User's Manual

FMC32

Compact Controller with Integrated Driver

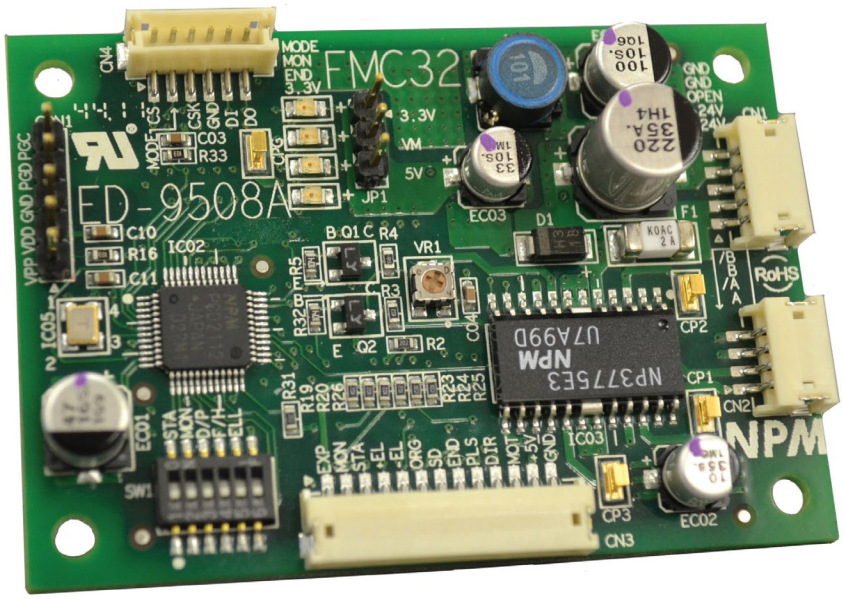

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Table of Contents

1. Preface

Thank you for considering our FMC32, a compact controller with integrated driver.
Before you read this manual, please install required software and hardware according to the PUSB3503 user's manual.

The product that you purchased contains the PCD2112: a pulse control LSI for serial-bus control. With it you can design execution sequence programs and write designed execution sequence program to the FMC32 using PUSB-3503. Before writing them to FMC32, you can also inspect and confirm the program on your PC.
By using this software, you can monitor the contents of all register of PCD 2112 in real time. You can use this function to understand PCD2112 thoughtfully.

The FMC32 is equipped with a CPU which allows you to repeat the execution sequence program that is written to FMC32, automatically. If you use a motor and a driver additionally, you can confirm operation in more detail.

This manual describes how to use the software to operate the PUSB-3503 and the FMC32 together. Please read this manual thoroughly to use this product's functions.

This manual does not describe the followings.
- FMC32 hardware function
- PUSB-3503's function and handling method
- The contents of PCD2112's register

Additionally, please use the following user's manual.
- Compact controller with integrated driver FMC32 Hardware, User's manual (Document No. YA7174)
- USB to 4- wire serial conversion unit PUSB-3503, User's manual (Document No. YA7176)
- Pulse Control LSI PCD2112 for serial bus controls, User's manual (Document No. DA70115)

1-1. FMC32's function

FMC32 has two modes: "PC control mode" that is controlled by a PC and "Standalone mode" that is used for standalone . This manual describes the software used on a PC.

1-1-1. PC control mode

When the FMC32 connects with PUSB-3503 and is powered on, the FMC32 is in PC control mode.
Even if the PUSB-3503 is removed while operating in PC control mode, the mode does not change to Standalone mode.
In PC control mode, the FMC32 will not run a program written in the FMC32. To get the FMC32 to work in this mode, operational directions from a PC are required.

1-1-2. Standalone mode

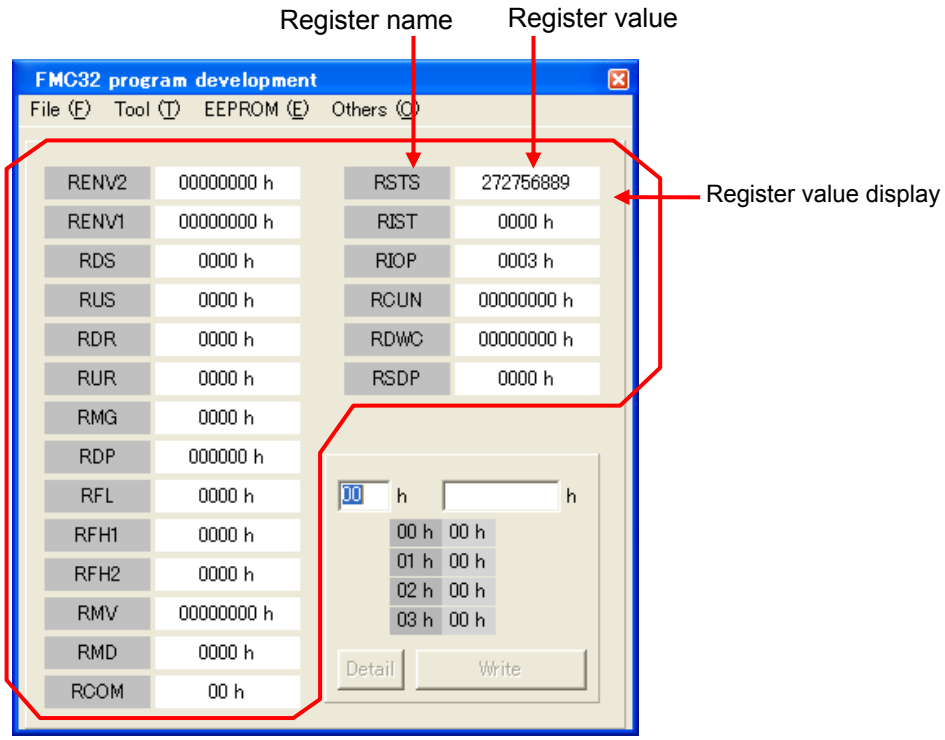
If the FMC is powered on without the PUSB-3503, the FMC 32 is in stand-alone mode. The FMC32 in stand-alone mode will automatically run a written program. If the PUSB3503 is connected to the FMC32 while the FMC32 is running in standalone mode, the mode does not change to the PC control mode.

2. Basic operation procedure of this software

2-1. Start software

First of all, confirm that FMC32 is connected with your PC.
Then, double-click the following software icon.

The software starts and the following main window appears.



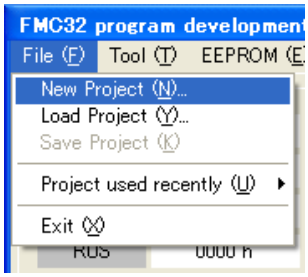
[Main window]

"PCD2112" is mounted on FMC32 and this PCD2112 controls a motor.
This windows allows you to set the register information of "PCD2112".

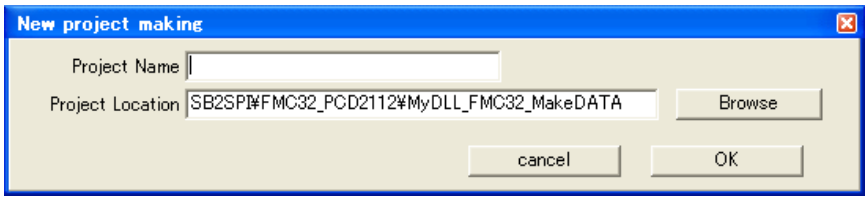
2-2. Create a project

Please create a project before you design operation patterns.

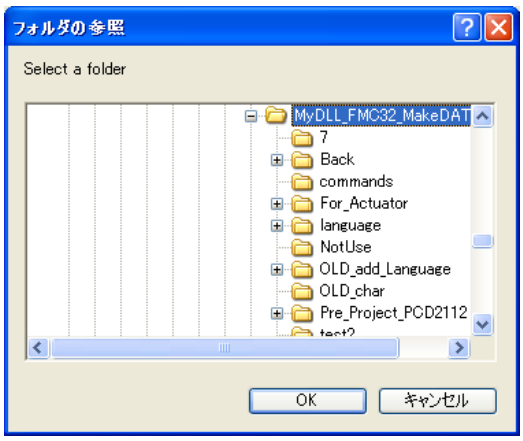
1. Select "New project" from the File menu.



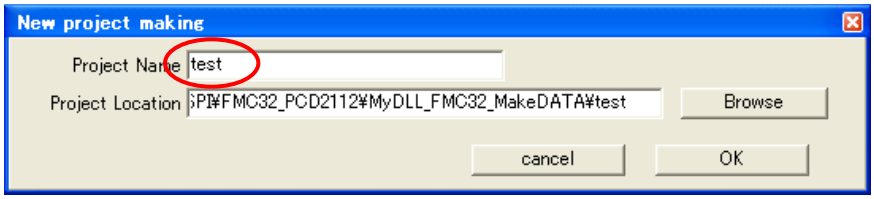
The following window appears.



2. Click the "Browse" button and select the folder where you want to save the project.
   A new folder that has the same name as the "Project Name" specified is made under the folder you select. The operation data, etc is saved in this new folder.



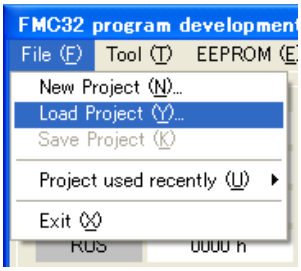
3. Input a project name.
   After you input a project name, click the "OK" button.



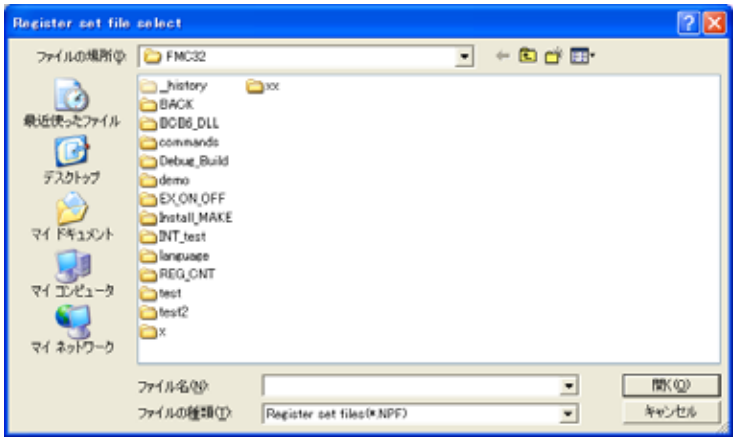
2-3. Load project

Load a project you created before.

1.Select "Load Project" from the "File" menu.



The window to select a project appears.

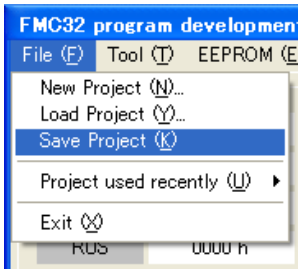


2. Select a project.
The extension of the project is ".npf".

2-4. Save a project

When you create an operation pattern and execution sequence program, save them in a project.

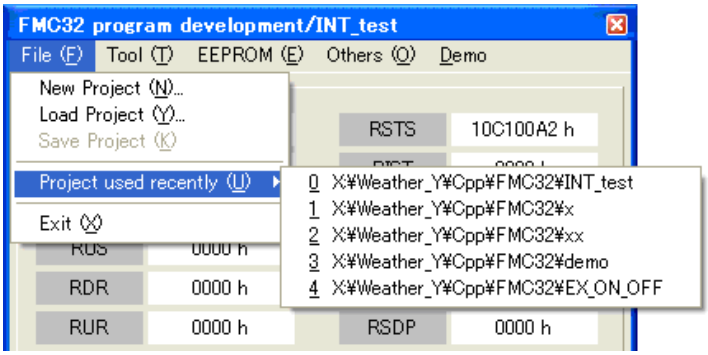
1.Select "Save project" in the "File" menu. The project is saved.



2-5. Load a project used recently

Among the projects edited by this software, the five most recent projects are listed for quick access. From these projects, you can select one project you want to use.

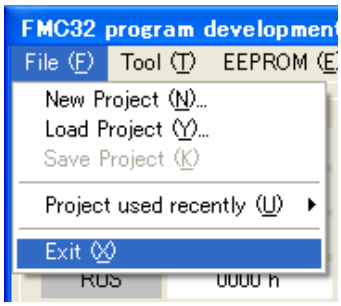
1. Select "Project used recently" from the File" menu.



2. In the sub-menu, up to five projects that are used recently appear. Select one project. Then, the project opens.

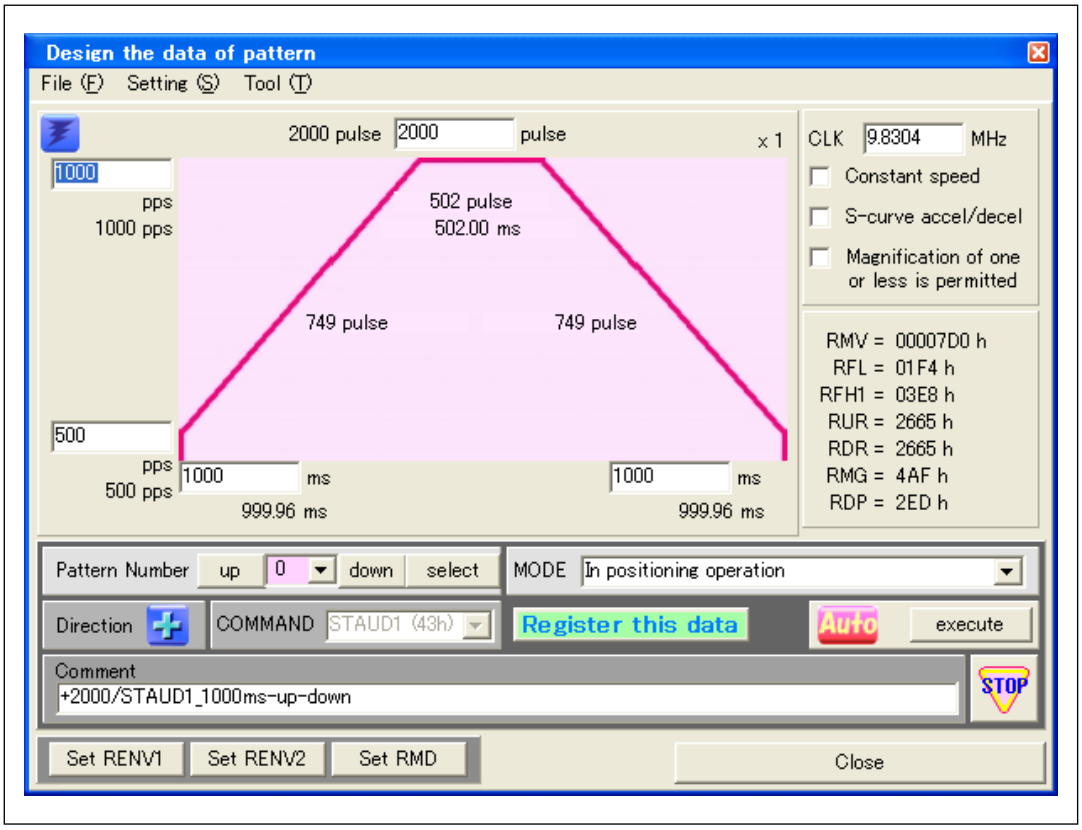
2-6. Exit software

Select "Exit" from the "File" menu to exit.



3. Design the data of pattern window

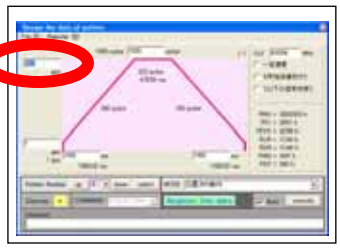
Design operation you want to do using FMC32.
Select "Design the data of pattern" from the "Tool" menu and the following window appears.



Using this window, PCD2112 mounted in FMC32 is controlled simply. At that time, RMD and RENV1 registers show default values as follows.

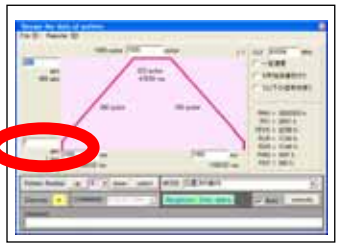
Register	Default value	Note
RMD	1085 h	Even though FMC 32 is in a mode waiting for start, if you confirm operation using the "execute" button in the above window, the waiting mode stops temporarily and starts operation. After the operation is completed, the mode return to the waiting mode.
RENV1	008862C4 h	This setting is fit for FMC32's hardware.

3-1. Set the maximum speed



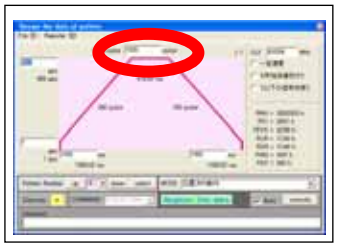
Set the maximum speed at the completion of acceleration in pps. Only whole numbers can be used.

3-2. Set the initial speed



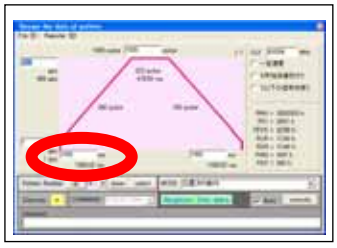
Set an initial speed at the start to accelerate
Only whole numbers can be used.

3-3. Set the number of positioning pulse



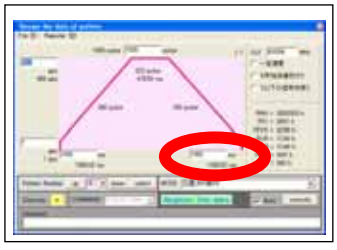
Set the number of output pulses in positioning operation.
Only whole numbers can be used.

3-4. Set the time for acceleration



Set the acceleration time for acceleration operation in msec.
Only whole numbers can be used.

3-5. Set the time for deceleration

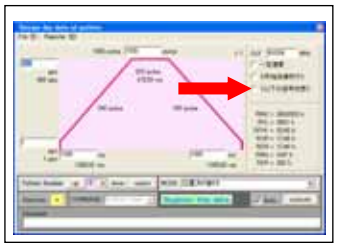


Set the deceleration time for deceleration operation in msec.
Only whole numbers can be used.

3-6. Select acceleration / deceleration characteristics

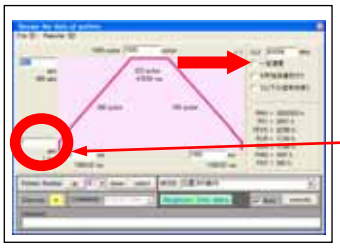
Select characteristics for acceleration / deceleration operation.
Uncheck: linear acceleration operation
Check: S-curve acceleration/deceleration

3-7. Magnification ratio option



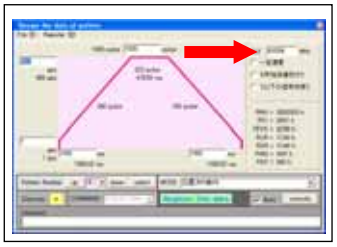
Uncheck: Magnification ratio that is smaller than 1 becomes 1 even if the magnification ratio is appropriate.
Check: Magnification ration that is smaller than 1 is effective.

3-8. Set a constant speed



Check to operate at constant speed without acceleration and deceleration.
Specify a speed in the "initial speed" field.

3-9. Set reference clock

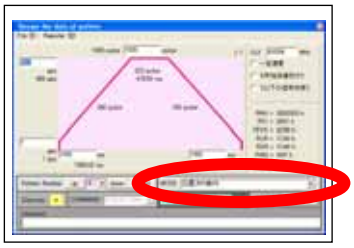


Set a clock frequency to be provided to PCD2112.
FMC32 uses 9.8304MHz clock frequency (Do not change this default value).

3-10. Set operational direction

To click this button, you can specify operation direction.
"＋" means CW direction and "－" means CCW direction.

3-11. Set operation mode



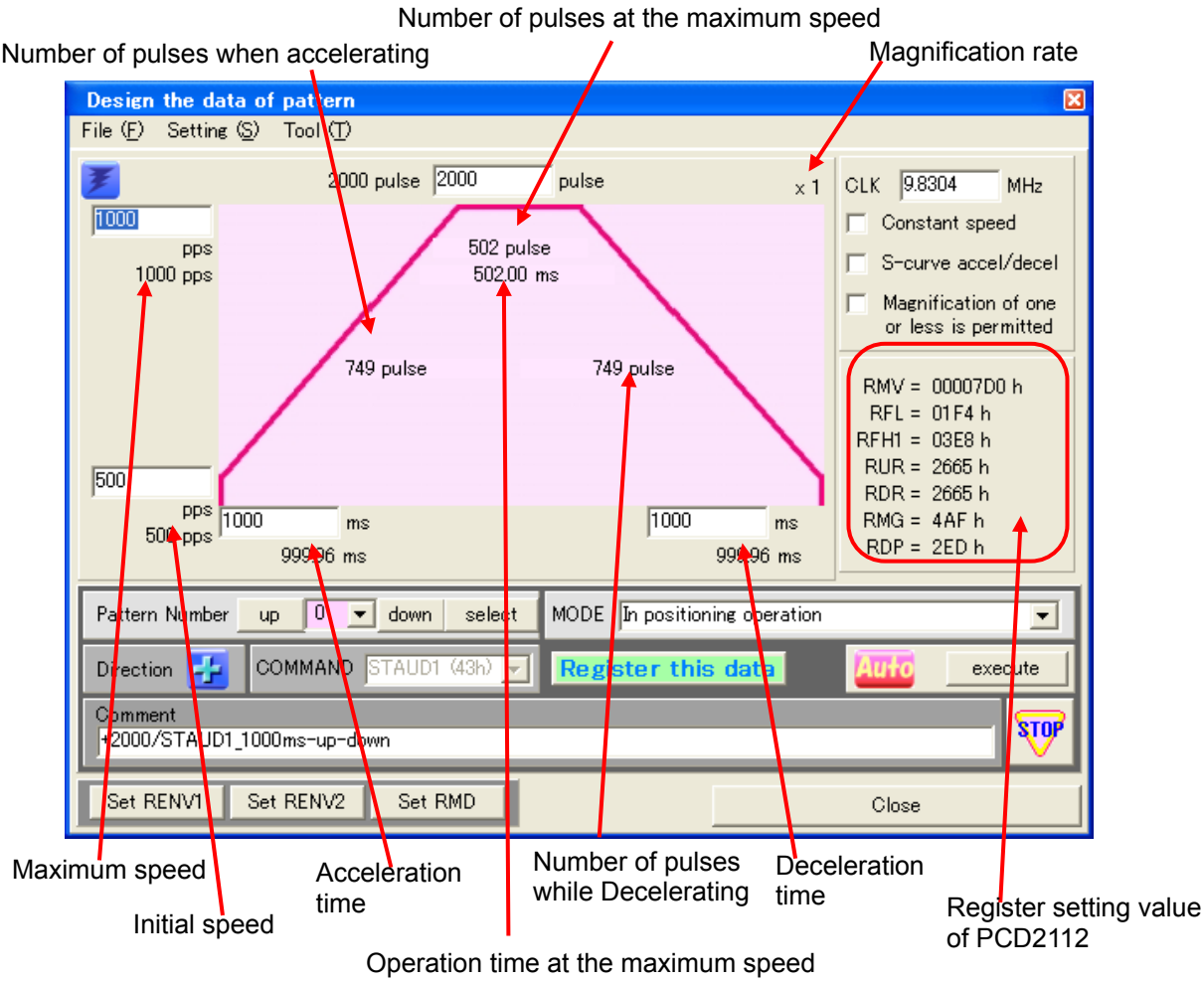
You can select among the following six operations.

1. Continuous operation
2. Origin return operation
3. Origin escape operation
4. EL escape operation
5. Positioning operation
6. Timer operation

Regarding the details of each operation, please refer to PCD2112 User's manual (Document Nol. DA70115).

3-12. Confirmation of setting value

Using the setting values, the PCD 2112 register values appears.
Based on these setting values, actual operation speed and operation time will be calculated and be shown. There are instances when the set values cannot be operation be achieved due to operation specifications.



3-12-1. Confirm the register setting value

Register setting value to be set for PCD2112 is shown in hex notation.
When you click the "Execute" button, these values are written to each register of PCD2112 and operation starts.

3-12-2. Confirmation of the maximum speed

If the value shown in the "Register setting value of PCD2112 " field is set, the actual maximum speed will be calculated and shown as a decimal.

3-12-3. Confirmation of the initial speed

When the value shown in the "Register setting value of PCD2112" field is set, the actual initial speed will be calculated and shown as a decimal.

3-12-4. Confirmation of acceleration time

When the value shown in the "Register setting value of PCD2112" field is set, the actual acceleration time will be calculated and shown as a decimal.

3-12-5. Confirmation of deceleration time

When the value shown in the "Register setting value of PCD2112" field is set, the actual deceleration time will be calculated and shown as a decimal.

3-12-6. Confirmation of time at the maximum speed

When the value shown in the "Register setting value of PCD2112" field is set, the actual time at the maximum speed will be calculated and shown as a decimal.

3-12-7. Confirmation of number of pulse when decelerating

When the value shown in the "Register setting value of PCD2112" field is set, the actual number of pulse for accelerating will be calculated and shown as a decimal.

3-12-8. Confirmation of number of pulse when accelerating

When the value shown in the "Register setting value of PCD2112" field is set, the actual number of pulse for decelerating will be calculated and shown as a decimal.

3-12-9. Confirmation of number of pulse at the maximum speed

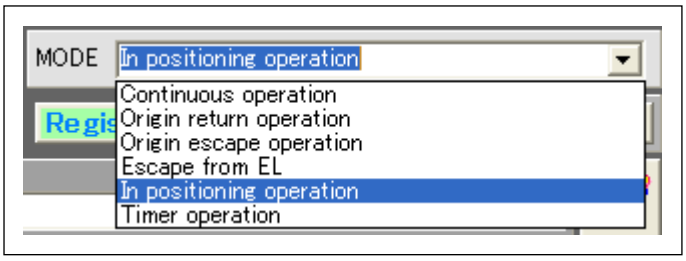
When the value shown in the "Register setting value of PCD2112" field is set, the actual number of pulse at the maximum speed will be calculated and shown as a decimal.

3-12-10. Confirmation of magnification rate

The magnification rate to be set in RMG register shown in the "Register setting value of PCD2112" will be shown as a decimal. This is a setting value that can actualize a setting speed in the maximum speed setting field.

3-13. Select operation mode

You can select operation mode from the "MODE" pull-down menu.



The following 6 operation modes can be selected.

Operation mode	Contents of operation
Continuous operation	The motor continues to operate when it is stopped intentionally (Continuous operation). *Note.
Origin return operation	After the motor starts to operate, it stops when the ORG input turns on (Origin return operation).
Origin escape operation	After the motor starts to operate, it stops when the ORG input turns off (Origin escape operation).
Escape from EL	After the motor starts to operate, it stops when the EL input turns off (Escape from EL).
Positioning operation	The pulses of the number set in RMV register are output and the motor stops automatically.
Timer operation	It is the same as positioning operation internally. PCD2112 does not output pulses to the external.

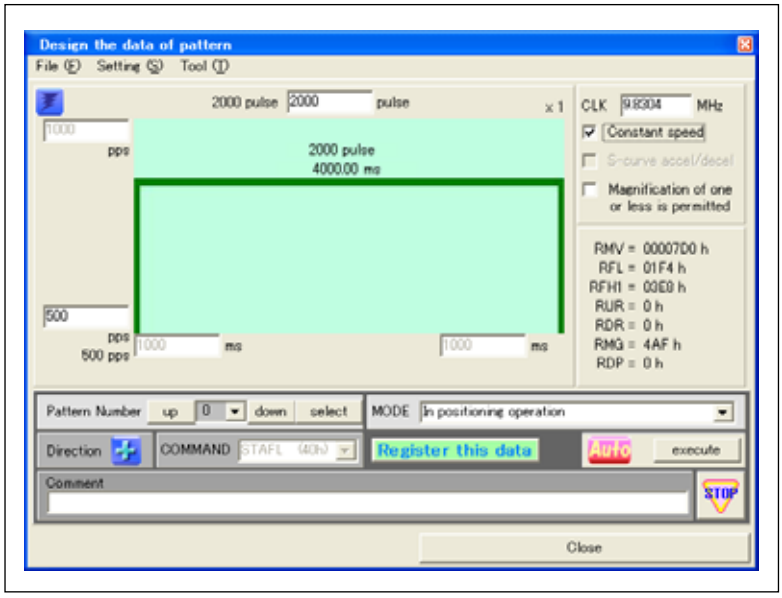
*Note: To operate the motor in stand-alone mode and stop intentionally, you should use end limit, slowdown point or excitation off. If you do not provide these signals, do not use the continuous operation mode.

3-14. Select characteristics of acceleration and deceleration.

You can select from "continuous speed operation without acceleration" and "operation with acceleration / deceleration". When you select acceleration and deceleration operation, you can select from linear acceleration and S-curve acceleration.

3-14-1. Select constant speed

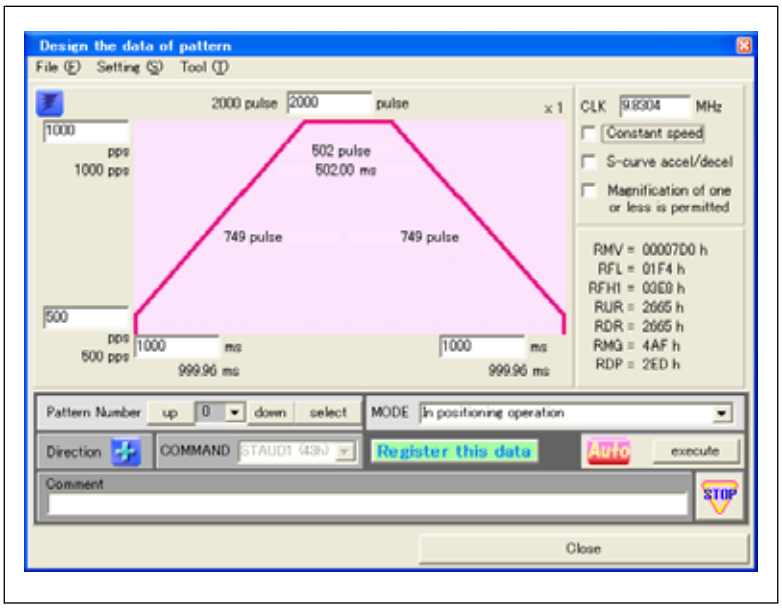
When you check the "Constant speed" check box, the following window appears.



In this window, you cannot input the maximum speed, acceleration time and deceleration time.
In this operation, the motor operates at the initial speed.

3-14-2. Select linear acceleration

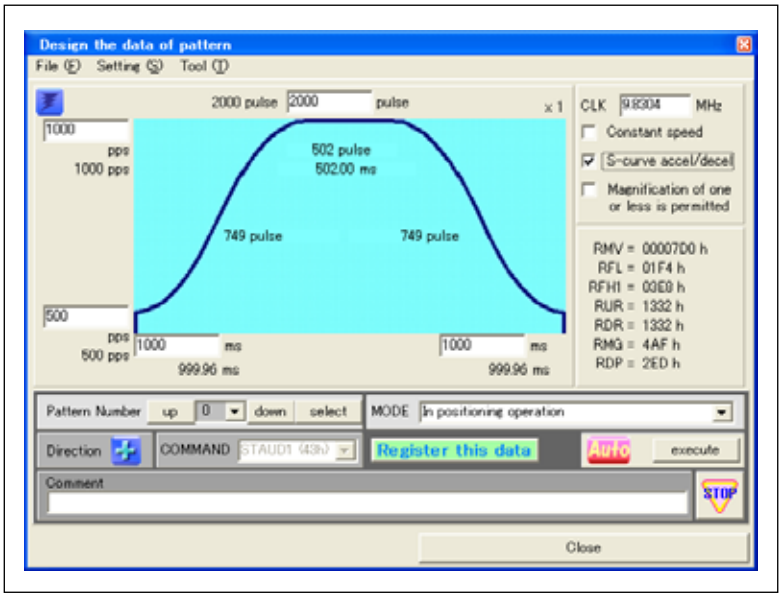
When you uncheck the "Constant speed" and "S-curve accel/decel" checkbox, the following window appears.



The motor operates with linear acceleration or deceleration.

3-14-3. Select S-curve acceleration

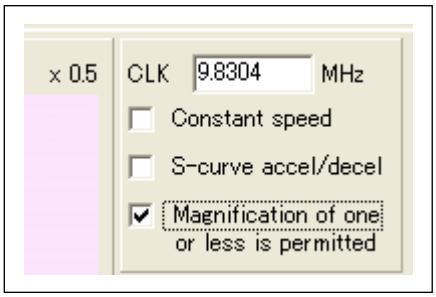
When you uncheck the "Constant speed" checkbox and check the "S-curve accel/decel" checkbox, the following window appears.



The motor operates with S-curve acceleration/deceleration.

3-15. Adjustment of magnification

To actualize the operation speed specified in the maximum speed or the initial speed, the maximum rate will be calculated automatically and a magnification rate that is more than 1 is used normally.
If you want to use the magnification rate that is less than 1, please check the "Magnification of one or less is permitted" checkbox. However, even if you check this checkbox, the magnification rate does not become less than 1 if the calculated magnification rate should be more than one.



3-16. Switch the operation direction

Click the following button to switch the operation direction (CW or CCW).
The display of the button shows the current operation direction.

 CW direction  CCW direction

3-17. Switch excitation

Click the following button to switch the excitation condition.
The display of the button shows the excitation condition.

 Excitation off  Excitation on

3-18. Start operation

Click the "execute" button to start a specified operation.

The value shown in the "Register setting value" field is written in each register of PCD2112 and then the command to start operation shown in the "COMMAND" column is written to PCD2112, and operation starts. ("Command" cannot be changed to an arbitrary start command.")
At that time, if the excitation of FMC32 is off, it is switched to ON forcibly. It is not returned to OFF automatically after operation is complete. However, if you click the "Stop" button to stop the motor forcibly, the excitation condition returns to OFF. (In the case that the excitation is ON from the start, it does not turn to OFF.)

3-19. Stop operation

While operating, you can stop the motor by clicking the "Stop" button.

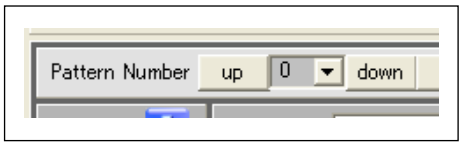
3-20. Register and confirm operation pattern

Up to 32 Operations (Operation patterns) designed in this window can be registered in one project. This number of operations is the same as the number of operation patterns controlled by an external EEPROM.

Please refer to PCD2112 User's Manual in detail.

3-20-1. Register operation

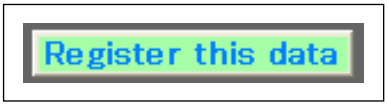
Up to 32 operation patterns created can be registered. At the registration, specify operation pattern number (0 to 31). To specify the number, use the "Pattern Number" buttons. By clicking the "up" or "down" buttons, you can change the number.



The background of number that the operation pattern is not registered is grey

The background of number that the operation pattern is registered is pink.

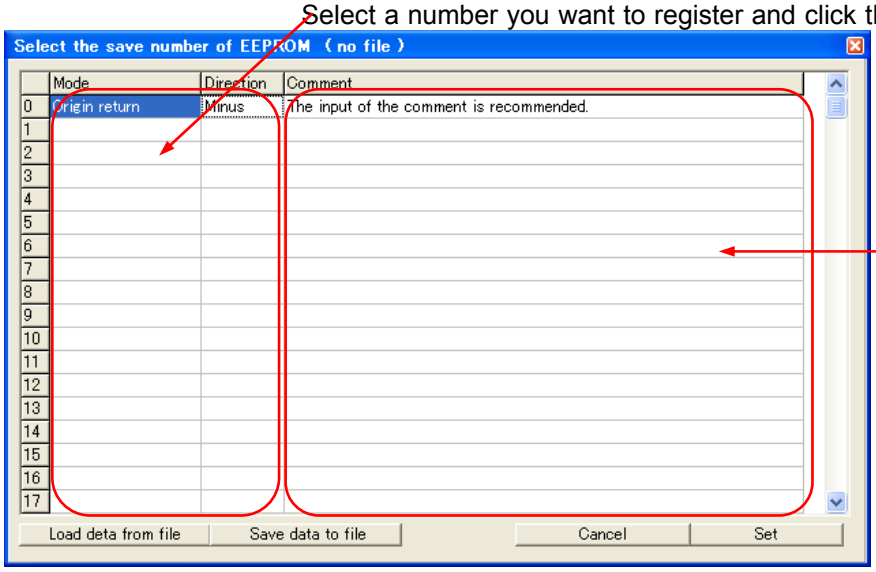
After selecting the number, click the "Register this data" button.



The next window appears. If there is no problem, click the "Set" button.

If you want to change the number that you want to register, select "Mode" or "Direction in the line number you want and click the "Set" button to be confirmed. (It can also be confirmed by double-click).

Select a number you want to register and click the column of the number.



If you select the number that operation pattern is already registered, the data is overwritten and the data registered before is deleted. (Confirmation message does not appear).

In the comment field, the character strings that are input in the "Comment" field in the lower of the "Design the data of pattern" window. If no comment is input, a comment input window appears after you clicking the "Set" button.

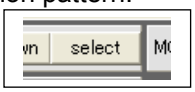
3-20-2. Confirmation operation 1

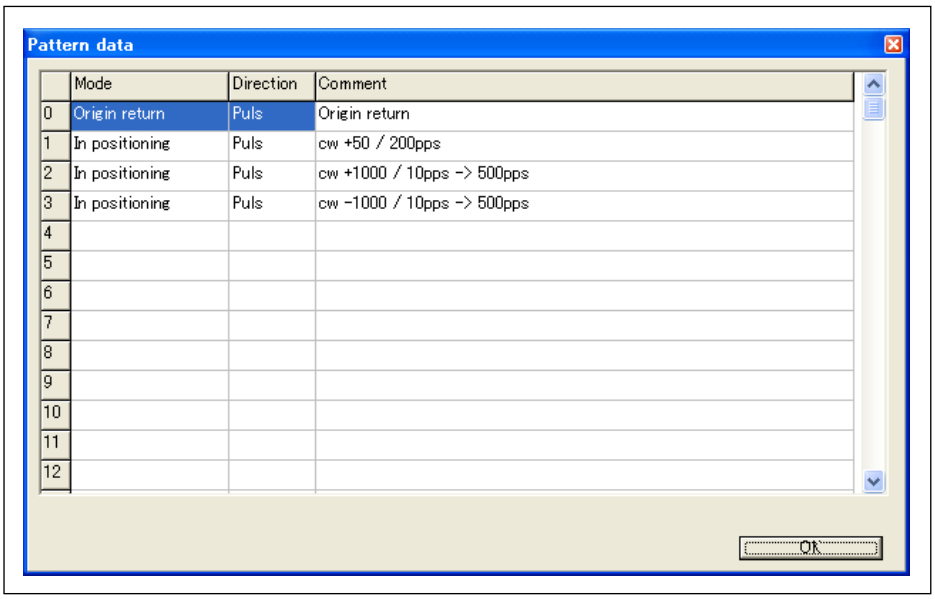
If you click the "up" or "down" button to change a pattern number, the value registered with the number is reflected on the "Design the data of pattern " window.

If you select a number from the pull-down menu, it produces the same result..

3-20-3. Confirmation operation 2

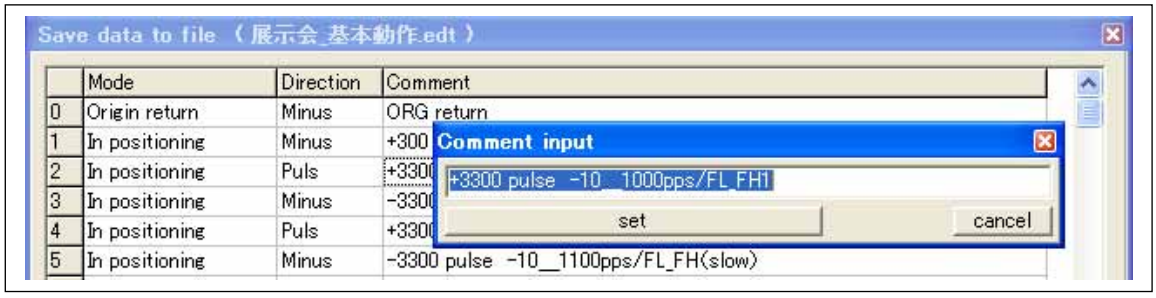
If you click the "select" button, the following window appears and you can check the registration of operation pattern.





In this window, all registered operation patterns are not shown, we recommend you to input a brief comment to describe each pattern number.

To input and modify a comment in this window, double-click the modified comment box. In the window shown newly, you can input and modify them.

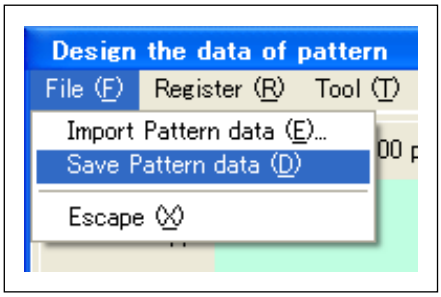


When you click the "set" button, the modified comments are reflected in the window.

3-21. Save the registered pattern data

Save the registered data to a project as an operation pattern.

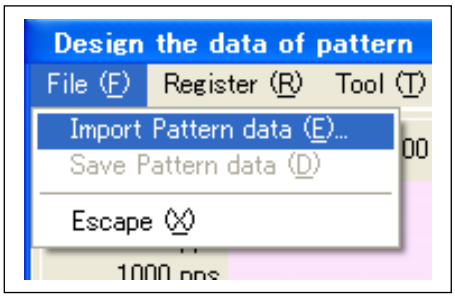
To save operation pattern, select "Save Pattern data" from the "File" menu.



3-22. Import pattern data

You can load the operation pattern created in the past.

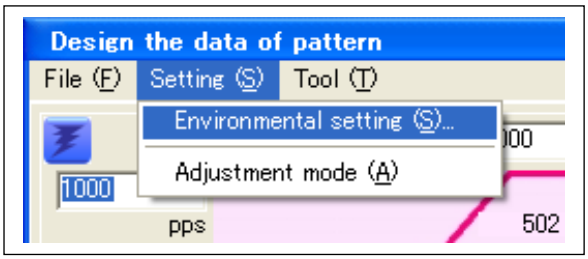
Select "Import pattern data" from the "File" menu. On the next window, select the file that you want to load.



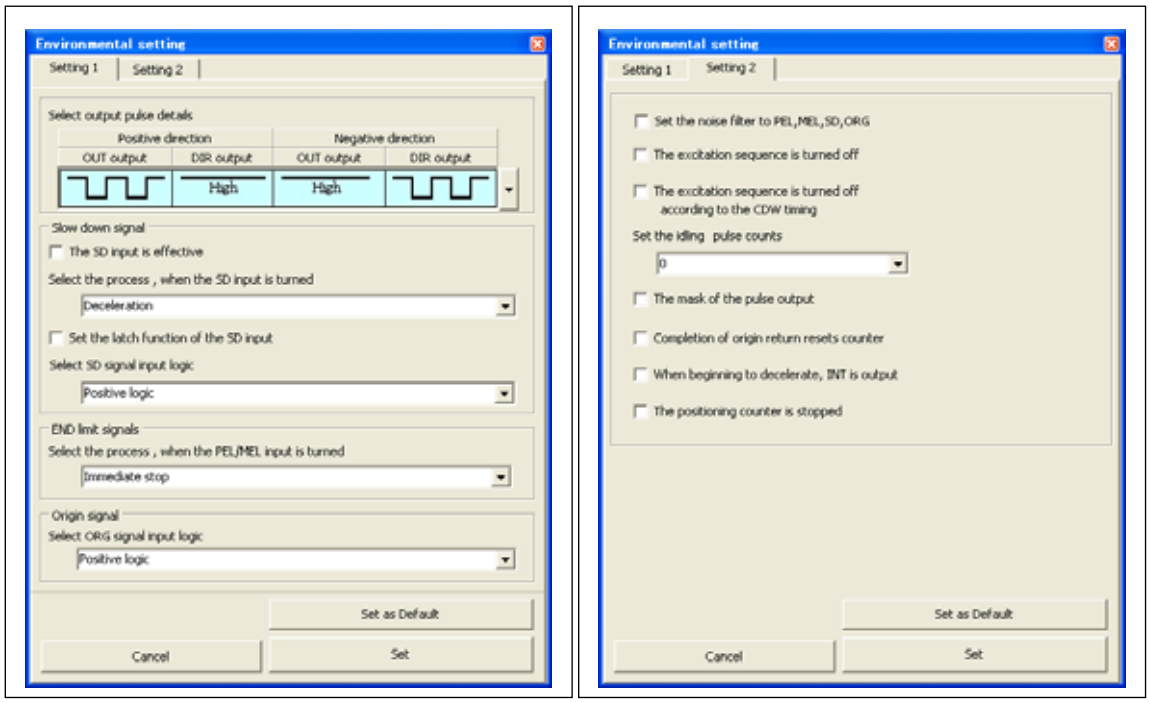
After you load the operation pattern, please save it.

3-23. Environment setting

You can set and change the environment of FMC32.
Select "Environmental setting" from the "Setting" menu.



The following function setting window are shown
(By selecting the "setting" tabs, the following two windows can be selected.)



Selecting any of the checkboxes alters the environmental parameters. These values are only applied after clicking the "Set" button in the bottom right of the window.
If you want to make the setting valid at the next program start, click the "Set as Default" button.

3-23-1. Select output pulse details

The FMC32 has a driver for stepper motors. However, there may be cases when you want to use other driver. In this case, the direction signals and driver command pulses output from FMC32 can be used.
Turn Switch 3 ON. Otherwise this selected setting is ignored and excitation sequence is output as pulses to drive a motor.

Selection item				Pulse specifications
(+) direction		(-) direction		
OUT	DIR	OUT	DIR	
	High		Low	OUT: Drive pulse (negative logic) DIR: Direction signal (High: + direction)
	High		Low	OUT: Drive pulse (positive logic) DIR: Direction signal (High: + direction)
	Low		High	OUT: Drive pulse (negative logic) DIR: Direction signal (Low: + direction)
	Low		High	OUT: Drive pulse (positive logic) DIR: Direction signal(Low: + direction)
	High	High		OUT: CW pulse (negative logic) DIR：CCW pulse (negative logic)
OUT DIR		OUT DIR		90-degree phase deference CW: OUT is ahead
OUT DIR		OUT DIR		90-degree phase difference CCW: OUT is ahead
	Low	Low		OUT: CW pulse (positive logic) DIR: CCW pulse (positive logic)

3-23-2. The SD input is effective

If you check this checkbox, the slow-down signal input is enable. Without check, the slow-down signal is ignored.

3-23-3. Select the process , when the SD input is turned

You can select one from the following operations when the SD signal is input.

1. Decelerate to the initial speed. (Does not stop.)
2. Decelerate to the initial speed and stop.

However, there are the following limits.

1) "The SD input is effective" checkbox is checked.
   If it is not checked, the SD input is ignored.
2) When the motor is operating at constant speed, it does not decelerate.

3-23-4. Set the latch function of the SD input

If you check this checkbox, the condition when the slow down signal turns ON is memorized. According to this, the motor ensures to slow down even though the width of slow-down signal is narrow.
The memorized slow-down signal will be cleared at the start of next operation.

3-23-5. Select SD signal input logic

Select a signal level to be recognized that slowdown signal is ON. When "Positive logic" is selected with FMC32, turning input photocoupler ON makes the SD input ON.

3-23-6. Select the process , when the PEL/MEL input is turned

You can select one of the following operations when the end limit signal is input.

1. Stop immediately.
2. Decelerate and stop.

Input logic of the end limit signal is specified using switch 5 (SW1-5) of the dip switch.

3-23-7. Select ORG signal input logic)

Select signal level to be recognized that ORG signals is ON.

3-23-8. Set the noise filter to PEL,MEL,SD,ORG

If you check this checkbox, filters are set to End limit signal (both plus and minus), slow-down signal, origin signal. According to filters, a pulse whose width is less than four micro sec is ignored.

3-23-9. The excitation sequence is turned off

If you check this checkbox, output of excitation sequence is turned off.

3-23-10. The excitation sequence is turned off according to the CDW timing

If you check this checkbox, output of excitation sequence is turned off while current down signal is output.

3-23-11. Set the idling pulse counts

Before starting acceleration, you can select a number of pulse counts to operate at the initial speed

3-23-12. The mask of the pulse output

The pulse output is masked. The output of excitation sequence is not changed.

3-23-13. Completion of origin return resets counter

If you check this checkbox, the current position counter (RCUN) is reset to 0 when origin return is complete. When the motor decelerates and stops, the counter counts pulse number to be output until the motor stops.

3-23-14. When beginning to decelerate, INT is output

If you check this checkbox, interrupt occurs when deceleration starts and the INT output of PCD 2112 becomes low.

3-23-15. The positioning counter is stopped

If you check this checkbox, the positioning counter (RDWC) does not operate.

3-24. STA input in PC control mode

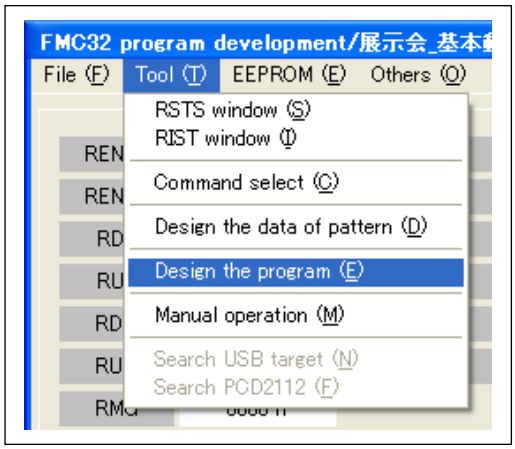
If the FMC32 is used in standalone mode, the operation pattern specified by the execution sequence program starts when external input terminal STA is high (when the photocoupler is ON).
On the other hand, when the FMC32 is used in PC control mode, the STA input is ignored and operation starts. PC control mode is often used to confirm operation as you like and write operation data to FMC 32.
If you want to use signals from the STA terminal while you confirm operation, click the "Auto" button and turn off the auto start mode.

Display	Function
	The STA input is ignored and operation starts.
	Operation starts when STA input is turned on.

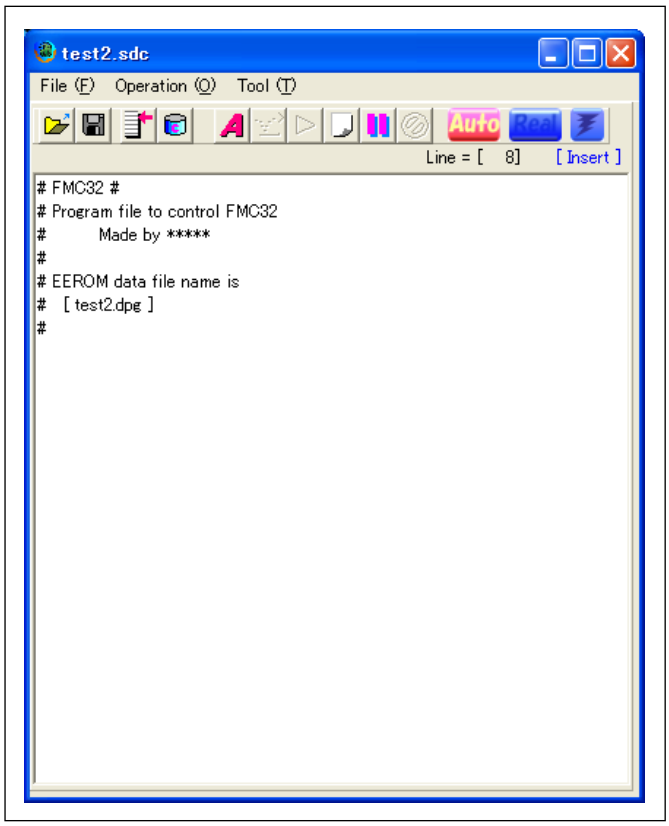
However, operation does not starts until STA input become Low to High (the photocoupler becomes OFF to ON). When STA input is high at the start of operation, STA input should become low once and then become high again. This is the specification of this product.
Please note that mechanism of operation start in standalone mode is different from one in PC control mode. (In the PC control mode with automatic start mode off, operation by command 1 (Pn) with a specified operation number is the same as operation by Command 2 (Sn) with the specified operation number.)

4. Design the data of pattern Window

This shows how to design FMC32 execution sequence program.
It is designed by arranging several operation patterns designed in the "Design the data of pattern" window. In the standalone mode, operation patterns are executed in order they are assigned.
Execution sequence program is simply called "program" here.
Select "Design the program" from the "Tool" menu in the main window.



The following editor window (simple text editor) appears. Input program using keys directly.



Comment that shows a program file is described by default.
Do not delete or change "#FMC32#" on the first line.

4-1. FMC32 command

In programming here, FMC32 specific program commands are used to design execution sequence program. Up to 255 bytes can be used for command and data.

4-1-1. Command _1to specify an operation number

Operate the specified numbered operation pattern.
The start of operation is when STA input become high. When STA input is low (photocoupler is off), the motor waits for STA input and starts after the STA input becomes high.
After operation is complete, the next command is processed immediately.
Specify the operation pattern number that is already created and follow the number after "P".

Example	Operation description
P0	Operation pattern 0 is executed.

4-1-2. Command_2 to specify an operation number.

Operate the specified numbered operation pattern.
Operation starts when STA input become high. When STA input is low, the motor waits for STA input and starts after the STA input becomes high.
After operation is complete, the motor waits until the STA input to becomes low. Operation shifts to the next command after STA input becomes low. When STA input is already low at the completion of operation, the next command is operated immediately.
Specify the operation pattern number that is already created and follow the number after "S".

Example	Operation description
S15	Operation pattern 15 is executed.

4-1-3. Wait for specified time

The unit of waiting time is msec. Specify a numerical value with one or more spaces following "WAIT".
The motor waits for 10 times the input value and operation shifts to the next command after waiting.
The range of value is 0 to 255. Specify values in decimal or hexadecimal.

Example	Operation description
WAIT 10	Wait for 100 msec. (Example in decimal)
WAIT 0x20	Wait for 320 msec. (Example in hexadecimal)

4-1-4. Excitation OFF

Excitation of the stepping motor driver that is mounted on the FMC32 is turned OFF.

Example	Operation description
EX_OFF	Excitation OFF

4-1-5. Excitation ON

Excitation of the stepping motor driver that is mounted on the FMC32 is turned ON.

Example	Operation description
EX_ON	Excitation ON

Note : When excitation ON command (EX_ON) is processed in program, Excitation OFF by external input (MON) (Photocoupler OFF) cannot be process on the program. (Priority to commands).

4-1-6. Setting value to variable

The FMC 32 has variables that are distinguished by the number 0 to 15.
Any number from 0 to 255 can be set to these 16 variables.
To specify values, select the variable number following "REG". and add more than one characters space and a value you want to set.

Example	Operation description
REG1 10	Set 10 to REG1.

4-1-7. Decrement variable value

Decrement 1 from the specified variable value.
Specify a variable number and follow after "DEC".

Example	Operation description
DEC2	Decrement the REG2 value.

4-1-8. Set label

You can set a label at any place in program.
The label is used as a jump address of jump command.
To specify labels, describe any character strings (alphanumeric characters and underscore) following ":" (colon).
Alphabetical capital letters and small ones are discriminated.
Up to 256 label can be set.
Labels are not commands to operate.

Example	Operation description
:LOOP_A	Label name is LOOP_A.

4-1-9. Conditional jump

When referred variable value is other than 0, the program process jumps to a specified label.
When referred variable value is 0, the program process shifts to the next line command.
Describe a referred variable number following "JNZ", add more than one characters space and specify a label.

Example	Operation description
JNZ REG3 LOOP_A	When REG3 variable is other than 0, jump to LOOP_A label.

4-1-10. Unconditional jump

Jump to a specified label.

Specify a label following after "JMP" and more than one character space.

Example	Operation description
JMP LOOP_B	Jump to LOOP_B.

4-1-11. INT Jump

Jump to the specified label while PCD2112 generates an interrupt cause.

When an interrupt cause does not occur, the process shifts to the next line command.

The interrupt is cleared only after an INT jump is executed.

Specify label following after "JP1" and more than one character space.

Example	Operation description
JPI LABEL	When an interrupt cause occurs, jump to the specified label.

4-1-12. Stop

This command stops program execution.

Even if other commands are written after this command, the program does not shift to the next process.

Example	Operation description
HALT	This command stops FMC32's operation.

4-1-13. Comment

When you describe "#" (one-byte crosshatch), the character strings from # to line feed character is treated as comments.

If you insert # at the head of the line, the whole line is treated as comments.

If you makes the last part as commands, separate command from "#" with more than one character space.

```
#Comment line

REG0  20  #“20” is substituted to Register 0
```

4-1-14. Command specification

Abbreviation	Command name	Command byte length	Bit train							
			7	6	5	4	3	2	1	0
Pn	Command_1 to specify operation number	1	0	0	0	n	n	n	n	n
Sn	Command_2 to specify operation number	1	0	0	1	n	n	n	n	n
WAIT	Wait for specified time	2	0	1	0	0	0	0	0	0
EX_OFF	Excitation OFF	1	0	1	0	1	0	0	1	0
EX_ON	Excitation ON	1	0	1	0	1	0	0	1	1
REGn	Set value to variables	2	0	1	1	0	n	n	n	n
DECn	Variable value-1	1	0	1	1	1	n	n	n	n
NJZn	Conditional jump	2	1	0	0	0	n	n	n	n
JMP	Unconditional jump	2	1	0	0	1	0	0	0	0
JPI	INT jump	2	1	0	0	1	0	0	0	1
HALT	Stop	1	1	1	1	1	1	1	1	1

Caution：

When the FMC32 is used in PC control mode, there are the following limits on operation.

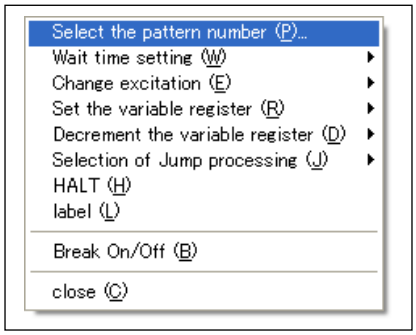
(Please bear in mind that controlling FMC32 by this software does not extend beyond confirmation of the execution sequence program.)

1) Using "PN" or "SN", the motor ignores the STA input and operates.
   (You can cancel to ignore the STA input. In details, see 4-7-5. STA input in PC control mode.)
2) Because FMC32 control software is controlled by windows, it takes some times to process the next command after one command is processed. (The length of this time depends on the PC's performance.)

4-2. Command input to editor

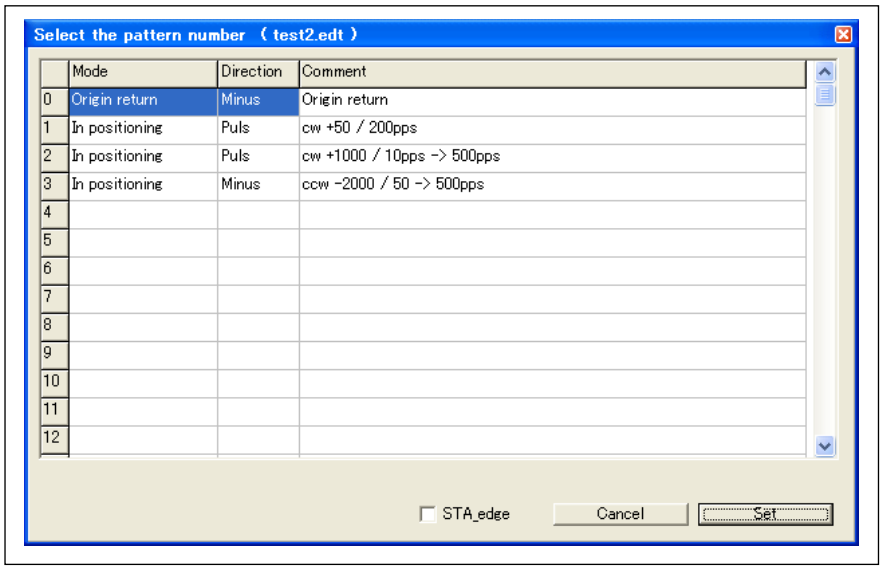
The FMC32 has a feature to support command input.
Click the line that you want to input commands to move a cursor and click the following button.
Or, right-click the line that you want to input commands on the editor window.

The following pop-up menu appears. Select a command you want to use from the menu.

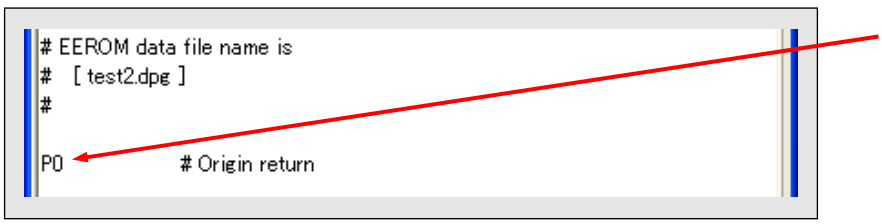


4-2-1. Select operation pattern

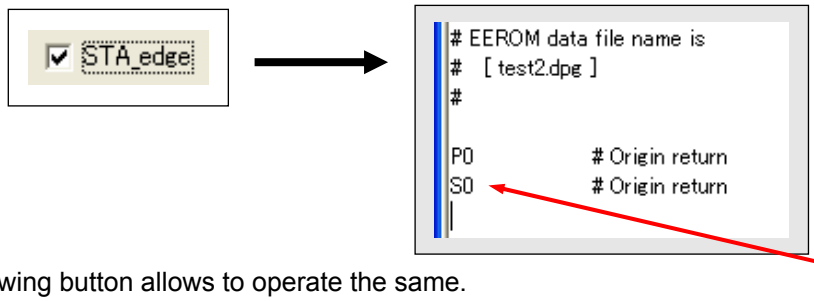
Select "Select the pattern number" from the pop-up menu. The following selection window appears.



Selecting an operation pattern you want to use adds the operation pattern in the line with cursor on the editor as follows. (Comments are also described at once.)



Check the "STA_edge" checkbox to specify a command waiting for falling of STA input.

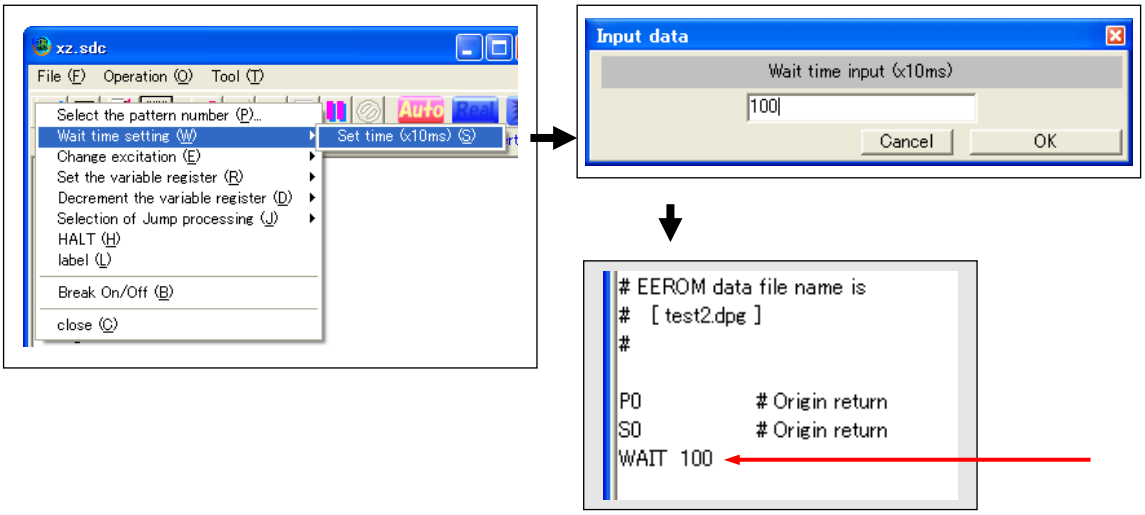


The following button allows to operate the same.

4-2-2. Input a command for the specified time

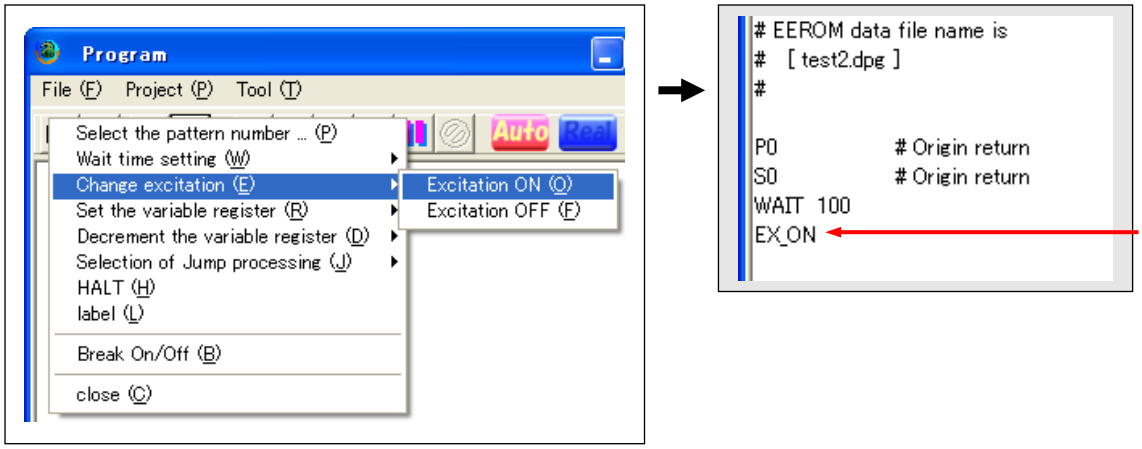
If you click "WAIT time setting" and "Set time" from the pop-up menu, the following input window appears.

Remember that the input time is multiplied by 10 when actually executed. (i.e. and entry of 10 yields a WAIT time of 100ms.)



4-2-3. Select Change excitation

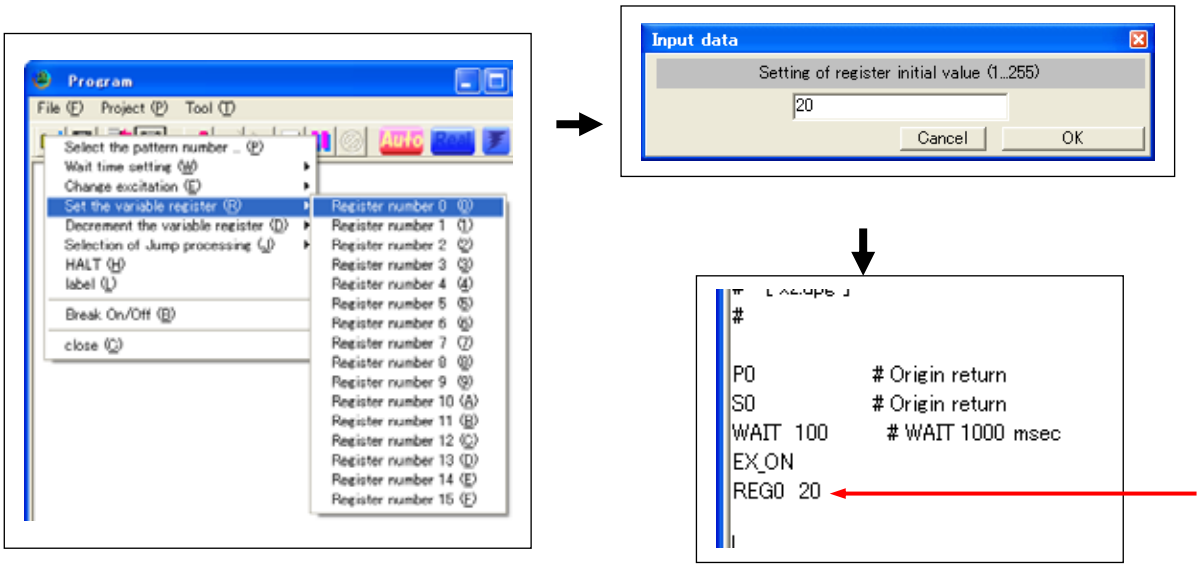
Click "Change excitation" and "Excitation ON or "Excitation OFF" from the pop-up menu, the specified setting command is described to the setting editor.



4-2-4. Select a value setting command to variables

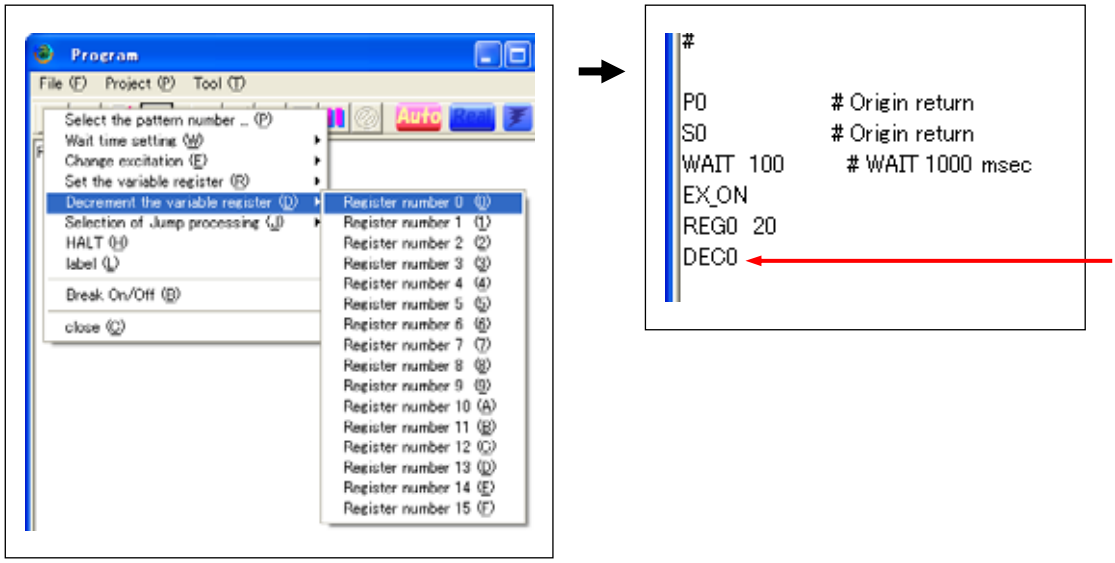
Click "Set the variable register" and "Register number 0 to 15" of the pop-up menu. The following entry window appears.

If you Input a value that you want to set to a variable in decimal, a REGx command is described in the editor.



4-2-5. Select a decrement the variable register

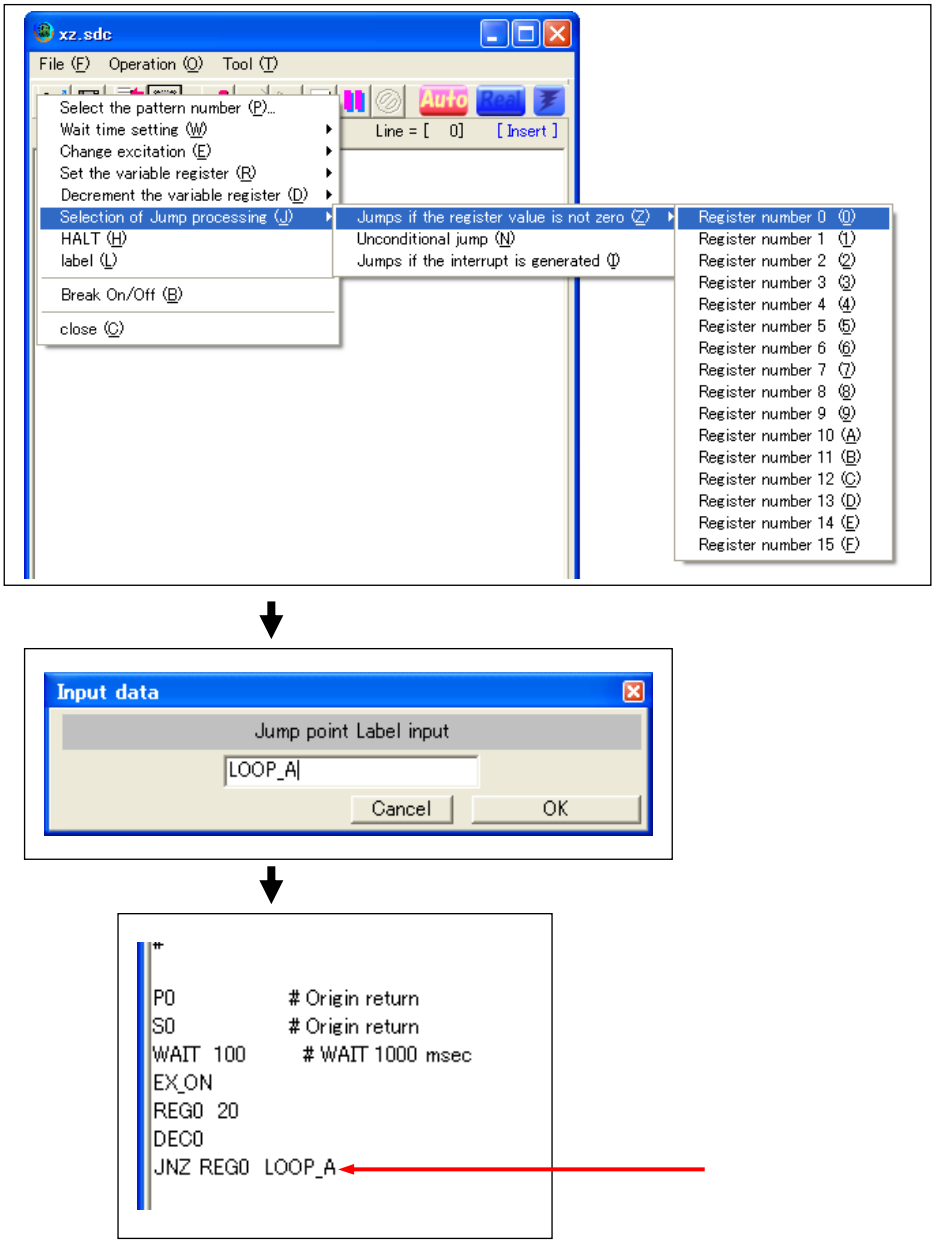
Click to "Decrement the variable register" and "Register number 0 to 15" from the pop-up menu. The setting command specified is described in the editor.



4-2-6. Selection of jump processing

Click "Selection the Jump processing", "Jumps if the register value is not zero" and "Register number 0 to 15" from the pop-up menu. The following entry window appears.

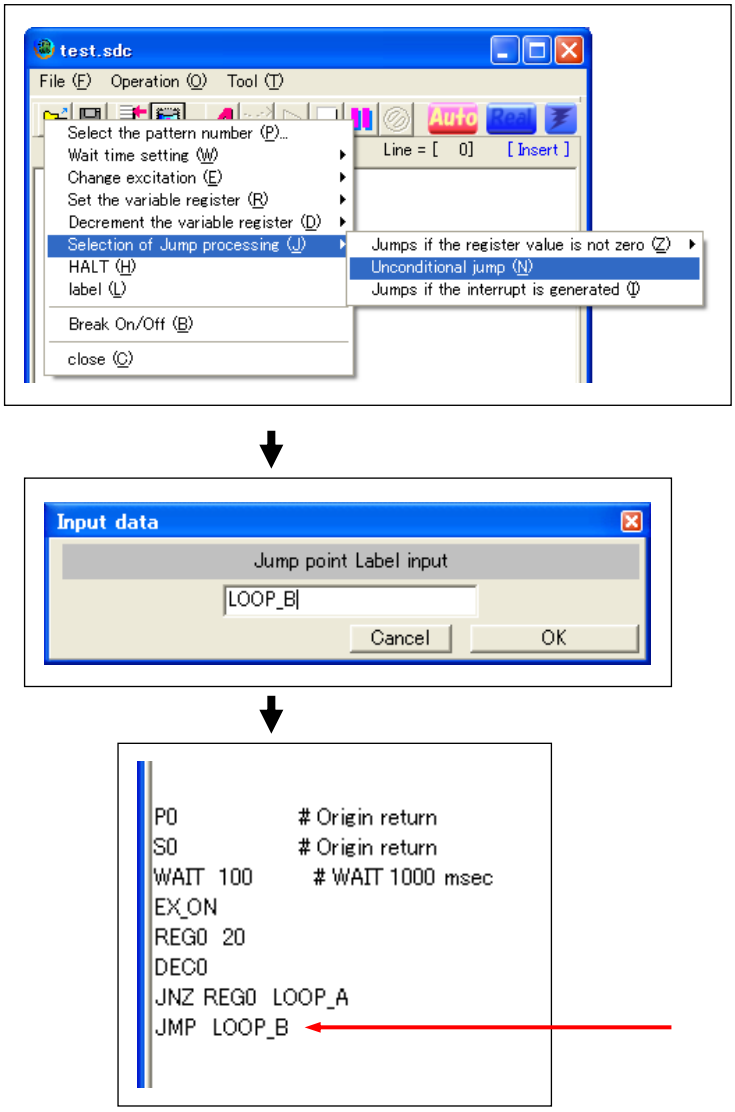
If you input the jump address label (Line head colon ":" should be omitted.), conditional jump command is described in the editor.



4-2-7. Input commands of unconditional jump and INT jump

Click "Selection the Jump processing", "Unconditional jump" or "Jumps if the interrupt is generated". The following entry window appears.

If you input the jump address label (Line head colon ":" should be omitted.), conditional jump command is described in the editor.

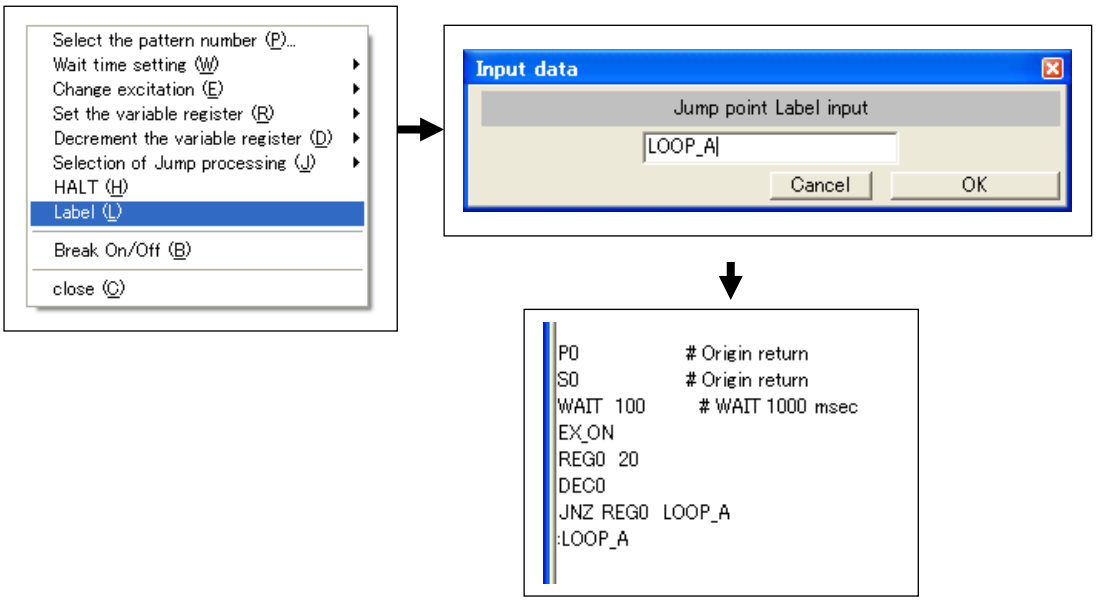


4-2-8. Label

Click "Label" from the pop-up menu. The following entry window appears.

When you input the jump address label (Line head Colon should be omitted), the label is described in the editor.

Up to 256 labels can be used in one project.



4-3. Save a program

Save a designed program before you assemble it.

Select "Save Program" from the "File" menu or click the following button to save a program to a project.

4-4. Import a program

You can load and reuse the program designed in the past.

Select "Import Program" from the "File" menu or click the following button. The window to select a file appears. Select a program file and load it.

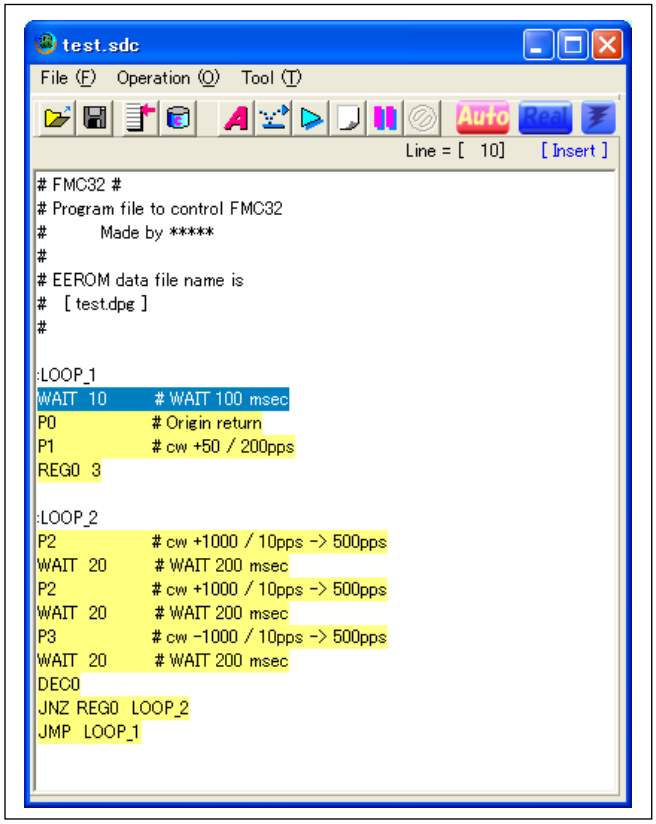
After you import a program, do not forget to save it.

4-5. Check description content and assemble

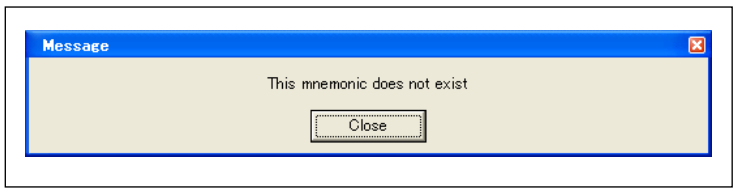
4-5-1. Assemble and check description content

Select "Assemble" from the "Project" menu or click the following button.

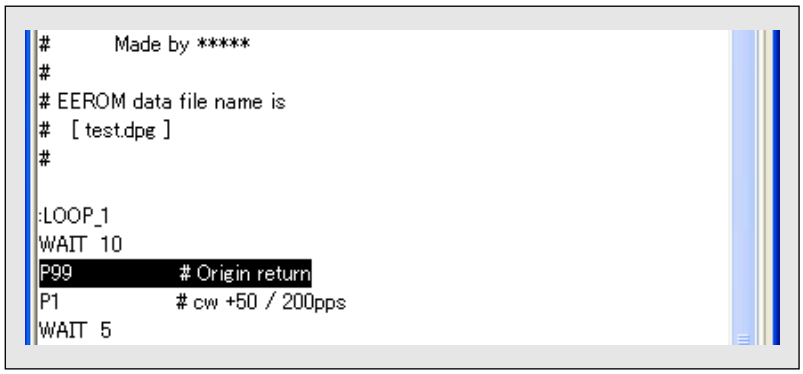
The designed program is checked to see if it meets the FMC command system grammar rules. If the program is grammatically correct, it is assembled.
If there is no violation of the grammar rules (i.e. errors), the described line is highlighted in yellow and the first line of the program is displayed inverted as follows. Any lines with comments and label are not highlighted.



There is an error, the following message appears.



Click the "Close" button to exit the error message. The lines with error points are highlighted. (To click the editor window deletes the highlight.)



In this example, "P99" becomes an error because operation pattern can only be specified from "P0" to "P31".

Caution: Save a designed program before you assemble. If there are no errors caused by assembling it, ".sdc" file can be generated. This file is used when it is written to EEPROM.

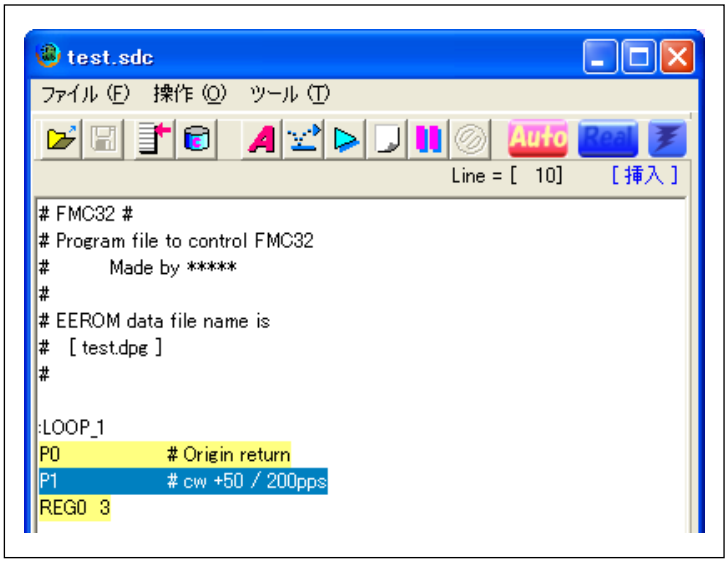
4-6. Run (Simulation)

4-6-1. Step execution (Simulation)

If there is no violation of the grammar rules and the operation description is checked normally, you can simulate the program.

Click "Step Execution" from the "Project" menu or the following "Step Execution" button. The highlighted first command line is processed and the next command line will be highlighted.

[Step Execution button]



By repeating "Step Execution", confirm that the program is processed in the order that you want. It is especially important to confirm that jump commands are processed in the order as you intended.

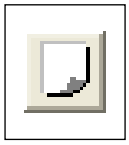
4-6-2. Continuous execution（Simulation）

Click "Execution" of the "Project" menu or the following "Continuous Execution" button. The highlighted line moves as execution sequence program. It shifts at the speed that you can follow with your eyes.

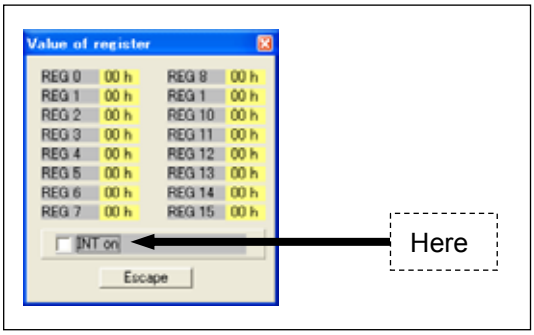
[Continuous execution button]

4-6-3. Simulation of interrupt

Click the following "Variable value display button" and "INT on". Pseudo interrupt occurs.



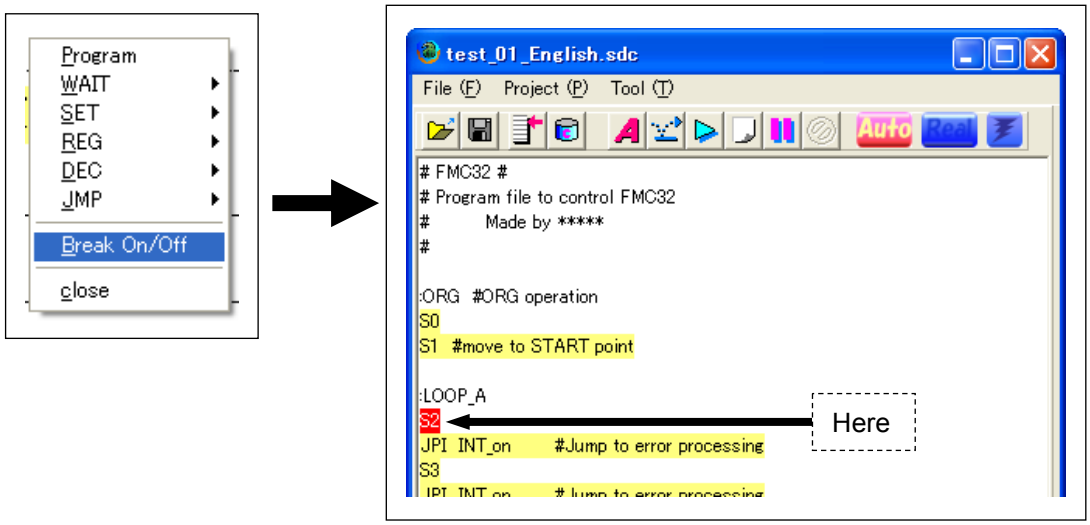
[Variable value display button]



4-6-4. Break function

During continuous execution, you can interrupt continuous execution at any line you want.

Click the line where you want to interrupt continuous execution. Next, right-click to show the pop-up menu. If you select "Break ON/Off" from the pop-up menu, the line is highlighted as follows.



To cancel a break, click the line and right-click and do the same operation. If the line is highlighted in yellow, the break function is canceled.

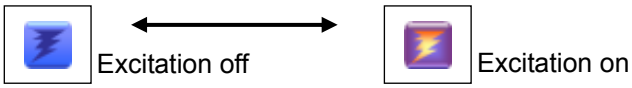
You cannot set a break in anything other than command lines. You cannot set a break in label line. (A label is not a command to be executed.)

4-7. Execution （Real operation）

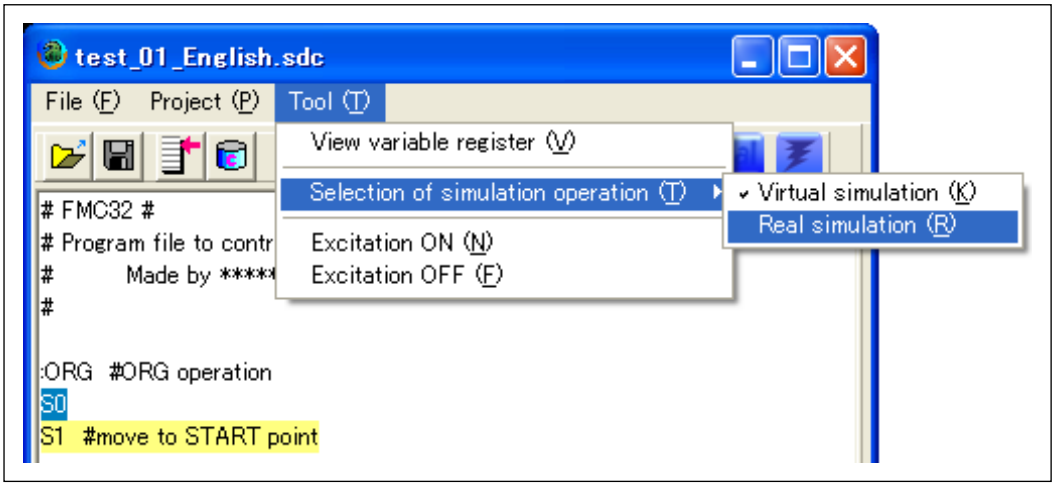
4-7-1. Step execution （Simulation）

After you confirm that the program is processed in the order you want to, you can confirm that the motor actually operates.

At first, turn external input signal "MON" of this product ON (photocoupler ON) or click the following button to set excitation to ON. (When an EX_ON command is used, you do not have to follow the procedure to turn excitation ON.

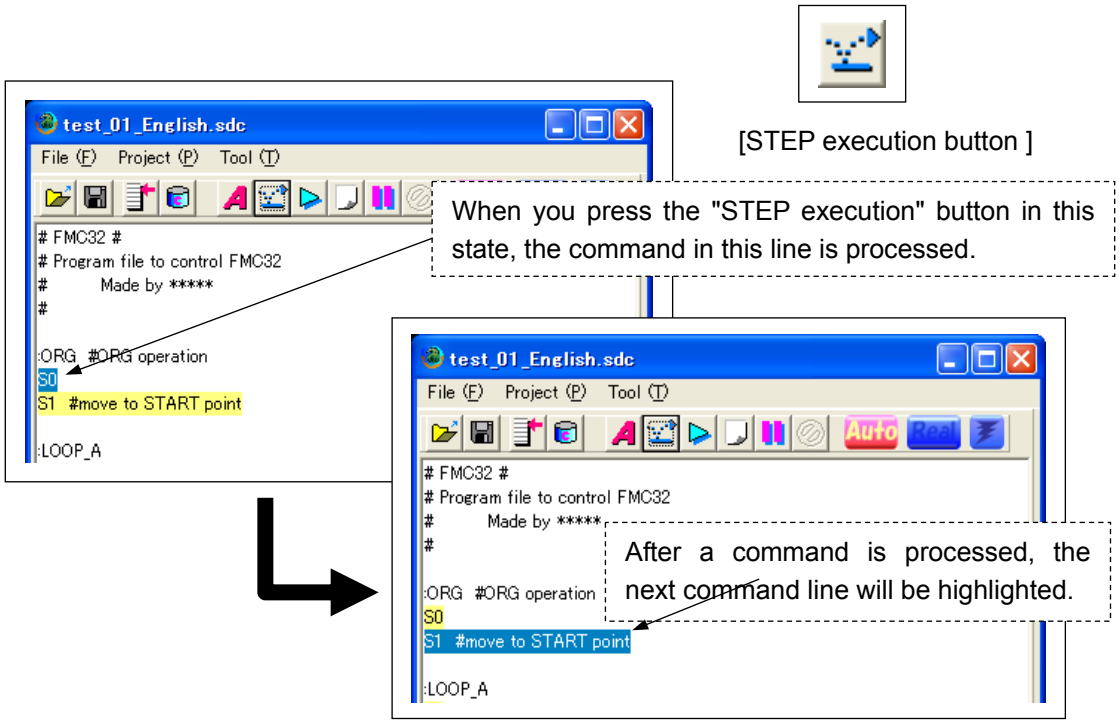


Then, select "Selection of simulation operation" and "Real simulation" from the "Tool" menu.
By doing this, the mode becomes the actual operation mode.



Switching to real operation mode can be done by the following button.
The condition of this button allows you to confirm whether or not the real operation mode.

Then, click the "STEP execution" button. The highlighted first command line is processed and the next command line will be highlighted.



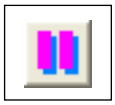
4-7-2. Continuous execution（Real operation）

Click "Execution" of the "Project" menu or the following "Continuous Execution" button. The highlighted line moves as execution sequence program. It shifts at a speed that you can follow with your eyes.

[Continuous execution button]

4-7-3. Temporary stop of continuous execution

You can stop continuous execution by clicking the following button.



When the motor is operating in real operation, it stops after command operation is complete. If an operation pattern that takes some time until the motor stops is processing, please wait until the operation is complete.

If you click the "Step execution button" or "Continuous execution button", the FMC32 starts to process the next command to the processed command.

If you want to restart the program from the beginning, click the "Assemble" button.

4-7-4. Forcible stop of continuous execution

Click the following button to stop operation forcibly at the moment you click. You can use this button only in real operation mode.

If you click the "STEP execution button" or "Continuous execution button" after a forcible stop, FMC32 restarts to process the next command to the processed command. However, the operation may not be as you want to because the stepper motor may not perform predictably during a forcible stop.
If you want to restart the program from the beginning, click the "Assemble" button.

4-7-5. STA input in PC control mode

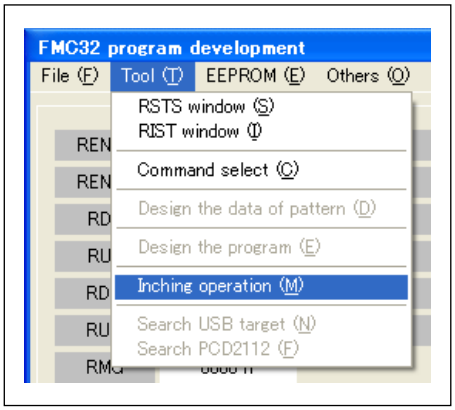
If the FMC32 is used in standalone mode, the programmed operation pattern starts when external input terminal STA turns High.
On the other hand, when the FMC32 is used in PC control mode, operation starts and ignores STA input.
The purpose of using the PC control mode is assumed to be for confirmation that the created programmed operates as you like and to write operation data to the FMC 32.
If you want to use signals from the STA terminal while you are confirming operation, click the "Auto" button and turn off the auto start mode.

Display	Function
	Operation starts and ignores an STA input.
	Operation starts when an STA input is turned on.

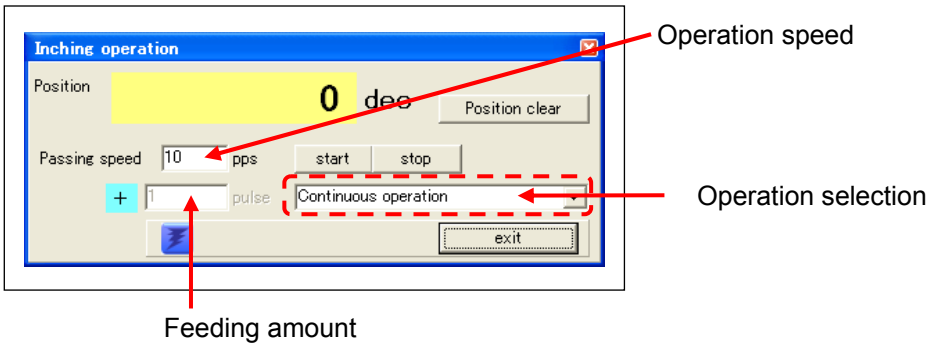
However, operation does not start until the STA input becomes from Low to High. When the STA input is high at the start of operation, STA input should become low once and then become high to start operation. This is the specification of this product.
Please note that mechanism of operation start in standalone mode is different from the one in PC control mode. (In the PC control mode with automatic start mode off, operation by command_1 (Pn) to specify an operation number is the same with operation by Command_2 (Sn) to specify an operation number.)

5. Inching operation

Click "Inching Operation" from the "Tool" menu on the menu bar.



The following window appears.



Next to "Position", the value of feeding amount in inching operation appears. The value is cleared by clicking the "Position clear" button.

5-1. Continuous operation

Select "Continuous operation" from the pull-down menu.
Next, input an operation speed in the "Passing speed" field.
Then, select operation direction. By clicking the "+" button, the display is switched to "-". Click the "start" button to start operation at the speed input ahead.
This operation continues until the "stop" button is clicked.

5-2. Positioning operation

Select "In positioning operation" from the pull-down menu. Next, input the operation speed in the "Passing speed" field and input feeding amount (the total number of pulses). Then, select operation direction. By clicking the "+" button, the display is switched to "-". Click the "start" button. The number of pulses input in the "Feeding amount" field is output at the speed input ahead. This operation stops automatically without clicking the "stop" button.

6. Access to Serial EEPROM

The FMC32 operates in standalone mode by writing designed operation patterns and execution subsequence program using operation patterns (program) to EEPROM on the FMC32.

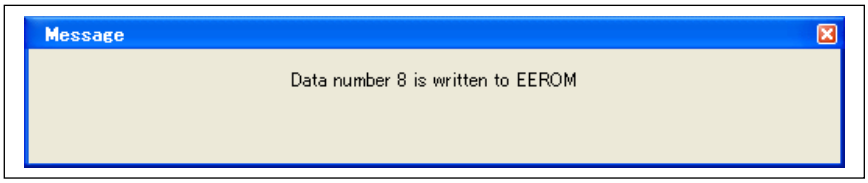
6-1. Write to EEPROM

Write the designed operation pattern and the program using the operation pattern to EEPROM on FMC32.

Click "Write to EEPROM" from the EEPROM menu on the Main window.

While operation pattern is being written, the following message appears.

Operation patterns are not written to the operation numbers that an operation pattern is not registered. Comments are also not written.



If writing operation patter is completed normally, writing program starts.

All writing is completed, the following message appears.

Caution: To Write created program, assemble it before writing program.

Check whether the program has any errors by assembling it.

If you write an unassembled program, the following error message appears and the program is not written. (Operation pattern is written.)

Unsaved programs are not written. Please save it ahead of time.

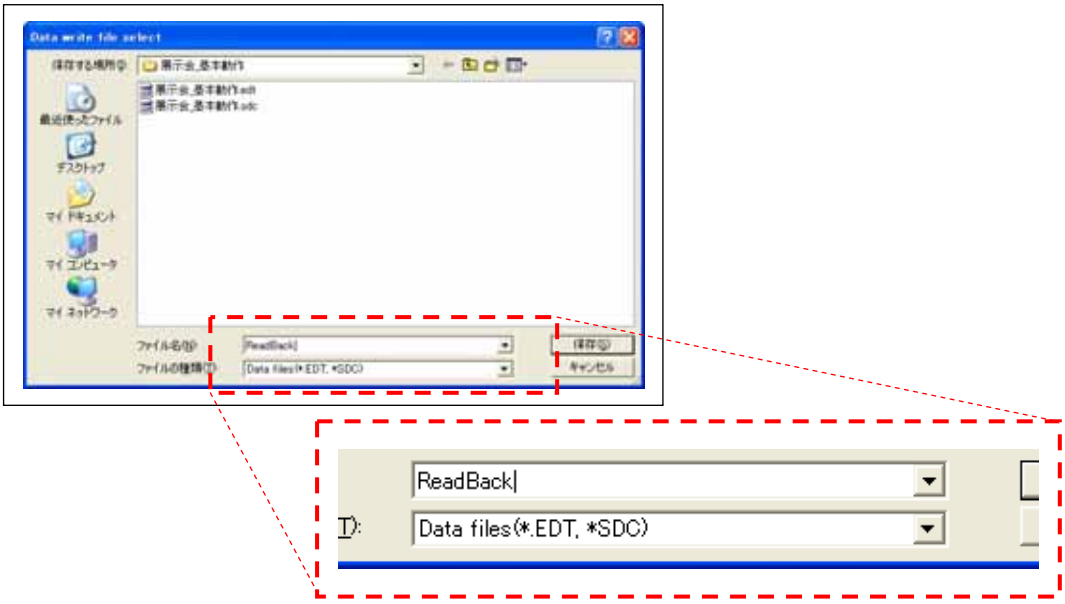
Message example
Please assemble the program.
The program has been changed. Please assemble it.
Please save the program.
Please save the data of pattern.

6-2. Read data in EEPROM

Read data written in EEPROM on FMC32.

Click "Read data in EEPROM" from the "EEPROM" menu on the main window.

The window to select saved files appears.



Input a file name without extension. The following two files with this file name are generated.

Generated files	Content
.edt	Operation pattern data read
.sdc	Read program data after assembling.

You can use an ".edt" file in other projects by importing. (Comments cannot be used.)

7. Language selection

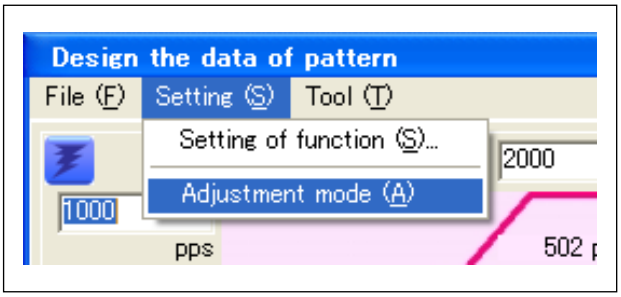
Select "language select" from the "Others" display. You can select language used such as Japanese or English, etc.

To select Japanese, The characters may be garbled if you do use an OS that does not supports Japanese.

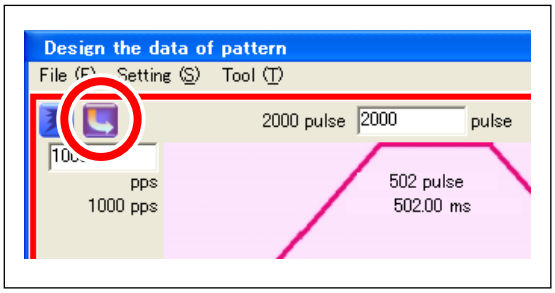
8. Adjustment mode

You can use the adjustment mode to adjust current to stepping motors. It allows to forcibly cancel current down function that is always available.
It also allows you to change all items that you cannot select on RENV1, RENV2, RMD and each register setting windows.

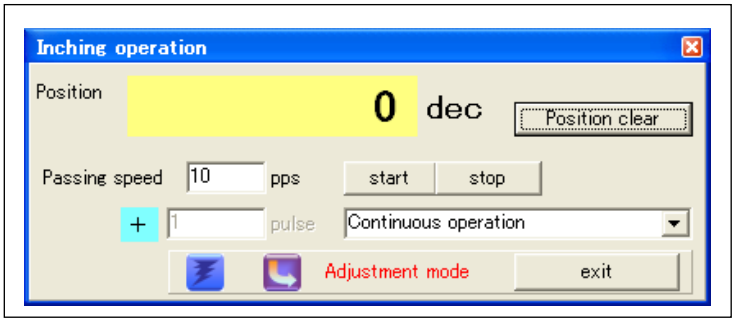
Open a project by selecting "New project" or "Load project", etc and open "design the data of pattern" window.
Select "Adjustment mode" from the "Setting" menu in this window.



The current down switching button appears in the window.



At the same time, the following inching operation window appears. In this window, the current down switch button is added.



By click the current down switching button, you can switch condition of current down signals.

Condition of button	Current down	Note
	Valid	Normally, current down is controlled automatically. During stopping, current down is always valid.
	Invalid	During stopping, you can make current down feature invalid. After operation start, it returns to invalid automatically at the operation stop.

In adjustment mode, you do not use the following features.

1. You cannot register operation patterns.
2. You cannot change environmental settings.

If you click the "execute" button with current down invalid, current down feature returns to valid forcibly.

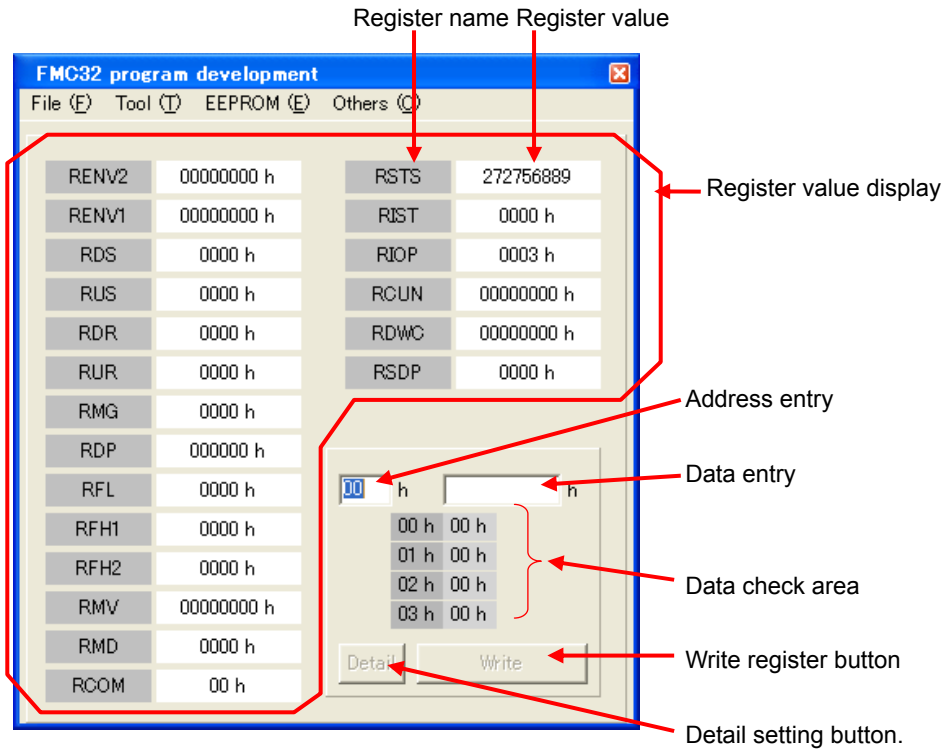
To quit adjustment mode, select "Adjustment mode" from the "Setting" menu again. If you quit adjustment mode with current down invalid, it returns to valid automatically.

9. Control PCD2112 directly

This software can control PCD2112 mounted on FMC32 directly.
Using this method, you can write value to the registers of PCD2112 directly, but the data etc. does not have any influence on designing operation patterns. (Register values set here are discarded at the time to create operation pattern.)
This function is designed to understand PCD2112 functions.

9-1. Function description of the main window

Each function description follows illustration of the main window again.



[Main window]

9-1-1. Register value entry

PCD2112 has 20 kinds of registers.
PCD2112 reads these registers each specified cycle through USB and shows the values.
In this window, you can check the condition that FMC32 is operating.

9-1-1-1. Set value to register

If you double-click each register, write address of the register appears in the address entry field by double-click and the cursor moves the "data entry" field.
If you input data in the "data entry" field and click "write" button, data is written in the register specified. Written data is read immediately and is reflected on the window.

9-1-1-2. Select radix of register value

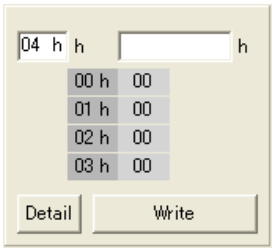
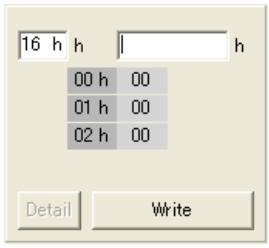
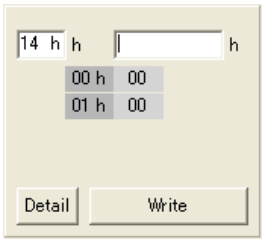
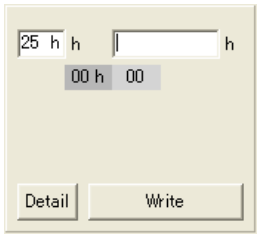
If "h" is attached to the last of register value shown, the value is displayed in hexadecimal notation. When you right-click this value, radix of register shown is switched from decimal to hexadecimal.

9-1-2. Address display

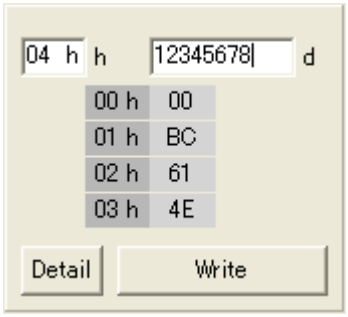
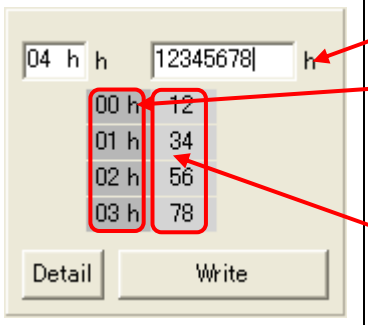
It shows the head address of the register that data is written to. You cannot input in this field using the keyboard.

9-1-3. Data entry field, Data confirmation field

According the types of registers, length of data to be written varies.
When you double-click register display to generate address automatically, the necessary number of data bytes is also automatically determined and FMC32 makes you input the number of bytes.
The radix of data input is the same as the radix of the register value.

			
Example of 4 byte write (RENV2 register)	Example of 3 byte write (RDP register)	Example of 2 byte write (RMG register)	Example of 1 byte write (RCOM register)

If the radix is hexadecimal ("h"), you cannot input data more than the necessary bytes. Using decimal, you can input data more than the necessary bytes. However, the parts of other than the necessary bytes are deleted.
The content of "data confirmation" field is as follows.

	
Decimal	Hexadecimal

Radix

Offset values.
The head is address input in the "address entry" field.

You can confirm to which part of specified address the data input in the data entry field is written.

In decimal, data is input in the data entry field in decimal, but is shown in hexadecimal notation in the data confirmation field.

9-1-4. Register write button

Data input in the data entry field is written to address input in the address entry.

9-1-5. Detail setting button

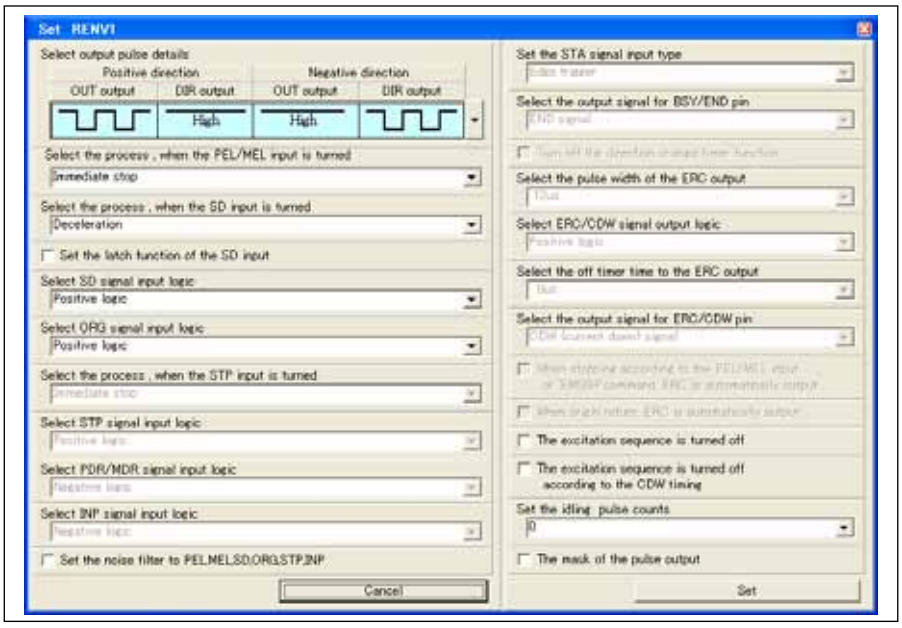
Each register of "RENV1", "RENV2", "RMG", "RMD, "RCOM" and "RIOP" has its meaning by bit.
User's manual describes these registers in details. To save the need of seeing user's manual, you can use the "detail" button when you create data of these registers.
If you click this button, the detail setting window of each register appears.

9-2. Advanced setting of registers

In each register of "RENV1","RENV2", "RMG", "RMD", "RCOM", and "RIOP", there is a detailed setting window.
If you click the "Detail" button, the window to support data design appears.
The setting window of each register is described as follows.

9-2-1. Advanced setting of RENV1 register

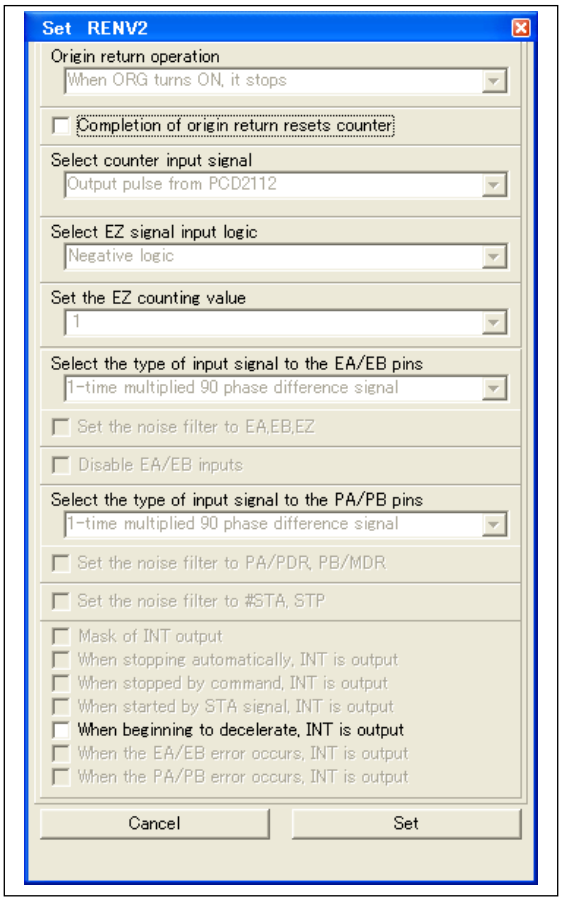
Double click the register value display of environmental setting 1 register (RENV1) and click the "detail" button to show the following window.



This window is composed of the pull-down menu and checkboxes. If you select each item of environmental setting 1 register and check the checkbox, the corresponding bit structure can be automatically generated. (The items that you cannot select cannot be changed because the FMC32 does not use them.)
After setting, click the "set" button to set automatically generated data in the data entry field of the main window and write in a register at the same time.
If you click the "Cancel" button, the automatically generated data is input in the data entry field of the main window, but data setting to the register is not made. Click the "Write" button in the main window to write this data to a register.

9-2-2. Advanced setting of RENV2

Double click the register value display of environmental setting 2 register (RENV2) and click the "detail" button to show the following window.



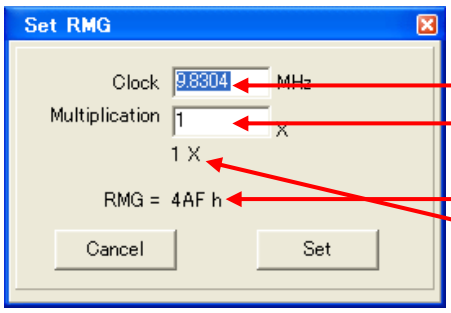
This window is composed of the pull-down menu and checkboxes. If you select each item of environmenta2 setting 1 register and check the checkbox, the corresponding bit structure can be automatically generated. (The items that you cannot select cannot be changed because the FMC32 does not use them.)

After setting, click the "set" button to set automatically generated data in the data entry field of the main window and write in a register at the same time.

If you click the "Cancel" button, the automatically generated data is input in the data entry field of the main window, but data setting to register is not made. Click the "Write" button in the main window to write this data to a register.

9-2-3. Advanced setting of RMG register

If you double-click "multiplication" field of setting register (RMG) and click the "Detail" button". The following window appears.

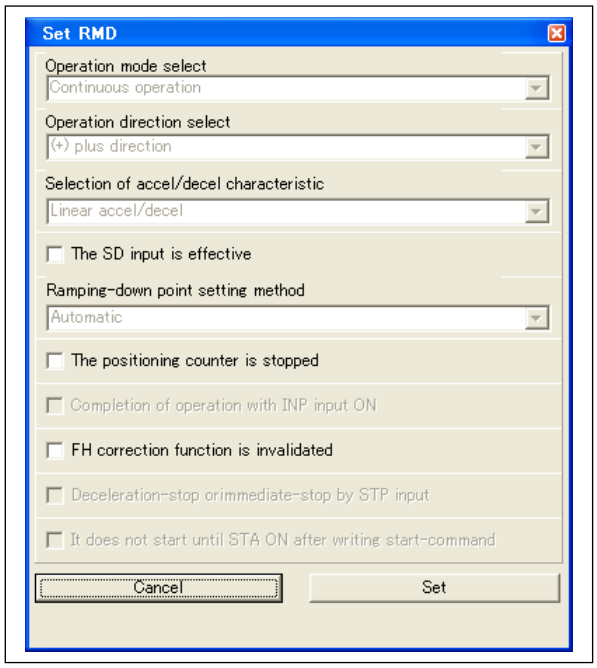


Setting reference clock
Setting multiplication
Value to be set to RMG register
Actual multiplication used when set value to RMG register is applied.

For setting reference clock, set the clock frequency that will be provided to the PCD2112.
The value for FMC32 is 9.8304MHz.
After setting, click the "set" button to set the automatically generated data in the data entry field of the main window and write it to the register at the same time.
If you click the "Cancel" button, the automatically generated data is input in the data entry field of the main window, but data setting to register is not made. Click the "Write" button in the main window to write this data to a register.

9-2-4. Advanced setting of RMD register

If you double-click "Operation mode select" setting register (RMD) field and click the "Detail" button". The following window appears. (If you open the RMD setting window using the window to design the data of pattern, the "Set as Default" button is added.

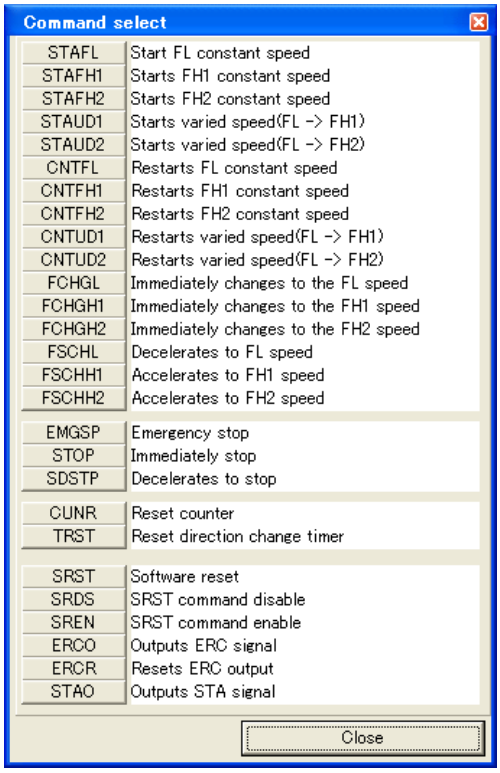


This window is composed of the pull-down menu and checkboxes. If you select each item of operation setting register or check the checkbox, the corresponding bit structure can be automatically generated. (The items that you cannot select cannot be changed because FMC32 does not use them.)
After setting, click the "set" button to set automatically generated data in the data entry field of the main window and write it in a register at the same time.
If you click the "Cancel" button, the automatically generated data is input in the data entry field of the

main window, but data setting to register is not made. Click the "Write" button in the main window to write this data to a register.

9-2-5. Advanced setting of RCOM register

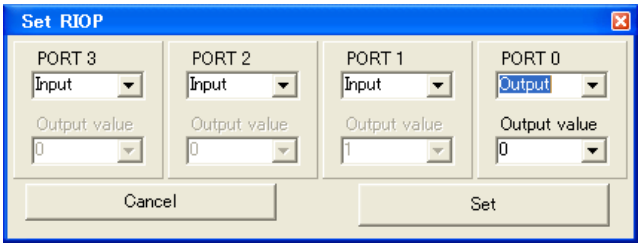
If you double-click "Command register (RCOM) field and click the "Detail" button", the following window appears.



This window shows buttons of all operation directives to be specified to the PCD2112. If you click each button, the corresponding directive is processed.

9-2-6. Advanced setting of RPIO register

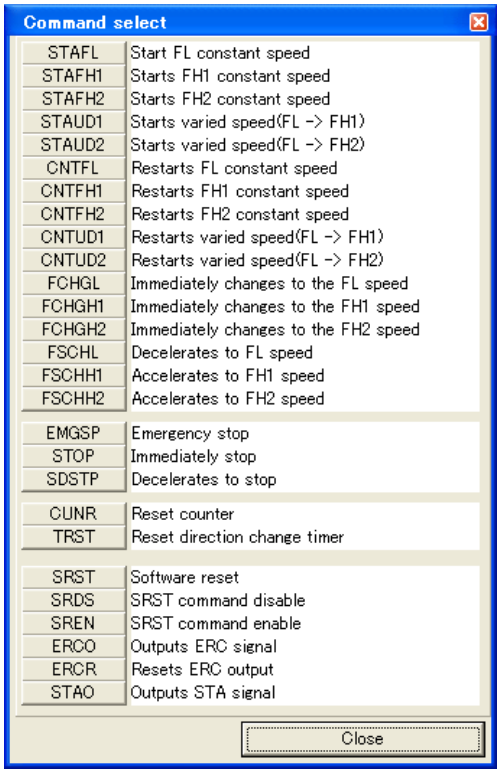
If you double-click "General-purpose port register (RPIO) field and click the "Detail" button", the following window appears.



This window is composed of the pull-down menu and setting data to operate each general-purpose port can be automatically generated.
After setting, click the "set" button to set automatically generated data in the data entry field of the main window and written in a register at the same time.
If you click the "Cancel" button, the automatically generated data is input in the data entry field of the main window, but data setting to register does not be made. Click the "Write" button to write this data to a register.

9-3. Select operation directive to FMC32

Select "Selection of instruction to FMC32" from the "Tool" menu. The following window appears.



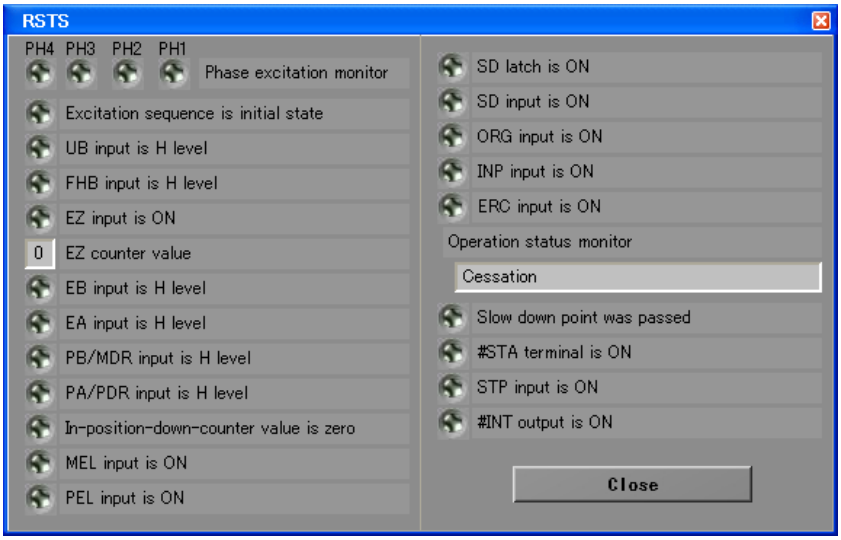
This window shows buttons of all operation directives to be specified to the PCD2112. If you click each button, the corresponding directive is processed.

9-4. Confirm the detail of registers

The register "RSTS", "RIST" and "RIOP" has each meanings by bit.
Regarding RSTS and RIST, the window to refer the information by bit is prepared.

9-4-1. Confirm the detail of RSTS register

Select "RSTS window" from the "Tool" menu, the following windows appears.
Here, the bit information of status information register (RSTS) appears visually.



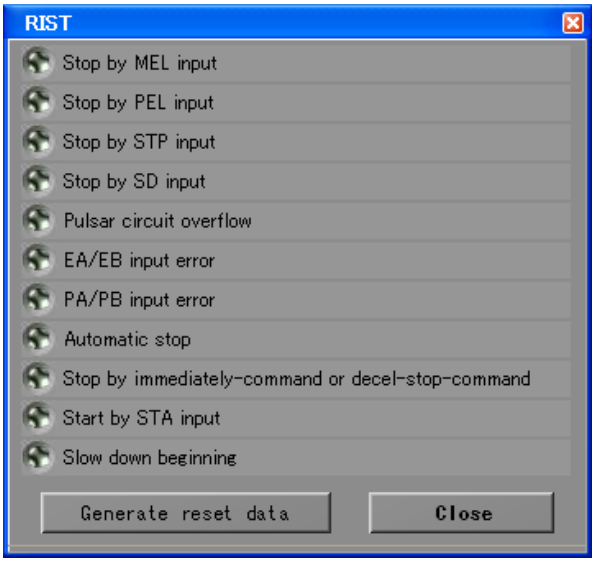
The bit of RSTS register that has meaning by bit, when the corresponding bits are "1" or "0", the bit status changes as follows.

Bit status	
0	
1	

When the multiple bits have one meaning, the numeral value that the multiple bits shows will be shown by characters.

9-4-2. Confirm the detail of RIST register

Select RIST window from the "Tool" menu. The following windows will be shown.
The bit information of the RIST register appears visually.



You can confirm the condition of each bits of the RIST register. The style of the display is the same as one of the RSTS register.

10. Meaning of messages and solution

While using the software, message may appears when trouble occurs. The followings show causes and countermeasures of each message.

Code	Message	Cause / Countermeasure
M0001	Failure of EEPROM access mode	Though FMC32 issues a transition command to "EEPROM access mode" to PCD2112 (See 5-1. Bus control command of PCD2112 User's Manual) and check a connected serial EEPROM, this serial EEPROM is not ready. Therefore, data is not written to the serial EEPROM. Wiring to serial EEPROM may be disconnected. Serial EEPROM may be broken. The device may need to be repaired.
M0002	Not ready for EEPROM access(1)	Though FMC32 issues a transition command to "EEPROM access mode" to PCD2112 (See 5-1. Bus control command of PCD2112 User's Manual) and issues "Write enable" command to a connected serial EEPROM, this serial EEPROM is not ready for this command. Therefore, data is not written to the serial EEPROM. Wiring to serial EEPROM may be disconnected. Serial EEPROM may be broken. The device may need to be repaired.
M0003	Not ready for EEPROM access(2)	After writing data of 32 bytes to connected serial EEPROM, serial EEPROM does not become ready. It is unclear Whether or not data is written to the serial EEPROM. Wiring to serial EEPROM may be disconnected. Serial EEPROM may be broken. The device may need to be repaired.
M0004	Not ready for EEPROM access(3)	After writing data of 32 bytes to connected serial EEPROM and sending "Write enable" command to serial EEPROM to write the next data, the status does not become ready after receiving this command. first 32 bytes of data is written to serial EEPROM, but the next data is not written. Serial EEPROM may be broken. The device may need to be repaired.
M0005	Not ready for EEPROM access(4)	After writing data of 32 bytes and 2 bytes continuously to a connected serial EEPROM, the status does not become ready. It is unclear whether or not the 2 bytes data (of second time writing) data is written to serial EEPROM. Serial EEPROM may be broken. The device may need to be repaired.
M0006	RMV becomes less than three	RMV reaches to a lowest limit you can set as a magnification setting register. This means that pulse cycle setting value at the high speed exceeds PCD2112 capacity. Procedure is interrupted. Step down the value of pulse cycle at high speed.
M0007	RFH register value cannot be set	This means that pulse cycle setting value at the high speed exceeds PCD2112 capacity. Procedure is interrupted. Step down the value of pulse cycle at high speed.
M0008	RFL register value cannot be set	1. The value set for pulse cycle setting value at low speed exceeds the capacity of PCD2112. Procedure is interrupted. Step down the value of pulse cycle at low speed. 2.Though magnification for pulse cycle setting at high speed is automatically calculated, smaller than this magnification cannot be set for pulse cycle at low speed. Procedure is interrupted. Step down the value of pulse cycle at low speed.

M0009	Please larger RFH than RFL	Setting value for pulse cycle at high speed is smaller than one at low speed. Procedure is interrupted. Make setting value for pulse cycle at high speed larger than one at low speed. (Actually, PCD2112 operates in spite of the setting like this.)
M0010	RMV register value cannot be set	Feeding amount is too large. Procedure is interrupted Make feeding amount smaller.
M0011	RUR register value cannot be set	Time for acceleration is too small or too large. Procedure is interrupted. Make this value appropriate.
M0012	RDR register value cannot be set	Time for deceleration is too small or too large. Procedure is interrupted. Make this value appropriate.
M0013	20MHz or more cannot be set	Procedure is interrupted. Do not change reference clock frequency basically. However, PCD2112 can operate normally up to 20MHz.
M0014	RMV register is too small	Feeding amount set is too small compared to the number of pulses generated during acceleration / deceleration. There may be cases that the pulse cycle cannot be reached to the setting value because of triangle drive or FH correction. You can select to stop or continue operation.
M0015	Please adjust RDR and RUR to the same value	In the case that slowdown point is set automatically, an acceleration rate should be the same as a deceleration rate. If manual setting is selected for slowdown point, this message can be ignored. You can select to stop or continue operation.
M0016	Search of USB device wait a moment	FMC32 is searching for PUSB3503 connected to PC. Just after PUSB3503 is connected to PC, the PC's OS may take some time to finish recognizing the USB device. In this case, this message appears.
M0017	USB device is not found.	PUSB3503 is not connected to PC, or OS cannot recognize an USB device. Possible causes are as follows. 1.Device driver is not installed correctly. - In windowsXP, you can check an USB device connection using device manager. In the case that device driver is not installed correctly, install device driver. 2.OS stays in recognizing. - Select "Initial" from the "Tool" menu to operate or restart software. 3.PUSB3503 is not connected. - Connect PUSB3503 or plug USB again.
M0018	PCD2112 is not found.	Though PUSB3503 is connected, PCD 2112 is not connected or power is switched off.
M0019	Set data is not written in the register	Because you exit the detail setting window using "Cancel", setting data has not saved in register. Click the "Write" button to save data.

When register data is written to serial EEPROM in standalone mode, 34 bytes of data will be written.
32 byte data is written to EEPROM at once process according to EEPROM's specification. Therefore, data write is processed two times with separating 32 bytes write and 2 bytes write.

CAUTION	The descriptions in this manual may be changed without prior notice to improve performance or quality.

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