UTC Series

UtcPanel+
QUICK SETUP GUIDE

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Contents

A Step-By-Step Setup Guide For UTC Series

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Chapter 1. Service Level Guide

This is a step-by-step quick reference for an uninitiated user to setup a UTC system. It is essential to have a computer with RS232 communication port for UTC system setup. For some latest model notebook computers, which have a few USB ports but no RS232 port, please purchase a USB-to-RS232 adaptor and setup the adaptor prior to start the UTC system setup. As well, a panel software running with Windows Operating System, Windows 95 or higher version, is needed for the setup. Please contact Micro Trend to get an application disk or visit Micro Trend website to download the panel software.

1.1 Setup UTCPanel+_Eng On A Computer

In this section, we will show the novice how to connect a computer to the UTC control. If you have already successfully connected please skip this section.

1.1.1 Download UTC System Setup Software From Micro Trend Website.

Please visit: http://www.utrend.com.tw and click “SERVICES” from any page of the site. Then enter name: utrend and password: 7173. In the service page, two different versions of the UTC operation manual and the setup software will be found. Please download the execution software – UTCPanel+_Eng from this page.

1. From Micro Trend Website, click “SERVICES”

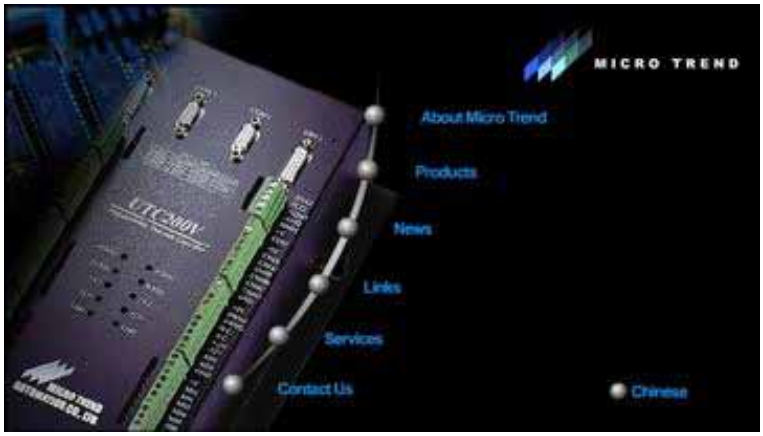


Fig1.1

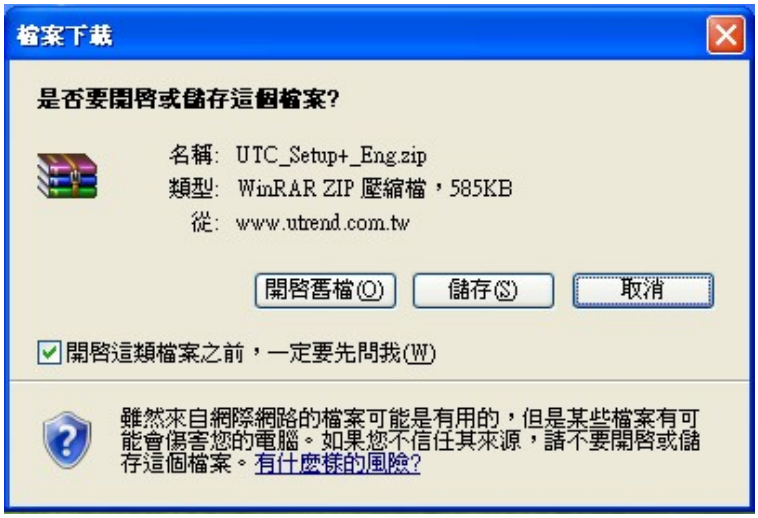
2. Then enter name: utrend and password: 7173

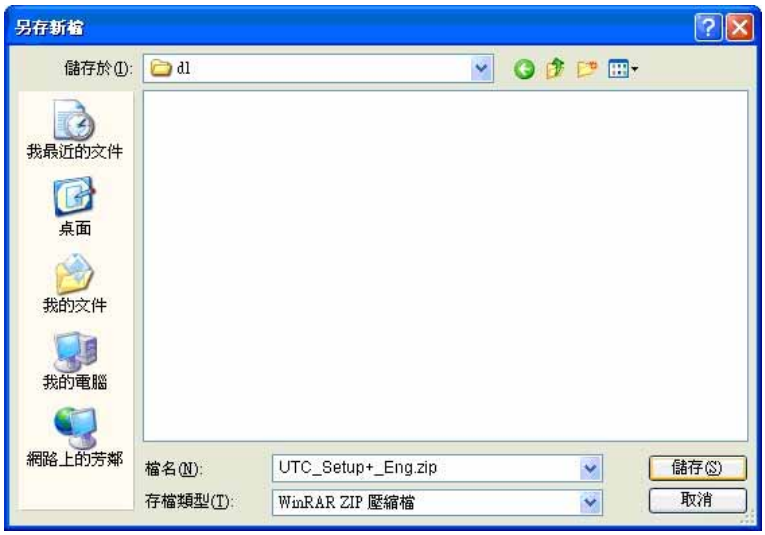
Fig1.2

3. Download the execution software – UTCPanel+_Eng

Fig1.3

4. Save UTC-Setup+_Eng.exe





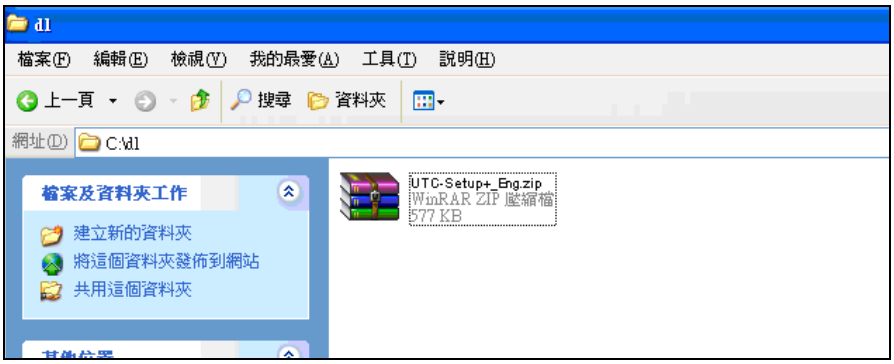


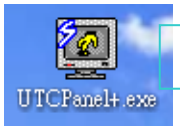
Fig1.4

1.1.2 Install the Application Software UTC_Setup+_Eng On the Computer

From Micro Trend application disk or downloaded resource, we get a file named UTC_Setup+Eng.zip. Unpack this file, we will get two files, UTCPanel+.exe and UTCPanel+.lng. File UTCPanel+.lng is used for multi-language, it's a text file. Anyone can modify the contents with his own characters.

The related solution of unpacking step please refer to Fig 1.6.

Unpack UTC_Setup+_Eng.zip to his own hard driver. We can make a short-cut of UTCPanel+.exe to the desktop, an icon named UTCPanel+.exe will be shown on the desktop screen. Please connect the RS232 cable and turn the UTC control power on before clicking the UtcPanel+.exe icon as Fig1.5.



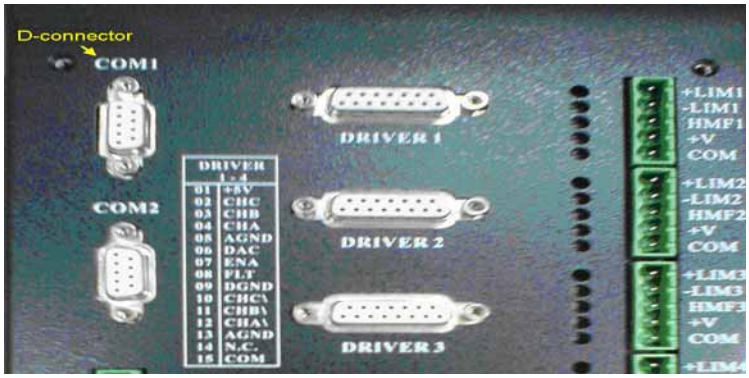
The icon.

Fig1.5

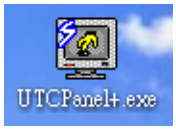
Fig1.6

1.1.3 Connecting RS232 Cable From the Computer to UTC Controller

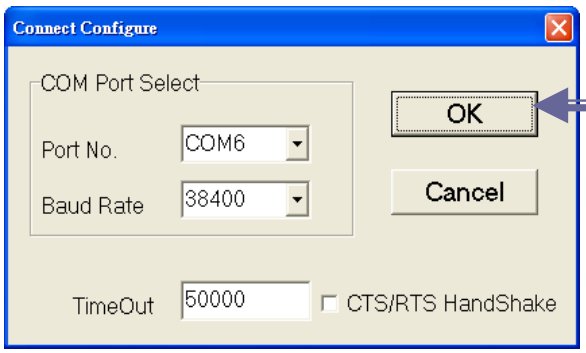
The connection cable for computer to UTC controller is a one-to-one 9 pin D-connector with pin 9 cut off. Please make the connection when control power is turned off. The default protocol for UTC COM1 is 38400, N, 8, 1 with RTS/CTS flow control. It can be changed by setting the dipswitch 2 and 3 on the control board. The default protocol for UTC COM2 is 19200, N, 8, 1 without flow control. It can be changed by I-Parameter 2 and 3 settings.



1.1.4 Run the UtcPanel+ On the Computer



With the RS232 cable connected, computer serial COM port properly installed and control power turned on, click the UTCPanel+ icon on the desktop. If UTCPanel+ is used in this computer for the first time, it can't be connected to the control. The information will be shown on the screen.

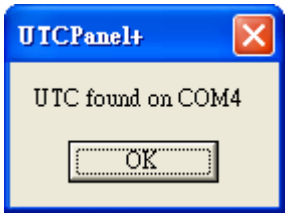


Setup window.
***The port number should be set to match the computer serial port, not the UTC port.*

Please setup, under the message, the RS232 connection protocol, including COM port number, BAUD rate, delay time and flow control handshake (CTS/RTS). Please correctly set the computer COM port number, BAUD rate 38400, delay time 50000 and select CTS/RTS to non-activate flow control. Then click "OK" to approach again

communicating with the UTC control. The information “Card found on Comx” will be shown on the screen to indicate that the software setup process has been finished and the communication between computer and UTC control is successful. If still “No control card found”, please follow section 1.1.5 to do the diagnostic process.

1. The information “Card found on Comx” the communication between computer and UTC control is successful



If this screen shows up, it indicates that the connection is successful;
Click “OK” to enter the panel page

1.1.5 Communication Failure between Computer and UTC

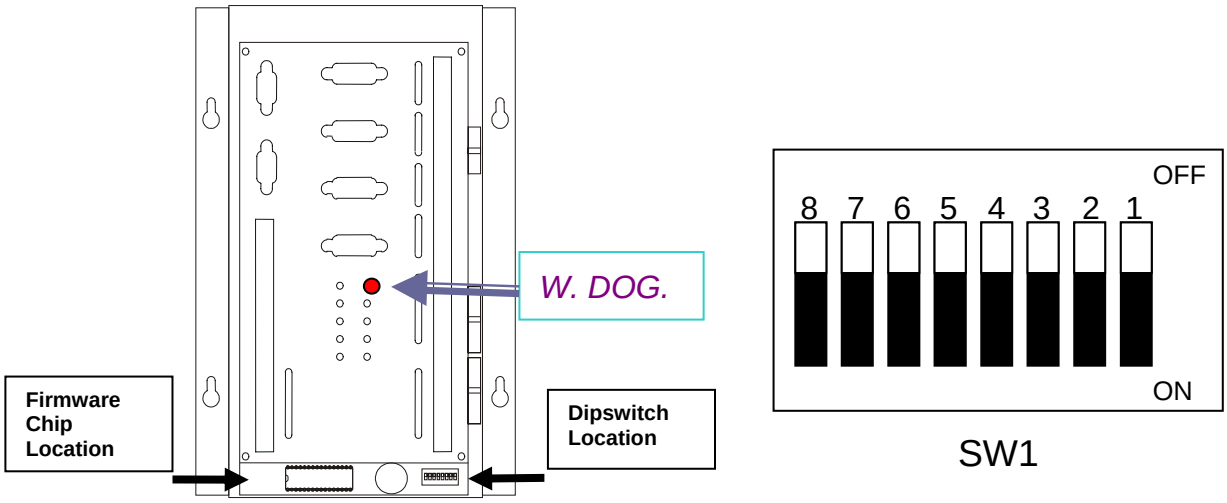
The communication failure problem could be at computer side, controller side or the connection. Please re-check the one-to-one connection cable, pin 9 should not be connected, and verify the computer serial port settings. At UTC controller side, please take the following steps to identify the problem.

1. If the message shows “Can’t open communication port!”
   It indicates that the problem is at the computer communication port; either set to a non-exist port number or this port has been occupied by other application software. Please check the computer property and then set it to right port number or turn off other application software that occupies this communication port.

**Sometimes this problem could happen by double clicking the icon twice to cause the second approach failure.

2. Check the dipswitch 2 and 3 settings.
   Please turn both the dipswitch 2 and 3 off if any of them not been turned off. Then re-turn-on the control power and try again to do the connection. The dipswitch 2 and 3 decide the COM1 BAUD rate. When both of them turned

off, the COM1 BAUD rate is 38400. Please use the following table for other BAUD rate settings.



NO.2	N0.3	COM1 baud rate
OFF	OFF	38400
ON	OFF	19200
OFF	ON	9600
ON	ON	115200

3. Check the “W. Dog” LED.
   This LED should turn on for a few seconds then turn off after power up. When “W. Dog” LED turns on, the control does not do any communication or run any user programs; it indicates that the control is in an abnormal situation.
4. What to do if the “W. Dog” LED does not turn off after power up?
   Please turn the dipswitch 1, on the control board, to on position then power up. This action reset the all the UTC parameters to the default values and clear all the preloaded motion programs and PLC programs. If the LED still keeps turned on all the time after this process, the control board or the firmware chip should be replaced. Please contact Micro Trend to request for service.
5. Try using COM2 instead of COM1.
   If the “W. Dog” LED turns off after the reset process but still unable to communicate with COM1, please turn off the control power and switch the connection to COM2. Then try COM2 with BAUD rate 19200 and no CTS/RTS flow control.
6. If the computer still cannot find the UTC control after all these approaches, please contact local service people or Micro Trend for help.

1.2 Using UTCPanel+ To Do the UTC Control Setup or Maintenance

In this section, we will explain the setup and program update procedure using a computer running UTCPanel+ software. These procedures are normally for a service engineer who would like to setup or update software to a new machine with a fully tested user program.

1.2.0 Get some information from the controller through “Online Commands” window.

Once the computer successfully finds the control card by running “UTCPanel+”, we can start the service level actions from the computer. We can download the basic setup file for different versions, change parameter or variable settings, monitor the system status, download motion programs or PLC programs, issue the Online-Commands, backup system configurations or update firmware. Now, we first get some information from the controller through “Online Commands” window. Also, we will request the controller to take some actions upon our Online Commands.

If the control is well connected to the computer, the following page will be on the screen.

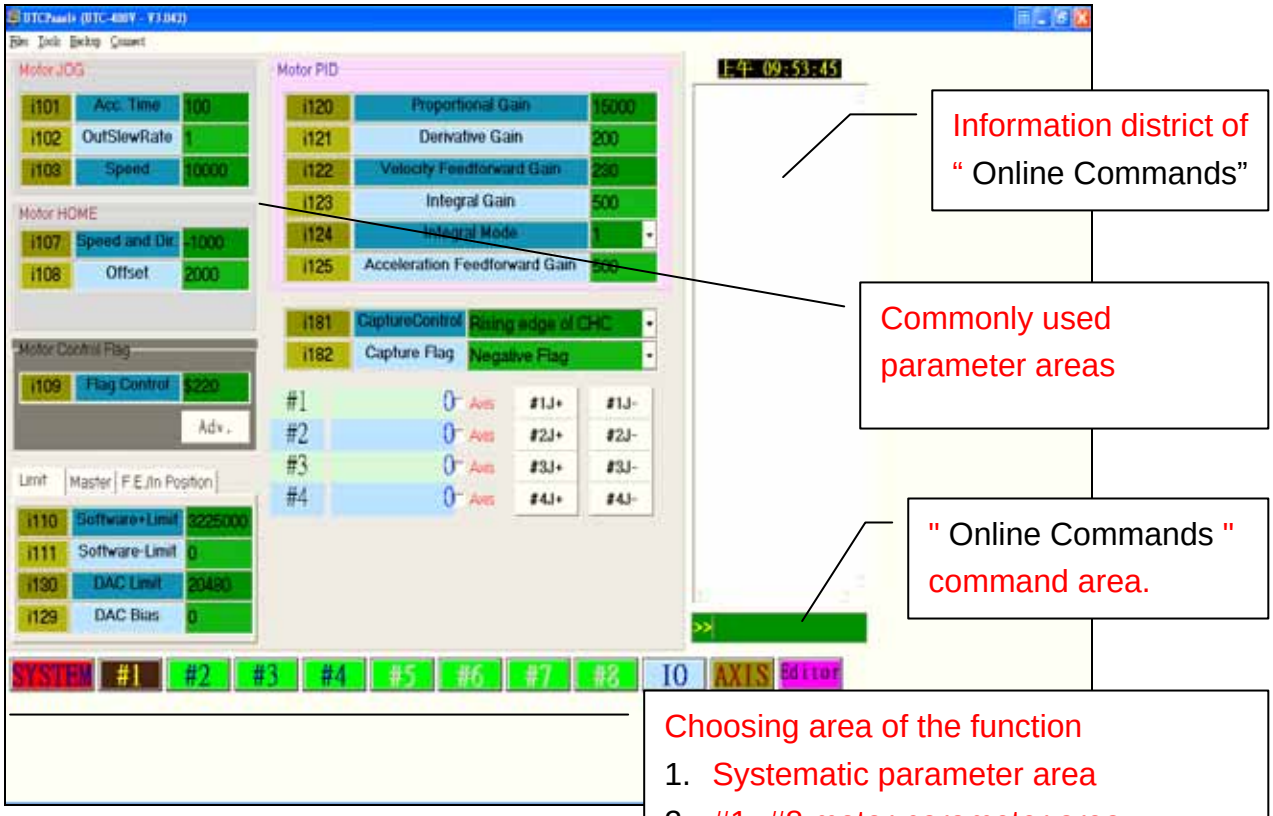


Fig 1.2.0.1

1. You can see window. Fig 1.2.0.1 including the Online Commands

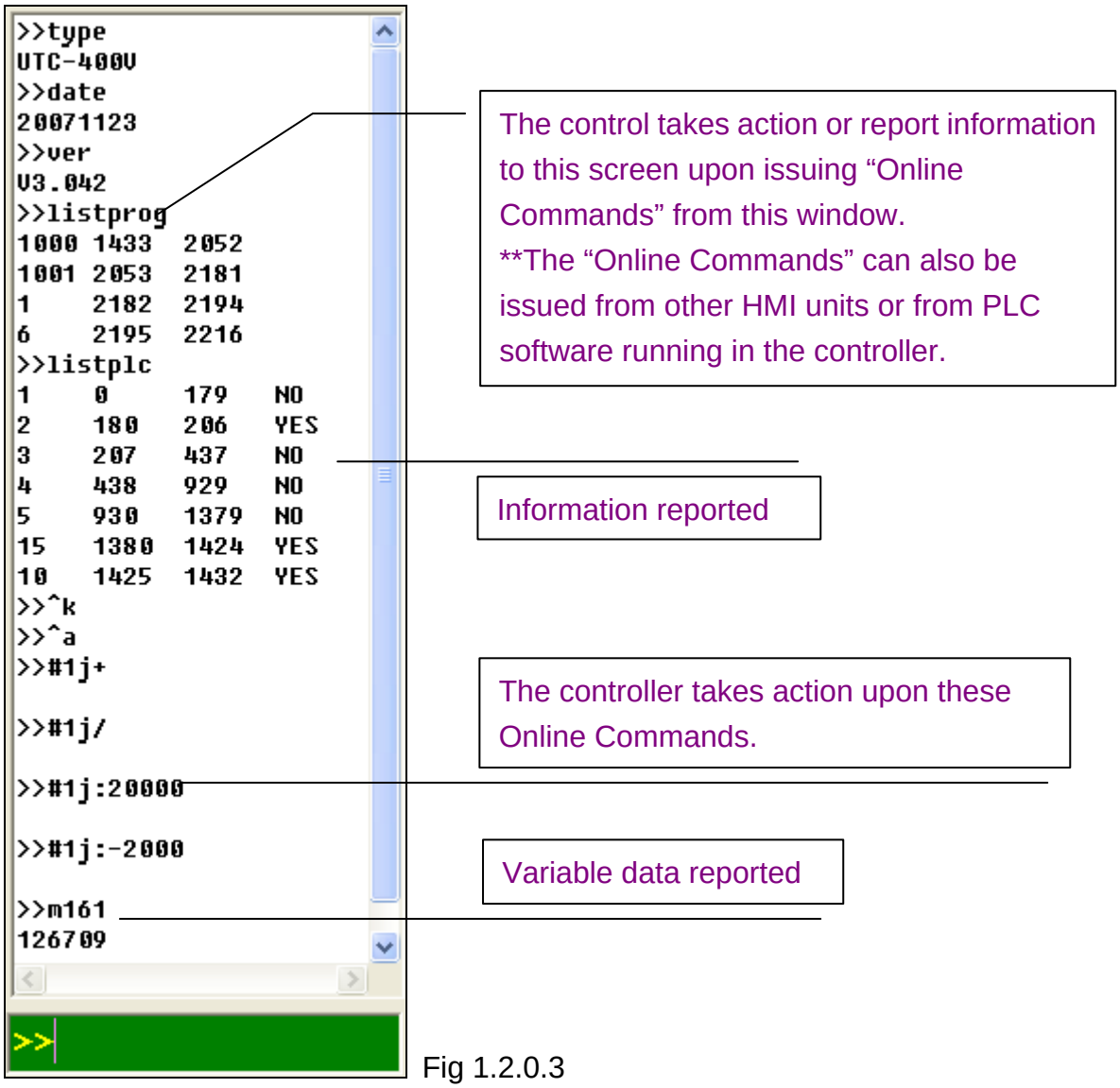


Fig 1.2.0.3

As shown in the Fig 1.2.0.3, we can see that the control reports information or takes action upon the online commands we issue from the window. Actually, the control report to any serial port, which sent commands to request information. Also, it takes action upon receiving any online command from any serial port even from a PLC program, which is enabled. A full set of “Online Commands” explanation can be found in the UTC control manual “Online Commands” section.

1.2.1 Download the UTC Default Setup File.

For each different model or version of UTC, Micro Trend preloads in the controller before shipment a dedicated default setup file bases on customers' orders. This basic setup file is a set of default M-Variable-definitions. These M variables are generally used in most of the PLC programs or motion programs. If the control firmware version has been changed or a hardware or software reset process has been performed, we should re-download the basic setup file. The following table shows the files for various models and versions.

Model	Version	M-Definition File
UTC400P/200P/100P	2.2x/2.1x	400P220.UTC
UTC400V/200V/100V	2.2x/2.1x	400V220.UTC

However, each of these M-Variable-Definitions can be redirected to different memory location for different purposes.
Please follow these procedures to download the default setup file to the controller.

1. For first time setup, before the downloading, please use the online command "$$$***" to clear all the memory in the controller.

Fig 1.2.1.1

2. Click “File” the “Download to UTC” then “File” as shown in Fig 1.2.1.2

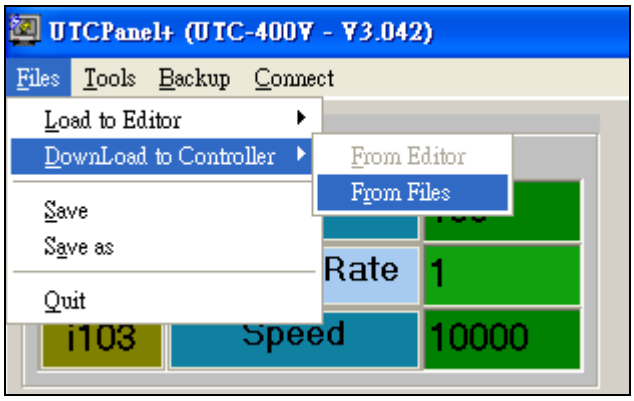


Fig 1.2.1.2

3. Select the right file type and then a target default setup file from the computer and then click “Open”

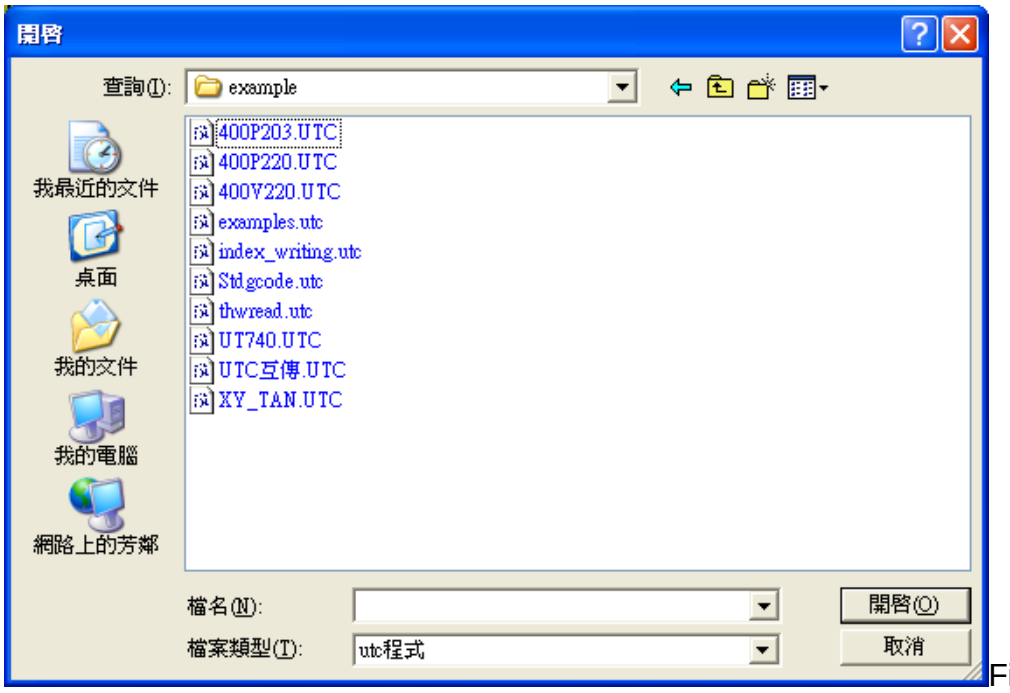


Fig 1.2.1.3

4. It takes a few seconds to minutes for the downloading depends on the file size. There is a blue bar to show the percentage of completed portion during download process, as Fig 1.2.1.4.

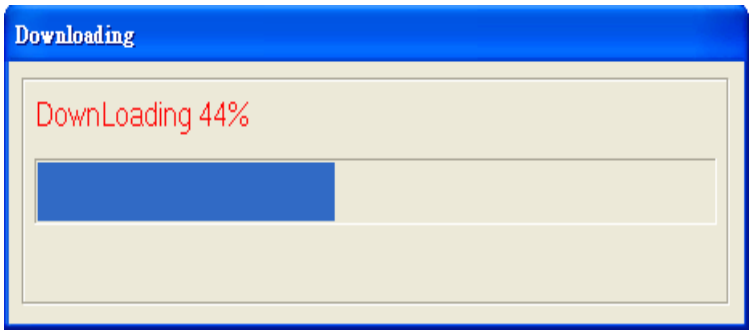


Fig 1.2.1.4

1.2.2 Download the User Program File or Backup File

To activate a UTC control system, there must be some PLC programs and/or some motion programs pre-loaded in the controller and activated. We call them user application programs or user programs. Normally, the user programs are put in a file; we call it user program file; with extension UTC. After a control system is fully tested, we may upload all the parameter and variable settings as well as all the user programs then store these items in a file. We call it backup file, with extension DAT. Please be aware that these UTC or DAT files are with simple ASCII text format. The process is the same as downloading the default setup file only choosing different file. Normally, the user program file should be loaded after the setup file. Otherwise, it is possible that some parameters, which have been set to match an individual application, will be reset to the default value and cause mal-function.

1.2.3 To Activate the Control System

After we go through the process 1.2.0 to 1.2.2, we have a well-tested user program loaded in the UTC controller. We may activate the control system at this moment if the initial variables and parameters are included in the user program. Otherwise, we might need to set some parameters or variables for an individual system before activating the control. For example, the unit ratio between the encoder counts and the customer define unit. It could be various for each individual machine and leave for the machine setup engineer to finish the settings.

There are some possible ways to activate the system control after first time the software is loaded in the UTC. It is flexible to allow the users to choose their own way to activate the control system. The following is some typical ways to activate a UTC control system.

1. Activates by setting PLC control parameter I6.
   Set the I6 to 1, 2 or 3 to activate the PLC control programs.
   In most situations, we write PLC programs to control the whole system, including starting a motion program. Set I6 to a suitable value can activate all the system PLC programs immediately.
2. Activate an individual PLC program by the PLC enable command.
   We may use the command “enaplc x” (x=0 to 15) to test an individual PLC program.
3. To run a motion program by the motion program enable command.
   We may use the command “BxR” (x= program number) to start a motion program running.

1.2.4 Saving All the Control Programs And Variables In the Flash ROM.

It is very important for a working control system to save all the content in the working space, SRAM with backup battery, to the Flash ROM space. In case someday the data in the SRAM are destroyed by low battery or any other reason, we can restore all the content back to the SRAM from the Flash ROM.
The saving process should be done whenever:

- The machine setup is first time finished.
- The PLC programs or motion programs are modified.
- The compensation data is changed.
- The EEPROM (Flash ROM) is replaced.
- The UTC system firmware is updated
- Any other variables settings are changed

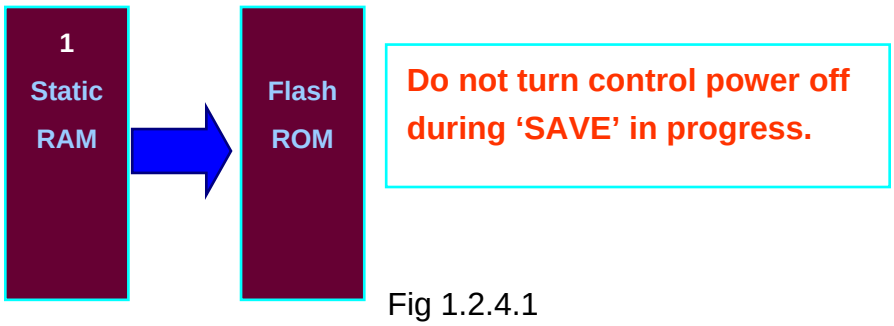


Fig 1.2.4.1

1. Before processing the saving process, please type from the online commands window to disable currently running motors and PLC programs.

   >>^A ;Abort currently running motion program.

   >>^D ;Disable currently running PLC program.

   >>^K ;Disable currently enabled motors

2. To do the saving process, we simply type “Save” in the online commands window.

   >>Save ;To start the saving process

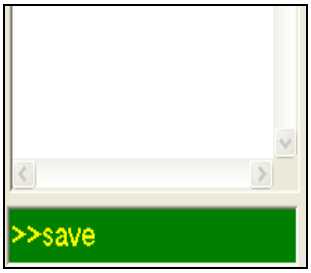


Fig 1.2.4.2

3. The saving process will take a few seconds; please do not turn the control power off during the saving process.

4. After the saving process, we may re-turn-on the control to get the controller back to normal operations.

1.2.5 Saving All the Control Programs And Variables In a File to the Computer.

Besides saving the control data in the Flash ROM, we can also save a copy of all the control variable settings and user programs in a computer. For the next identical UTC control setup, we may download this backup file instead of the default setup file and the user program files. Please see section 1.2.2 for the download process.

The backup process is as follows.

1. Select “Backup Configurations” from the tools menu or directly from the tool bar.

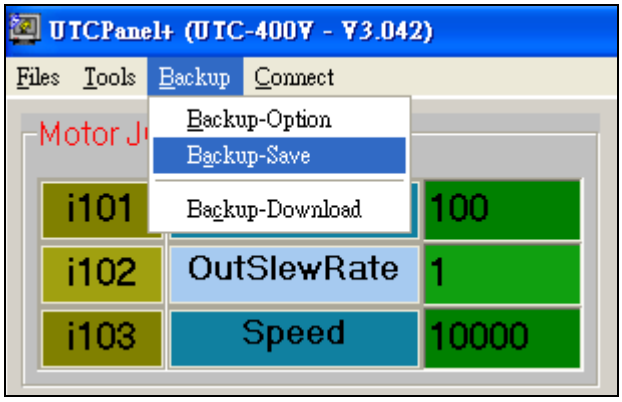


Fig 1.2.5.1

2. Give a file name for this backup file and save it in a selected directory.
   The default extension of the backup file is XXXX.dat.

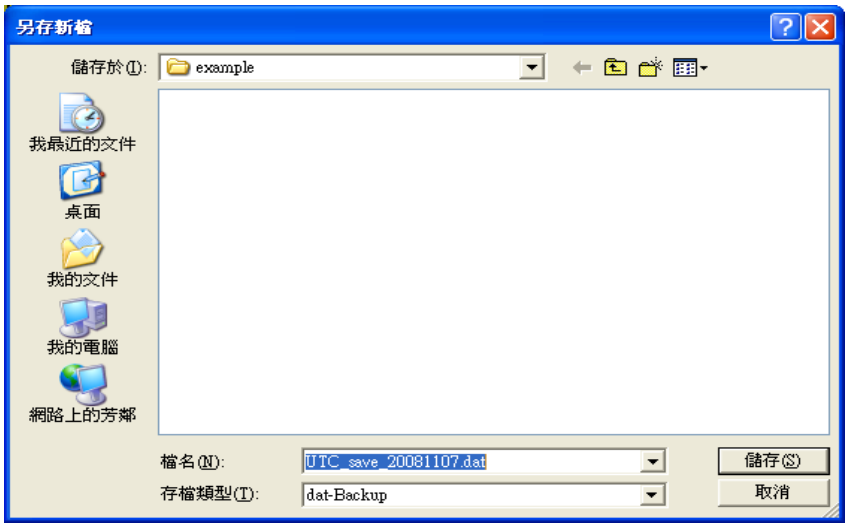


Fig 1.2.5.2

4. The backup process could take a few seconds to minutes. There is a blue bar to show each data group processing. (Fig 1.2.5.3)

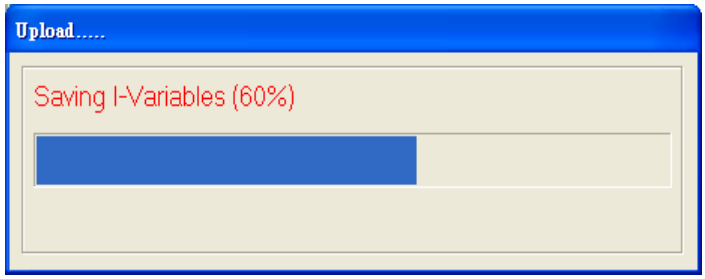
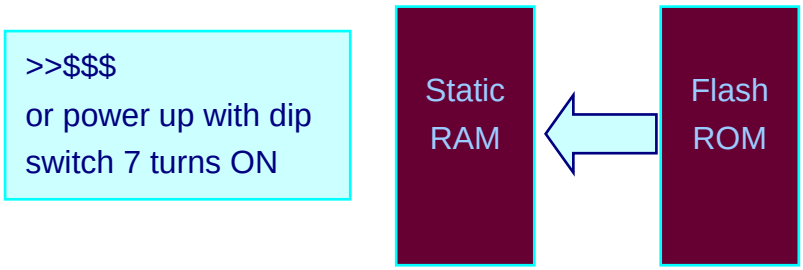


Fig 1.2.5.3

1.2.6 Restore the Data saved in Flash ROM to the SRAM

No matter what reason causes the control working space data losses, we may restore all the data back from the Flash ROM. There are two ways to get the data back from the Flash ROM.

1. If the RS232 communications still works fine when the control data losses happens, we may simply type “$$$” in the online commands window to get the data back from the Flash ROM.
2. If the RS232 communication no longer works, please turn the control power off. And then, turn the control power on with the dipswitch 7 ON. The dipswitch location is described in section 1.1.5.



1.2.7 UTC Firmware Update

The UTC control system software handles all the control behaviors including decoding the PLC and motion program, communicating with HMI through RS232, servo controls and other protection features. Micro Trend keeps updating this software to provide better features or improve the control performances. To update the UTC control system software for the hardware in the customer site, we can also use the UTC_Setup+_Eng setup software.

This is the procedure to do the system software update.

The same as the saving process, before doing the firmware upgrade, please type from the online commands window to disable currently running motors and PLC programs.

```
>>^A        ;Abort currently running motion program.
>>^D        ;Disable currently running PLC program.
>>^K        ;Disable currently enabled motors
```

1. From the tool bar, click “Tools” then select “Firmware Upgrade”

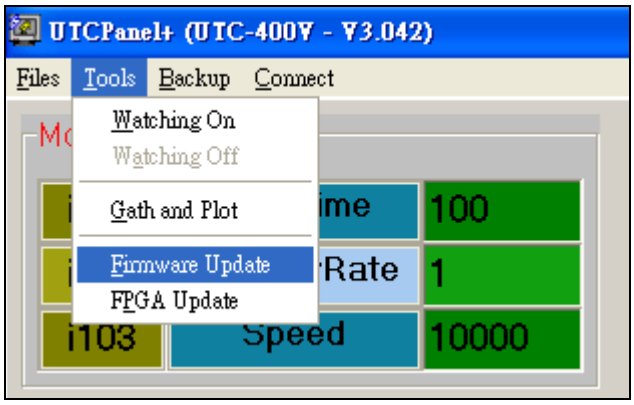


Fig 1.2.7.1

2. Select the target BIN file that stored in the computer

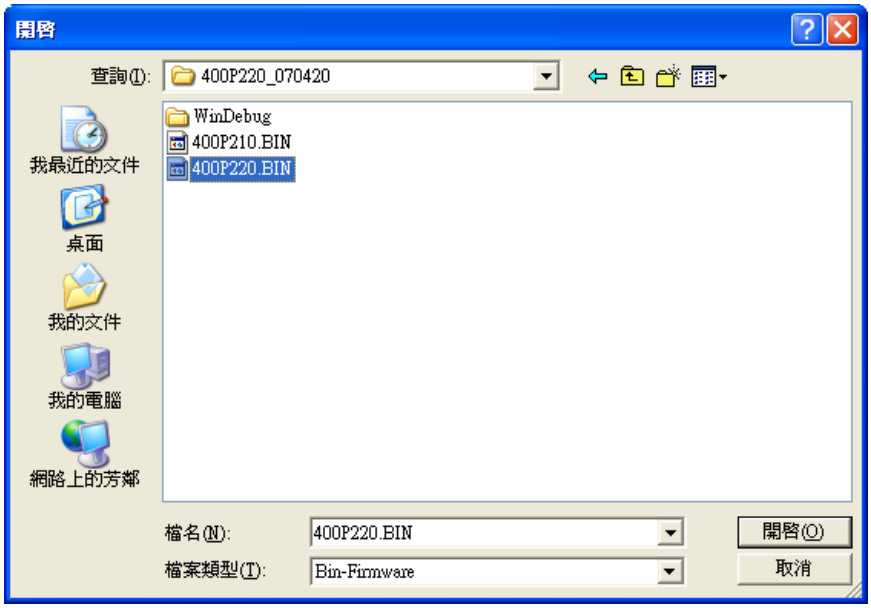
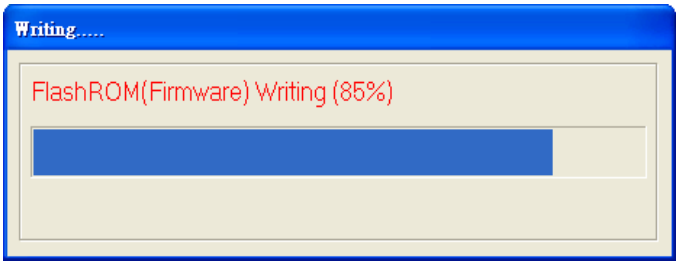
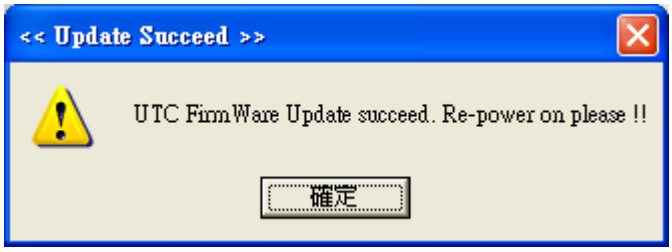


Fig 1.2.7.2

3. The firmware upgrades process. All over the new firmware downloading process, please do not turn of the control power. Otherwise, the system firmware will be permanently destroyed. And, the control will no longer works unless we replace the Flash ROM.
   i. The flash erases process; the erasing message shows on the screen for a few seconds. Then, turn to process b to write the new bin code to the flash ROM.
   ii. Write the new bin code to the flash ROM; there will be a blue bar to show the downloading progress on the screen.



iii. After the Flash Writing completed, there will be following message shows on the screen.

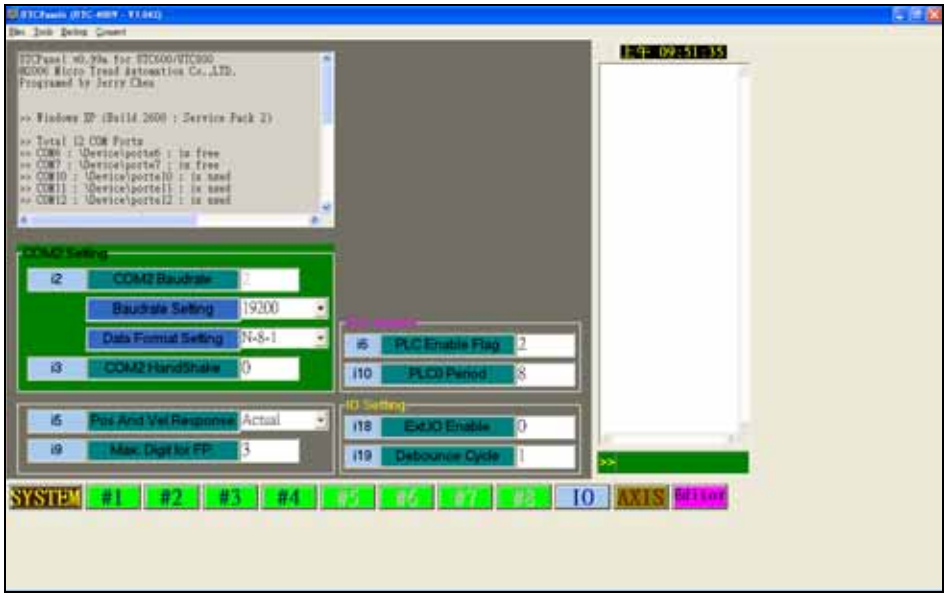


iv. Now, we can turn off and re-turn-on the control power to run the new system software.

4. If the major firmware version code is changed, it indicates that there are major changes have been made in the new version. We may need to re-setup the system. In this case, please turn the control power on with dipswitch 1 in the “ON” position to re-initiate the control. And then, follow section 1.2.1 to 1.2.5 to re-setup the control. **Please don’t forget to turn the dipswitch 1 back to off position each time after we turn it on at power up.** Otherwise, the data in the SRAM area will be cleared at next power up. In that case, we will have to process 1.2.1 to 1.2.5 one more time.

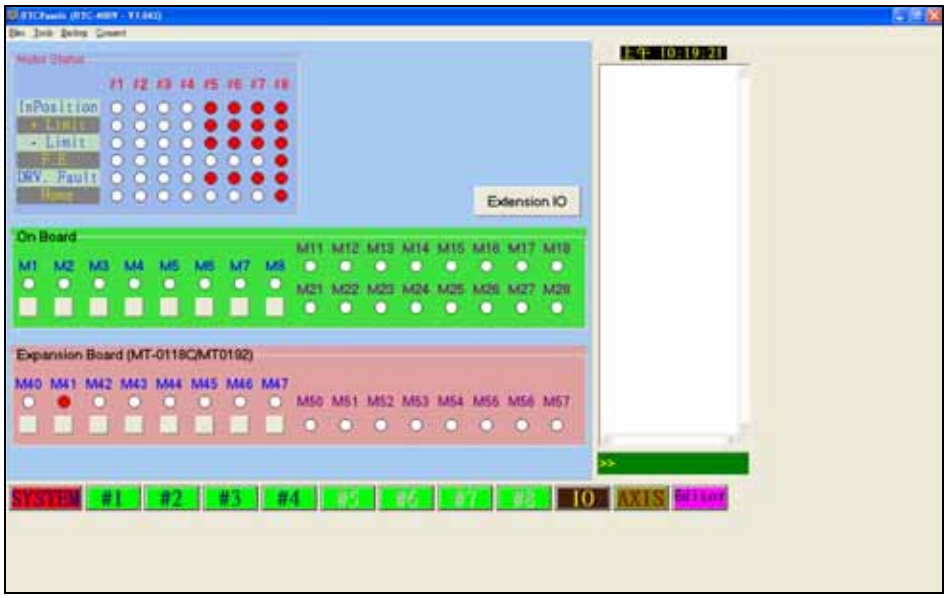
1.2.8 Introduction of all kinds of UTCPanel+ functions

1. Systematic function display
   It is a system parameter setting area, like the setting of COM2, the setting of PLC etc. There is also relevant explanation about the connection of the computer on the left-top of the display. This version can understand the COM port status of the computer and is helpful on the connection to the computer.
   (This future, because of the administration authority of Vista, is not able to use under Vista)



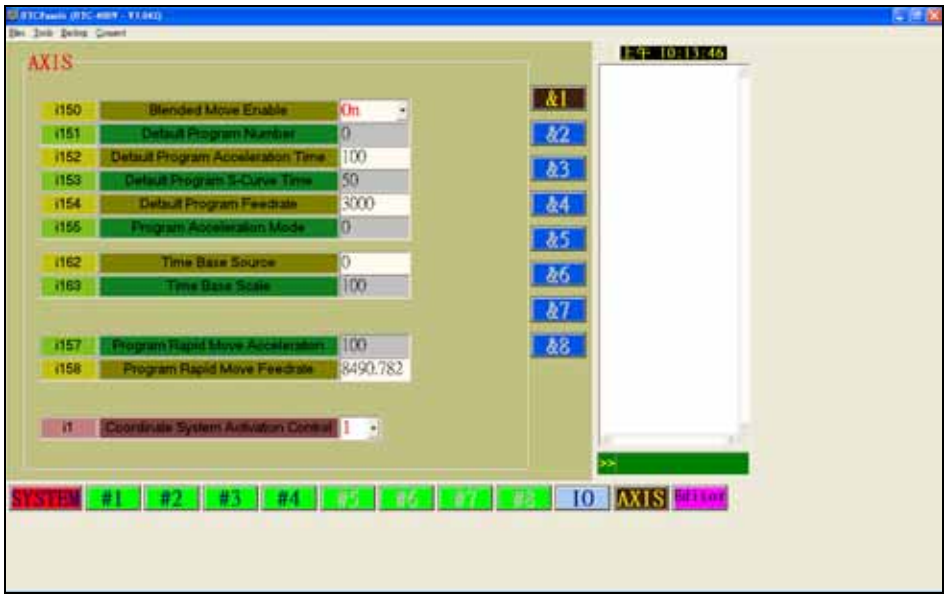
2. I/0 Status display

It is used for measuring and setting up the status of I/0, also support the extension card like, MT-0118C / MT-0192 / MT-0170.



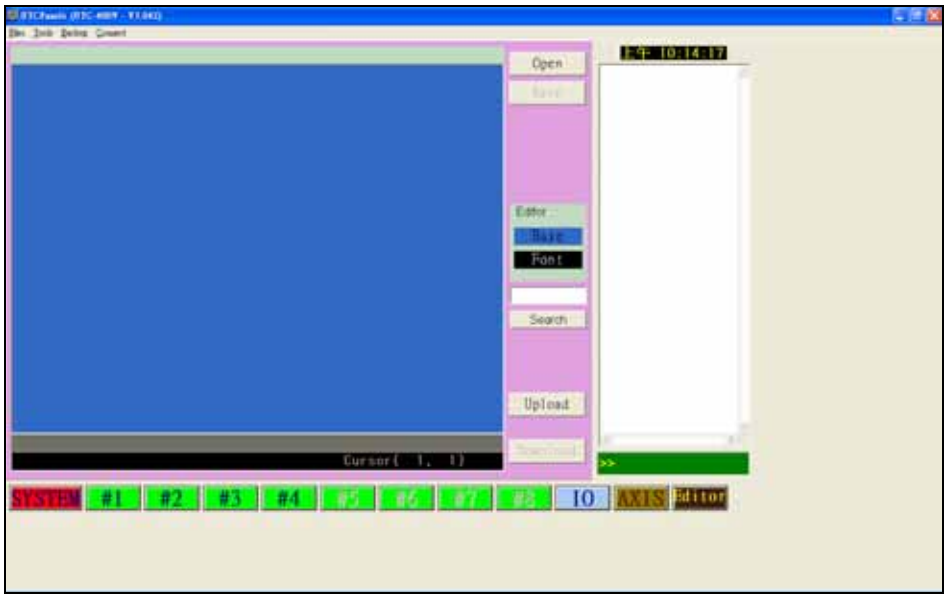
3. Coordinate systematic parameter display

Used for setting up the parameter of all kinds of the coordinate systems.

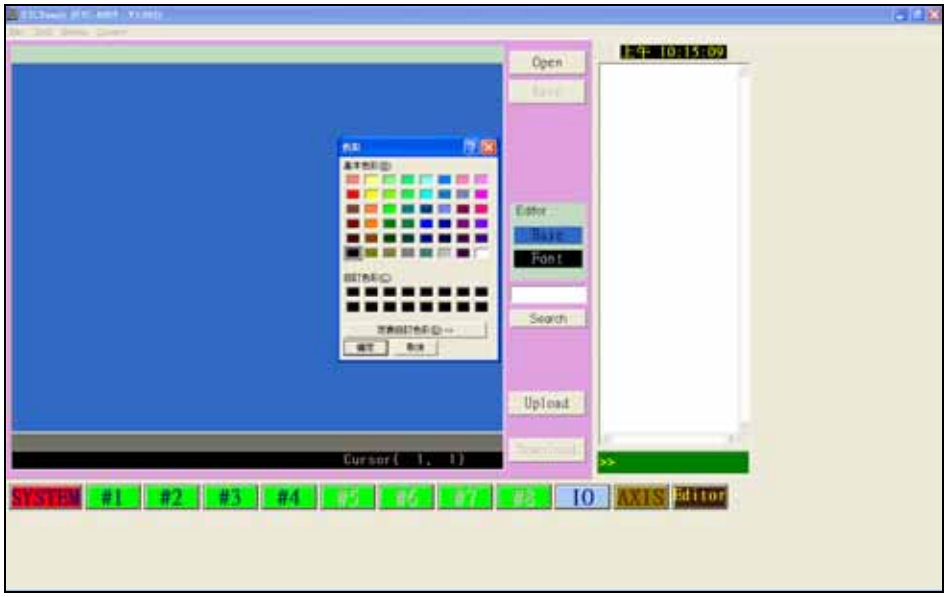


4. Display of the simple and easy editor

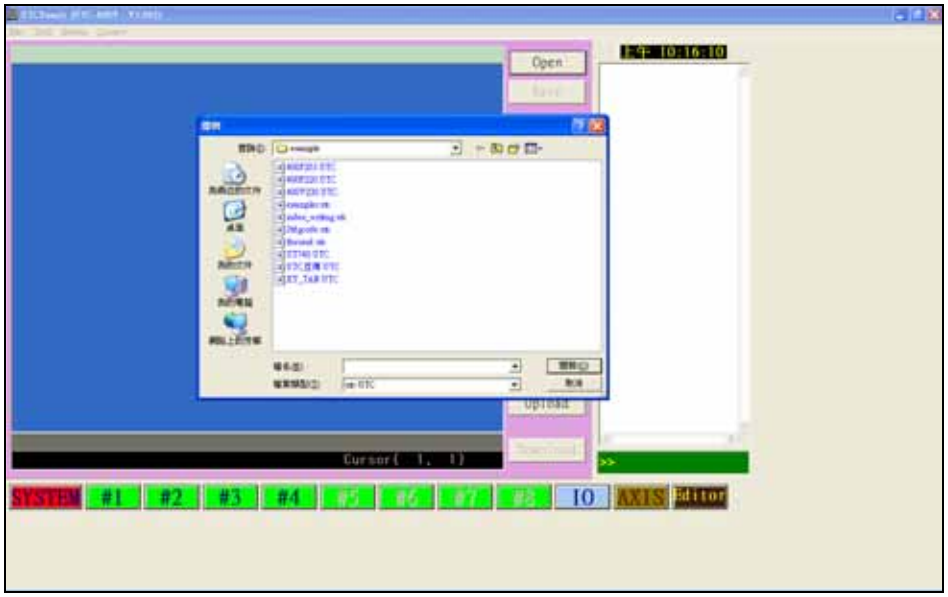
Offer a simple and easy editor to write or revise programs.



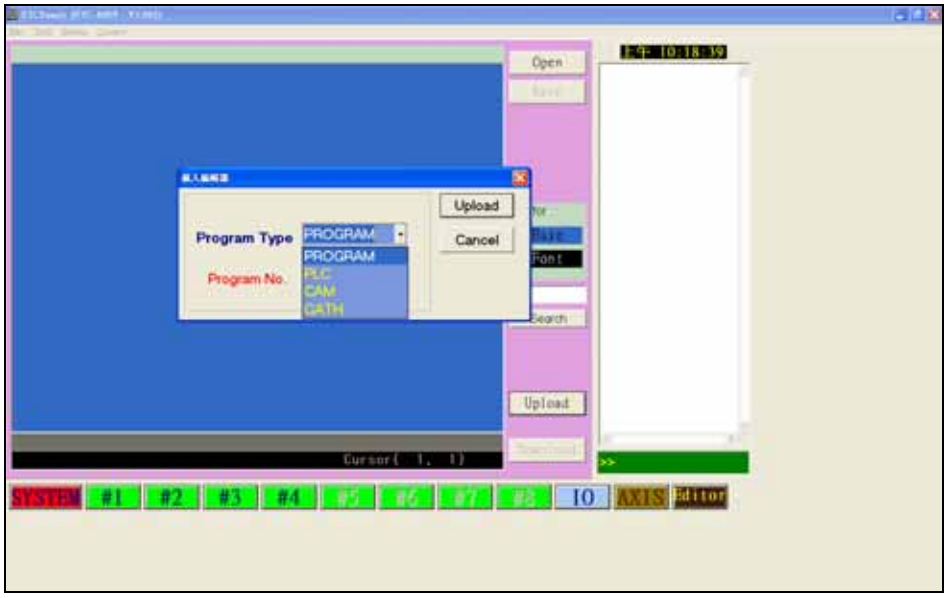
< Can alter the color of the base or the character of the editor >



< Download the file to the editor >



< Upload the program or the plc of the controller to the editor >



1.2.9 Some More Online Commands On Service Propose

There are many online commands that are dedicated for service proposes. Please read the “UTC Motion Controller Manual” for the detail. The following are some of the examples.

>>Type --- The control will report a short description of this firmware version

>>Ver ---

>>Date

>>

1.3.0 Some Parameters Regarding Control Setup

1. Online Command Summary

Notes

spaces	**:** Spaces are not important unless special noted
{ }	**:** Item in **{ }** can be replaced by anything fitting definition
[ ]	**:** Item in **[ ]** is an option
[{item}…]	**:** Repeated syntax
[..{item}]	**:** The periods are used to specify a range

Definitions

constant	**:** Number that is non-changeable
variable	**:** Variable like **I , M , P , Q**
expression	**:**combination of constant, variable, function and operator
data	**:**constant without parentheses or expression with parentheses
axis	**:** element of coordinate system. It can be X, Y, Z, U, V, W, A, B, C

2. Global Online Command

<CONTROL-A>

Function Abort all Program Execution and motor moves
Syntax ASCII Value 1

<CONTROL-D>

Function Disable all PLC programs
Syntax ASCII Value 4

<CONTROL-K>

Function Disable all drivers
Syntax ASCII Value 11

$$$

Function Card Flash Reload
Syntax $$$

$$$***

Function Card reset and re-initialization
Syntax $$$***

CLEAR

Function Clear currently opened buffer
Syntax CLEAR
CLEARALL

CLOSE

Function Close the currently opened program buffer
Syntax CLOSE

DATE

Function Report the controller firmware date.
Syntax DATE

DISPLC

Function Disable the specified PLC(s)
Syntax DISPLC{constant}[,{constant}. . .]
{constant} is a positive integer representing PLC number, ranging 0~15

ENAPLC

Function Enable the specified PLC program.
Syntax ENAPLC{constant}[,{constant}. . .]
{constant} is a positive integer representing PLC number, ranging 0~15

HM

Function Motor home searching
Syntax HM

HMZ

Function Do a Zero-Move Homing
Syntax HMZ

I{constant}

Function Report the specified I-variable value
Syntax I{constant}[..{constant}]
{constant} is an integer representing I variable number, ranging 0~1023

I{constant}={expression}[;]

Function Assign The specified I-variable value.
Syntax I{constant}[..{constant}]={expression}
{constant} is an integer representing I variable number, ranging 0~1023
The second {constant} should be greater than the first one; it represents the ending I-variable number.
{expression} is an expression
[;] means to report the value of this I-variable value.

J+

Function Jog to positive direction.
Syntax J+

J-

Function Jog to negative direction.
Syntax J-

J/

Function Jog stop.
Syntax J/

J:

Function Jog a variable specified distance
Syntax J:

J:{constant}

Function Jog a distance specified by {constant}
Syntax J:{constant}
{constant} is a floating point value representing the distance to jog in count..

J=

Function Jog to a variable specified absolute position.
Syntax J=

J={constant}

Function Jog a motor to a specified position
Syntax J={constant}
{constant} is a floating point value representing the absolute position to jog in count..

J*

Function Jog the addressed motor back to the motion program stop
Syntax J*

LIST PLC

Function Report the existed PLC program number or specified PLC Program contents

Syntax LIST PLC {constant}

{constant} is positive integer representing the number of the PLC Program to reported, ranging 0~15.

LISTPROG

Function Report the existed motion program numbers or specified motion program contents

Syntax LIST PROG{constant}

{constant} is positive integer representing the number of the motion program to be reported.

M{constant}

Function Report the specified M variable value

Syntax M{constant}[..{constant}]

{constant} is an integer representing the variable number to be specified or the starting variable number, ranging 0 ~ 1023.

The 2nd {constant} representing the end number of variable to be reported, its value should be larger than the 1st one.

M{constant}={expression}[;]

Function Set the specified M variable value

Syntax M{constant}[..{constant}]={expression}

{constant} is an integer representing the variable number to be specified or the starting variable number, ranging 0 ~ 1023.

The 2nd {constant} representing the end number of variable to be set, its value should be larger than the 1st one.

{expression} Representing the value to be set.

[;] means to report the value of this M variable.

M{constant}->

Function Report M variable definition

Syntax M{constant}[..{constant}]->

{constant} is an integer representing the variable number to be specified or the starting variable number, ranging 0 ~ 1023.

The 2nd {constant} representing the end number of variable to be reported, its value should be larger than the 1st one.

M{constant}->*

Function Assign M{const} as a normal variable.

Syntax M{constant}[..{constant}]->*

{constant} is an integer representing the variable number to be specified or the starting variable number, ranging 0 ~ 1023.

The 2nd {constant} representing the end number of variable to be assigned, its value should be larger than the 1st one.

O{constant} For Pulse Command (UTCx00P)

Function Set the output pulse frequency in the unit Pulses/msec

Syntax O{constant}

{constant} is an integer representing the pulse number per msec, ranging -250~250.

OUT{constant} For Voltage Command (UTCx00V)

Function Set the output voltage

Syntax OUT{constant}

{constant} is an integer representing the ratio of **Ix30** voltage, ranging -100~100.

P{constant}

Function Report specified P variable value

Syntax P{constant}[..{constant}]

{constant} is a positive integer representing the P variable, ranging 0~1023

The 2nd {constant} representing the end number of variable to be assigned, its value should be larger than the 1st one.

P{constant}={expression}[;]

Function Set the specified P variable value

Syntax P{constant}[..{constant}]={expression}

{constant} is a positive integer representing the P variable, ranging 0~1023

The 2nd {constant} representing the end number of variable to be assigned, its value should be larger than the 1st one.

{expression} is the value to be assigned.

[;] means to report the value of this P variable.

Q{constant}

Function Report specified Q variable value

Syntax Q{constant}[..{constant}]

{constant} is a positive integer representing the Q variable, ranging 0~1023

The 2nd {constant} representing the end number of variable to be assigned, its value should be larger than the 1st one.

Q{constant}={expression}[;]

Function Set the specified Q variable value

Syntax Q{constant}[..{constant}]={expression}

{constant} is a positive integer representing the Q variable, ranging 0~1023

The 2nd {constant} representing the end number of variable to be assigned, its value should be larger than the 1st one.

{expression} is the value to be assigned.

[;] means to report the value of this Q variable.

RD{address}[,{length}]

Function Report the contents of the addressed buffer memory.

Syntax RD(D(dec)/H(hex) /L(float){address}[,{length}]

{address} points to the buffer memory you want to list. It should be 16 bit, ranging from $0~FFFF

{length} means the length of the buffer memory you want to list.

SAVE

Function Save all the contents from static RAM to FLASH ROM.

Syntax SAVE

SIZE

Function Report the available buffer size.

Syntax SIZE

TYPE

Function Return UTC module number, and version description.

Syntax TYPE

VER

Function Report the controller firmware version.

Syntax VER

Chapter 2. Designing With UTC Control

In this chapter, we will study how to start a project design with UTC control. We will start with some simple application projects that are ready for applying to a customer's machine. All the sample projects include a series of illustrations of the design procedures. Before going through with this chapter, please at least have a rough review on "UTC Motion Controller Manual" to get the basic idea of all the variables, parameters, online commands and buffer commands.

2.1 A cut to length with timer cut tool output control

This is a single axis servo control system project. When the system auto-cycle stops, some manual control is allowed. When the system auto-cycle starts, the control will go over the sequences described as following. The auto cycle can be terminated by a stop button.

1. The cut tool output turns on for the 1st pre-set timing.
2. When the 1st setting timer is over, the cut tool turns off and starts the 2nd pre-set timer.
3. When the 2nd timer timeout, servomotor feed a pre-set length.
4. When the servomotor finishes the feed length, the cutting counter increase by one and the control go back to sequence 1.
5. If the cutting count over a pre-set limit, the control stops feeding.

2.1.1 The details of project requirement

2.1.1.1 Parameter Settings

1. Length setting --- ---
   Basic unit: 0.1 mm
   Setting range: 0 to 99999.9 mm
2. Speed setting ---
   Setting range: 1 mm/second to 999mm/second
3. Count limit setting ---
   Setting range: 0 to 999999; zero setting indicates unlimited cutting.
4. Cut tool on time setting (timer1): 0.1 seconds to 99.9 seconds
5. Cut tool off time setting (timer2): 0.1 seconds to 9.9 seconds
6. Machine gear ratio: encoder counts per basic unit (0.1 mm)
7. Acceleration/deceleration time setting. 100msec to 999 msec

2.1.1.2 Control System Consideration

1. Parameter settings will be done with a customer-designed panel to run with UTC_Setup+_Eng application software. Please read the “PMWIN Manual” to get the idea of the user panel design.
2. The manual control keys.
   The manual control buttons are placed on the computer screen.
   As well, there are some digital inputs are ready for external control connections.
3. Cut tool output.
   One digital output to drive a solid-state relay as an interface to the control valve.
4. Servomotor control
   Use UTC controller Driver1 port to connect with a servo driver.

2.1.2 Start the Design

2.1.2.1 Hardware Assignments

1. Digital inputs assignments
   M11: START --- This input signal (M11=0) to trigger the system to start auto cycle.
   M12: STOP --- This input signal (M12=0) to stop the auto cycle.
   M13: JOG + --- This input signal to jog the motor in positive direction at stop cycle.
   M14: JOG- --- This input signal to jog the motor in negative direction at stop cycle.
   M15: Clear --- This input signal to clear the current cutting counter to zero.
2. Digital output assignments
   M01: Cut Tool --- M01=0 (LED lit) to turn on the cut tool.

2.1.2.2 Internal Variable Assignments

1. Setting parameters variable assignments
   Cutting length: P400
   Speed setting: P401
   Count limit: P402
   Tool on time (timer1): P403
   Tool off time (timer2): P404

2. Display and control information variable assignments
   Accumulated cut counts: P410
   Current servo position: P411
   Current status: P412

3. System configure and protection variables
   Gear ratio: P420 (Encoder counts per basic unit, 0.1mm)
   Maximum speed: P421 counts/second
   Minimum acceleration time: P422 msec
   Error message: P423

2.1.2.3 PLC programs planning example

1. PLC0 foreground (not used)

2. PLC1: Power up initial settings

3. PLC2: PLC enable/disable management

4. PLC3: Individual key/push-button handling

5. PLC4: Calculations

6. PLC5: Auto cycle handling

7. PLC6: Alarm/protection handling

8. PLC7: External inputs handling

2.1.2.4 PLC and motion programs coding example

1. PLC program

```
Open plc1 clear      ;open a buffer area for plc1 and clear that area
……                   ;the program content
close                ;close plc1 area
```

2. Motion program

```
Open prog1 clear     ;open a buffer area for motion program1
                     ;and clear that area
……                   ;the program content
close                ;close program 1 area
```

2.2 A cut to length with two sensors cut tool output control, mark signal capture and Hitech ADP3 as HMI

This project is similar to the first project in section 2.1. We add a signal capture option and also change the HMI design to fit Hitech ADP3. We can learn how to fit the Hitech HMI to UTC control.

The following portion is different from the project in section 2.1.

- When the cut tool output turns on, a lower limit sensor to trigger the cut tool off.
- When the cut tool output turns off, an upper limit sensor to trigger next feeding.
- Before the setting length feeding, the servomotor speed up and catch a mark signal to determine the feeding length. The total length will be as length before mark plus setting length.
- The Hitech ADP3 will be the target HMI.

1 The cut tool output turns on until a lower limit switch on. If the 1st pre-set timer timeout, the control generate an error message, cutter on timeout.
2 When the lower sensor turns on, the cut tool turns off and looks for the upper sensor turns on. If the sensor does not turn on before timer2 timeout, the control generate an error message, cutter off timeout.
3 When the upper sensor turns on, the servomotor keeps feeding and looks for a mark signal to continue to feed the pre-set length.
4 When the servomotor finishes the pre-set feed length, the cutting counter increase by one and the control go back to sequence 1.
5 If the cutting count over a pre-set limit, the control stops feeding.

2.2.1 The details of project requirement

2.2.1.1 Parameter Settings

1. Length setting --- ---
   Basic unit: 0.1 mm
   Setting range: 0 to 99999.9 mm
2. Speed setting ---
   Setting range: 1 mm/second to 999mm/second
3. Count limit setting ---
   Setting range: 0 to 999999; zero setting indicates unlimited cutting.
4. Cut tool on limit timer (timer1): 0.1 seconds to 99.9 seconds
5. Cut tool off limit timer (timer2): 0.1 seconds to 9.9 seconds
6. Machine gear ratio: encoder counts per basic unit (0.1 mm)
7. Acceleration/deceleration time setting. 100msec to 999 msec

2.2.1.2 Control System Consideration

1. Parameter settings will be done with Hitech ADP3 HMI.
2. The panel control keys and push-buttons are on Hitech touch panel.
   As well, there are some digital inputs ready for external control connections.
3. Cut tool output.
   One digital output is assigned to drive a solid-state relay as an interface to the control valve.
4. Servomotor control
   Use UTC controller Driver1 port to connect with a servo driver.

2.2.2 Start the Design

2.2.2.1 Hardware Assignments

1. Digital inputs assignments
   M11: START --- This input signal (M11=0) to trigger the system to start auto cycle.
   M12: STOP --- This input signal (M12=0) to stop the auto cycle.
   M13: JOG + --- This input signal to jog the motor in positive direction at stop cycle.
   M14: JOG- --- This input signal to jog the motor in negative direction at stop cycle.
   M15: Clear --- This input signal to clear the current cutting counter to zero.
   M21: Lower limit sensor
   M22: Upper limit sensor
   M23: Mark signal to trigger the pre-set length.

2. Digital output assignments
   M01: Cut Tool --- M01=0 (LED lit) to turn on the cut tool.

2.2.2.2 Internal Variable Assignments

1. Setting parameters variable assignments
   Cutting length: P400
   Speed setting: P401
   Count limit: P402
   Tool on timer (timer1): P403
   Tool off timer (timer2): P404

2. Display and control information variable assignments
   Accumulated cut counts: P410
   Current servo position: P411
   Current status: P412

3. System configure and protection variables
   Gear ratio: P420 (Encoder counts per basic unit, 0.1mm)
   Maximum speed: P421 counts/second
   Minimum acceleration time: P422 msec
   Error message: P423
4. Hitech interface parameters
   Cutting length: P500, P501
   Speed setting: P502
   Count limit: P503, P504
   Tool on timer (timer1): P505
   Tool off timer (timer2): P506
   Accumulated cut counts: P507, P508
   Current servo position: P509, P510
   Current status: P511

   Gear ratio: P512
   Maximum speed: P513, P514
   Error message: P423

2.2.2.3 PLC programs planning example

1. PLC0: Mark capture handling
2. PLC1: Power up initial settings
3. PLC2: PLC enable/disable management
4. PLC3: Individual key/push-button handling
5. PLC4: Calculations
6. PLC5: Auto cycle handling
7. PLC6: Alarm/protection handling
8. PLC7: External inputs handling

2.3 A single axis motion program example for drilling cycle and Hitech ADP3 as HMI

(Home finding // limit switches // motion program for the drilling // hand wheel for master following setting // AD1 for federate override // AD2 and DA1 for spindle speed control)

Chapter 3. Appendix

3.1 PROJECT_1

```
CLOSE

;==========EXTERNAL INPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M11       ;START
;M12       ;STOP
;M13       ;+JOG
;M14       ;-JOG
;M15       ;CLEAR
;==========EXTERNAL INPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M21       ;NO MATERIAL
;==========OUTPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M01       ;CUT TOOL
;M02       ;ALARM LAMP
;==========SETTING PARAMETERS====
;P400     ;CUTTING LENGTH SETTING
;P401     ;SPEED SETTING
;P402     ;COUNT LIMIT SETTING
;P403     ;TOOL ON TIME SETTING
;P404     ;TOOL OFF TIME SETTING
;P405     ;ACC/DEC TIME SETTING
;==========DISPLAY=========
;P410     ;ACCUMULATED CUT COUNTS
;P411     ;CURRENT SERVO POSITION
;==========SYSTEM CONFIGURE===
;P420     ;GEAR RATIO
;P421     ;MAXIMUM SPEED
;P422     ;MINIMUM ACCELERATION TIME
;P423     ;ERROR MESSAGE
;P424     ;ACTION CODE
```

```
;P425     ;AUTO RUN STATUS
;P426     ;FEEDING FLAG
;P427     ;COUNT OVER FLAG

;=============PLC0=============
OPEN PLC0 CLEAR
CLOSE

;=============PLC1=============
OPEN PLC1 CLEAR              ;POWER UP INITIAL SETTINGS
DISPLC2,3,4,5,6,7
M71=2000
WHILE(M71>0)                 ;DELAY 2 SECOND
ENDW
P11=M11                      ;START FLAG
P12=M12                      ;STOP FLAG
P13=M13                      ;+JOG FLAG
P14=M14                      ;-JOG FLAG
P15=M15                      ;CLEAR FLAG
P424=0                       ;NO ACTIONS AT POWER ON
P425=0                       ;NOT IN AUTO RUN STATUS
P426=0                       ;NOT IN AUTO FEEDING
P427=0                       ;NO COUNT OVER
P2=0                         ;P2=1 WHENT AUTO RUNNING
CMD"#1J/"                    ;ENABLE #1 SEVRO ON
ENAPLC2,4,6,7
DISPLC1
CLOSE

;=============PLC2=============
OPEN PLC2 CLEAR              ;PLC ENABLE/DISABLE MANAGEMENT
IF(P424!=0)                  ;ANY ACTIONS?
        ENAPLC3              ;IF YES, ENABLE PLC3.
ENDIF
IF(P425!=0)                  ;AUTO CYCLE STARTED?
        ENAPLC5              ;IF YES, ENABLE PLC5.
ENDIF
CLOSE
```

```
;=============PLC3=============
OPEN PLC3 CLEAR              ;INDIVIDUAL KEY/PUSH-BUTTON HANDING
IF(P424=1)                                ;JOG+
        P424=0
        IF(P425=0)
                I101=P405                 ;ACC/DEC TIME SETTING
                I103=P401*M191            ;JOG SPEED SETTING
                CMD"#1J+"
                P426=0                    ;NOT IN AUTO FEEDING
        ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P424=2)                                ;JOG-
        P424=0
        IF(P425=0)
                I101=P405
                I103=P401*M191
                CMD"#1J-"
                P426=0
        ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P424=3)                                ;JOG/
        P424=0
        IF(P425=0 AND M144=0)             ;NOT AUTO & NO FOLLOWING ERROR
                CMD"#1J/"                 ;STOP JOGGING
        ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P424=4)                                ;CLEAR
        P424=0
        P410=0                            ;CLEAR CUT COUNTS
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P424=10)                               ;START
        P2=1                              ;STARTED FLAG
        P424=0
        IF(P425=0 AND M141=0 AND P423=0)
```

```
			IF(P426=0)
				P425=1		;CUT ONCE THEN MOVE
			ELSE
				P425=3		;BACK TO UNFINISHED MOVING
			ENDIF
		ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P424=11)				;STOP
		P2=0				;STOP AUTO CYCLE
		P424=0
		IF(P425!=0)			;IF IN AUTO CYCLE.
			P425=10			;TO STOP PLC5
		ELSE
			CMD"#1J/"		;STOP JOGGING
		ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
DISPLC3					;DISABLE PLC3
CLOSE

;============PLC4============
OPEN PLC4 CLEAR				;CALCULATIONS
P411=ROUND(M161/M191)			;CURRENT SERVO POSITION
IF(P400<0 OR P400>99999.9)		;LENGTH SETTING RANGE
		IF(P400>99999.9)
			P400=99999.9
		ELSE
			P400=0
		ENDIF
ENDIF
IF(P400!=Q400)				;CHECK LENGTH SETTING
		P426=0
		Q400=P400
ENDIF
IF(P401<1 OR P401>P421)			;SPEED SETTING RANGE
		IF(P401>P421)			;MAXIMUM SPEED FOR P421
			P401=P421
		ELSE
```

```
                P401=1
        ENDIF
ENDIF
IF(P402<0 OR P402>999999)       ;COUNT LIMIT SETTING RANGE
        IF(P402>999999)
                P402=999999
        ELSE
                P402=0
        ENDIF
ENDIF
IF(P403<0.1 OR P403>99.9)       ;TOOL ON TIMER RANGE
        IF(P403>99.9)
                P403=99.9
        ELSE
                P403=0.1
        ENDIF
ENDIF
IF(P404<0.1 OR P404>99.9)       ;TOOL OFF TIMER RANGE
        IF(P404>99.9)
                P404=99.9
        ELSE
                P404=0.1
        ENDIF
ENDIF
IF(P405<P422 OR P405>999)       ;ACCELERATION/DECELERTION
                                ;TIMER RANGE
        IF(P405>999)            ;MINMUM ACC/DEC TIMER FOR P422
                P405=999
        ELSE
                P405=P422
        ENDIF
ENDIF
IF(P420<=0)                     ;GEAR RATIO
        P420=1
ENDIF
M191=P420*10
CLOSE
```

```
;=============PLC5=============
OPEN PLC5 CLEAR                         ;AUTO CYCLE HANDLING
IF(P425=1)                              ;FIRST TOOL ON
        M1=0                            ;TOOL ON
        M71=P403*1000                   ;SET TOOL ON TIME
        WHILE(M71>0)
        ENDW
        P425=2
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P425=2)                              ;FIRST TOOL OFF
        M1=1
        M71=P404*1000                 ;SET TOOL OFF TIME BEFORE FEEDING
        WHILE(M71>0 AND P425=2)
        ENDW
        IF(P425=10)
                RET
        ENDIF
        P425=3
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P425=3)                              ;FEEDING
        IF(P426=0)
                CMD"#1HMZ"              ;SET CURRENT POSITION = 0
        ENDIF
        M71=10
        WHILE(M71>0)                    ;WAIT FOR CLEAR POSITION
        ENDW
        M163=M191*P400                  ;M163 = TARGET POSITION
        I101=P405                       ;ACC/DEC TIME
        I103=P401*M191                  ;SPEED
        CMD"#1J="                       ;ACTION
        M71=20
        WHILE(M71>0)                    ;WAIT FOR FIRMWARE PROCESSING
        ENDW
        P426=1                          ;FEEDING FLAG = 1
        WHILE(M161!=M163 AND M141!=0 AND P425=3)
        ENDW
```

```
        IF(P425=10)                 ;STOP
                RET
        ENDIF
        P426=0                      ;STOP FEEDING
        P425=4                      ;NEXT STEP
ENDIF
IF(P425=4)                          ;TOOL ON
        M1=0
        M71=P403*1000
        WHILE(M71>0)
        ENDW
        P425=5
ENDIF
IF(P425=5)                          ;TOOL OFF
        M1=1
        M71=P404*1000
        WHILE(M71>0 AND P425=5)
        ENDW
        IF(P425=10)
                RET
        ENDIF
        P410=P410+1                 ;COUNT
        IF(P402>P410 OR P402=0)     ;CHECK COUNT LIMIT
                P425=3
        ELSE
                P423=4              ;ALARM MESSAGE FOR P423=3
                P425=10
        ENDIF
ENDIF
IF(P425=10)                         ;GET READY FOR STOP
        CMD"#1J/"
        M1=1
        P425=0
ENDIF
IF(P425=0)                          ;DISABLE PLC5 TO STOP AUTO CYCLE
        DISPLC5
ENDIF
CLOSE
;.....
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
;============PLC6============
OPEN PLC6 CLEAR                          ;ALARM/PROTECTION HANDING
IF(P402>P410 OR P402=0)                  ;COUNT OVER FLAG
        P427=0
ELSE
        P427=1
ENDIF
IF(M143=1 OR M21=0 OR M144=1)            ;DRIVER FAULT OR NO MATERIAL OR
                                         ;FOLLOWING ERROR
        IF(M143=1)
                P423=1
        ELSE
                IF(M21=0)
                        P423=2
                ELSE
                        P423=3
                ENDIF
        ENDIF
ELSE
        IF(P427=1)                       ;COUNT OVER
                P423=4
        ELSE
                P423=0
        ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(P423!=0)
        M2=P2^1
        P430=P423
ELSE
        M2=1
        IF(P425=0 AND P426=1)
                P430=29
        ELSE
                P430=20+P425
        ENDIF
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
```

```
CLOSE
;=============PLC7=============
OPEN PLC7 CLEAR                    ;EXTERMAL HMI INPUTS
IF(M11=0 AND P11!=0)               ;START EXTERMAL INPUTS
        P11=0
        P424=10
ENDIF
IF(M11=1 AND P11!=1)
        P11=1
ENDIF
IF(M12=0 AND P12!=0)               ;STOP EXTERMAL INPUTS
        P12=0
        P424=11
ENDIF
IF(M12=1 AND P12!=1)
        P12=1
ENDIF
IF(M13=0 AND P13!=0)               ;JOG+ EXTERMAL INPUTS
        P13=0
        P424=1
ENDIF                              ;JOG/ EXTERMAL INPUTS
IF(M13=1 AND P13!=1)
        P13=1
        P424=3
ENDIF
IF(M14=0 AND P14!=0)               ;JOG- EXTERMAL INPUTS
        P14=0
        P424=2
ENDIF
IF(M14=1 AND P14!=1)               ;JOG/ EXTERMAL INPUTS
        P14=1
        P424=3
ENDIF
IF(M15=0 AND P15!=0)               ;CLEAR EXTERMAL INPUTS
        P15=0
        P424=4
ENDIF
IF(M15=1 AND P15!=1)
        P15=1
```

```
ENDIF
CLOSE

;==============PLC8=============
OPEN PLC8 CLEAR
CLOSE
```

3.2 PROJECT_2

```
CLOSE

;==========EXTERNAL INPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M11       ;START
;M12       ;STOP
;M13       ;+JOG
;M14       ;-JOG
;M15       ;CLEAR

;==========EXTERNAL INPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M21       ;NO MATERIAL
;;M22       ;CUT UP LIMIT
;;M23       ;CUT DOWN LIMIT

;==========PANEL INPUT==========
;STATUS =0         (FALSE)
;          =1          (TRUE)
M501..505->*
;;M501    ;+JOG
;;M502    ;-JOG

;==========OUTPUT==========
;STATUS =0         (TRUE)
;          =1          (FALSE)
;M01       ;CUT TOOL
;M02       ;ALARM LAMP

;==========SETTING PARAMETERS====
;P400     ;CUTTING LENGTH<*****.*>
;P401     ;SPEED SETTING<***>
;P402     ;COUNT LIMIT<******>
;P403     ;TOOL ON TIME(TIMER1)<**.*>
;P404     ;TOOL OFF TIME<**.*>
```

```
;P405     ;ACC/DEC TIMER<***>
;;P406    ;TOOL TO LIMIT TIME OUT<***>

;==========DISPLAY=========
;P410     ;ACCUMULATED CUT COUNTS<******>
;P411     ;CURRENT SERVO POSITION<*****.*>
;P412     ;CURRENT STATUS

;==========SYSTEM CONFIGURE===
;P420     ;GEAR RATIO<****.***>
;P421     ;MAXIMUM SPEED<***>
;P422     ;MINIMUM ACCELERATION TIME<***>
;P423     ;ERROR MESSAGE<1~60>
;P424     ;ACTION STATUS<1~20>
;P425     ;AUTO RUN STATUS<1~5>
;P426     ;FEEDING FLAG<0,1>
;P427     ;COUNT OVER FLAG<0,1>
;;P428    ;TOOL ON TIME OUT FLAG<0,1>
;;P429    ;TOOL OFF TIME OUT FLAG<0,1>

;;P430    ;INFORMATION

;==========HUMAN MACHINE INTERFACE=========
;;;;;;;READ UTC-CONTROLLER;;;;;;;;;
;P450     ;P400---
;P451     ;P401(SPEED SETTING)
;P452     ;P402---
;P453     ;P403(TOOL ON TIME)
;P454     ;P404(TOOL OFF TIME)
;P455     ;P405(ACC/DEC TIMER)
;P456     ;P406(TOOL TO LIMIT TIME OUT)

;P460     ;P410---
;P461     ;P411---

;P470     ;P420---
;P471     ;P421(MAXIMUM SPEED)
;P472     ;P422(MINIMUM ACCELERATION TIME)
```

;P480 ;LOW_Word FOR P400(CUTTING LENGTH)
;P481 ;HI_Word FOR P400(CUTTING LENGTH)
;P482 ;LOW_Word FOR P402(COUNT LIMIT)
;P483 ;HI_Word FOR P402(COUNT LIMIT)
;P484 ;LOW_Word FOR P410(ACCUMULATED CUT COUNTS)
;P485 ;HI_Word FOR P410(ACCUMULATED CUT COUNTS)
;P486 ;LOW_Word FOR P411(CURRENT SERVO POSITION)
;P487 ;HI_Word FOR P411(CURRENT SERVO POSITION)
;P488 ;LOW_Word FOR P420(GEAR RATIO)
;P489 ;HI_Word FOR P420(GEAR RATIO)

;;;;;;;WRITE TO UTC-CONTROLLER;;;;;;;;;
;P550 ;P400---
;P551 ;P401(SPEED SETTING)
;P552 ;P402---
;P553 ;P403(TOOL ON TIME)
;P554 ;P404(TOOL OFF TIME)
;P555 ;P405(ACC/DEC TIMER)
;P556 ;P406(TOOL TO LIMIT TIME OUT)

;P560 ;P410---
;P561 ;P411---

;P570 ;P420---
;P571 ;P421(MAXIMUM SPEED)
;P572 ;P422(MINIMUM ACCELERATION TIME)

;P580 ;LOW_Word FOR P400(CUTTING LENGTH)
;P581 ;HI_Word FOR P400(CUTTING LENGTH)
;P582 ;LOW_Word FOR P402(COUNT LIMIT)
;P583 ;HI_Word FOR P402(COUNT LIMIT)
;P584 ;LOW_Word FOR P410(ACCUMULATED CUT COUNTS)
;P585 ;HI_Word FOR P410(ACCUMULATED CUT COUNTS)
;P586 ;LOW_Word FOR P411(CURRENT SERVO POSITION)
;P587 ;HI_Word FOR P411(CURRENT SERVO POSITION)
;P588 ;LOW_Word FOR P420(GEAR RATIO)
;P589 ;HI_Word FOR P420(GEAR RATIO)

```
;=============PLC0=============
OPEN PLC0 CLEAR
CLOSE

;=============PLC1=============
OPEN PLC1 CLEAR                    ;POWER UP INITIAL SETTINGS
DISPLC2,3,4,5,6,7,8
M71=2000
WHILE(M71>0)                       ;DELAY 2 SECOND
ENDW
CMD"#1J/"                          ;ENABLE #1 SEVRO ON
P11=M11                            ;START FLAG
P12=M12                            ;STOP FLAG
P13=M13                            ;+JOG FLAG
P14=M14                            ;-JOG FLAG
P15=M15                            ;CLEAR FLAG
P501=M501                          ;START FLAG
P502=M502                          ;STOP FLAG
P503=M503                          ;+JOG FLAG
P504=M504                          ;-JOG FLAG
P505=M505                          ;CLEAR FLAG
P424=0                             ;NO ACTIONS AT POWER ON
P425=0                             ;NOT IN AUTO RUN STATUS
P426=0                             ;NOT IN AUTO FEEDING
P427=0
P428=0
P429=0
P2=0                               ;P2=1 WHENT AUTO RUNNING
CMD"P550..599=0"
ENAPLC2,4,6,7,8
DISPLC1
CLOSE

;=============PLC2=============
OPEN PLC2 CLEAR            ;PLC ENABLE/DISABLE MANAGEMENT
IF(P424!=0)                      ;ANY ACTIONS?
        ENAPLC3                  ;IF YES, ENABLE PLC3.
ENDIF
```

```
IF(P425!=0)                    ;AUTO CYCLE STARTED?
        ENAPLC5                ;IF YES, ENABLE PLC5.
ENDIF
CLOSE

;=============PLC3=============
OPEN PLC3 CLEAR          ;INDIVIDUAL KEY/PUSH-BUTTON HANDING
IF(P424=1)                          ;JOG+
        P424=0
        IF(P425=0)
                I101=P405           ;ACC/DEC TIME SETTING
                I103=P401*M191      ;JOG SPEED SETTING
                CMD"#1J+"
                P426=0              ;NOT IN AUTO FEEDING
        ENDIF
ENDIF
IF(P424=2)                          ;JOG-
        P424=0
        IF(P425=0)
                I101=P405
                I103=P401*M191
                CMD"#1J-"
                P426=0
        ENDIF
ENDIF
IF(P424=3)                          ;JOG/
        P424=0
        IF(P425=0)
                CMD"#1J/"           ;STOP JOGGING
        ENDIF
ENDIF
IF(P424=4)                          ;CLEAR
        P424=0
        P410=0                      ;CLEAR CUT COUNTS
        P428=0                    ;;
        P429=0                    ;;
ENDIF
IF(P424=10)                         ;START
        P2=1                        ;STARTED FLAG
```

```
        P424=0
        IF(P425=0 AND M141=0 AND P423=0)
                IF(P426=0)
                        P425=1          ;CUT ONCE THEN MOVE
                ELSE
                        P425=3          ;BACK TO UNFINISHED MOVING
                ENDIF
        ENDIF
ENDIF
IF(P424=11)                             ;STOP
        P2=0                            ;STOP AUTO CYCLE
        P424=0
        IF(P425!=0)                     ;IF IN AUTO CYCLE.
                P425=10                 ;TO STOP PLC5
        ELSE
                P423=0
                P427=0
                P428=0
                P429=0
                CMD"#1J/"               ;STOP JOGGING
        ENDIF
ENDIF

DISPLC3                                 ;DISABLE PLC3
CLOSE

;=============PLC4=============
OPEN PLC4 CLEAR                         ;CALCULATIONS
P411=ROUND(M161/M191)                   ;CURRENT SERVO POSITION
IF(P400<0 OR P400>99999.9)              ;LENGTH SETTING RANGE
        IF(P400>99999.9)
                P400=99999.9
        ELSE
                P400=0
        ENDIF
ENDIF
IF(P400!=Q400)                          ;CHECK LENGTH SETTING
        P426=0
        Q400=P400
```

```
ENDIF
IF(P401<1 OR P401>P421)          ;SPEED SETTING RANGE
        IF(P401>P421)            ;MAXIMUM SPEED FOR P421
                P401=P421
        ELSE
                P401=1
        ENDIF
ENDIF
IF(P402<0 OR P402>999999)        ;COUNT LIMIT SETTING RANGE
        IF(P402>999999)
                P402=999999
        ELSE
                P402=0
        ENDIF
ENDIF
IF(P403<0.1 OR P403>99.9)        ;TOOL ON TIMER RANGE
        IF(P403>99.9)
                P403=99.9
        ELSE
                P403=0.1
        ENDIF
ENDIF
IF(P404<0.1 OR P404>99.9)        ;TOOL OFF TIMER RANGE
        IF(P404>99.9)
                P404=99.9
        ELSE
                P404=0.1
        ENDIF
ENDIF
IF(P405<P422 OR P405>999)        ;ACCELERATION/DECELERTION
                                 ;TIMER RANGE
        IF(P405>999)             ;MINMUM ACC/DEC TIMER FOR P422
                P405=999
        ELSE
                P405=P422
        ENDIF
ENDIF
IF(P420<1)                       ;GEAR RATIO
        P420=1
```

```
ENDIF
M191=P420*10
CLOSE

;=============PLC5=============
OPEN PLC5 CLEAR                     ;AUTO CYCLE HANDLING
IF(P425=1)                          ;FIRST TOOL ON
        M1=0                        ;TOOL ON
        M71=P406*1000               ;TO DOWN LIMIT TIME
        WHILE(M71>0    AND P425=1 AND M23=1)
        ENDW
        IF(M71<0)                   ;TIME OUT
                P428=1
                P425=10
                RET
        ENDIF
        IF(P425=10)                 ;STOP
                RET
        ENDIF
        M71=P403*1000               ;SET TOOL ON TIME
        WHILE(M71>0)
        ENDW
        IF(P425=10)                 ;STOP
                RET
        ENDIF
        P425=2
ENDIF
IF(P425=2)                          ;FIRST TOOL OFF
        M1=1
        M71=P406*1000               ;TOOL OFF TO UP LIMIT TIME
        WHILE(M71>0 AND P425=2 AND M22=1)
        ENDW
        IF(M71<0)                   ;TIME OUT
                P429=1
                P425=10
                RET
        ENDIF
        IF(P425=10)
                RET
```

```
        ENDIF
        M71=P404*1000               ;SET TOOL OFF TIME BEFORE FEEDING
        WHILE(M71>0 AND P425=2)
        ENDW
        IF(P425=10)
                RET
        ENDIF
        P425=3
ENDIF
IF(P425=3)                          ;FEEDING
        IF(P426=0)
                CMD"#1HMZ"          ;SET CURRENT POSITION = 0
        ENDIF
        M71=10
        WHILE(M71>0)                ;WAIT FOR CLEAR POSITION
        ENDW
        M163=M191*P400              ;M163 = TARGET POSITION
        I101=P405                   ;ACC/DEC TIME
        I103=P401*M191              ;SPEED
        CMD"#1J="                   ;ACTION
        M71=20
        WHILE(M71>0)                ;WAIT FOR FIRMWARE PROCESSING
        ENDW
        P426=1                      ;FEEDING FLAG = 1
        WHILE(M161!=M163 AND M141!=0 AND P425=3)
        ENDW
        IF(P425=10)                 ;STOP
                RET
        ENDIF
        P426=0                      ;STOP FEEDING
        P425=4                      ;NEXT STEP
ENDIF
IF(P425=4)                          ;TOOL ON
        M1=0
        M71=P406*1000
        WHILE(M71>0    AND P425=4 AND M23=1)
        ENDW
        IF(M71<0)                   ;TIME OUT
                P428=1
```

```
                P425=10
                RET
        ENDIF
        IF(P425=10)                     ;STOP
                RET
        ENDIF
        M71=P403*1000                   ;SET TOOL ON TIME
        WHILE(M71>0)
        ENDW
        IF(P425=10)                     ;STOP
                RET
        ENDIF
        P425=5
ENDIF
IF(P425=5)                              ;TOOL OFF
        M1=1
        M71=P406*1000
        WHILE(M71>0    AND P425=5 AND M22=1)
        ENDW
        IF(M71<0)                       ;TIME OUT
                P429=1
                P425=10
                RET
        ENDIF
        IF(P425=10)                     ;STOP
                RET
        ENDIF
        M71=P404*1000                ;SET TOOL OFF TIME BEFORE FEEDING
        WHILE(M71>0 AND P425=5)
        ENDW
        IF(P425=10)
                RET
        ENDIF
        P410=P410+1                     ;COUNT
        IF(P402>P410 OR P402=0)     ;CHECK COUNT LIMIT
                P425=3
        ELSE
                P423=3                  ;ALARM MESSAGE FOR P423=3
                P425=10
```

```
        ENDIF
ENDIF
IF(P425=10)                             ;GET READY FOR STOP
        IF(M114=0)
                CMD"#1J/"
        ENDIF
        M1=1
        P425=0
ENDIF
IF(P425=0)                          ;DISABLE PLC5 TO STOP AUTO CYCLE
        DISPLC5
ENDIF
CLOSE

;=============PLC6=============
OPEN PLC6 CLEAR                         ;ALARM/PROTECTION HANDING
IF(P402>P410 OR P402=0)                 ;COUNT OVER FLAG
        P427=0
ELSE
        P427=1
ENDIF
IF(M143=1 OR M21=0 OR M144=1)       ;DRIVER FAULT OR NO MATERIAL OR
                                        ;FOLLOWING ERROR
        IF(M143=1)
                P423=1
        ELSE
                IF(M21=0)
                        P423=2
                ELSE
                        P423=3
                ENDIF
        ENDIF
ELSE
        IF(P427=1 OR P428=1 OR P429=1)
                IF(P427=1)
                        P423=4
                ELSE
                        IF(P428=1)
                                P423=5
```

```
                        ELSE
                                P423=6
                        ENDIF
                ENDIF
        ENDIF
ENDIF
IF(P423!=0)
        M2=P2^1
        P430=P423
        IF(P2=1)
                P424=11                 ;STOP
                P426=0
        ENDIF
ELSE
        M2=1
        IF(P425=0 AND P426=1)
                P430=29
        ELSE
                P430=20+P425
        ENDIF
ENDIF

CLOSE
;=============PLC7=============
OPEN PLC7 CLEAR                         ;EXTERMAL&PANEL INPUTS
IF(M11=0 AND P11!=0)                    ;START EXTERMAL INPUTS
        P11=0
        P424=10
ENDIF
IF(M11=1 AND P11!=1)
        P11=1
ENDIF
IF(M12=0 AND P12!=0)                    ;STOP EXTERMAL INPUTS
        P12=0
        P424=11
ENDIF
IF(M12=1 AND P12!=1)
        P12=1
ENDIF
```

```
IF(M13=0 AND P13!=0)                    ;JOG+ EXTERMAL INPUTS
        P13=0
        P424=1
ENDIF                                   ;JOG/ EXTERMAL INPUTS
IF(M13=1 AND P13!=1)
        P13=1
        P424=3
ENDIF
IF(M14=0 AND P14!=0)                    ;JOG- EXTERMAL INPUTS
        P14=0
        P424=2
ENDIF
IF(M14=1 AND P14!=1)                    ;JOG/ EXTERMAL INPUTS
        P14=1
        P424=3
ENDIF
IF(M15=0 AND P15!=0)                    ;CLEAR EXTERMAL INPUTS
        P15=0
        P424=4
ENDIF
IF(M15=1 AND P15!=1)
        P15=1
ENDIF
;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;
IF(M501=1 AND P501!=1)                  ;JOG+ PANEL INPUTS
        P501=1
        P424=1
ENDIF                                   ;JOG/ PANEL INPUTS
IF(M501=0 AND P501!=0)
        P501=0
        P424=3
ENDIF
IF(M502=1 AND P502!=1)                  ;JOG- PANEL INPUTS
        P502=1
        P424=2
ENDIF
IF(M502=0 AND P502!=0)                  ;JOG/ PANEL INPUTS
        P502=0
        P424=3
```

```
ENDIF
CLOSE

;=============PLC8=============
OPEN PLC8 CLEAR
;;;;;;;READ UTC-CONTROLLER;;;;;;;;;
;P450     ;P400---
P451=P401                          ;P401(SPEED SETTING)
;P452     ;P402---
P453=P403*10                       ;P403(TOOL ON TIME)
P454=P404*10                       ;P404(TOOL OFF TIME)
P455=P405                          ;P405(ACC/DEC TIMER)
P456=P406                          ;P406(TOOL TO LIMIT TIME OUT)

;P460     ;P410---
;P461     ;P411---

;P470     ;P420---
P471=P421                          ;P421(MAXIMUM SPEED)
P472=P422                          ;P422(MINIMUM ACCELERATION TIME)

P481=INT(P400*10/65536)            ;HI_Word FOR P400(CUTTING LENGTH)
P480=INT(P400*10)-P481*65536       ;LOW_Word FOR P400(CUTTING LENGTH)
P483=INT(P402/65536)               ;HI_Word FOR P402(COUNT LIMIT)
P482=P402-P483*65536               ;LOW_Word FOR P402(COUNT LIMIT)
P485=INT(P410/65536)               ;HI_Word FOR P410(ACCUMULATED CUT
COUNTS)
P484=P410-P485*65536               ;LOW_Word FOR P410(ACCUMULATED
                                   ;CUT COUNTS)
P487=INT(P411*10/65536)                ;HI_Word FOR P411(CURRENT SERVO
POSITION)
P486=INT(P411*10)-P487*65536       ;LOW_Word FOR P411(CURRENT SERVO
POSITION)
P489=INT(P420*1000/65536)          ;HI_Word FOR P420(GEAR RATIO)
P488=INT((P420+0.0001)*1000)-P489*65536    ;LOW_Word FOR P420(GEAR RATIO)

;;;;;;;WRITE TO UTC-CONTROLLER;;;;;;;;;
;P550     ;P400---
IF(P551!=0)                        ;P401(SPEED SETTING)
```

```
        P401=P551
        P551=0
ENDIF
;P552   ;P402---
IF(P553!=0)                     ;P403(TOOL ON TIME)
        P403=P553*0.1
        P553=0
ENDIF
IF(P554!=0)                     ;P404(TOOL OFF TIME)
        P404=P554*0.1
        P554=0
ENDIF
IF(P555!=0)                     ;P405(ACC/DEC TIMER)
        P405=P555
        P555=0
ENDIF
IF(P556!=0)                     ;P406(TOOL TO LIMIT TIME OUT)
        P406=P556
        P556=0
ENDIF

;P560   ;P410---
;P561   ;P411---

;P570   ;P420---
IF(P571!=0)             ;P421(MAXIMUM SPEED)
        P421=P571
        P571=0
ENDIF
IF(P572!=0)             ;P422(MINIMUM ACCELERATION TIME)
        P422=P572
        P572=0
ENDIF

;P580   ;LOW_WORD FOR P400(CUTTING LENGTH)
;P581   ;HI_WORD FOR P400(CUTTING LENGTH)
IF(P580!=0 OR P581!=0)
        P400=(P580+P581*65536)*0.1
        P580=0
```

```
        P581=0
ENDIF
;P582    ;LOW_WORD FOR P402(COUNT LIMIT)
;P583    ;HI_WORD FOR P402(COUNT LIMIT)
IF(P582!=0 OR P583!=0)
        P402=P582+P583*65536
        P582=0
        P583=0
ENDIF
;P584    ;LOW_WORD FOR P410(ACCUMULATED CUT COUNTS)
;P585    ;HI_WORD FOR P410(ACCUMULATED CUT COUNTS)
IF(P584!=0 OR P585!=0)
        P410=P584+P585*65536
        P584=0
        P585=0
ENDIF
;P586    ;LOW_Word FOR P411(CURRENT SERVO POSITION)
;P587    ;HI_Word FOR P411(CURRENT SERVO POSITION)
IF(P586!=0 OR P587!=0)
        P411=(P586+P587*65536)*0.1
        P586=0
        P587=0
ENDIF
;P588    ;LOW_Word FOR P420(GEAR RATIO)
;P589    ;HI_Word FOR P420(GEAR RATIO)
IF(P588!=0 OR P589!=0)
        P420=(P588+P589*65536)*0.001
        P588=0
        P589=0
ENDIF
CLOSE
```