Flexible Controller

One-Axis Stage Controller

PAT-001

For Your Safety

User's Manual

SIGMA KOKI CO., LTD.

SIGMA KOKI CO., LTD.

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R100 Percentage of Waste Paper pulp 100% R70 Percentage of Waste Paper pulp 70%

2008.3. Third edit

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Scope

This Instructions Manual is applicable to the PAT-001 Flexible Stepping Motor Controller.

Revision History

First Edition FEBRUARY 6,2006

Notes on Using This Manual and This Product

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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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④ If the equipment is used in a manner not specified by the SIGMA KOKI CO. , LTD. , the protection provided by the equipment may be impaired.

⚠ WARNING

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

⚠ CAUTION

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

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Flexible Stepping Motor Controller

PAT-001 START GUIDE

Notes and Qualifications on Using This Manual and This Product

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⚠ Warning

Never use the product in areas with flammable gases, in explosive, corrosive, moist, humid or poorly-ventilated environments, or around combustibles.

Do not check the product, or perform connecting work while the product is energized. You may receive an electric shock.

Do not bend forcibly, pull, damage, or modify the power cable or connection cables.

Do not touch the inside of the product. Do not disassemble or modify the product.

Turn off the product immediately if it is overheated or generates unusual odors or noises.

If the product is dropped or strongly impacted, do not energize the product and call SIGMA KOKI for the check/repair.

Clean the product with dry cloth.

⚠ Caution

Do not touch the input/output terminals immediately after you turn off the product because of the presence of residual voltage.

Do not leave the product at vibrating or sealed places, or exposed to sunlight.

Do not insert foreign matters into the openings or clearances.

Do not touch the product with wet hands.

Do not hold the power cable, but hold the mains connector to disconnect it from the power supply.

Connect the product and other devices correctly after every power supply is cut off.

If encountering an abnormal event, turn on or operate the product in the state that allows you to e-stop or power off the product immediately.

1. Check Inside the Package

Make sure your package includes all the following items before you first use the product. It is convenient to check in the boxes. If there is any missing or damaged item, contact our sales office.

Standard Equipment		Options (sold separately)
□ **PAT-001 Main Unit**	**x 1**	□ PAT-001-POW (specifically designed AC adapter)
□ **CD-ROM (attached)**	**x 1**	□ RS232C/STR (9-pin, male/female, straight cable for RS-232C)
□ **User's Manual(this manual)**	**x 1**	

*** The detailed instructions manual is an electronic manual formatted in the PDF format and contained on the attached CD-ROM.**

*** For your safety and avoiding misoperations, read through the electronic manual before using the product. Use the product correctly.**

*** You can use equivalents instead of genuine optional parts. Use +24 [V]DC, 2.5 [A] or higher power supply with fewer noises, ripples, etc.**

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2. Contents of Attached CD-ROM

The contents of the attached CD-ROM are as follows. For the details of each item, see the instructions manual contained on the CD-ROM.

Contents: The contents shown in the list below are stored under the ENGLISH folder on the CD-ROM. The JAPANESE folder contains the Japanese version.

Names of Folders	Descriptions of Contents	Remarks
Tools	Files necessary for installing PAT-001 Configuration Program	Use these files by installing on your PC.
Manual	Contains a series of the Instructions Manuals for PAT-001 in the PDF format.	
Acrobat Reader	Files necessary for installing Acrobat Reader	Install the program if necessary.

* The **ConfigData** folder contains SIGMA's typical stage data (extension: pat) configuration samples for PAT-001 configuration program.
* The software on this CD-ROM supports the Windows 98, Windows 98SE, and Windows XP operating systems.
* Windows 98, Windows 98 SE, and Windows XP are registered trademarks of Microsoft Corporation in the U.S. and/or other countries.
* Adobe and Acrobat are trademarks of Adobe Systems Incorporated.
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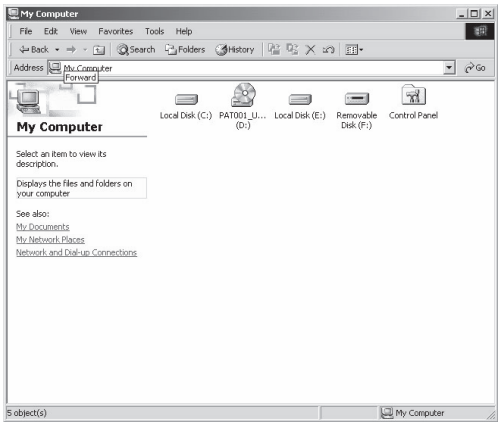
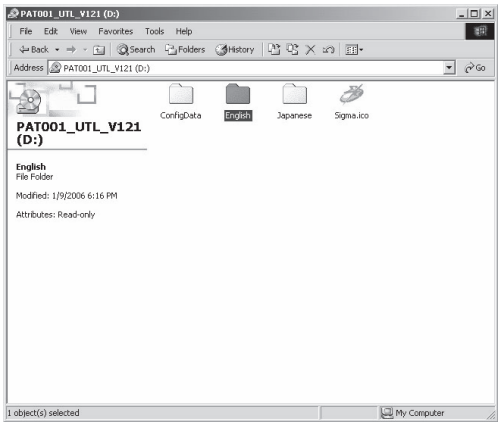
3. Install the PAT-001 Configuration Program

Install the configuration program on your PC to set the options on the PAT-001. Configure operational settings for PAT-001 with this tool before you use it. Using the PAT-001 without configuring may cause not only malfunctions but also damage to this device and/or the stages.

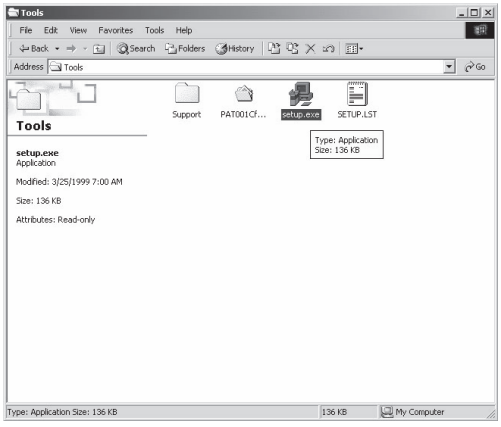
(1) Install from CD-ROM

Insert the attached CD-ROM into the CD-ROM drive on your PC correctly, and open the drive reading the CD-ROM with **My Computer**.





Double click setup.exe in the Tools folder.



When the installer starts up, follow the instructions on the screens to continue the installation of the program.

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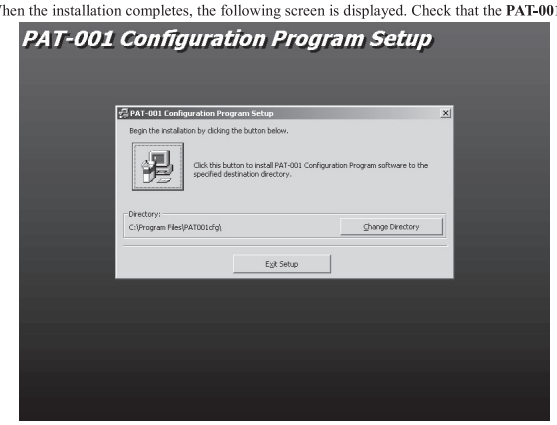
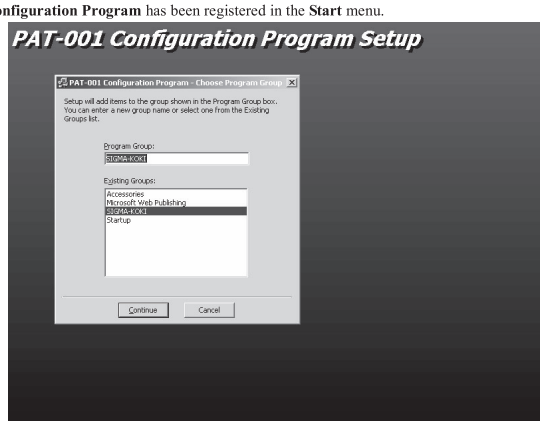
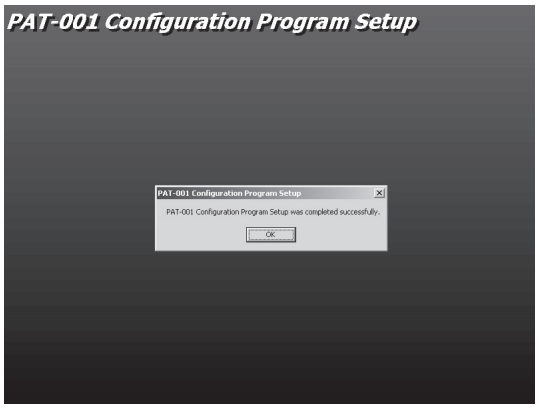
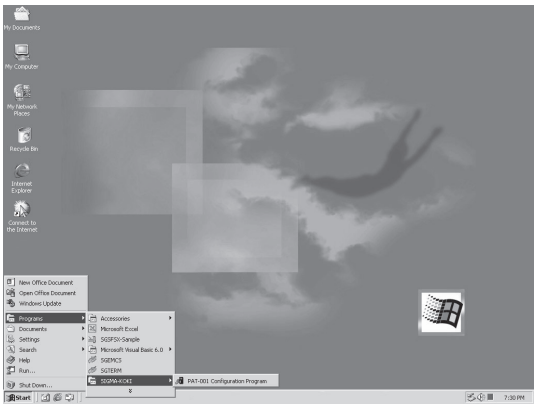
When the installation completes, the following screen is displayed. Check that the **PAT-001 Configuration Program** has been registered in the **Start** menu.



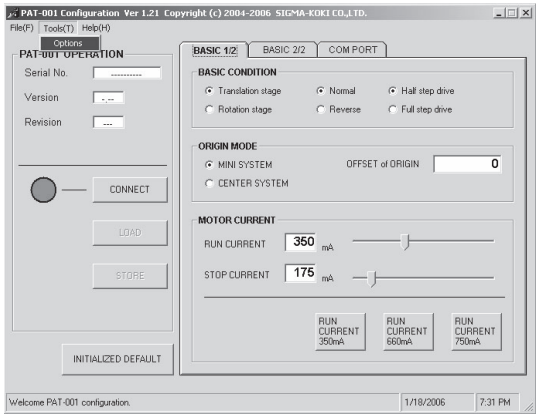


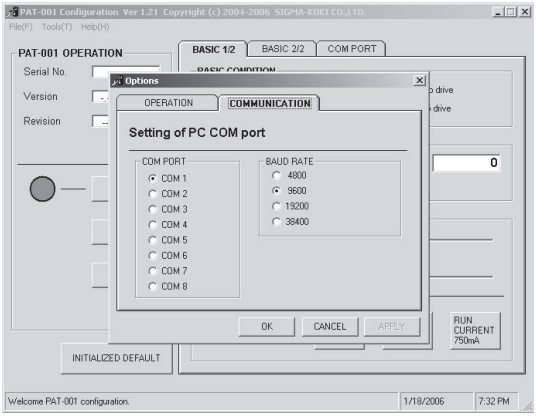




(2) Use the Configuration Program

Correctly connect the PAT-001 and the PC where **the Configuration Program** has been installed. Connect with an adequate serial communications cable (SIGMA's RS232C/STR, etc). Click the icon registered in the **Start** menu to start up **the Configuration Program**. When the program is started up, select **Tools**, and then select **Options** to select port/baud rate settings for PC. Select the port where the PAT-001 is connected as the communications port. Set the baud rate to 9600.





Next, supply the power via the terminals on the PAT-001 rear panel. Take great care to never connect to wrong terminals such as the terminals for different power voltages or reverse polarities. After turning the power on, make sure the power indicator LED lights up in green on the PAT-001 front panel, and then click the **CONNECT** button.

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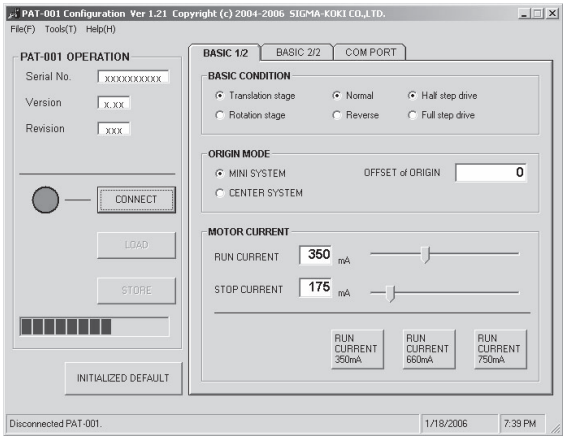
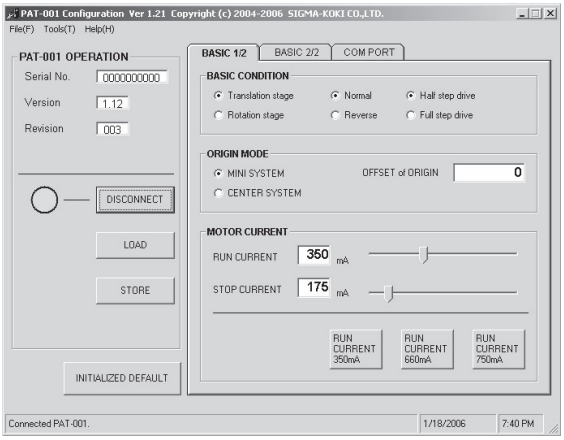




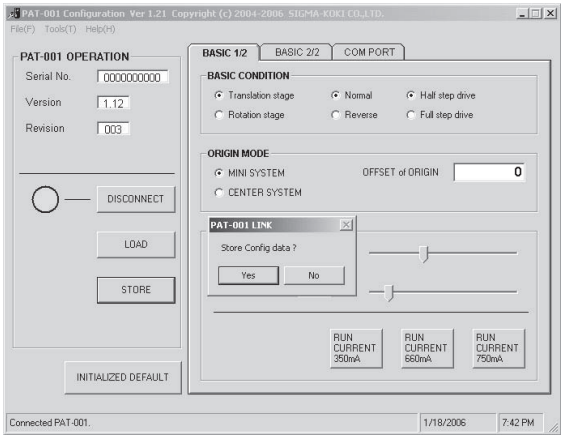
If the communications have been established successfully, the above screen is displayed, the indicator turns green, and information such as the Serial No. and internal ROM version of your PAT-001 is displayed. If an error is displayed, you must check the connection and the baud rate setting again.

(3) Customize Configurations for Your Environment

The parameters on the tabs (**BASIC 1/2**, **BASIC 2/2**, and **COM PORT**) in **the Configuration Program** are customizable to match to the environment where the system is used.
Note that you must write the contents to the PAT-001 to reflect the changes. To write the configurations to the PAT-001, click the **STORE** button.
If you do not write the configuration to PAT-001 by following the above steps, changed configurations are not effective on the PAT-001.

After writing, click the **DISCONNECT** button to cut the communications.
Then turn off the PAT-001 power, and wait approximately ten seconds to turn on the power again.
After the PAT-001 has restarted, the changed configurations are effective.

To check the contents, click the **CONNECT** button in **Configuration Program** to connect to the PAT-001, and then click the **LOAD** button. The configurations written in the PAT-001 are reflected in the items on the screen.



* For the details of operations, see the electronic manual contained on the CD-ROM.

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Chapter 1 : Before You Begin

1. Before the Use of the Product

1-1. Check Inside the Package

Your new package must contain the following items. If there are any missing or damaged items, contact our sales office. A genuine serial cable and a specifically designed AC adapter set are available as options (sold separately) for PAT-001.
In addition to the items below, the driving actuator (stepping motor specifications stage type) and connection cables are necessary for using this controller.

PAT-001 Contents in Package (Standard Equipment)

- ☐PAT-001 Controller Main Unit ×1
- ☐PAT-001 User's Manual (This manual) ×1
- ☐Product CD-ROM ×1

*The CD-ROM contains the configuration software and the instructions manual.

PAT-001 Options (sold separately)

- ☐Genuine serial cable Model No.: RS232C/STR
  * Necessary for configuring PAT-001 operations and controlling motors.
- ☐AC adaptor set Model No.: PAT-001-POW
  * Unnecessary if you use an external power unit you already have.

1-2. Setup Automatic Stage

PAT-001 supports the SIGMA KOKI' s automatic stages below. Use the configuration software on the CD-ROM to set adequate values to configure PAT-001 operations.

- ◆Direct Acting Automatic Stages: **SGSP15-10, SGSP20-20/35/85, SGSP26-50/100/150/200 TSDM40-15X, TSDM60-20X**
- ◆Z-Axis Automatic Stages: **SGSP40-5ZF, SGSP60-5ZF/10ZF, SGSP80-20ZF**
- ◆Rotating Automatic Stages: **SGSP-40YAW/60YAW/60YAW-0B,SGSP-60-GTPC/GTPC-0B SGSP-60-WPQ/WPQ-0B,SGSP-60-ND/ND-0B SGSP-60-NDU/NDU-0B**
- ◆Gonio Automatic Stages: **SGSP-60ROLL/PITCH,SGSP-60A75/100/130**
- ◆Actuator Automatic Stages: **SGSP-13ACT/13ACT-B0/25ACT/25ACT-B0**

See "A-2. List of Configurations for Applicable Automatic Stages" for the values for configuration.

Use the following motor communications cable for the connection between PAT-001 and an automatic stage.

◆Motor Communications Cable Model No.: MINI-CA-Δ
*Δ presents the length of the cable (1, 2, 3, 4 or 5 [m])

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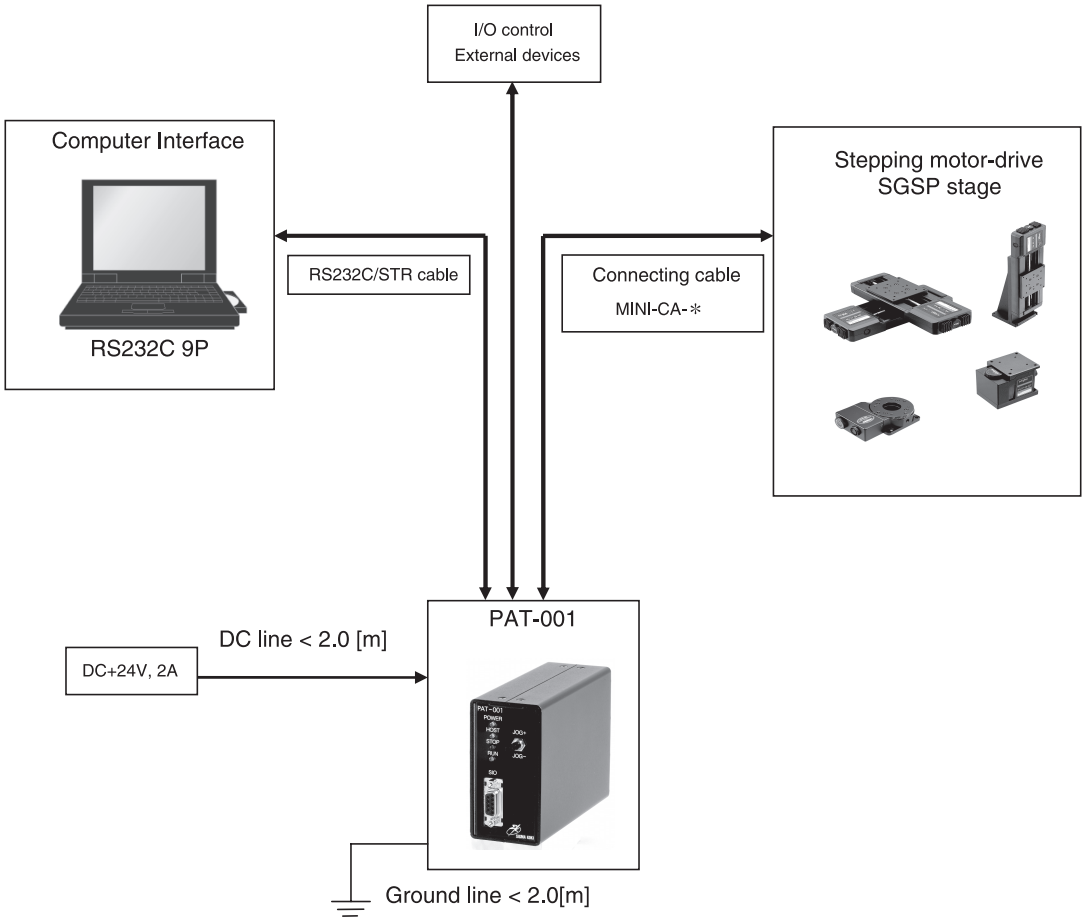
1-3. The PAT-001 System Diagram



⚠ Please make sure to set up and wire the cable supplying DC+24[V] and GND to the PAT-001 so that the maximum length of cable is not longer than 2[m.]

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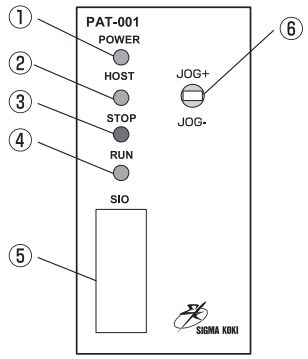
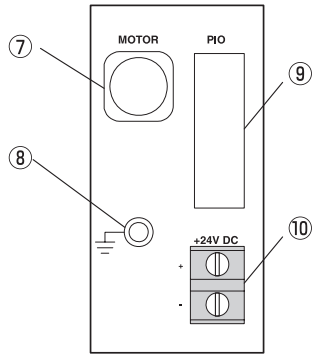
2. Names and Functions of Each Part

2-1. Front Panel



(1)POWER LED	Lights up in green when powered.
(2)HOST LED	Lights up in green during communications with the host.
(3)STOP LED	Lights up in red when e-stopped.
(4)RUN LED	Lights up in orange when the motor is operated.
(5)SIO connector	Connect a serial cable.
(6)JOG switch	Controls movement in jog mode.

2-2. Rear Panel



(7)MOTOR connector	Connect a motor cable.
(8)FG terminal	Terminal for frame ground connection. To use this controller, you should connect it to ground.
(9)PIO connector	The connector for parallel interface.
(10)Power terminals	Connect to the power source (+24[V] 2[A]).

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3. Specifications

3-1. General Specifications

・Name of Product		PAT-001
・Model No.		SC-42101
・Rating		+24 [V], 2 [A]
・Number of Controllable Axes		1 axis
・Control/Indicator	Control Device	JOG switch
	Indicator	Power ON Indicator (Green LED) Host Communications Indicator (Green LED) E-Stop Indicator (Orange LED) Motor Operation Indicator (Red LED)
・Positioning Specifications	Range of Coordinates	0-16,777,215
	Driving Speed	100-20,000 [PPS] * Programmable in 100 [PPS].
	Acceleration/ Deceleration Control	Available By setting min. speed, max. speed and acceleration/ deceleration time.
	Origin System	MINI System/CENTER System switchable
・Safety Provisions	E-Stop Input	Enable/Disable switchable B Contact Connections Stops immediately after positioning Switchable energize/deenergize after stop
・Other Specifications	Power Supply	+24 [V] limited energy circuit
	Operating Temperature	5 - 40 degrees centigrade
	Humidity	20 to 80 [%RH] *No condensation
	Altilude	up to 2000 [m] In door use only
	Installation category	Ⅱ
	Pollution degree	2
	Dimensions	47 (W) [mm] x 90 (H) [mm] x 125 (D) [mm] * Excluding protrusions
	Weight	400 [g]

3-2. Automatic Stage Interface Specifications

・Motor	Type	Five-phase stepping motor
	Driving Current	0.1-0.8 [A/phase] (Drive: RUN current) 0.1-0.8 [A/phase] (Stop: STOP current)
	Current Down	Automatic
	Driving Mode	Half/Full step drive
・Limit Sensor Input	Number of Sensors	2 (max.)
	Polarity	Normal Close/Normal Open switchable

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3-3. Interface Specifications

・ Serial Interface	I/F Type	Start-Stop Synchronization Serial Interface
	Signal Level	EIA/TIA-232E compliant
	Baud Rate	4800/9600/19200/38400 [bps]
	Protocol	SIGMA KOKI's SHOT-202 subset command system
	Flow Control	Enable (via RS-CS)/Disable switchable
	Connector	D-Sub 9-pin female connector
	Pin Assignments	EIA-574 compliant
	Cable	Straight serial cable Recommended cable is SIGMA KOKI's RS232C/STR.
・ Parallel Interface	I/F Type	Insulation Parallel Interface +24 [V] capable photo isolated input +24 [V] capable open collector photo coupler output
	Number of Input Signals	E-Stop Input: 1 JOG move: 2 General purpose: 4
	Number of Output Signals	General purpose: 4
	Connector	D-Sub 15-pin female connector
	Photo coupler Power	Available

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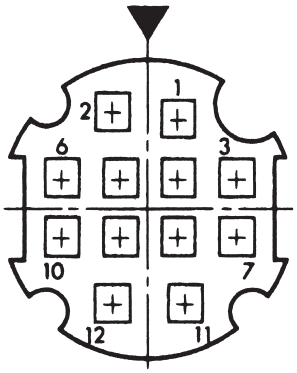
4. Connector Pin Specifications

4-1. Motor Connector

PAT-001 Controller is connected to the stage with the SIGMA KOKI' s MINI cable.
The pin assignments used for connecting with the motor are as follows:



1) MOTOR (Blue)
2) MOTOR (Red)
3) MOTOR (Orange)
4) MOTOR (Green)
5) MOTOR (Black)
6) Reserved
7) +VS
8) GND
9) LS (+)
10) LS (-)
11) F.G.
12) FG.

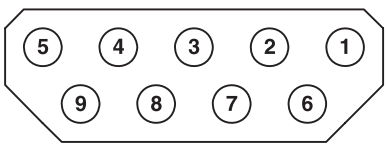
* Do not use the reserved pin (No. 6) for any connection.

4-2. Serial Interface (SIO)

PAT-001 Controller is operated by the commands from host PC, etc. via the EIA-574 compliant serial interface.
The serial interface is comprised of the following signal wires of RS-232 levels:

・	RD(RxD)	Output	Data output to host PC
・	SD(TxD)	Input	Data input from host PC
・	CS(CTS)	Output	Flow control output to host PC
・	RS(RTS)	Input	Flow control input to host PC
・	SG(GND)	-	Signal ground

The pin assignments used for the serial interface are as follows:



D-SUB 9 pins (female)

1) N.C **6) N.C**
2) RD **7) RS**
3) SD **8) CS**
4) N.C **9) N.C**
5) SG

PAT-001 Controller can switch the use of (enable/disable) the flow control in communications. This option is enabled in the factory settings.

* Note 1: The functions and directions of the signal wires are opposite to the normal presentation. This is because the signals are presented as seen from host PC.
* Note 2: The RS-232 levels in PAT-001 Controller are about -10[V] for "0" and about +10[V] for "1."

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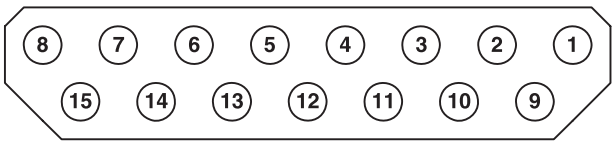
4-3. Parallel Interface (PIO)

PAT-001 Controller has the photo-isolated parallel input/output interface, which can be used to control from an external controlling device. The parallel interface of PAT-001 Controller is comprised of the following signal wires:

- DI_{3-0} Input General purpose input
- DO_{3-0} Output General purpose output
- EMGSTOP Input E-Stop Input
- JOG+ Input JOG operation input in the positive direction
- JOG- Input JOG operation input in the negative direction
- COM+ Input common
- COM- Output common
- INT+24V Internal +24 [V] power output
- INTGND Internal power ground

The pin assignments used for the parallel interface are as follows:



D-SUB 15 pins (female)

1) INT+24V	**9) JOG+**
2) EMGSTOP	**10) JOG-**
3) INTGND	**11) DO0**
4) DI0	**12) DO1**
5) DI1	**13) DO2**
6) DI2	**14) DO3**
7) DI3	**15) COM-**
8) COM+	

The parallel input of PAT-001 is turned ON if the signal is connected to COM-; turned OFF if released. The input circuit is connected to +24 [V] at COM+, and the current limiter resistor (2.2[KΩ], 1/2[W]) is inserted in series. Turning ON the parallel output turns the photo-coupler ON, and vice versa. The output circuit is connected to the external ground at COM-.

PAT-001 Controller is equipped with 4 general purpose input/output signals. The signals can be set or read as required by the command from host PC. If controlled by the internal program, these signals can be used as triggers for operating from an external device, or control output to an external device.

The PAT-001 is equipped with a photo-isolated emergency stop (e-stop) input. The e-stop signal is of a b-contact type, which, if turned ON, operates the device normally while e-stops the device if turned OFF. An e-stop state stops the motor being driven, and disables every operation that starts the motor. To release the disabled state, reset the e-stop signal to ON. You can enable/disable the use of the e-stop signal with the internal jumper cable setting. It is disabled in the factory settings.
Deenergizing the motor in an e-stop state can be enabled/disabled in the command setting.

The PAT-001 Controller is equipped with the JOG operating switch that allows external jog operations. Two JOG operation pins (for + and - directions) are equipped. Turning ON one of the signals performs JOG operation for that direction. JOG operation mode is not available while PAT-001 e-stops.

To supply power for JOG operation or an e-stop, The PAT-001 Controller has +24[V] power source being wired to the parallel interface connector. Note that this internal power source is provided to drive the photo-couplers on PAT-001, and unable to supply a larger current. Also take great care in using the internal power source by checking operational conditions, etc. since no protection circuit is provided for it.

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Chapter 2: Configuration program

Scope

This Instruction Manual is applicable to the configuration program for the PAT-001 Flexible Stepping Motor Controller.
The PAT-001 Flexible Stepping Motor Controller is called This Device in this manual.

- Configuration program **Versions 1.20 and later**

This manual describes the Configuration Program for this device.

1. Contents of CD-ROM

The contents of this CD-ROM are as follows:

Contents: The contents shown in the list below are stored under the ENGLISH folder on the CD-ROM. The JAPANESE folder contains the Japanese version.

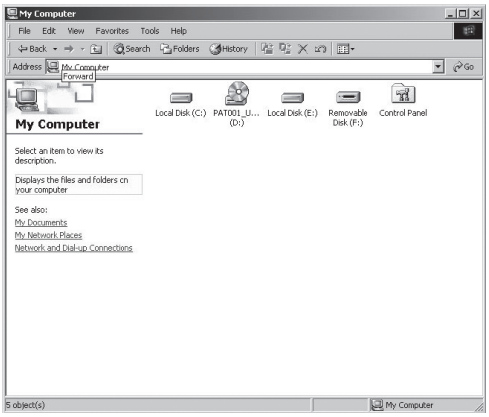
Names of Folders	Descriptions of Contents	Remarks
Tools	Files necessary for installing PAT-001 Configuration Program	Use these files by installing on your PC.
Manual	Contains a series of the Instructions Manuals for PAT-001 in the PDF format.	Same content as this manual
Acrobat Reader	Files necessary for installing Acrobat Reader	Install the program if necessary.

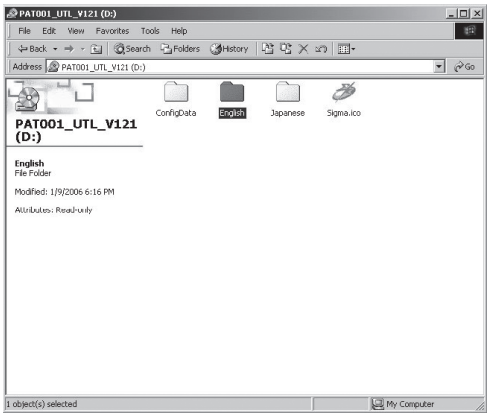
* The ConfigData folder contains SIGMA's typical stage data (extension: pat) configuration samples for PAT-001 configuration program.
* The software on this CD-ROM supports the Windows 98, Windows 98SE, and Windows XP operating systems.
* Windows 98, Windows 98 SE, and Windows XP are registered trademarks of Microsoft Corporation in the U.S. and/or other countries.
* Adobe and Acrobat are trademarks of Adobe Systems Incorporated.
* All other company names and product names referred herein may be used as either trademarks or registered trademarks of their respective companies.

2. Install PAT-001 Configuration Program

Install the configuration program for setting up the operation of the PAT-001 on your PC. Configure operational settings for PAT-001 with this tool before you use it. Using the PAT-001 without the configuring it may cause not only malfunctions but also damage to this device and/or the stages.

Insert the attached CD-ROM into the CD-ROM drive on your PC correctly, and open the drive reading the CD-ROM with **My Computer.**





NOTE Make sure to install PAT-001 Configuration Program Setup as administrator for Windows Xp and Windows 2000.
NOTE Display shown is Windows 2000 version. The display of another OS may differ from it.

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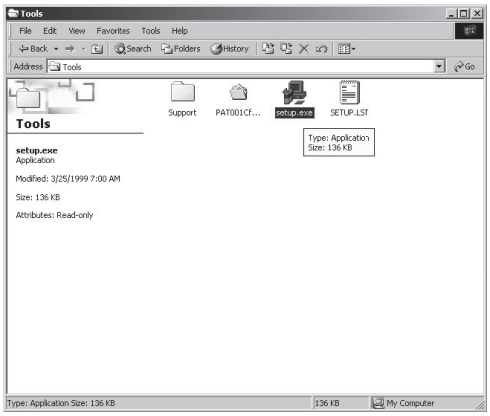
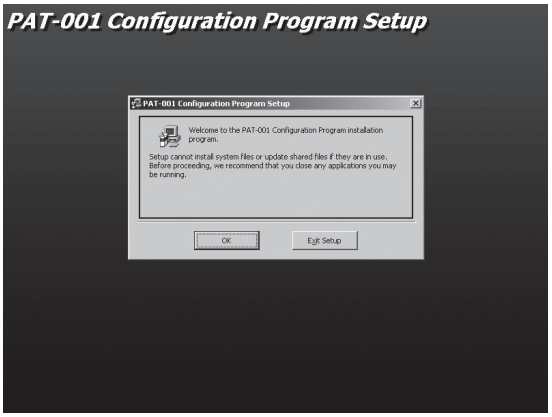
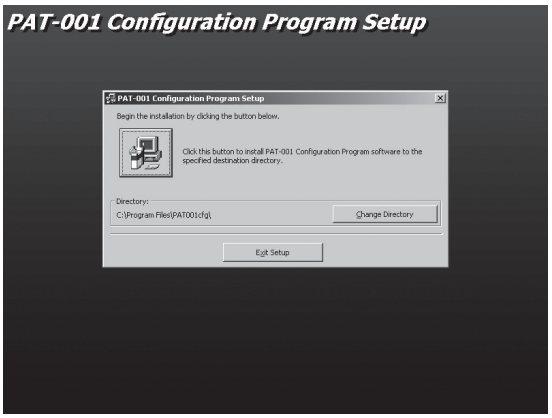
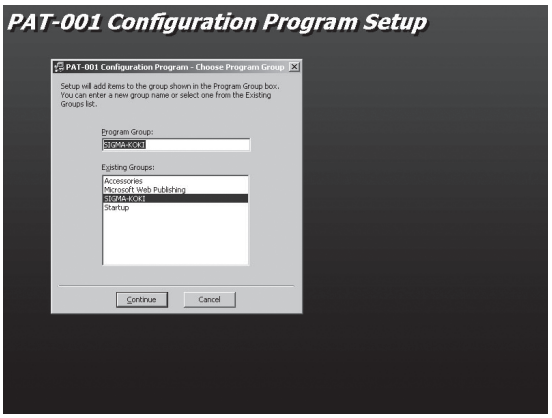
In the Tools folder, double click the setup.exe to start up the installer.
Start setting up the Configuration Program.



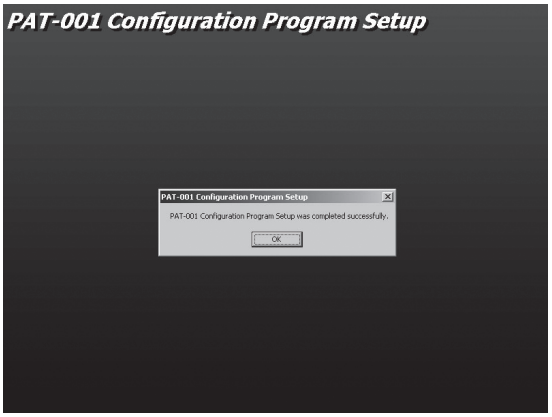


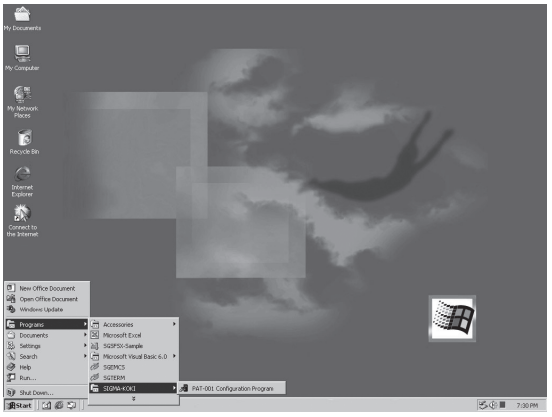
Starting the setup starts up the installer. Follow the instructions on the screens to continue the installation of the program. You can specify your own installation destination.





When the installation completes, the following screen is displayed. Check that the program has been registered in the Start menu.





SIGMA KOKI has been created in the **Start** menu, and **PAT-001 Configuration** has been registered.

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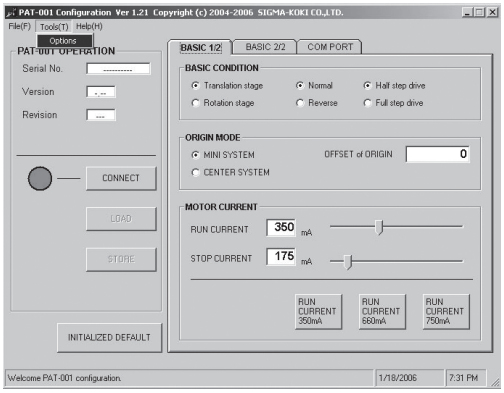
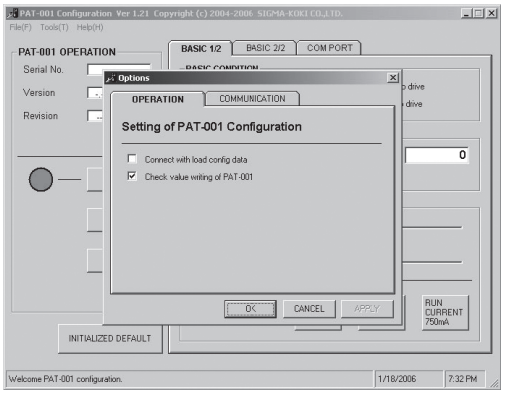
3. Use the Configuration Program

3-1. Setup Communications

Correctly connect the PAT-001 to the PC where **the Configuration Program** has been installed. Connect with the genuine RS232C/STR cable or one of other adequate serial communications cables. Click the icon registered in the **Start** menu to start up **Configuration Program**. When the program is started up, select **Tools**, and then select **Options** to make port/baud rate settings for PC. Select the port where PAT-001 is connected as the communications port. Set the baud rate to 9600.

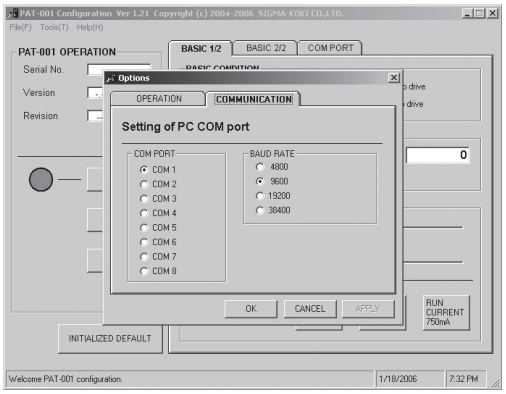




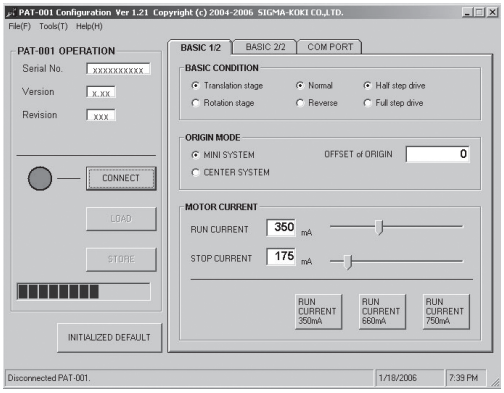
1) The **OPERATION** and **COMMUNICATION** tabs are provided in the **Options** screen. Select the **Check value writing of PAT-001** option in the **OPERATION** tab.

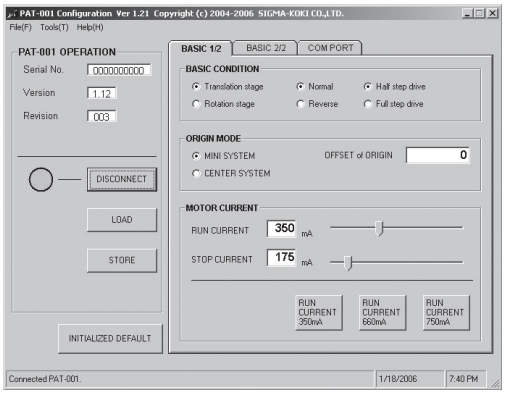
2) After that, set **BAUD RATE** to **9600**, select a port (**COM PORT**) for connecting with PAT-001 in the **COMMUNICATION** tab. Then click **OK**.

   The settings for PC have been completed.



Next, connect the power via the terminals on the PAT-001 rear panel. Take great care to never connect to wrong terminals such as the terminals for different power voltages or reverse polarities. After turning the power ON, make sure the power indicator LED lights up in green on the PAT-001 front panel. If you do not find no problem, click the **CONNECT** button.





If the communications have been established successfully, the above screen is displayed, the indicator turns green, and information such as the Serial No. and internal ROM version of your PAT-001 is displayed. If an error is displayed, you must check the connection and the baud rate setting again.

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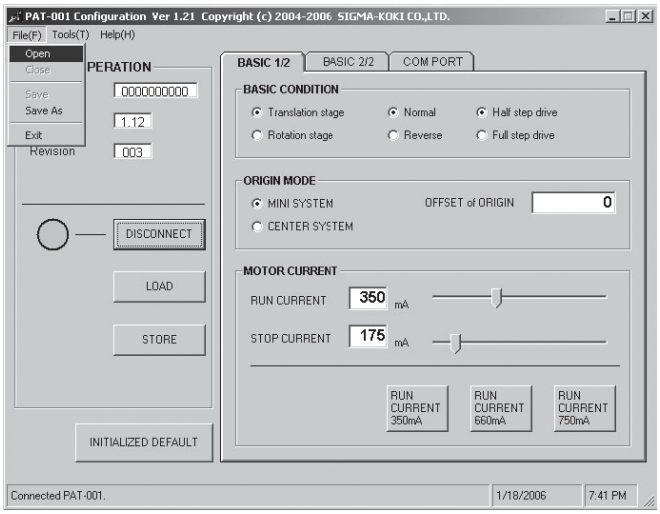
3-2. Customize Configurations

PAT-001 Configuration Program enables you to setup the optimum control parameters for stages you are using. The attached CD-ROM contains sample files for SIGMA's typical automatic stages. You can also customize your configurations by editing the sample files and saving them.

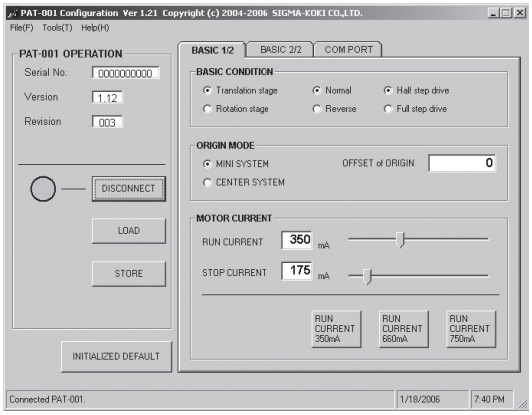
3-2-1. Load Sample Data

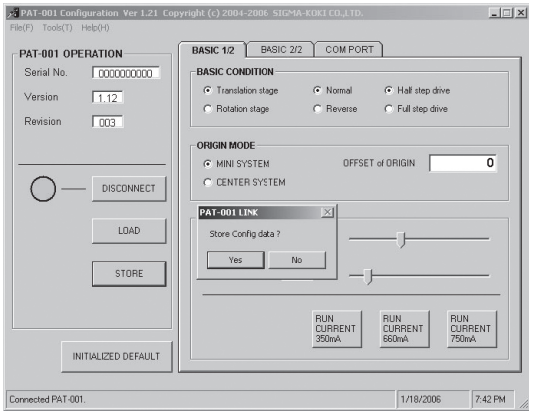
Load the sample data on the CD-ROM to Configuration Program. Select **Open** in the **File** menu. Then open the **ConfigData** folder on the CD-ROM to select a file with the name of a stage you are using. Fields on the screens are populated with typical configurations. Note that the loaded configurations has not yet been transerred to the PAT-001.



3-2-2. Write Configurations to PAT

Write the loaded data to the PAT-001 by clicking the **STORE** button while the PAT-001 and the **Configuration Program** are communicating with each other successfully (indicator in green). Note that you cannot write to the PAT-001 while the indicator is red. The program shows a confirmation message before writing. Select **Yes** to start writing.





When you have finish writing configurations to the PAT-001, turn OFF the PAT-001 power. Wait ten seconds. Then turn ON the power again to restart the PAT-001. After the PAT-001 has restarted (power indicator LED lights up on the front panel), the written configurations are effective. Note that the written configurations will not be effective without this restarting process.

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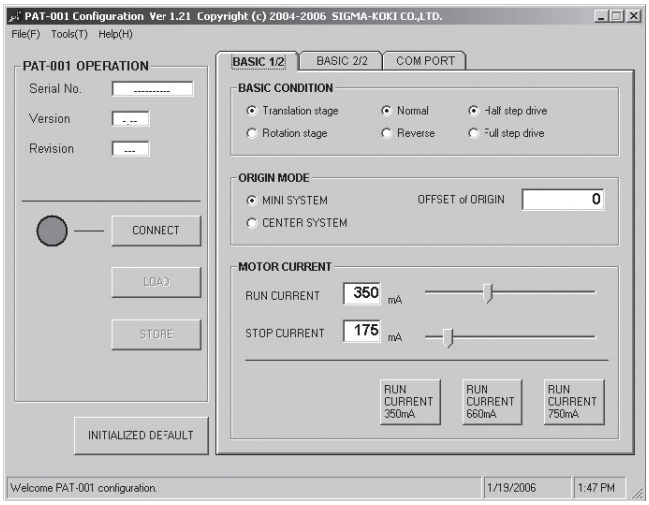
3-3. Change Configurations

The configuration Program has three tabs to allow you to change the settings of the PAT-001 if necessary.
Clicking the **INITIALIZED DEFAULT** button can restore the factory-set configurations completely.
If you change configurations, you must write them to PAT-001 by referring to the descriptions in "**3-2-2 Write Configurations to PAT.**"

3-3-1 BASIC 1/2 Tab

Check/change drive parameters for the stages you are using.



· **BASIC CONDITION:** Set a model of stage, the rotating direction of the motor and select full step drive/half step drive.
For SIGMA's stages, the normal rotating direction means the same moving direction as the existing controllers. Note that the locations of the limit switches are reversed.

· **ORIGIN MODE:** Sets operational mode for homing the stage. Selecting MINI SYSTEM sets the home position in the negative limit switch (LS-) direction. This is compatible with the MINI mode for SIGMA's existing controllers.

Setting a numeric value in the OFFSET of ORIGIN box allows you to move a stage equal to the specified number of pulses after the home position is determined, and to change the home position (coordinate = 0) to the reached point.
Setting zero in the box can invalidate the offset.

Selecting the CENTER SYSTEM mode will place the home position at the center point between the limit switches. This mode is convenient for applications for which you want to set the home position at the center of the stage (e.g. the stage of a microscope). OFFSET of ORIGIN is ineffective in the CENTER SYSTEM mode.

· **MOTOR CURRENT:** Set the drive current (RUN CURRENT) and stop current (STOP CURRENT) of the motor. For SIGMA's stages, use an appropriate RUN CURRENT button. The buttons also set the corresponding stop currents at the same time. In this case, the stop current set will be half the value of the run current.

Alternatively, you can use the sliders for the current settings. With the sliders, the run and stop currents can be specified independently unless a stop current value does not exceed the corresponding run current value. The sliders allows you to set a current in 1 [mA].

Specify the currents within the ratings of the motor. Operating the motor at higher currents than rated, the motor may overheat or be damaged.

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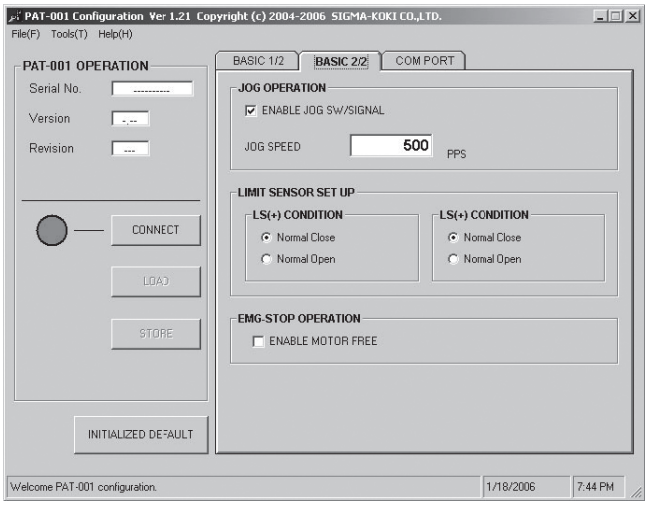
3-3-2 BASIC 2/2 Tab

Check/change the settings for jog switch operations and limit switch signals for PAT-001.



· **JOG OPERATION:** If the ENABLE JOG SW/SIGNAL check box is checked, the jog switch on the PAT-001 front panel and the jog signals via the PIO terminals on the rear panel are enabled.

The JOG SPEED box allows you to set the speed of the stage when it is operated with the jog switch or a jog signal is input.
Note that since jog moves are not accelerated/decelerated, setting too high speeds may cause loss of synchronism.
Select an adequate speed that does not cause loss of synchronism. A stage may be damaged if you continue to move it with loss of synchronism for a long time.

· **LIMIT SENSOR SET UP:** Set the determination logic for the limit sensors. Normally select Normal Close for SIGMA's stages. Note that selecting a wrong logic may cause malfunctions.

· **EMG-STOP OPERATION:** Energize/deenergize the motor on an emergency stop. Note that a Z-axis stage may fall on an e-stop.

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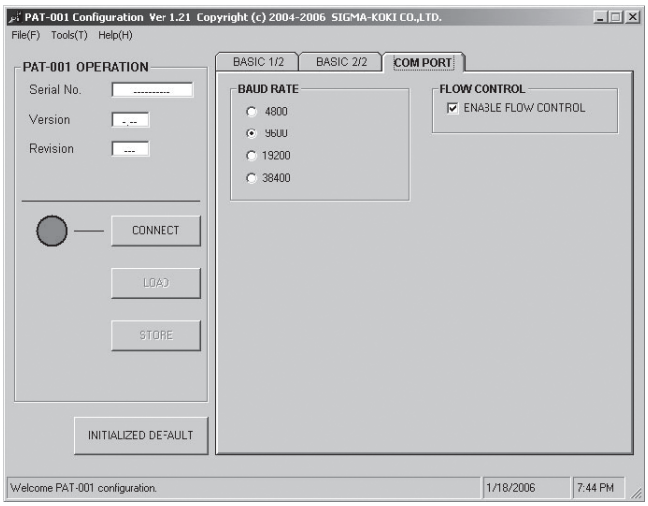
3-3-3. COM PORT Tab

Check/change the communications setup for PAT-001.
Changing the communications setup for PAT-001 requires the reconfiguration of the communications setup on the host. Note that if the communications setups for the PAT-001 and the host do not match, the both side cannot communicate each other successfully.



· **BAUD RATE:** Select a baud rate applied in the communications with the host. Select the same baud rate as set on the host.

· **FLOW CONTROL:** Enable/disable the flow control. Check the ENABLE FLOW CONTROL check box to enable the flow control for the hardware. Set the flow control setup to Hardware on the host.

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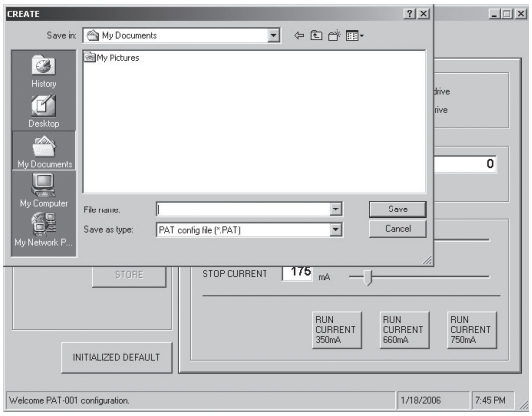
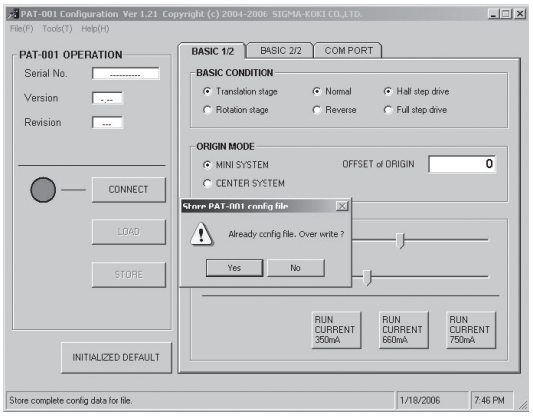
4. Create/Save Configuration File

The PAT-001 Configuration Program enables you to create/save a configuration file.
The feature is convenient for using the same configuration for two or more PAT-001s, or switching configurations.

Select **Create** in the **File** menu of the **PAT-001 Configuration Program**, and then specify the file name and destination.

Change settings according to **"3-3 Change Configurations"**, and then select **Save** in the **File** menu. When an existing configuration file already has the same file name, the confirmation message is displayed. Select **Yes** to overwrite the configuration.

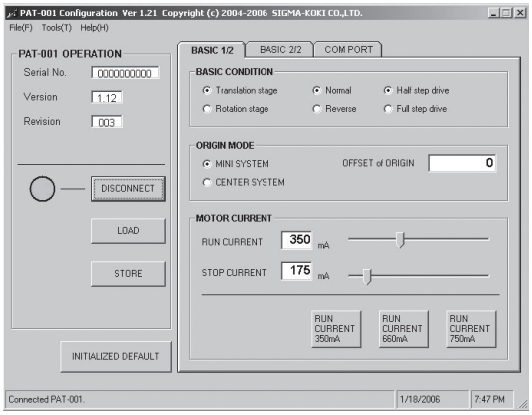


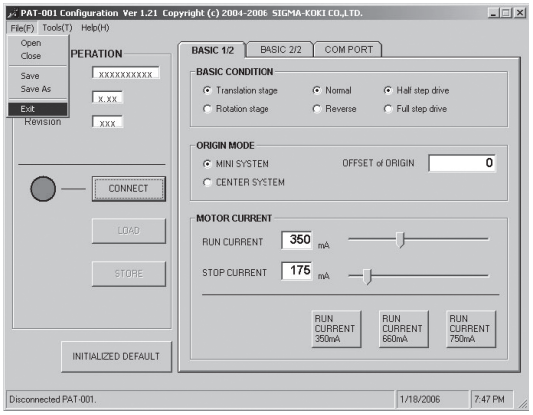


* If you edit sample data and save it, make sure to change the file name before saving to avoid possible misuses.

5. Exit the PAT-001 Configuration Program

To exit the **PAT-001 Configuration Program**, first click the **DISCONNECT** button, and when the indicator turns red, select **Exit** in the **File** menu. You can exit the program safely.





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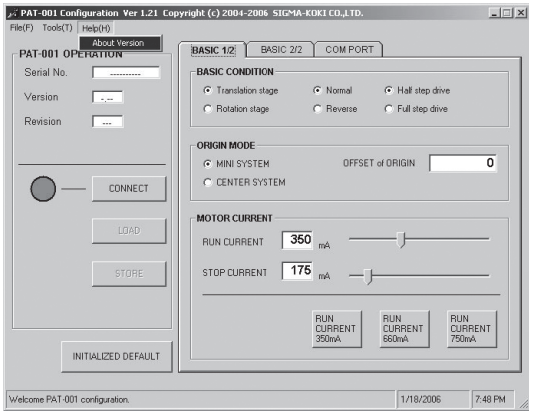
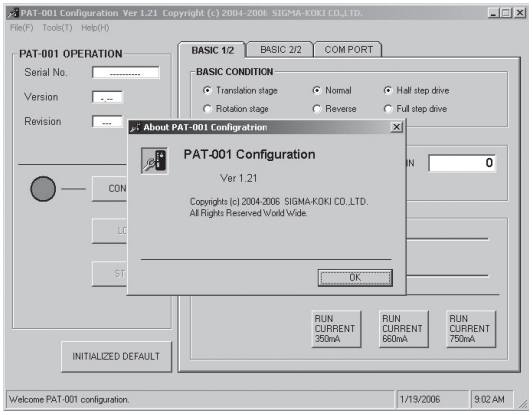
6. About Version

Displays the version information of the **PAT-001 Configuration Program**. Select **About Version** in the **Help** menu. The version information of the program is displayed on the screen.

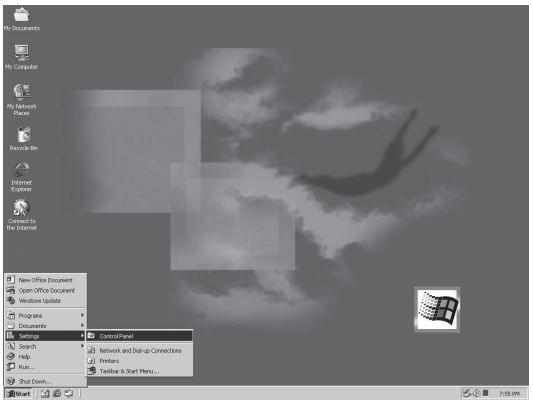


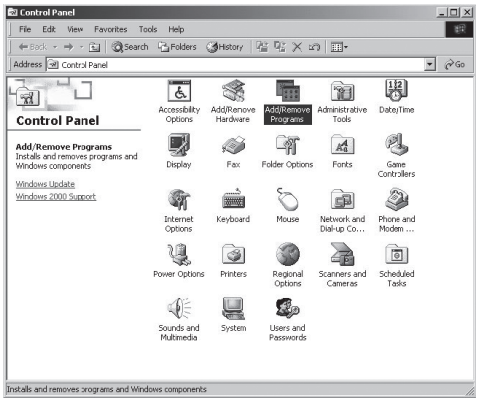


7. Uninstall PAT-001 Configuration Program

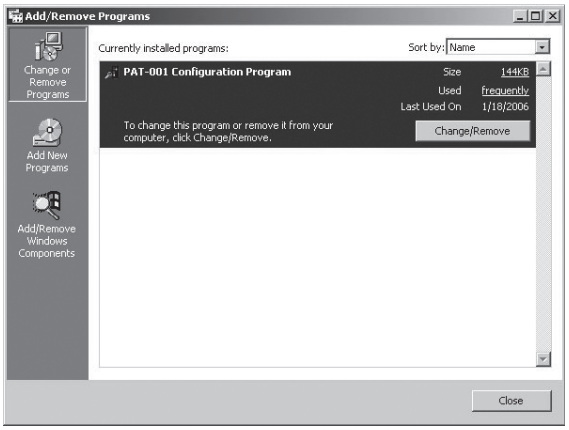
This section describes how to remove the **PAT-001 Configuration Program**.

1) Open the **Control Panel** in the **Start** menu.





2) Open Add/Remove Programs in **the Control Panel**, select the **PAT-001 Configuration Program**, and then click the **Change or Remove Programs** button.



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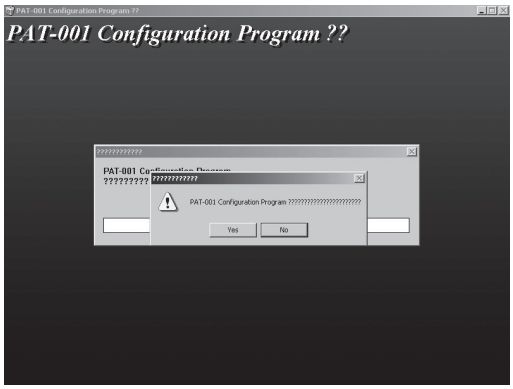
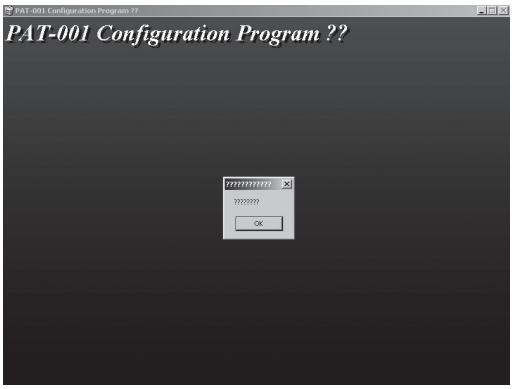
3) The uninstaller starts up. Follow the instructions displayed on the screens to continue the process. The lower display appears when the uninstallation completes.

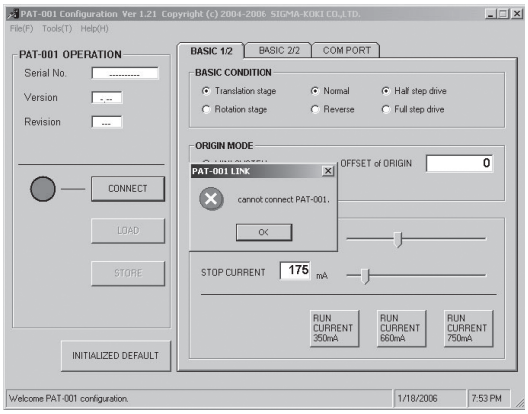




8. Error Displays

This section describes the typical error displays and the countermeasures in **PAT-001 Configuration Program**.

1) Message: Cannot connect PAT-001.



◆ Countermeasures ◆

- **Are your PAT-001 and PC connected correctly?**
  Connect with a 9-pin, male/female, serial communications straight cable.

- **Is PAT-001 powered?**
  Connect to noise-free, 24 [V] DC, 2.5 [A] or higher power supply as labeled on the rear panel.

- **Is the baud rate set correctly in PAT-001 Configuration Program?**
  See "**3. Use the Configuration Program**" for checking the communications setup.

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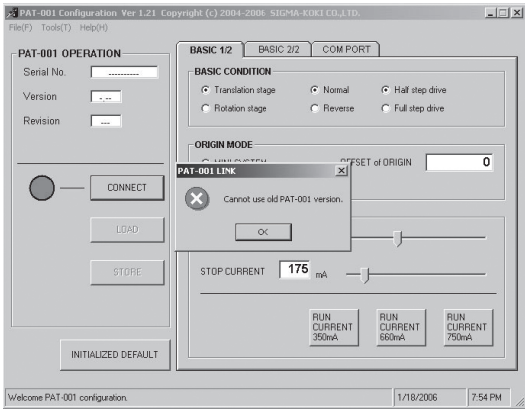
2) Message: Cannot use old PAT-001 version.



◆ Countermeasures ◆

· The internal ROM data in your PAT-001 may be older. Contact our sales representative.

If either of an error above persists after you try the countermeasures, contact SIGMA KOKI's sales office below:

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Chapter 3: Host Command Instructions

Scope

This instruction Manual is applicable to the firmware of the PAT-001 Flexible Stepping Motor Controller as follows. The PAT-001 Flexible Stepping Motor Controller is called This Device in this document.

- Firmware Versions: Versions 1.00 and later

This manual describes the host commands for this device.

1.Overview

This device is a motor controller that allows an external PC or control device to control a 1-axis 5-phase stepping motor.
This device receives controlling commands from a PC or an external control device via a serial interface to realize desired operations. This device employs a start-stop synchronization serial interface at RS-232 levels to communicate with an external control device.
This device follows the command system from the SHOT series. Part of functions of the system has been extended. To send a controlling command to this device from an external device, specified command codes and parameters should be followed by the terminator characters (CR, LF). This device sends strings and the terminator characters (CR, LF) to return the execution results and requested values for a command sent from an external device.
Command codes and parameters given to this device are not case-sensitive. This device always returns answers and results in upper-case.

The commands prepared for this device are roughly categorized as the following two groups:

a) SHOT series compatible commands
b) SHOT series extended command

1-1. SHOT Series Compatible Commands

The following commands for this device are compatible with the command system of the SHOT series:

・Return to Mechanical Origin Command	**H:**
・Command to Set Relative Move Pulse Count	**M:**
・Command to Set Absolute Move Pulse Count	**A:**
・Jogging Command	**J:**
・Driving Command	**G:**
・Electronic (Logical) Zero Set Command	**R:**
・Deceleration and Stop Command	**L:**
・Emergency Stop Command	**L:E**
・Command to Set Speed	**D:**
・Motor Free/Hold Command	**C:**
・Checking Command Status 1 Command	**Q:**
・Checking Command Status 2 Command	**!:**
・Command to Acquire Internal Information Version Number	**?:V**
・Command to Acquire Internal Information Revision Number	**?:-**
・Port Input Command	**I:**
・Port Output Command	**O:**

Note that the parameters and returns in same commands are different from the other SHOT series devices owing to the number of axes.

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1-2. SHOT Series Extended Commands

The following commands for this device have been added to the existing SHOT series command system:

・Offset of Origin Command	**S:N**
・Jogging Speed Set Command	**S:J**
・Offset of Origin Acquisition Command	**V:N**
・Jogging Speed Acquisition Command	**V:J**
・Sensor Status Acquisition Command	**?:L**

2. Details of Commands

2-1. SHOT Series Compatible Commands

2-1-1. Control Commands 1 (Driving System)

2-1-1-1. Return to Mechanical Origin Command

Command: **H:**

Parameter: Axis name

Axis name	"**1**" or "**W**"	Name of axis to operate

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: The command to perform the homing operation of the stage.
After the homing operation, the axis 1 coordinate position returned by the status 1 command becomes effective.
Running a stop command during the homing operation suspends the operation.
Limit sensor's detection unplanned in the sequence during the homing operation suspends the operation.

Notes: Any commands except the stop command or checking command are not acceptable during the homing operation.
The driving speeds and acceleration/deceleration speeds will follow the values in the last speed setting command.
Deceleration is not available if the limit sensor is activated.
For driving in the normal rotation, the limit sensors are assigned as follows:
1) LS0 CW (+)
2) LS1 CW (-)
For driving in the reverse rotation, the limit sensors are assigned as follows:
1) LS0 CW (-)
2) LS1 CW (+)
If deenerginzed, an error is generated to inhibit the homing operation.

Example of the command: **H:W** Perform the homing operation.

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2-1-1-2. Command to Set Relative Move Pulse Count

Command: **M:**

Parameter: Axis name + Direction + Moving distance

Axis name	**"1"** or **"W"**	Name of axis to operate
Direction	**"+"**	Moves the axis in the positive direction
	"-"	Moves the axis in the negative direction
Moving distance	**"P"** + number	Set a number from 0-16,777,215

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: The command to set the moving distance and direction of the stage.
This device runs this command and then runs the driving command to drive the actual stage.
The stage accelerates/decelerates as set in the speed setting command.
After the move finishes, the moved distance is added/subtracted to/from the coordinate before the movement.

Notes: If this command is repeated without running the driving command, the last run this command or the **Command to Set Absolute Move Pulse Count** is effective.
If the Return to Mechanical Origin Command, **Jogging Command** or **Stop (Emergency Stop)** Command is run, the values set in this command are canceled.
A command error is generated if a coordinate after the move exceeds the specified limit (+/- 16,777,215).
While deenergized, running this command causes a command error.

Example of the command:

M:1+P1000	Sets 1000-pulse move in the positive direction.
M:W-P5000	Sets 5000-pulse move in the negative direction.

2-1-1-3. Command to Set Absolute Move Pulse Count

Command: **A:**

Parameter: Axis name + Direction + Moving distance

Axis name	**"1"** or **"W"**	Name of axis to operate
Direction	**"+"**	Moves the axis in the positive direction
	"-"	Moves the axis in the negative direction
Moving distance	**"P"** + number	Set a number from 0-16,777,215

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: The command to set the moving distance and direction of the stage to a coordinate from the origin position.
This device runs this command and then runs the driving command to drive the actual stage.
The stage accelerates/decelerates as set in the speed setting command.
After the move finishes, the current position is set to the position specified by this command.

Notes: If this command is repeated without running the driving command, the last run this command or the **Command to Set Relative Move Pulse Count** is effective.
If the **Return to Mechanical Origin Command**, **Jogging Command** or **Stop (Emergency Stop)** Command is run, the values set in this command are canceled.
A command error is generated if a coordinate after the move exceeds the specified limit (+/- 16,777,215).
While deenergized, running this command causes a command error.

Example of the command:

A:1+P1000	Set a move to coordinate 1000.
A:W-P5000	Set a move to coordinate -5000.

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2-1-1-4. Jogging Command

Command: **J:**

Parameter: Axis name + direction

Axis name	**"1"** or **"W"**	Name of axis to operate
Direction	**"+"**	Moves the axis in the positive direction
	"-"	Moves the axis in the negative direction

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Set jogging operation for the stage.
This device runs this command and then runs the driving command to drive the actual stage.
The stage moves at a preset jogging speed without acceleration/deceleration.
The jogging speed is set in the **Jogging Speed Set** command.

Notes: Running a different moving command (**Command to Set Relative Move Pulse Count**, etc) without running the driving command cancels this command.
While deenergized, running this command causes a command error.

Example of the command: **J:1+** Set jogging operation in the positive direction.

2-1-1-5. Driving Command

Command: **G:**

Parameter: None

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: The command to perform the driving operation of the stage.
The stage is driven according to the **Command to Set Relative/Absolute Move Pulse Count** and the **Jogging Command** run immediately before.
On detecting a limit, the stage being driven stops immediately without acceleration/deceleration.
If a limit is detected in a driving operation by the **Command to Set Relative/Absolute Move Pulse Count**, the pulse count to the detected position is added/subtracted to/from the coordinate before the drive to set the new coordinate.
Before sending "M:" or "A:" command, please once execute "H:" or "R:" command to make PAT-001 recognize the coordinate value.

Notes: Running this command without running a moving command (**Command to Set Absolute/Relative Move Pulse Count** command or **Jogging Command**) generates a command error.
Give a new moving command after this command finishes. Running this command without giving any moving command generates a command error.
If the moving distance is set to zero, this command finishes normally without any move.
While deenergized, running this command causes a command error.

Example of the command:
M:1+P1000
G: Moves 1000-pulse in the positive direction.

J:1+
G: Jogs in the positive direction.

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2-1-2. Control Commands 2 (Setting System)

2-1-2-1. Electronic (Logical) Zero Set Command

Command: **R:**

Parameter: Axis name

Axis name	**"1"** or **"W"**	Name of axis to operate

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Set the current coordinate to the electronic (logical) zero.
After running this command, the current position is set to zero.
If running this command after jogging, the current position is also set to the electronic (logical) zero.

Notes: Running this command with neither jogging nor the homing operation performed causes an error.

Example of the command: **R:1** Sets the current coordinate to the electronic (logical) zero.

2-1-2-2. Deceleration and Stop Command

Command: **L:**

Parameter: Axis name

Axis name	**"1"** or **"W"**	Name of axis to operate

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Stops the operation of the axis being driven. The axis is stopped by deceleration.
The stop position becomes the new coordinate position.

Notes: This command is effective only when the stage is operated by a Command to Set Relative/Absolute Move Pulse Count.
If the stage is not operated, this command finishes normally without the stop operation.
During jogging, this command stops the jog operation.

Example of the command: **L:W** Stops axis drive.

2-1-2-3. Immediate Stop Command

Command: **L:E**

Parameter: None

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Stops the driving of the motor without deceleration.

Notes: Unlike e-stop signal input, this command does not deenergize the motor.

Example of the command: **L:E** Stops immediately.

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2-1-2-4. Command to Set Speed

Command: **D:**

Parameter: Axis name + minimum speed + maximum speed + acceleration/deceleration time

Axis name	**"1"** or **"W"**	Name of axis to operate
Minimum Speed	**"S"** + number	Set a number from 100-20000.
Maximum Speed	**"F"** + number	Set a number from 100-20000
Acceleration/Deceleration Time	**"R"** + number	Set a number from 0-1000.

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Sets the minimum/maximum speeds and acceleration/deceleration time for moving the stage.
The minimum speed is the driving speed **S**, the speed when the motor starts. The maximum speed is the driving speed **F** that specifies the maximum speed of the motor. The unit of the speeds is [pps].
Acceleration/deceleration time specifies the acceleration time from the driving speed **S** to **F**, and the deceleration time from **F** to **S**. The unit of time is ms.

Notes: Be sure to set the maximum speed higher than the minimum speed. If set wrong, an error is generated and the set value is canceled.
If this command is run continuously, the last run this command is effective.
If this command has not been run, the initial values are as follows:

Minimum time	500 [pps]
Maximum time	5000 [pps]
Acceleration/Deceleration Time	200 [mS]

Set the speed in 100 [pps]. Values less than 100 [pps] are rounded down.
Some stages do not operate normally with values set by this command. In this case, correct the values by considering the torque, load, etc. of the motor.

Example of the command: **D:1S500F5000R200** Set the minimum speed to 500 [pps], the maximum speed to 5000 [pps], and the acceleration/deceleration time to 200 [mS].

2-1-2-5. Motor Free/Hold Command

Command: **C:**

Parameter: Axis name + operating mode

Axis name	**"1"** or **"W"**	Name of axis to operate
Operating mode	**"0"**	Deenergize (OFF)
	"1"	Energize (ON)

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Deenergize (OFF)/energize (ON) the motor.

Notes: If deenergized (OFF), the current position becomes undefined.
Even when energized (ON), perform the homing operation, or run the **Electronic (Logical) Zero Set Command**.

Example of the command:

C:10	Deenergize (OFF) the motor.
C:W1	Energize (ON) the motor.

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2-1-3. System Status Commands

2-1-3-1. Status 1 Command

Command: **Q:**

Parameter: None

Return: Axis 1 coordinat, ACK1, ACK2, ACK3

Axis 1 coordinate		Current coordinate Range: 0 through +/- 16,777,215
ACK1	**"X"**	Command/parameter error
	"K"	Command accepted normally
ACK2	**"L"**	Axis 1 LS stop
	"K"	Normal stop
ACK3	**"B"**	Device busy
	"R"	Device ready

Descriptions: Returns the detailed status of this device.
ACK1 returns the executing result of an immediately preceding command.
ACK2 shows the result of the last move. Returns **"K"** if a limit is detected, or the move of the axis is terminated forcibly by the **Stop/E-Stop Command** during the move.
ACK3 returns **"B"** while this device is in the process of positioning. Returns **"R"** in other status.

Notes: No specific notes.

Example of the command: **Q:** Acquires the detailed status of this device.

2-1-3-2. Status 2 Command

Command: **!:**

Parameter: None

Return: ACK3 **"B"** Device busy
"R" Device ready

Descriptions: Returns the status of this device.
ACK3 returns **"B"** while this device is in the process of positioning. Returns **"R"** in other status.

Notes: No specific notes.

Example of the command: **!:** Acquires the status of this device.

2-1-4. Commands to Acquire Internal Information

2-1-4-1. Version Number

Command: **?:V**

Parameter: None

Return: Version

Descriptions: Returns the version number of the firmware in this device.
A version is returned in a **"Vx.yy"** format. In this format, **"x"** means the major version number, while **"yy"** is the minor version number.

Notes: No specific notes.

Example of the command: **?:V** Returns the version number of this device.

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2-1-4-2. Revision Number

Command: **?:-**

Parameter: None

Return: Revision

Descriptions: Returns the revision number of the firmware in this device. The revision number is a three-digit number.

Notes: No specific notes.

Example of the command: **?:-** Returns the revision number of this device.

2-1-5. I/O Commands

2-1-5-1. Port Input Command

Command: **I**:

Parameter: None

Return: The status of the parallel interface

Descriptions: Returns the current status of the parallel interface input ports.
The status of a port is returned in a number from 0-15.
Each port status corresponds to an input port as follows:

DI0 is **"ON"**: **1**
DI1 is **"ON"**: **2**
DI2 is **"ON"**: **4**
DI3 is **"ON"**: **8**

Returns the sum of these values and the port status. If an input port is in the "OFF" state, zero is added.

Notes: No specific notes.

Example of the command: **I:** Returns the status of the parallel interface.

Returns	**0**	All ports are **"OFF"**.
	1	Only **DI0** is **"ON"**.
	2	Only **DI1** is **"ON"**.
	4	Only **DI2** is **"ON"**.
	8	Only **DI3** is **"ON"**.
	3	**DI1** and **DI0** are **"ON"**.
	7	**DI2**, **DI1** and **DI0** are **"ON"**.
	10	**DI3** and **DI1** are **"ON"**.

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2-1-5-2. Port Output Command

Command: **O:**

Parameter: Parallel I/F output port data

Return:
Normal **"OK"**
Error **"NG"**

Descriptions: Sets the status of the parallel interface output ports.
The status of a port is set to a number from 0-15.
Each port status corresponds to an output port as follows:
DO0 is **"ON"**: **1**
DO1 is **"ON"**: **2**
DO2 is **"ON"**: **4**
DO3 is **"ON"**: **8**
Sets the sum of these values and the port data. If an output port is "OFF," zero is added.

Notes: No specific notes.

Example of the command:

O:0	Sets the parallel interface output ports DO3-DO0 to **"OFF"**.
O:1	Sets the parallel interface output port DO0 to **"ON"**.
O:2	Sets the parallel interface output port DO1 to **"ON"**.
O:4	Sets the parallel interface output port DO2 to **"ON"**.
O:8	Sets the parallel interface output port DO3 to **"ON"**.
O:5	Sets the parallel interface output ports DO2 and DO0 to **"ON"**.
O:12	Sets the parallel interface output ports DO3 and DO2 to **"ON"**.

2-2. SHOT Series Extended Commands

2-2-1. Control Commands (Setting System)

2-2-1-1. Offset of Origin Setting Command

Command: **S:N**

Parameter: An offset value

Offset value	A number	Set a value from 0-16,777,215.

Return:
Normal **"OK"**
Error **"NG"**

Descriptions: Sets an offset of origin.
Specifying an offset with this command inserts a move by an equal distance to the offset value after the homing operation. When the offset move finishes, the position reached replaces the origin position.

Notes: The offset of origin is effective only for the homing operation in MINI system. If the Center system is selected for the homing operation, the value set in this command is ignored.
Turning the power off initializes the value specified in this command.
The factory-set initial value is zero.

Example of the command: **S:N10000** Sets a 10000-pulse offset of origin from the machine zero.

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2-2-1-2. Jogging Speed Set Command

Command: **S:J**

Parameter: Jogging speed

Jogging speed	A number	Set a number from 100-20,000

Return:

Normal	**"OK"**
Error	**"NG"**

Descriptions: Sets a driving speed in pps for jogging operations (by the Jogging Command, JOG switch on the front panel or jogging signal in the parallel I/F).

Notes: Turning the power off initializes the value specified in this command.
The factory-set initial value is 500.
Set a speed in 100 [pps]. A value less than 100 [pps] will be rounded down.

Example of the command: **S:J1000** Sets the jogging speed to 1000 [pps].

2-2-2. System Status Commands

2-2-2-1. Offset of Origin Acquisition Command

Command: **V:N**

Parameter: None

Return: Offset value

Descriptions: Returns an offset value from the origin position in pulses.
The number to be returned is 0-16,777,215.

Notes: No specific notes.

Example of the command: **V:N** Acquires the Offset value.

2-2-2-2. Jogging Speed Set Command

Command: **V:J**

Parameter: None

Return: Jogging speed

Descriptions: Returns a jogging speed in pps.
The number to be returned is 100-20,000.

Notes: No specific notes.

Example of the command: **V:J** Acquires a jogging speed.

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2-2-2-3. Sensor Status Acquisition Command

Command: **?:L**

Parameter: Sensor name

Sensor name		
	"0"	LS0
	"1"	LS1
	"2"	Parallel I/F JOG+ signal
	"3"	Parallel I/F JOG- signal
	"4"	Parallel I/F E-Stop signal

Return: Sensor status

Descriptions: Returns the status of the sensor designated with the sensor name.
For the sensor names of the limit sensors, "0"/ indicates OFF and "1" indicates ON.
For parallel I/F signals, "0" indicates OFF and "1" indicates ON.

Notes: No specific notes.

Example of the command:

?:L0	Acquires the status of **LS0**.
?:L4	Acquires the status of the e-stop signal.

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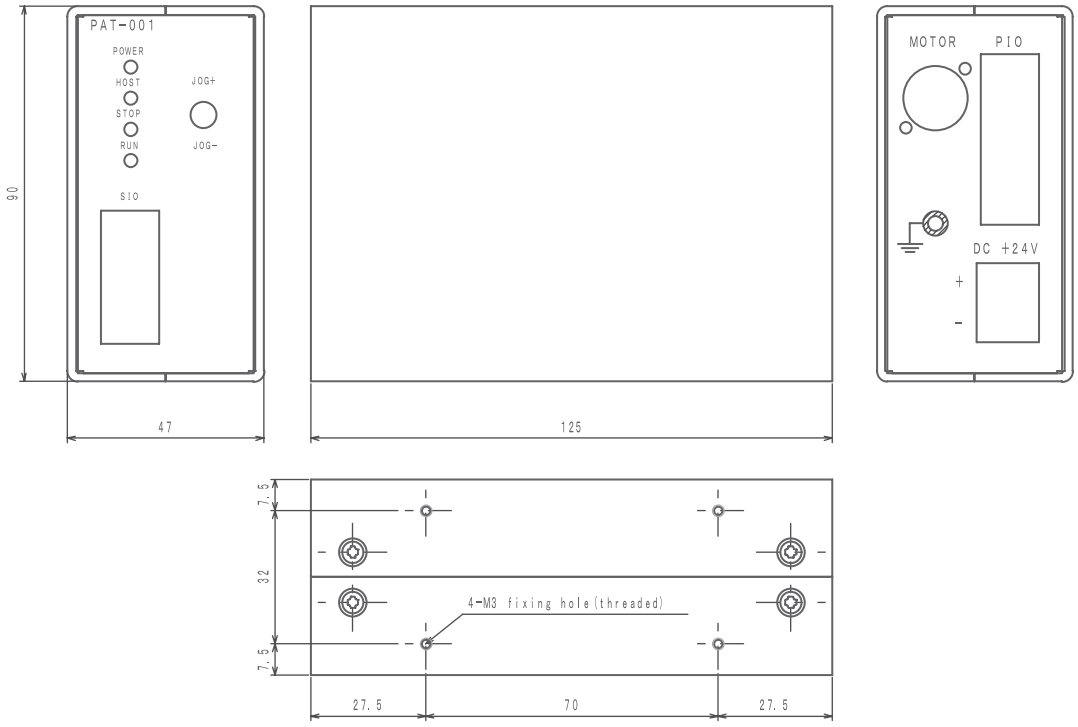
A.Appendices

A-1. PAT-001: OUTLINE DRAWING OF CABINET



Note that the protruding portions such as levers of the switches or connectors are not included in the dimensions. The weight of the AC adapter and conversion cables are excluded from the cabinet weight.

A-2. List of Configurations for Applicable Automatic Stages

Type	Model No.	Drive current	Origin	Rotation	No. of LS	LS Polarity
Direct Acting Type	SGSP15-10	0.75	MINI	正転	2	Normal close
	SGSP20-20/35/85	0.66	MINI	正転	2	Normal close
	SPSP26-50/100/150/200	0.75	MINI	正転	2	Normal close
	TSDM40-15X/TSDM60-20X	0.35	MINI	正転	2	Normal close
ZF-Axis Type	SGSP40-5ZF	0.75	MINI	正転	2	Normal close
	SGSP60-5ZF/10ZF	0.75	MINI	正転	2	Normal close
	SGSP80-20ZF	0.75	MINI	正転	2	Normal close
Rotating Type	SGSP-40YAW/60YAW/60YAW-0B	0.66	MINI	正転	1	Normal close
	SGSP-60-GTPC/GTPC-0B	0.66	MINI	正転	1	Normal close
	SGSP-60-WPQ/WPQ-0B	0.66	MINI	正転	1	Normal close
	SGSP-60-ND/ND-0B	0.66	MINI	正転	1	Normal close
	SGSP-60-NDU/NDU-0B	0.66	MINI	正転	1	Normal close
Gonio Type	SGSP-60ROLL/PITCH	0.75	MINI	正転	2	Normal close
	SGSP-60A75	0.75	MINI	正転	2	Normal close
	SGSP-60A100	0.75	MINI	正転	2	Normal close
	SGSP-60A130	0.75	MINI	正転	2	Normal close
Actuator Type	SGSP-13ACT/13ACT-B0/25ACT/25ACT-B0	0.35	MINI	正転	2	Normal close

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A-3. Factory Settings

・Homing	Origin Mode	MINI System
	Offset of Origin	0
・Current Settings	Driving (RUN) Current	0.35 [A]
	Stop (STOP) Current	0.175 [A]
	Auto Current Down Time	After 100 [mS]
・Driving Method	Half Step Drive	
・Driving Direction	Normal Rotation	
・Limit Sensor Setup	Number of LS	2
	LS (+)	Normal Close
	LS (-)	Normal Close
	Power Supply	+ 24 [V] with resistor in series
・E-Stop Processing	E-Stop Signal Input	Disabled
		E-stop signal setting jumper; Open
	Energize in an e-stop state	Enabled (energize)
・Serial Interface	Baud Rate	9600 [bps]
	Flow Control	Enabled
・Other Specifications	JOG Operating Speed	500 [pps]
	JOG switch/Signal	Enabled
	Energize on Startup	Enabled (energize)

The factory-set initial values of this device are as follows:

・Offset of origin		0
・Initial Speed	Minimum Speed(S)	500 [pps]
	Maximum Speed(F)	5000 [pps]
	Acceleration/Deceleration Time(R)	200 [mS]
・Stage mode	Stage Model Setting	Linear Stage
・Jogging Speed		500 [pps]

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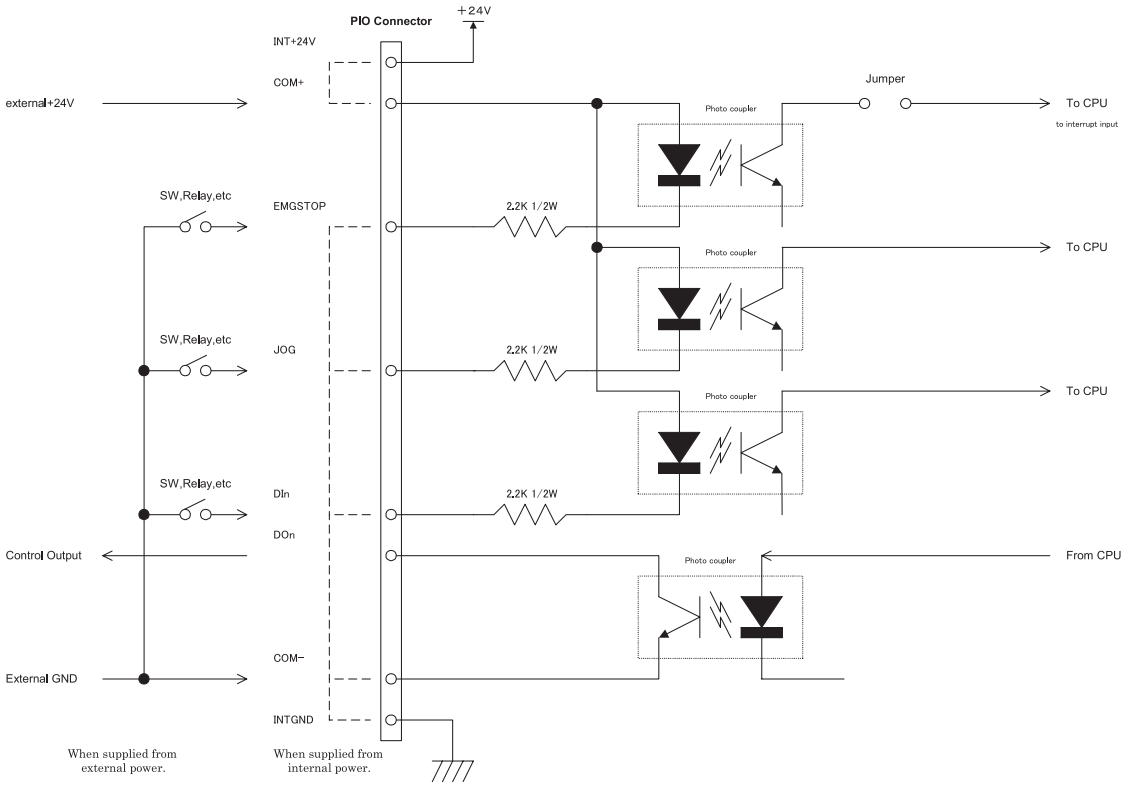
B. Equivalent Circuit

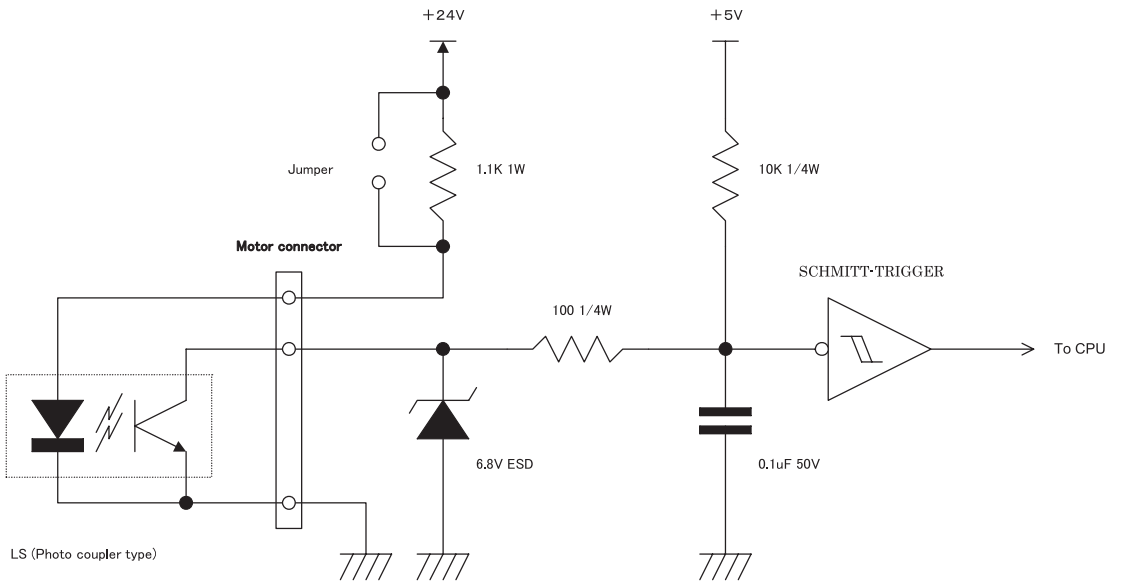
B-1. Parallel Interface Equivalent Circuit

The following chart shows the parallel interface equivalent circuit of PAT-001:



B-2. Limit Sensor Input Equivalent Circuit

The following chart shows the equivalent circuit of the PAT-001 limit sensor input circuit:



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C. About Origin System

PAT-001 is equipped with two types of Origin systems as follows:

- MINI System
- CENTER System

The systems are described below. Note that the chart is prepared for normal rotation. For reverse rotation, the relationship between LS (-) and LS (+) is reversed.

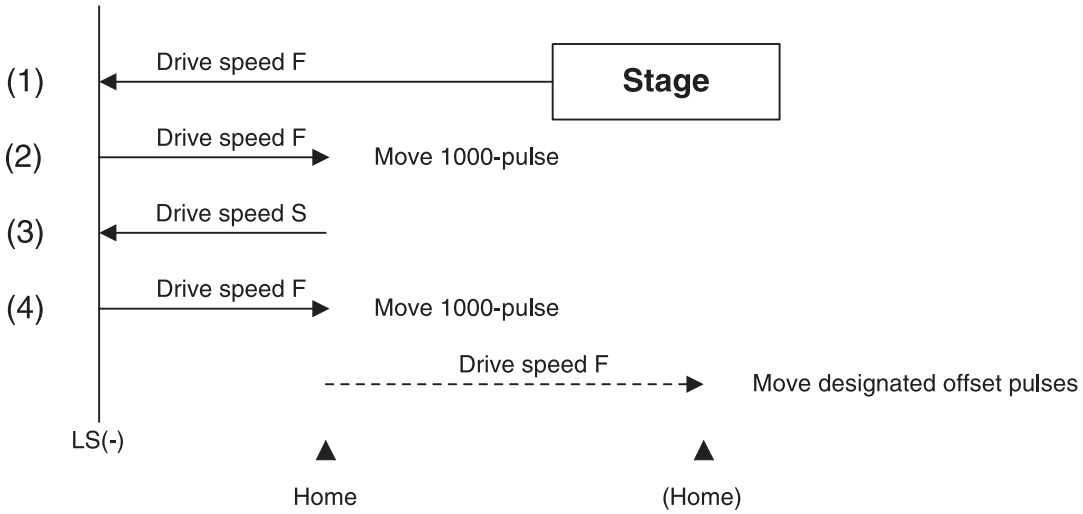
The moving speeds and acceleration/deceleration time in homing are as follows:

- Driving Speed **S** 500 [pps]
- Driving Speed **F** 5000 [pps]
- Acceleration/Deceleration Time **R** 200 [mS]

These parameters are not affected by the Command to Set Speed (D command).

C-1. MINI System

The method having been applied to existing SIGMA KOKI's controllers. The operation is shown below:



(1) On receiving the Return to Mechanical Origin Command, PAT-001 moves the stage toward the LS (-) at the driving speed **F**.

(2) After detecting the limit, the stage moves back by 1000-pulse toward the opposite direction to LS (-) at the driving speed **F**.

(3) The stage moves toward LS (-) at the driving speed **S**.

(4) After detecting the limit, the stage moves back by 1000-pulse toward the opposite direction to LS (-) at the driving speed **F**.

(5) If no offset is specified, PAT-001 sets the home position there.
If the offset is specified, the stage moves by the specified offset pulses toward the opposite direction to LS (-) at the driving speed **F**, and set the home position there.

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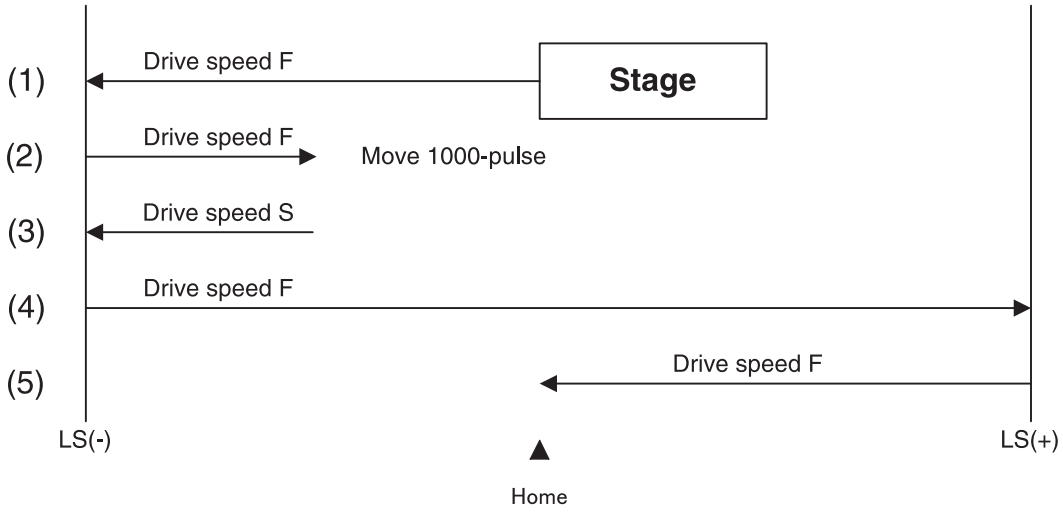
C-2. CENTER System

The new system has been developed for the PAT-001. The operation is shown below:



(1) On receiving the Return to Mechanical Origin Command, PAT-001 moves the stage toward the LS (-) at the driving speed **F**.

(2) After detecting the limit, the stage moves back by 1000-pulse toward the opposite direction to LS (-) at the driving speed **F**.

(3) The stage moves toward LS (-) at the driving speed **S**.

(4) The stage moves toward LS (+) at the driving speed **F**.

(5) After detecting the limit, the stage moves to the intermediate position between LS (-) and LS (+), and set the home position there.

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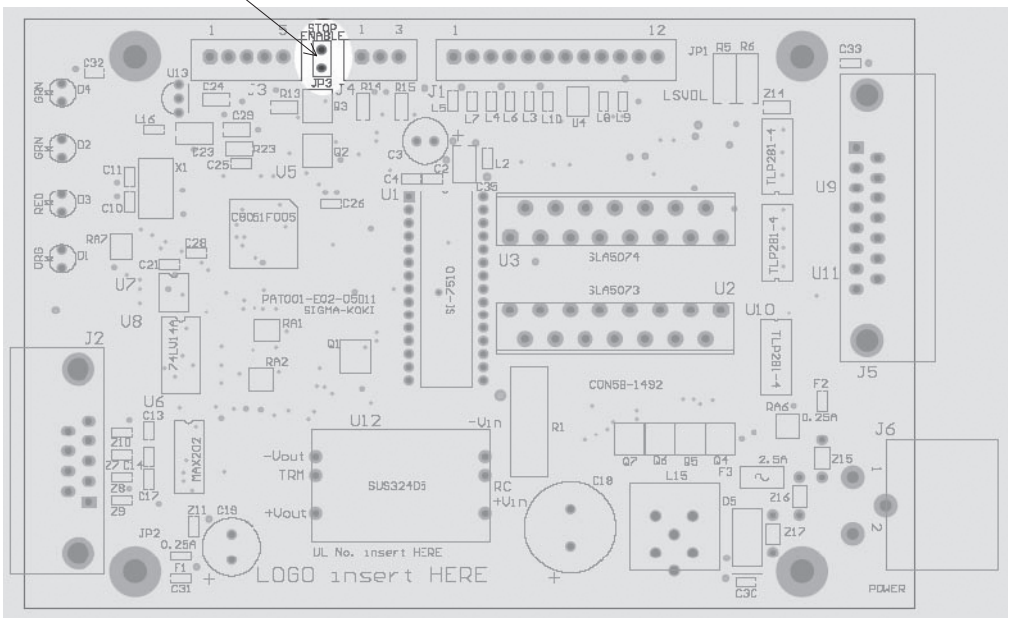
D. How to Use E-Stop Signal

The e-stop signal is disabled in the factory settings. To enable the e-stop signal, set the jumper cable for enabling e-stop inside PAT-001.

(1) Enable E-Stop Signal



* To set the above jumper, make sure to turn off the power for every relating device. If you fail to turn off the power, a serious accident such as an electric shook, injury, or damage to the devices may occur.
* Note that during the work, set the above jumper only. Never allow your hands or tools to touch the other PCBs, parts, connectors or etc. Otherwise, an electric shook or damage to the electronic components may occur.
* After setting the jumper, make sure there are no dust or dirt left inside the cabinet. Reassemble the cabinet before using the PAT-001.
  Using PAT-001 with the cabinet left open may cause a serious accident such as an electric shook or a burn.
* If the PAT-001 does not operate normally after changing the setting, turn off the power immediately, and contact SIGMA KOKI about checking/repairing your controller. If you continue to use such a controller without a check or repair, a serious accident such as a fire or damage to the devices can occur.
* For the details of the setting, contact our sales office

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