This command is change the F rate of speed parameter (S, F, R). The moving axis will move at F speed after the change. In addition, the rate of after the axis has completed the positioning will return to F speed before you change in this command. It is unable to set the multiple number of axes at the same time.

For instructions with respect to the axis in Busy, if this command is sent under ready condition of axis, it will be responded by NG as a command error and all command will stop to operate.

(2) Example

D : axis,spdf

axis : axis number 1~4

spdf : Change speed range of setting: 1~999999999 (unit : 0.01 μ m/s)

Note : the condition of Start-up speed (s) \leq spdf

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

D : D,1,5000000,200000,200 means Immediately change the axis1 of the speed of running to 50mm / sec.

4-1-13 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 responded 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.1~4

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

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

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

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

Note : the condition of $s \leq m \leq f$

*) Maximum speed (calculated by pulse) is 4000000(pulse/s). In case of over speed setting (travel : 0.01 μ m/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.

4-1-14 C command (Excitation On/OFF command)

(1) Function

This command indicates an Excitation On/OFF (servo 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 responded by NG as a command error and all command will stop to operate.

(2) Example

C : p1,p2,p3,p4

p : 0,1 or abbreviated

1 is an Excitation ON(Servo ON) to the stage of the axis number.

0 is an Excitation OFF (Servo OFF) to the stage of the axis number. The abbreviation is NOP (No Operation)

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

4-1-15 Q command (Reading current position command)

(1) Function

This command indicates to return the current position information of 4 stages of axis.unit No 1-4 (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, no connection for axis No3, and 0mm to axis No4.

4-1-16 Q:S command (Reading status command)

(1) Function

This command indicates to return the status information of controller and axis No1-4.

The returned data is separated by (,).

(2) Example

Q : S

stm,sts1,sts2,sts3,sts4

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 or 1	0	0 or 1	0 or 1	0 or 1	0 or 1	0 or 1

Example of returned data

00,01,02,40,01

means controller accepted the received command. Detect -LS by axis No1 and 4, detect +LS by axis No2 and detect Driver-alarm by axis No3.

4-1-17 ! command (Reading status command)

(1) Function

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

(2) Example

! :

sts1, sts2 ,sts3, sts4 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

1,0,0,1 means the ready status of axis No2 and 3, Busy status of axis No1 and 4.

4-1-18 ? 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 No1-4 must be written only when D or B string parameter is applied.

String parameter	Returned data	Example of returned data
N	Device name	PGC-04-U
V	Version	V1.01-001
D	Travel speed	100,1000,200
B	Returning origin speed	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.

4-1-19 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												
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	ON	ON													

(2) Example O : 14

4-1-20 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												
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	ON	ON													

(2) Example

I : Returned data 14

4-1-21 U command (Alarm reset output command)**(1) Function**

This command output the alarm reset to the servo pack/ Driver.

Alarm reset according to the this command, servo pack/Driver has been outputs a reset signal from the controller to, but can not release the alarm as long as you do not remove the true cause.

Because by each servo pack and driver has a unique difference, please check each manual.

(2) Example

U : p1,p2,p3,p4

p : 0,1 or abbreviated 1 is output Alarm reset signal to the stage of the axis number.

0 is no operation. The abbreviation is NOP (No Operation)

U : 0,0,1 Output Alarm reset signal of the axis No3, and no operation of axis No1,2,4.

4-1-22 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 responded 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**

4-2. Program functions

10 kinds of program, numbered 0 to 9, can be stored in PGC-04-U 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 Sigma Koki when composing, editing, loading and saving programs.

Please set distance modulus (unit 0.01 μ m) 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.

4-2-1 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
- A** : Absolute travel positioning
- H** : Origin return
- K** : Linear Interpolation movement (capable of up to 3 axes)
- E** : Circular Interpolation movement
- ?** : IO terminal input confirmation
- F** : Setup repeating No. (1 – 2,147,483,647 can be input)
- N** : Stop repeating movement
- Y** : Exit program

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

③~⑥ : Travel distance of axis 1 to 4

In case of M/A/H/K/E, it is equal to command specification. Please set distance modulus (unit 0.01 μ m) 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, please set 3 only and omit 4 to 6.

In case of N/Y, please omit 3 to 6.

⑦~⑩ : 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 7 to 8 and omit 9 to 10.

In case of M/A/H/?/F/N/Y, please omit 7 to 10.

⑪~⑭ : Speed settings for axis 1 to 4

Please select one from 4 types of Speed_sel on Memory Switch. In case of K/E, please set 11 only and omit 12 to 14. 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 14.

⑮ : 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.

⑯ : 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 — 'be omitted at all times' in table below.

②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯
M	○	○	○	○	—	—	—	—	○	○	○	○	○	○
A	○	○	○	○	—	—	—	—	○	○	○	○	○	○
H	○	○	○	○	—	—	—	—	—	—	—	—	○	○
K	◎	◎	○	◎	◎	○	—	—	◎	—	—	—	○	○
E	◎	◎	◎	◎	◎	◎	◎	○	◎	—	—	—	○	○
?	◎	—	—	—	—	—	—	—	—	—	—	—	○	○
C	◎	—	—	—	—	—	—	—	—	—	—	—	—	—
F	◎	—	—	—	—	—	—	—	—	—	—	—	—	—
N	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Y	—	—	—	—	—	—	—	—	—	—	—	—	—	—

4-2-2 Program Examples

```

1,M,1000,-1000,,,,,1,2,,,15,100
2,H,1,1,1,1,,,,,,5,100
3,A,200000,200000,,,,,3,3,,,10,5
4,K,1,2,3,10000,20000,30000,,,3,,,1,500
5,E,1,2,3,0,1000000,1000000,180,,4
6,?,3
7,F,1000
8,M,100,,,,,,1
9,N
10,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 0.4seconds 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. Quit.

4-2-3 Issuing command in program execution

Issuable commands when program is running are as below.

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

I/O control series : Command **O**, Command **I**

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.

4-3. Emergency STOP

The connector model "MSTB2,5/2-GF-5,08" (PHOENIX CONTACT Inc.) is used.

When in use, connect a plug component "MSTB2,5/2-STF-5,08" (PHOENIX CONTACT Inc.) that attached to the product.

The EMG_STOP switch operates in the logic of "Normal Close". Attach a jumper wire while normal operation.

For each axes, the motor excitation ON/OFF status during activation of the EMG STOP is selectable.
(Use memory switch (No.25) to (No.28) "EMG EXT" for this setting.)

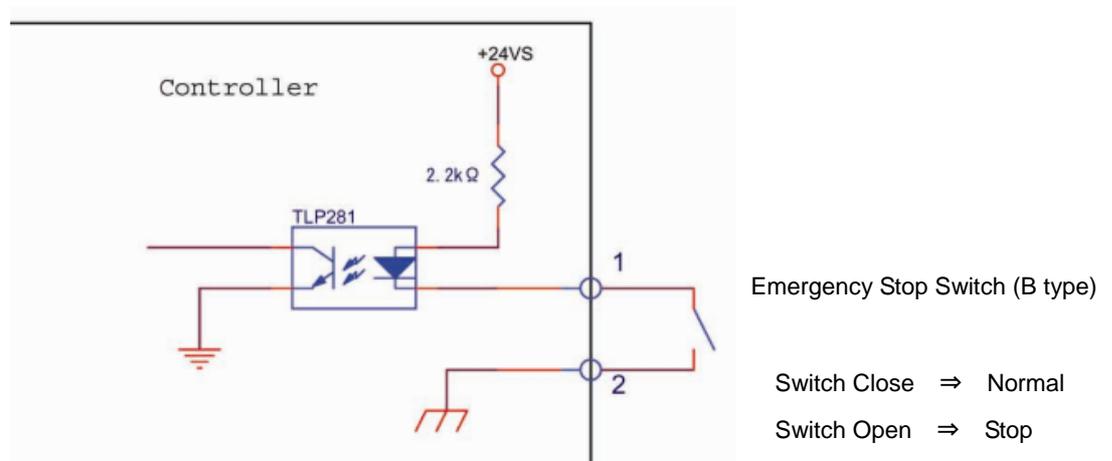


Fig. 4-3-1 : An Example of "EMG_STOP Switch" connection

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 rotation stage.

Appoint movement distance by A command and the M command of the Translation stage.

On the other hand, in the case of Gonio-Stage such as rotation stage or OSMS-60A75 such as OSMS-120YAW, it is necessary to set it at a rotary angle not movement distance.

5-1-1 Setting item

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

PLS_RATE (Memory-SW) : Set the travel Rotary 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.

5-1-2 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.

5-1-3 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 $300,000 \times 0.0001$ degree = 30 degrees/s.

Chapter 6: Specifications

6-1. Specifications

1. General Specifications

Power Supply	DC24V/1.4A
Operating Temperature	5~40°C
Storage Temperature	-20~60°C
Ambient Humidity	20~80%RH (No Condensation)
Altitude	up to 2000m
Indoor use only	
Installation category	II
Pollution degree	2
External Dimensions	180mm x 140mm x 60mm
Weight	1.0kg

2. Performance

Controlling Axis/Axes	up to 4 axes
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 <ul style="list-style-type: none"> ▪ Baud Rate 4800/9600/19200/38400/57600/128000/230400bps ▪ Data Bits 8bit ▪ Parity None ▪ Stop Bit 1bit ▪ Flow Control Hardware ▪ Delimiters CR+LF Ethernet Interface <ul style="list-style-type: none"> ▪ Data Rate 10/100Mbps(Full duplex) ▪ Maximum Data Length 256Byte
I/O	Input 4-pin (Photo-coupler Input, Internal Resistance 2.2kΩ) Output 4-pin (Open-collector Output Maximum Use Conditions DC24V 20mA)

6-2.Connector Pin Assignments

6-2-1 I/O Connector

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

Connector 10220-52A2PL (by 3M Company) used

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

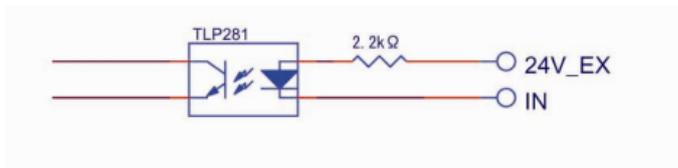


Figure 6-2-1 : IN1~4 Input Circuit Diagram

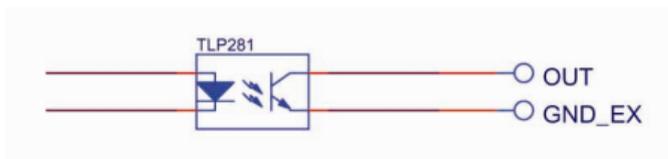


Figure 6-2-2 : OUT1~4 Output Circuit Diagram

6-2-2 USB Connector

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

Connector XM7B-0442 (By Omron) used

6-2-3 ETHERNET Connector

No.	Description	No.	Description
1	Tx+	5	-
2	Tx-	6	Rx-
3	Rx+	7	-
4	-	8	-

Connector J0011D21BNL (By PULSE) used

6-2-4 DRIVER1~4 Connector

No.	Description	No.	Description
1	PP+	14	INP
2	PP-	15	TIM+ (Z_P+)
3	PM+	16	TIM- (Z_P-)
4	PM-	17	LS+
5	CLR (ERC)	18	LS-
6	Servo_ON/STEP4	19	ORG
7	P_Reset/STEP3	20	NEAR
8	ALM_RST/STEP2	21	24V
9	CCM/STEP1	22	24V
10	FREE/H.O	23	5V
11	#RES	24	5V (with180Ω)
12	Auto_Config	25	GND
13	ALARM_IN(Driver)	26	GND

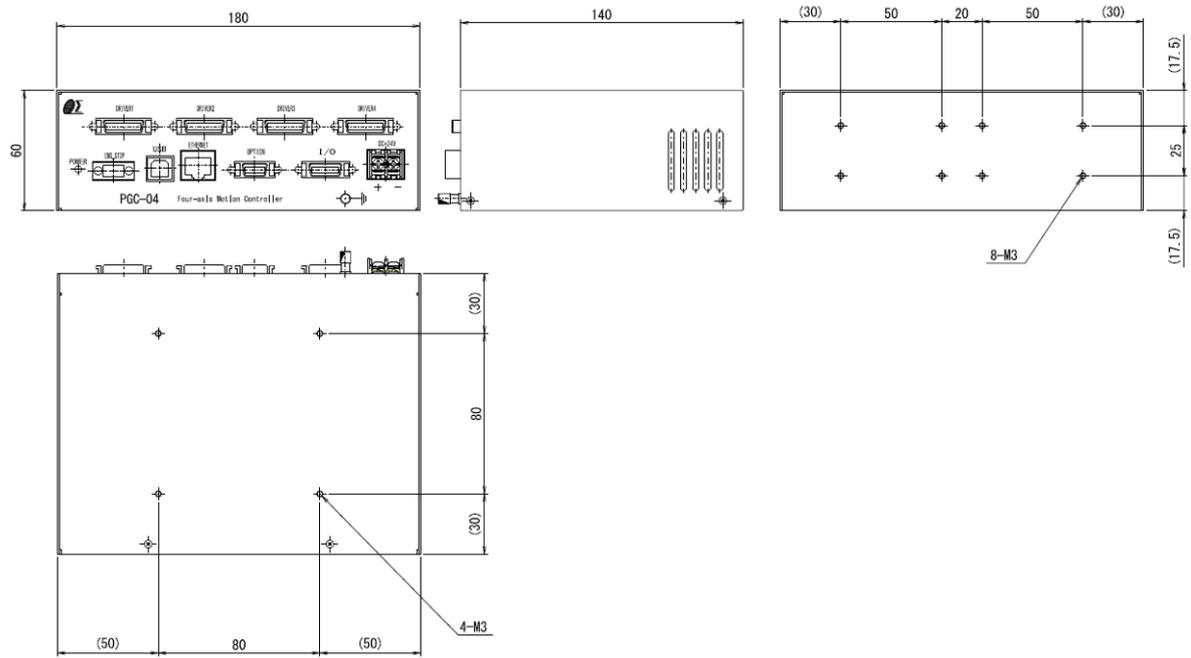
Connector 10226-52A2PE (by 3M Company) used

6-2-5 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 3M Company) used

6-3.Outlines



SIGMAKOKI CO., LTD.

<http://www.global-optosigma.com>

Tokyo Head Office SIGMAKOKI Tokyo Head office 19-9, Midori 1 chome,
Sumida-ku, Tokyo 130-0021, JAPAN
TEL+81-3-5638-8228 FAX+81-3-5638-6550 E-mail:international@sigma-koki.com

Osaka office 9-28, Nishi-Nakajima 4 chome, Yodogawa-ku, Osaka 532-0011,
JAPAN
TEL+81-6-6307-4835 FAX+81-6-6307-4834 E-mail:sales.osaka@sigma-koki.com

Kyushu office 3-17,hiemachi, hakata-ku, Fukuoka 812-0014
TEL+81-92-481-4300 FAX+81-92-481-4310 E-mail:sales.kyushu@sigma-koki.com

Technology Center 1-1Yatsukaho, Hakusan-shi, Ishikawa 924-0838, JAPAN