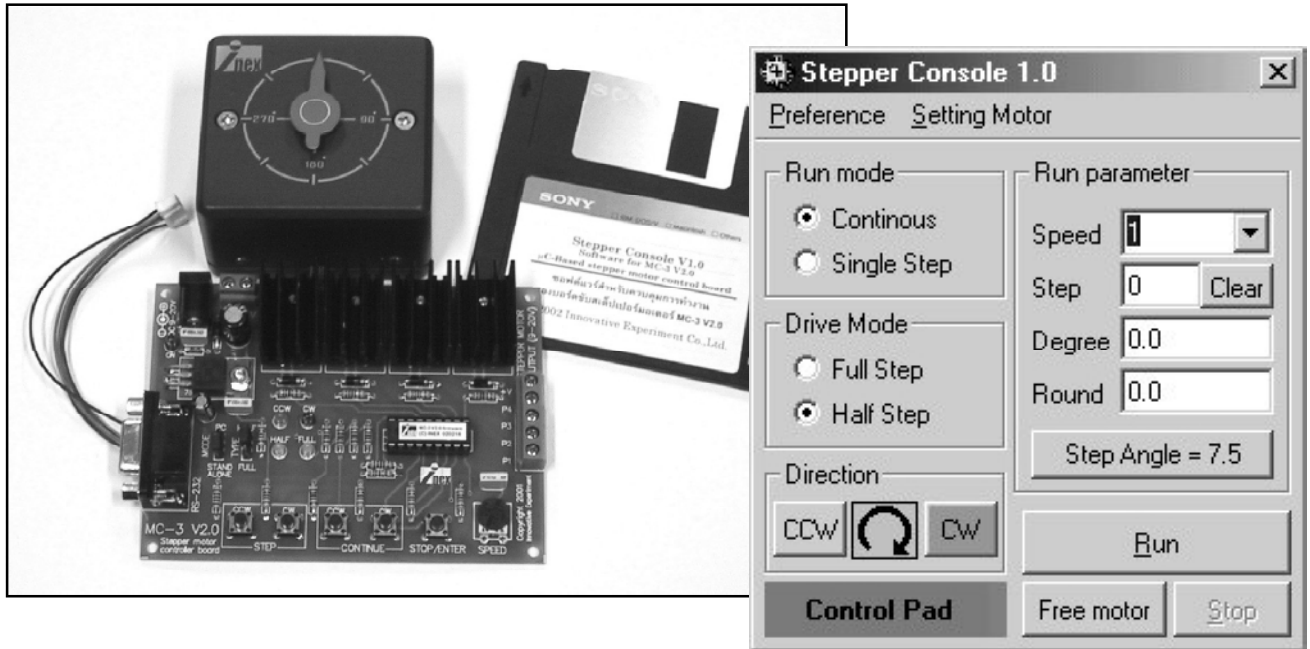


MC-3 V2.0

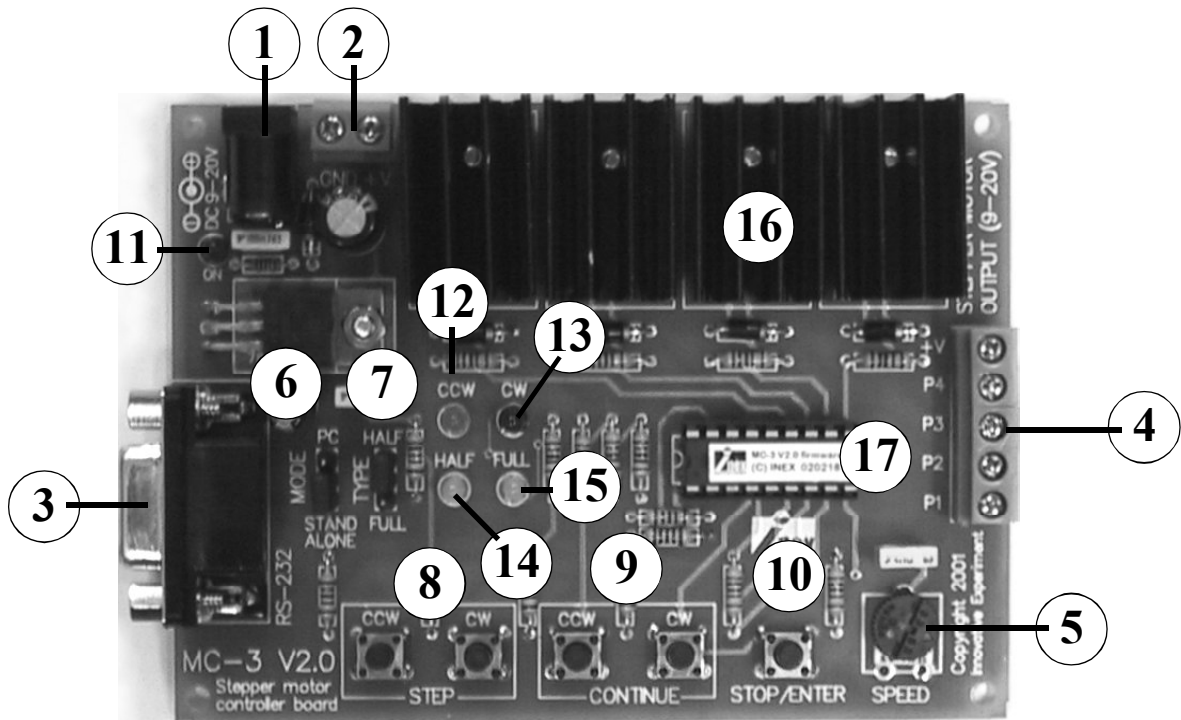
µC-based Stepper motor controller board



Features :

Supply	9-20V Current 500mA minimum.
Output current/phase	1.5A maximum
Size (WxL)	8.1x10.9 cm.
Standby current	Stand alone mode : 42mA @12V PC mode : 47mA@12V
Interface	RS-232 serial port, Baudrate 9,600 bits per sesond
Type of motor	Support only unipolar type 9-20V
Driving mode	Step and Continuous
Direction	Clockwise and Anti-clockwise
Driving method	Full and Half step selected by jumper
ControllingÁ	Manual by on-board switches and via computer selected by jumper
indicator	Direction LED, Driving Method LED and Power indicator

MC-3 V2.0 board layout



Number 1 and 2 : DC jack and DC supply terminal

Number 3 A Female DB-9 connector for connect with RS-232 Serial port to control in PC mode

Number 4 Motor Terminal

Number 5 SPEED knob for adjust motor speed in STAND ALONE

Number 6 MODE jumper for selection Stand alone and PC

Number 7 TYPE jumper for selection method HALF STEP and FULL STEP

Number 8 Direction control button in Step mode. Select 2 modes; CCW (Counter Clock Wise) control and CW (Clock Wise) control. Both switches can use to BRAKE

Number 9 Continue mode switch. CCW (Counter Clock Wise control) and CW (Clock Wise control)

Number 10 STOP/ENTER switch for stop and select mode of motor control

Number 11 LED Power indicator

Number 12 LED CCW mode indicator

Number 13 LED CW mode indicator

Number 14 LED Half step driver mode indicator

Number 15 LED Full step driver mode indicator

Number 16 Motor driver's heatsink

Number 17 Pre-programmed microcontroller for this controller board

1. Circuit description

The figure 1 shows the complete circuit of MC-3 V2.0 motor driver board. The heart of this board is IC1 pre-programmed PIC16F819 microcontroller. IC1 will check mode selection at jumper JP1 MODE. If jumper does not fit, SA (Stand alone) mode is selected. If jumper fit, PC mode will be selected.

In case SA mode selected, JP2 jumper is used for driving mode selection ; Full step and Half step. Full step driver mode can drive the speed more than the half step mode 2 times but resolution less than 2 times. LED3 is used for full step mode indicator and LED4 is used for half step mode indicator.

S1 to S4 switch are used for selection direction and operation. S1 and S2 are used for setting direction of motor in the step mode.

If S1 (STEP CCW) is pressed one time, motor will be rotate in counter clock wise direction one step. LED1 will on for indicator.

If S1 is pressed hold, motor will be rotate in counter clock wise direction continuous step. LED1 will on for indicator.

If S2 (STEP CW) is pressed one time, motor will be rotate in clock wise direction one step. LED2 will on for indicator.

If S2 is pressed hold, motor will be rotate in clock wise direction continuous step. LED2 will on for indicator.

If S3 (CONT CCW) is pressed, motor will be rotate in counter clock wise direction continuous.

If S4 (CONT CW) is pressed, motor will be rotate in clock wise direction continuous.

User can select any mode in any time.

S5 is Stop switch and Enter switch for confirmation the mode selection between SA and PC mode.

Speed adjustment in SA mode will use VR1 and C3 capacitor. If adjust VR1 high value, the speed will be decrease and increase when VR1 value is adjeusted to low value.

In driver section, transistor Q1-Q4 join with diode D1-D4 and resistor R10-R13. R10-R13 are bias circuit for Q1-Q4. In counter clock wise direction driving Q1 will work the first after that Q2, Q3 and Q4 will work order. In clock ise direction driving Q4 will work the first after that Q3, Q2 and Q1 will work order. D1-D4 are protection diodes. They are used for protect Q1-Q4 transistors and microcontroller's port from reverse current from back electromagnetic force effect.

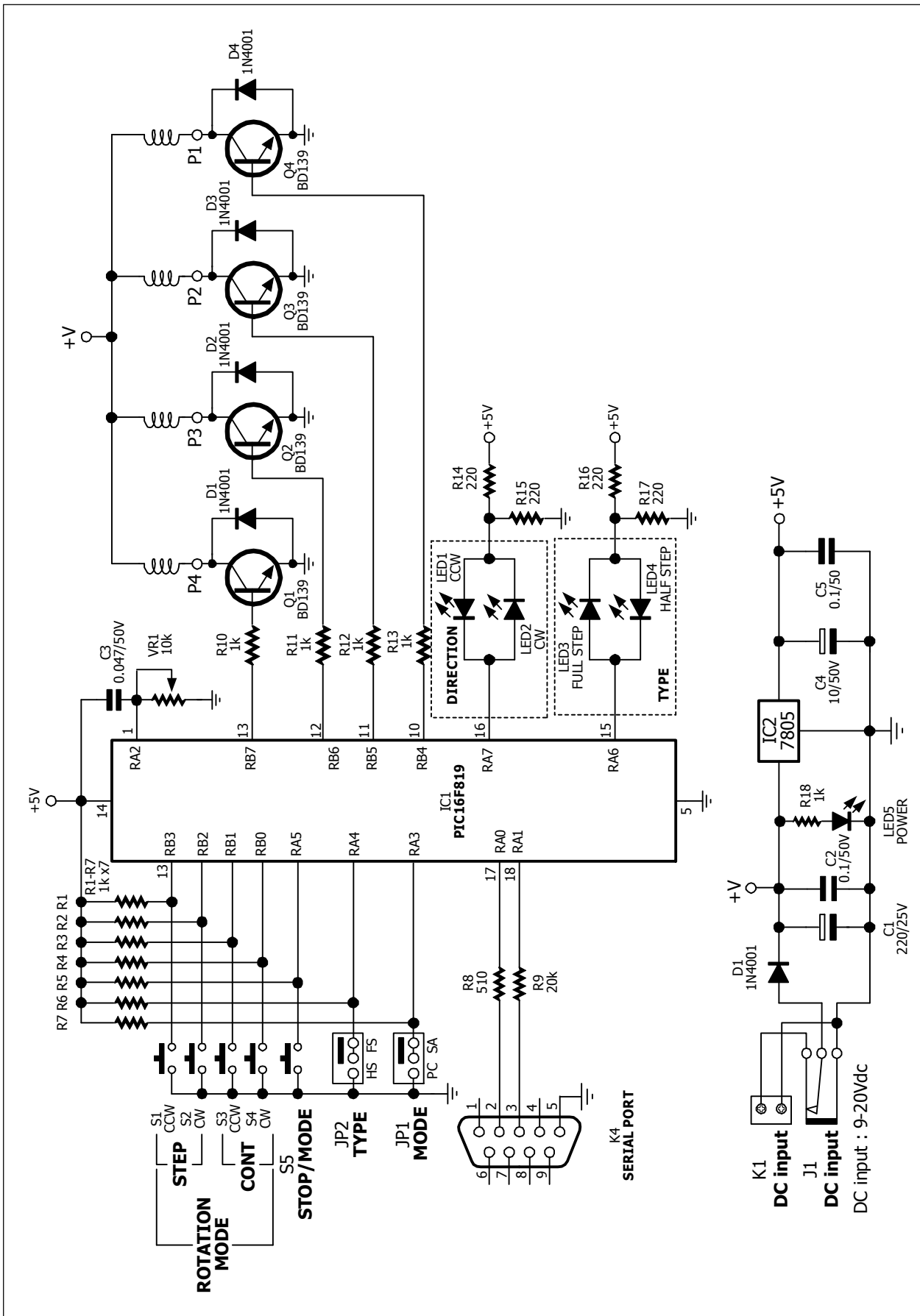


Figure 1 MC-3 V2.0 Stepper motor control board schematic diagram

Serial port interfacing circuit IC1 connect RA0 and RA1 to DB-9 connector for connect to computer serial port. Resistor R8 and R9 are used to current limit for both microcontroller ports and computer serial port.

In PC mode, all switches and jumpers will be disable except JP1 jumper and S5 switch. User will switch to control by Stepper Console software via serial port instead. This mode can control many parameters include set rotation resolution, rotation step, calculate the round of rotation from step setting, select direction, driving mode and speed adjustment.

The supply voltage of MC-3 V2.0 board can get from 2 points. One is DC jack adaptor (J1) and terminal block (K1). Must apply only one point. Diode D5 is polarity protection device. The supply voltage will split 2 paths. One is supplied to the stepper motor. Another is applied to +5V regulator circuit for making +5V supply to microcontroller. LED5 is power indicator.

2. Using MC-3 V2.0 Stepper motor driver board

This board can operate 2 modes as :

1. Stand alone Mode
2. PC Mode

2.1 Stand alone mode (SA)

Enter to Stand alone very easy by fit MODE jumper to STAND ALONE mode and press STOP/ENTER switch one time.

2.1.1 How to use switches in SA mode

2.1.1.1 STEP-CCW switch

Operation 1 : This switch is used for control motor in single-step mode and rotate in counter clock wise direction. LED at CCW position will on following switching pressing. The yellow LED at FULL label will on. Because in single-step operation will be use full step mode only. The motor rotates one step and locks the shaft in brake operation. If still hold this switch over 1 second, motor will rotate continuous until release the switch. In during motor rotates, still can adjust the speed at VR1.

Operation 2 : If press this switch after any switch except STOP/ENTER switch, the driver board will enter to BRAKE function. It locks the motor's shaft. The next pressing will set the mode to single-step mode.

2.1.1.2 STEP-CW switch

The function is similar STEP-CCW switch but the motor direction will be opposite. The direction is clock wise and LED at CW label will on instead.

2.1.1.3 CONTINUE-CCW and CONTINUE-CW switch

Both switches are used for continuous control in different direction. If any switch is pressed only one time, the motor operate in continuous mode. The green LED at CCW position will on if CONTINUE-CCW switch is pressed and the red LED at CW position will on if CONTINUE-CW switch is pressed. Both switches will work with TYPE jumper.

2.1.1.4 STOP/ENTER switch

This switch has 2 functions. One is stop motor function. All LED will off and motor not rotate. Another is enter to the new mode function after MODE jumper is selected.

2.1.2 Function of jumper and knob in SA mode

2.1.2.1 TYPE jumper

Used for Full or Half step driving mode. User can change anytime and no need stop operation before or change on the fly operation.

2.1.2.2 SPEED knob

This knob is used for speed adjustment. If turn in clock wise, motor speed will increase. If turn in counter clock wise, motor speed will decrease.

2.2 Computer control mode (PC mode)

Enter to PC mode by fit MODE jumper to STAND ALONE mode or remove jumper and press STOP/ENTER switch one time. After that connect the serial cable between MC-3 V2.0 board and Computer's serial port.

The suitable software is **Stepper Console V1.0**. **User can select the rotation mode, type of driving, adjust speed and calculate the rounds from step value.**

2.2.1 Installation

(1) Prepare this software by download from <http://www.inexglobal.com> free of charge. The file is SetupStepperConsole.exe or Install from bundled CD-ROM of MC-3 V2.0 board.

(2) Double-click at SetupStepperConsole.exe file for start the installation. Wait until complete. The figure 2 shows main window of Stepper Console software.

2.2.2 Menu function

2.2.2.1 Preference

Comm Port : Select the serial port that connected. Available 4 ports COM1 to COM4.

Always on top : Select to the main window active on the top of screen always.

2.2.2.2 Setting Motor

Reset step when finish : Clear the values in Step box, Degree box and Round box after the stepper motor operate finish. The latest value still shows in all box if not changing.

Set start position : Set the start point of motor. The motor's shaft will lock in brake operation and waiting for the next command.

2.2.2.3 Run mode box

Select the rotation mode. It has 2 modes :

(1) Continuous : Select the motor rotation in continuous when selected.

(2) Single step : After this mode selected, motor will operate in full step mode and rotate in single-step

2.2.2.4 Drive Mode box

This box is used to select the driving mode. One is full Step, another is half step mode. User can select only one mode and cannot select the driving mode to half steps when single-step mode operation selected.

CCW button : Set the motor to count clock wise direction.

CW button : (Clock Wise) : Set the motor to clock wise direction.

Control Pad : Set to controlled via keyboard.

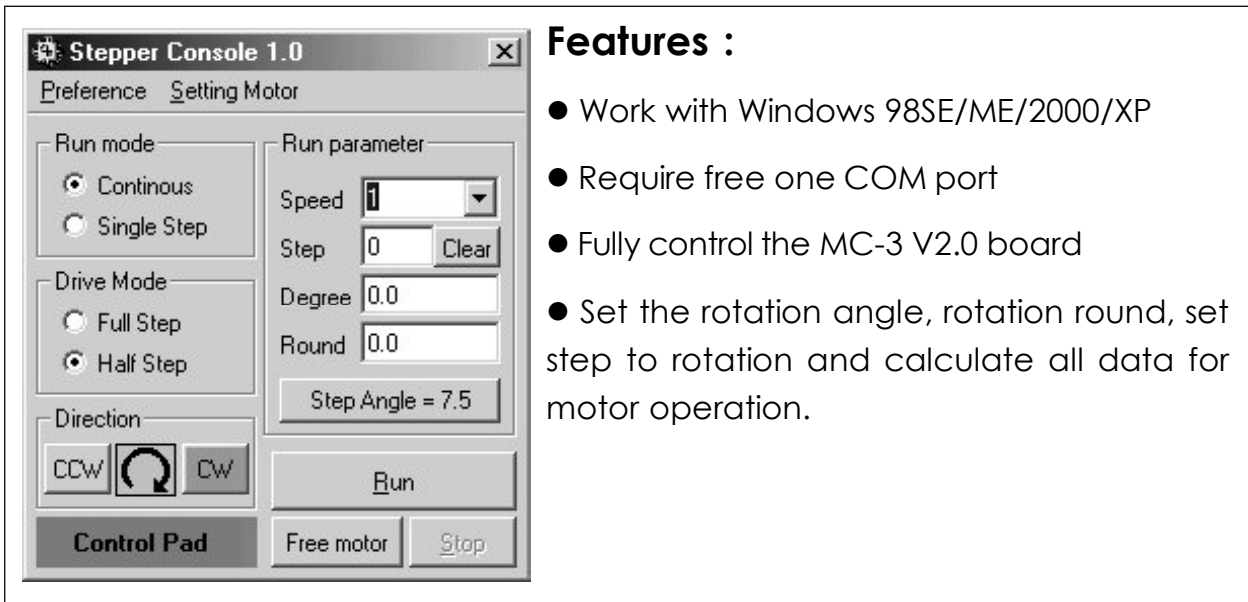
2.2.2.5 Run parameter box

This box is used to set the parameter about relate the motor rotation.

Speed : Set motor speed. The range is 1 to 250. The low value means low speed.

Step : Select the motor's step. The range is 0 to 65,535 steps. If set to 0, motor will rotate continue and not stop until change the value to other or Stop the motor by STOP button.

Degree : Set the rotation angle



Features :

- Work with Windows 98SE/ME/2000/XP
- Require free one COM port
- Fully control the MC-3 V2.0 board
- Set the rotation angle, rotation round, set step to rotation and calculate all data for motor operation.

Figure 2 Stepper Console main window and features

Round : Set the rotation round

Step Angle : Set the rotation angle in degree/step unit. The default value is 7.5 degree/step. If click this button, the setting window following the figure 3 will appear.

Clear : Clear all data in Run parameter box.

However, all parameter in Run parameter box will be relate and always truth in mathematics. User set the Step angle and Rotation step value. Software will calculate the Rottion round automatically. Or, set the angle value. Program will be calculate the rotation round and Step value. Thus, the important parameter is Step Angle of motor. must select the real value always.

Run button : Start the operation.

Free motor button : Stop the operation only driving circuit. The motor shaft will free.

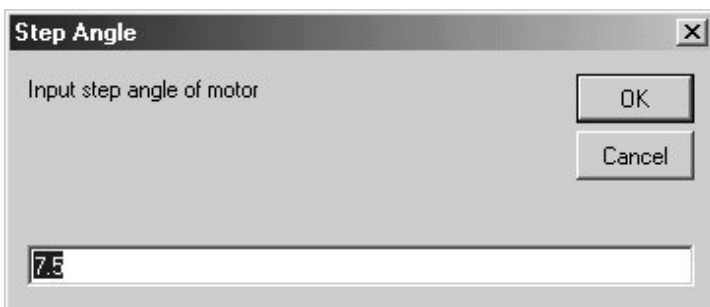


Figure 3 Step angle setting window in Stepper Console software



Figure 4 The example setting about set the motor rotate continuous in clock wise direction with full step mode at maximum speed and step angle of motor is 7.5 degree/step.



Figure 5 The operation window after click Run button in Setting window from figure 4.

2.2.3 Setting example

Require to set the motor rotate continuous in clock wise direction with full step mode at maximum speed and step angle of motor is 7.5 degree/step. The setting window will show in the figure 4.

Click Run button to start the operation. The window will change the display following the figure 5. At MC-3 V2.0 board, Red LED at CW label and yellow LED at FULL label will on both.

Pause button in figure 5 is used to stop the motor in a moment.

Stop button in figure 5 is used to atop all operations. All switches on the MC-3 V2.0 board cannot work in PC mode except STOP/ENTER swtich.

The figure 6 will show the example setting about selection motor rotate in counter clock wise direction, full step mode, step value 48 steps to stop.

The figure 7 will show the example setting about selection motor rotate in single-step mode. User must click at Single Step button before and following Run button. After that click at CCW and CW button to control the direction.



Figure 6 shows the example setting about selection motor rotate in counter clock wise direction, full step mode, step value 48 steps to stop.



Figure 7 shows the example setting about selection motor rotate in single-step mode.

2.2.4 Warning message

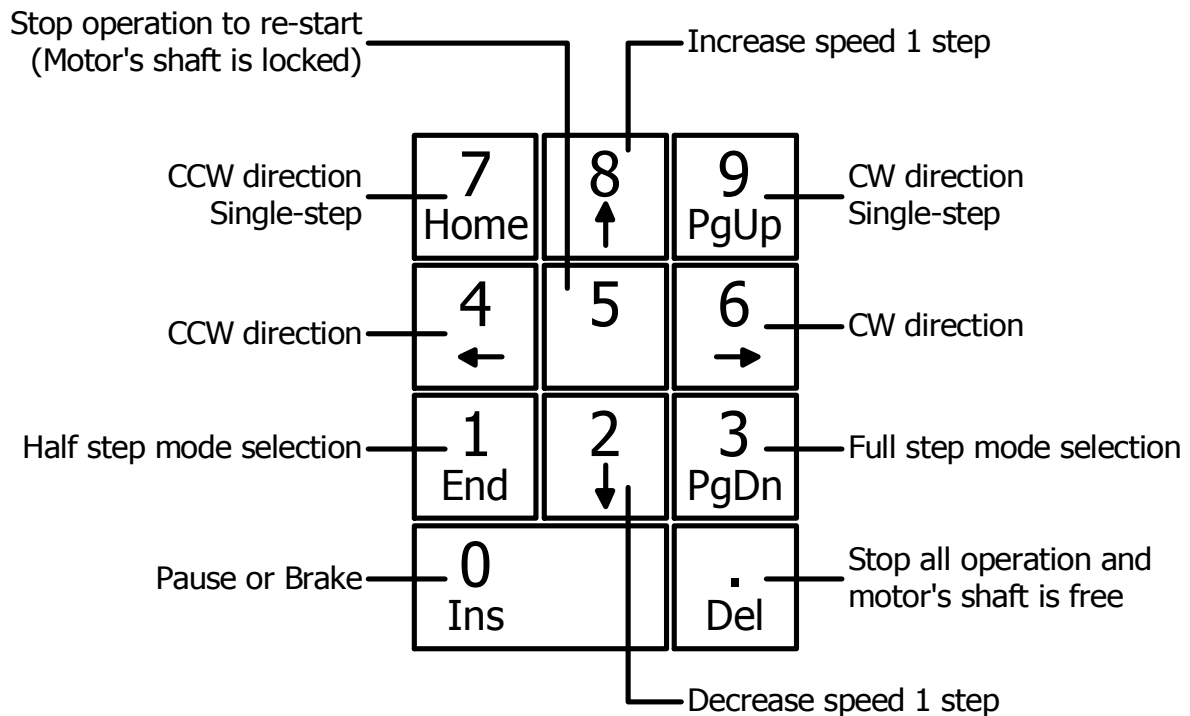
If the connection between computer and board in PC mode is failed, the error dialogue box will appear following the figure 8. User cannot control via computer. The solution is re-connect the cable or change the cable and click OK button in figure 8.



Figure 8 The error dialogue box about connection between computer and board is failed.

2.2.4 Control MC-3 V2.0 board with keyboard

User can control the MC-3 V2.0 board via keyboard. The first, press NumLock key on your keyboard. The NumLock indicator will turn-on. All numerical key will used to control. See the figure below:



3. Serial communication protocol

- RS-232 standard with 9600 baud in 8N1 format
- Start operation protocol :

MC-3 V2.0 board will set to standby mode for waiting for 4-digit ASCII command from computer. In this receiving does not send ACKNOWLEDGE signal back to computer. In case computer send code not complete 4-digit, MC-3 V2.0 board still wait for the command code complete.

The start operation command has 3 commands.

1. `xFF` : set to Single-step mode.
2. `xEE` : set to Continuous mode.
3. `xx00` : Off the driver circuit.

x means any ASCII character

● Operation communication protocol :

This protocol will use after the motor driver board is running. MC-3 V2.0 board will wait for 1-digit ASCII command. After receive command complete, microcontroller will send acknowledge signal back to computer. The acknowledge is ASCII code of * or # .

The command includes :

Command 0 : Brake motor

Command 1 : Half step mode selected

Command 2 : Decrease motor speed

Command 3 : Full step mode selected

Command 4 : Set motor to rotate left

Command 5 : Stop only driver circuit*

Command 6 : Set motor to rotate right

Command 7 : Brake and rotate left direction in one step.

Command 8 : Increase motor speed

Command 9 : Brake and rotate right direction in one step.

* Only this command the MCU will send ASCII of # to acknowledge. For another command will use ASCII of * to acknowledge.

