FATEK

FATEK AUTOMATION CORPORATION

26FL., NO.29, SEC.2, JUNGJENG E. RD.,
DANSHUEI JEN, TAIPEI, TAIWAN, R.O.C. 251

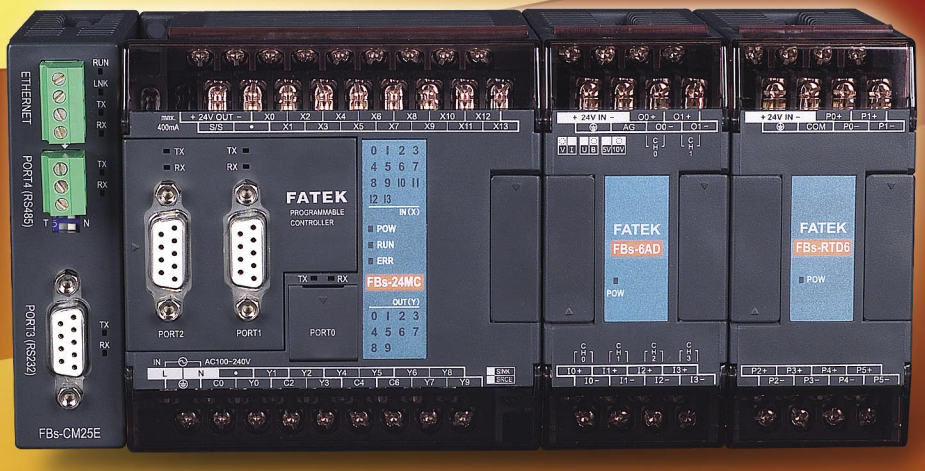
Tel: 886-2-2808-2192
Fax: 886-2-2809-2618
E-mail: sales@fatek.com
tech@fatek.com
http://www.fatek.com

Since 1992

Advanced Functions, and more Excellent Quality

FATEK FBs Series

SoC Based Micro-PLC



FATEK FATEK AUTOMATION CORPORATION

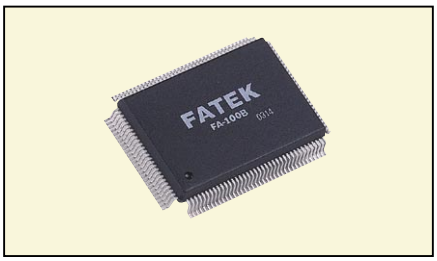
Over a decade or so,

Speak to the FATEK, the "excellent quality" comes first in mind,

The great functions of their products that have surpassed the competitors are simply setoffs.

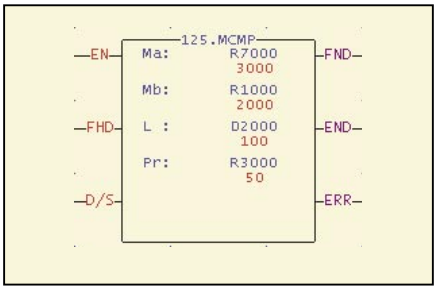
Contents

Features



High speed, high performance and low cost

FBs-PLC's design incorporates a System on Chips (SoC) developed independently by FATEK. The chip consists of over 120,000 gates which integrate powerful features such as Central Processing Unit (CPU), hardware logic processor, five high-speed communication ports, four sets of hardware high-speed counter/timer, four axes of high speed pulse output for NC positioning with linear interpolation or dynamic tracking, high speed interrupts, and captured inputs. It presents a higher speed with better functionality and more reliability. Compared to PLC of its kind, FBs-PLC is the most functional and competitive with a reasonable low price.

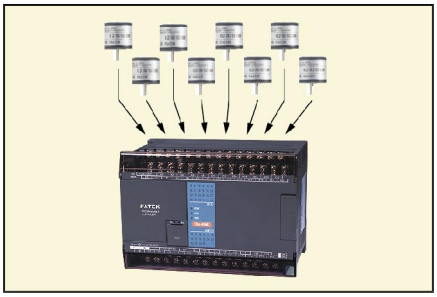


Most user friendly, most powerful instruction sets

FBs-PLC has more than 300 instructions, which adopts the most user friendly and readable multiple-input/multiple-output function structure. As shown in the left figure, with one instruction, three inputs can derive 5 kinds of functions which other brands of PLC may require a lots of instructions to achieve this. Also the operation result can acquire directly from the outputs. To increase the program readability, the inputs or outputs for each function instruction have its own mnemonic symbol attached and the content of each operand also can be shown beneath it. For high-end application, such as PLC networking(LINK),PID control and NC positioning etc, FBs-PLC provides the dedicated convenient instructions to help user to reduce barrier in usage.

Communication functions incomparable with up to 5 ports for RS232, RS485, USB, Ethernet

With the help of communication ports inside the SoC, the FBs-PLC are more than sufficient even with all five ports operating at the maximum speed (921.6KHz). Communication can be conducted using ASCII code or the double-speed binary code. Besides the FATEK standard protocol, Modbus or user-definable protocol is also available. FBs-PLC is also provided with six different communication boards and eight different communication modules for various applications. It has the most communication ports with highest speed and functionality in the PLC of its kind. Moreover, each communication port contains LED indicators for transmission (TX) and reception (Rx) to enable the user to monitor the operation and debug



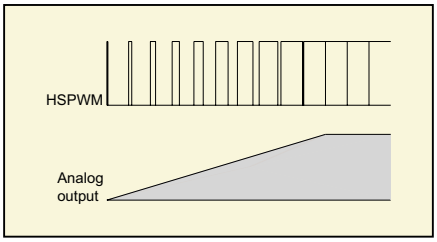
Highly integrated 8 sets of high-speed counter with counting frequency up to 920KHz

FBs-PLC, at most, can have 4 sets of hardware high-speed counter (HHSC) and 4 sets of software high-speed counter (SHSC). The highest counting frequency of HHSC is 120KHz (MC) or 920KHz (MN). Each HHSC also has clear and mask function. There are 8 counting modes including U/D, U/Dx2, K/R, K/Rx2, A/B, A/Bx2, A/Bx3 and A/Bx4 which makes the HHSC most powerful and efficient. For example, if the encoder, running at 200 pulses per revolution, adopts A/Bx4 mode can achieve the result that 800 pulses per revolution encoder can provide. Besides, the counter is implemented by hardware so do not occupy CPU time. Four sets of SHSC has three counting modes including U/D,K/R and A/B and the total counting frequency is limited to 10KHz.

```
001   SPD R0
      DRV ADR,+,R2,Ps
      WAIT TIME 50
      GOTO NEXT
002   SPD 20000
      DRV ADR,+,9999,Ut
      GOTO NEXT
003   SPD 3000
        ⋮
```

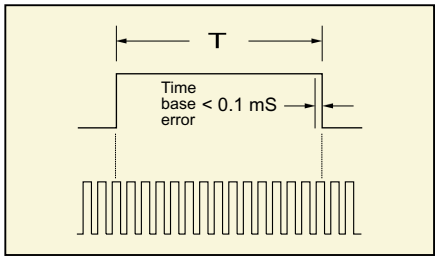
NC control+PLC in one, dedicated NC Position Language, maximum of 4 axes control for single unit with linear interpolation

The NC Position Control is incorporated into the SoC of FBs-PLC to integrate PLC+NC control into one unit in order for resources sharing and reduce the need of dada exchange. The NC position control adopts dedicated positioning command language, which allows programming by mechanical or electrical unit and changing control parameters during execution. One single unit has up to four axes of output with maximum frequency of 120KHz (MC) or 920KHz (MN) and equips with multi-axial linear interpolation and dynamic tracking. If being combined with the four sets of built-in HHSC, it can achieve positioning control of closed loop with higher precision.



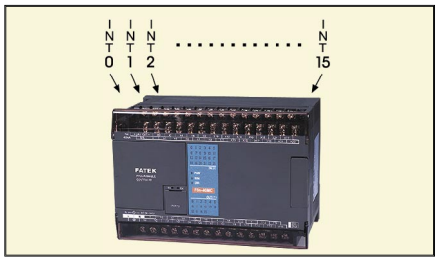
A maximum of 4 points high-speed pulse width modulation (HSPWM) output

The SoC inside FBs-PLC incorporates four sets of hardware high-speed pulse width modulation output, with maximum frequency of 184.32KHz and 18.432KHz with resolutions 1% and 0.1%, respectively. Different from the PWM function operated by software alone in ordinary PLC, the hardware driven high-speed PWM in FBs-PLC operates with high precision and stability, which provides the user easy control with tremendous accuracy.



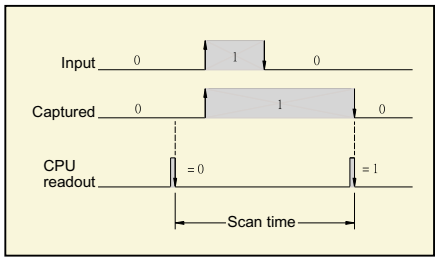
High-speed timer with 0.1mS resolution, the fastest timer that PLC ever can provide

FBs-PLC is the only PLC providing 0.1mS high-speed timer in the same grade PLC (At most, FBs-PLC has one set of 16-bit and 4 sets of 32-bit HST.).Currently, the fastest time base of the timer used in other brands of PLC only reaches 1ms, so can't work in the application requiring higher precision. Because the inaccuracy of 0.1ms time base high-speed timer of FBs-PLC is only 0.1mS, by incorporating interrupt function, FBs-PLC can easily achieve more precise speed detection or can be used as frequency meter. In most cases, expansive speed detection equipment can be replaced by this economic wise choice.



Single unit with 16 points of high-speed interrupt

FBs-PLC can provide up to 16 points of external interrupt. The interrupt is driven by edge and user can define which edge can cause interrupt, positive or negative or both edges. With interrupt can perform high speed, emergency processing which can't withstand the time jilter caused by the delay and deviation of the scan time and can be used for precision high speed position, machine home, high speed RPM measurement applications.

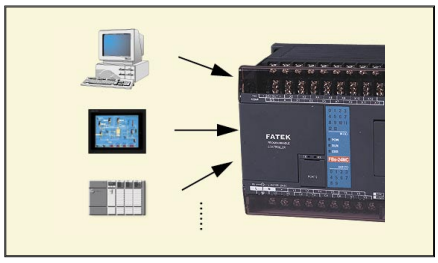


Up to 36 points of captured input in single unit

The SoC in FBs-PLC is capable of capture input, which captures and stores the external pulse input shorter than scan time for access by CPU. Compared to ordinary PLC that either lacks this capability or requires highly sophisticated interrupt function which increase the CPU overhead. FBs-PLC can handle this task easily as general input, which is carefree with high efficiency and convenience.

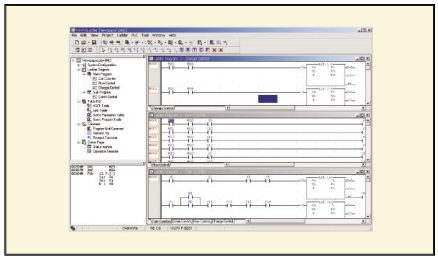
Full line peripherals

Besides 204 models of main unit can be chosen, FBs-PLC also provides 72 models of expansion I/O and peripherals for selection. The expansion I/O modules include basic DI/O and AI/O, 7/16-segment LED display module, 8 types(J,K,R,S,E,T,B,N) thermocouple, Pt100, Pt1000 RTD temperature measurement module. FBs-PLC also provide FB-DAP LCD data access panel which can be linked together with a single RS485 bus. FB-DAP can be simply a Timer/Counter editor and it can also be used as a simple human machine interface through the function of user definable key and message. Besides, FB-DAP can be equipped with wireless sensing module and applied to entrance control, parking equipment and elevator control.



Abundant communication driver

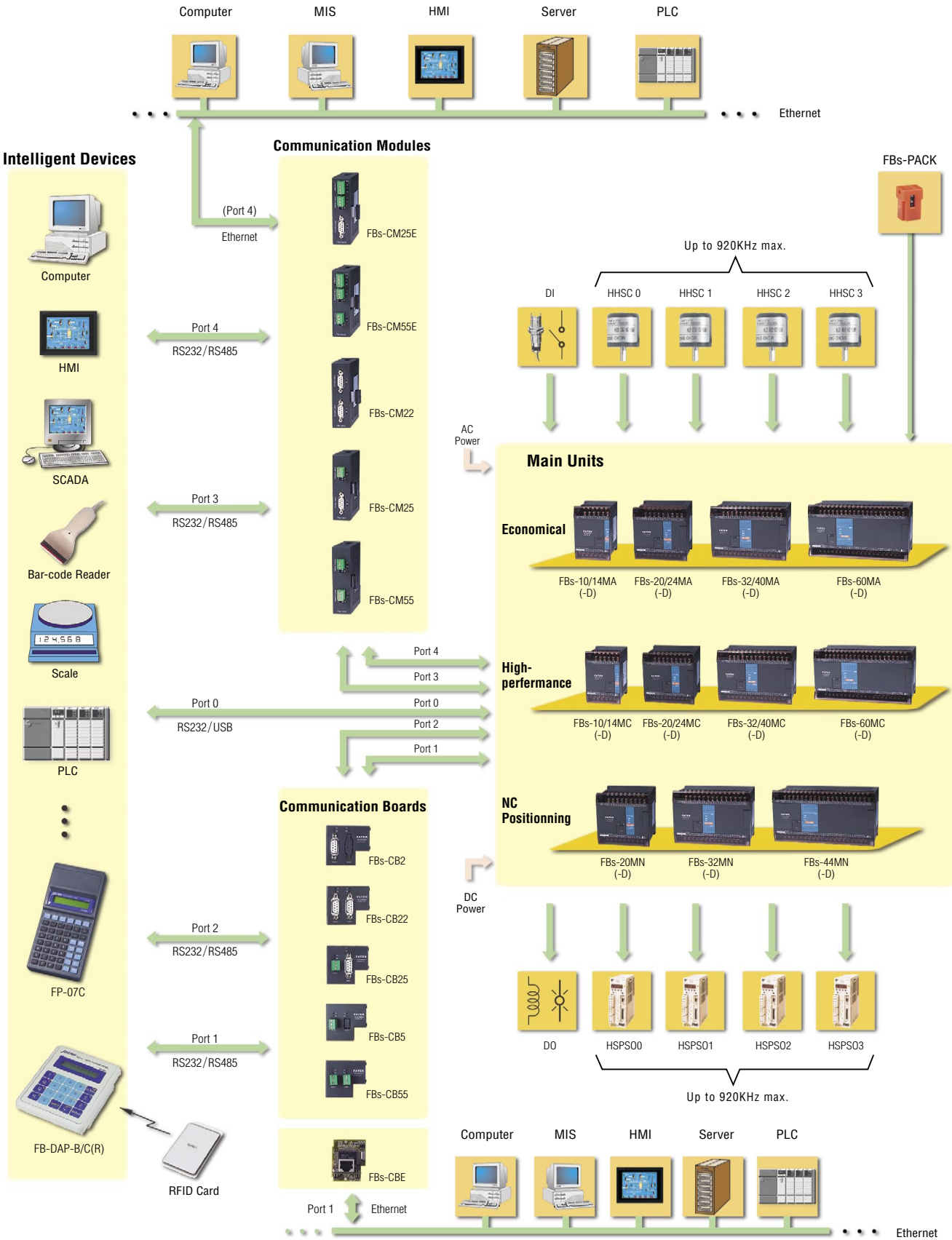
The FATEK software drivers of FBs-PLC are supported by world-famous graphic supervisory software (SCADA) and leading brands of human-machine interfaces, that can be directly connected with FBs-PLC. Moreover, FATEK also provides Modbus protocol and FATEK DDE standard communication server software for the user to easily connect FBs-PLC to various graphic control or computer systems in Office applications or self programming.

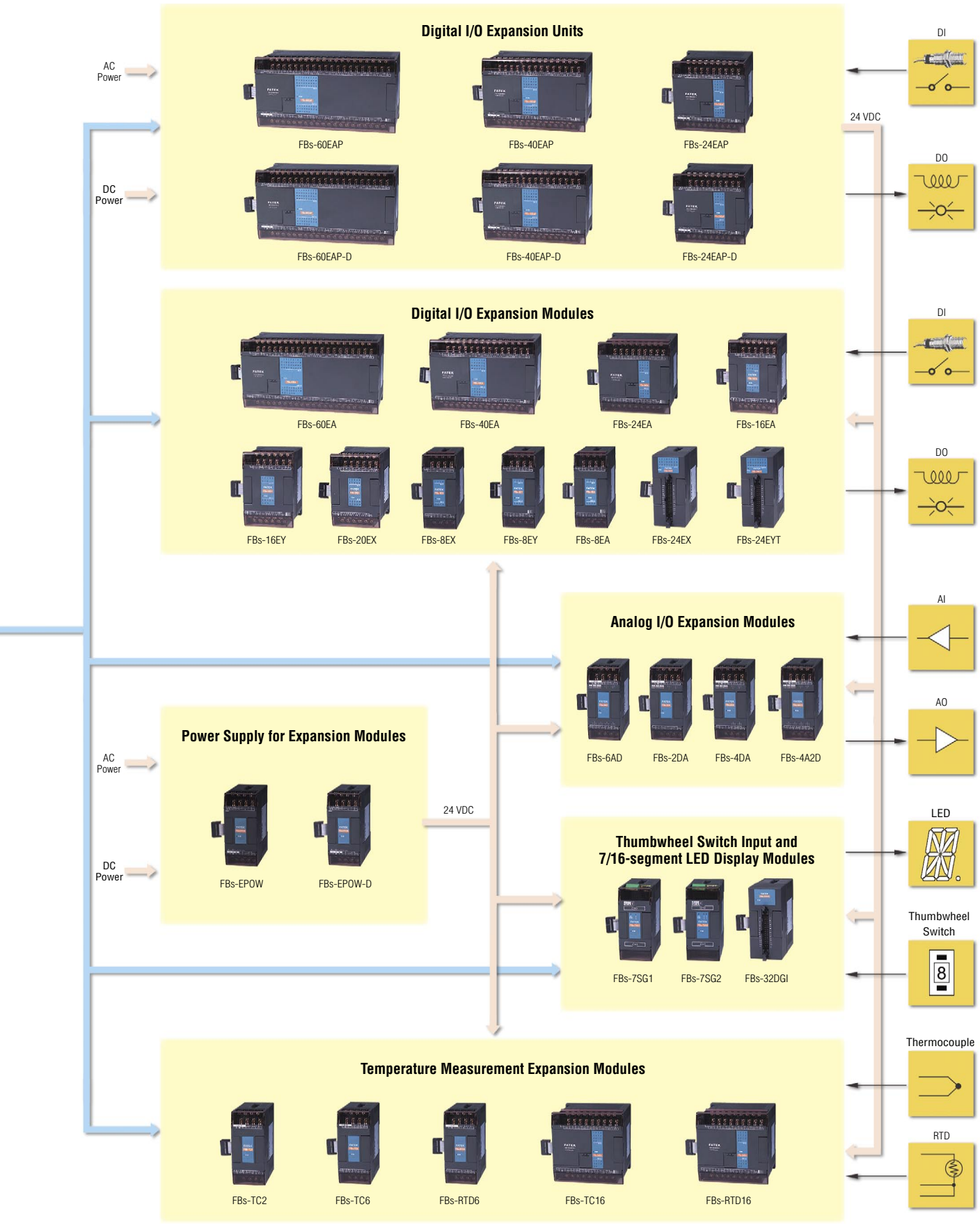


User-friendly operating environment

"WinProladder"is a Windows-based ladder diagram programming software for FBs-PLC. It provides a user-friendly operating environment. Thoughtful and considerate arrangement of editing, monitor and debugging function let user be familiar with the operation of system in short time. The powerful editing function of WinProladder, assisted with keyboard, mouse, online help of ladder instruction and operating guide, can greatly improve your working efficiency. The features which can show the register's data directly in the ladder diagram and provides multiple status page monitoring let user be able to conduct status monitoring and debugging easily.

Symtem Configuration



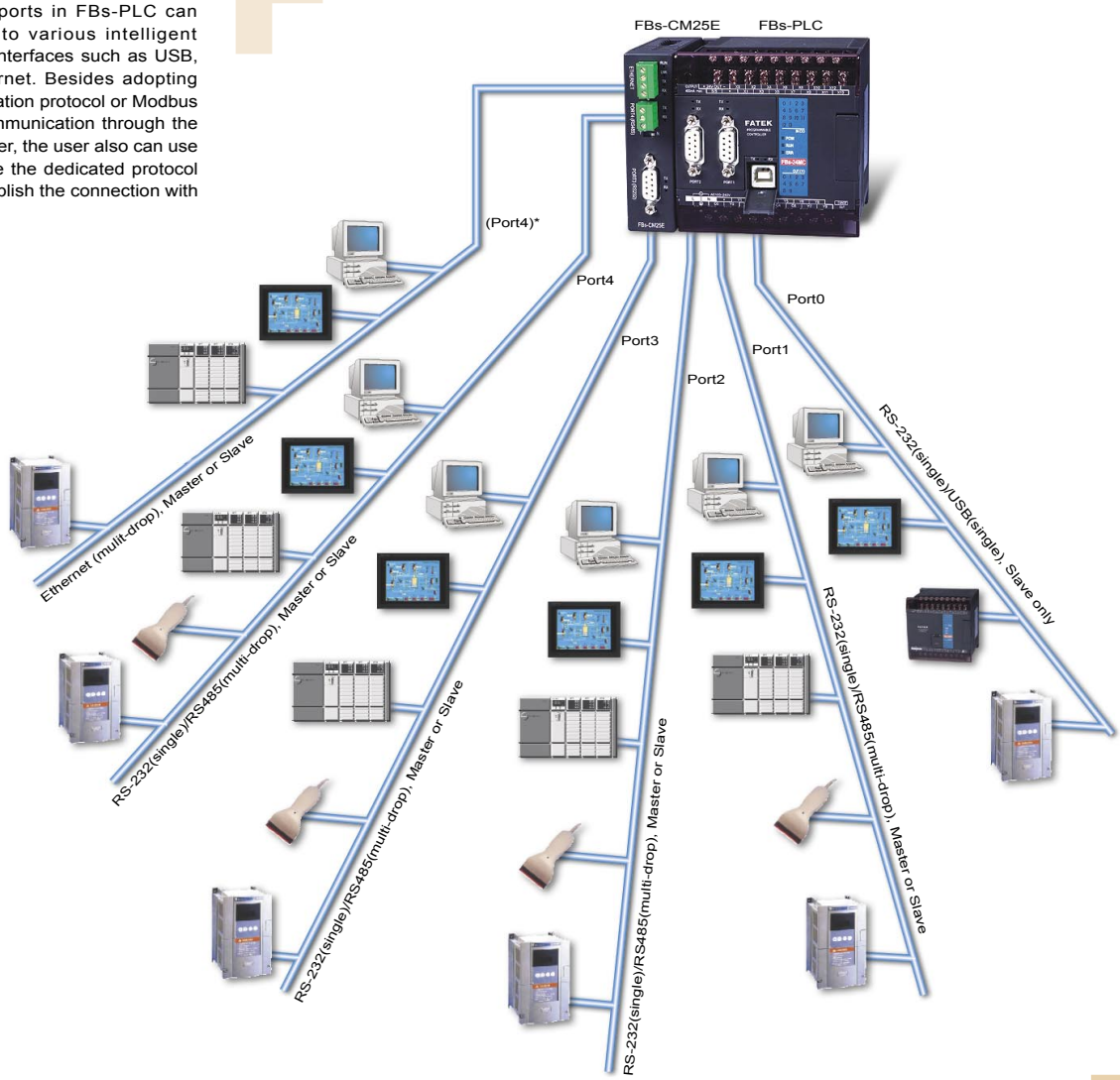

Digital I/O Expansion Units
AC Power
DC Power
FBs-60EAP
FBs-40EAP
FBs-24EAP
FBs-60EAP-D
FBs-40EAP-D
FBs-24EAP-D
DI
24 VDC
DO
Digital I/O Expansion Modules
FBs-60EA
FBs-40EA
FBs-24EA
FBs-16EA
FBs-16EY
FBs-20EX
FBs-8EX
FBs-8EY
FBs-8EA
FBs-24EX
FBs-24EYT
DI
DO
Analog I/O Expansion Modules
FBs-6AD
FBs-2DA
FBs-4DA
FBs-4A2D
AI
AO
Power Supply for Expansion Modules
AC Power
DC Power
FBs-EPOW
FBs-EPOW-D
24 VDC
Thumbwheel Switch Input and 7/16-segment LED Display Modules
FBs-7SG1
FBs-7SG2
FBs-32DGI
LED
Thumbwheel Switch
Temperature Measurement Expansion Modules
FBs-TC2
FBs-TC6
FBs-RTD6
FBs-TC16
FBs-RTD16
Thermocouple
RTD

■ Communication

Connection with intelligent peripherals:

The five communication ports in FBs-PLC can simultaneously connect to various intelligent peripherals with available interfaces such as USB, RS232, RS485, and Ethernet. Besides adopting FATEK standard communication protocol or Modbus protocol, or conducting communication through the FATEK communication server, the user also can use CLINK commands to define the dedicated protocol to actively or passively establish the connection with any intelligent peripherals.

Sample application

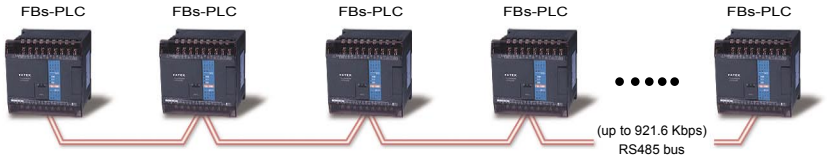


*Use the RS485 port4 to bridge the Ethernet

High-speed CPU link:

The Port 2 with optional RS485 interface can be used as the high-speed LINK between up to 254 FATEK PLC units, accomplished with merely one CLINK command at the main station. The communication speed can be up to 921.6Kbps, which is suitable to application of distributed real time control on multiple PLC units. (Only exchange the data in the high-speed common data areas, which may occupy more CPU time of PLC because of the frequently real time update.)

Sample application

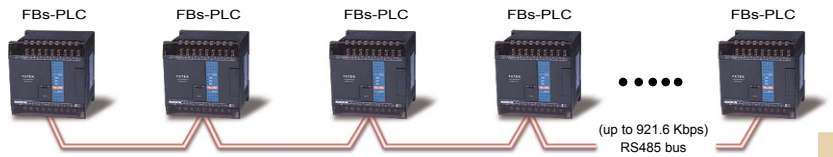


Max. 254 stations(Processed during communication interrupt)

General CPU link:

The RS485 interface in any of port1~port4 can link between up to 254 FATEK PLC units, accomplished with merely one CLINK command at the main station. It is suitable for distributed data collection and application of non-real time control. (Any data in PLC can conduct Link exchange, since non-real time update, which occupies less CPU time of PLC.)

Sample application

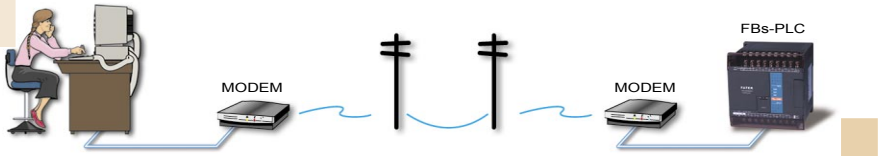


Max. 254 stations(Processed by normal scan loop)

Modem for remote communication:

Through MODEM, various functions such as remote program modification, control, diagnosis and monitoring can be performed even at the office distant from overseas.

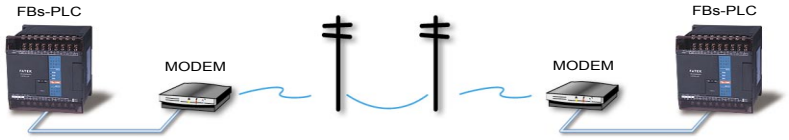
Sample application



CPU link through MODEM:

Through ladder diagram program, FBs-PLC can control MODEM to dial automatically to link with remote MODEM and PLC without the intervention of operator or computer. With this function, the headquarter of company can connect to branch factories automatically to perform the data collecting, data monitoring, alarm logging and abnormal report and etc.

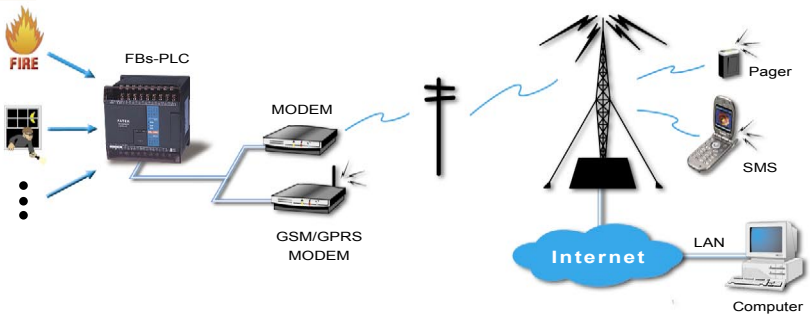
Sample application



Calling through pager or mobile phone:

In an emergency situation, before disaster happens or operator awares the situation, PLC program can detect this and call out to maintenance personnel or security personnel. So the situation can be taken care of at the first moment. The feature is especially suitable for the applications of fire alert, guard security and other application requiring high security.

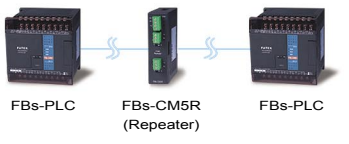
Sample application



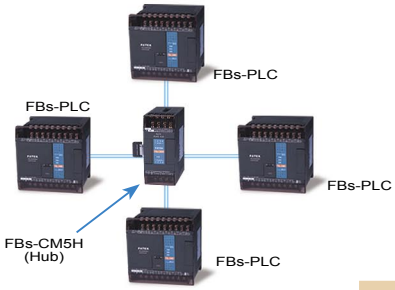
The RS485 repeater or Hub can be applied in long distance or special topological routing:

Use the Repeater or Hub of the RS485 interface to extent the coverage distance and to meet the variety of wiring topology demand (such as Bus or Star structure).

Sample application



The RS485 repeater FBs-CM5R can be used to extend the distance and expand the range of RS485 network



Star connection of RS485 can be realized by using FBs-CM5H (Hub) to meet the requirement of special topological routing.

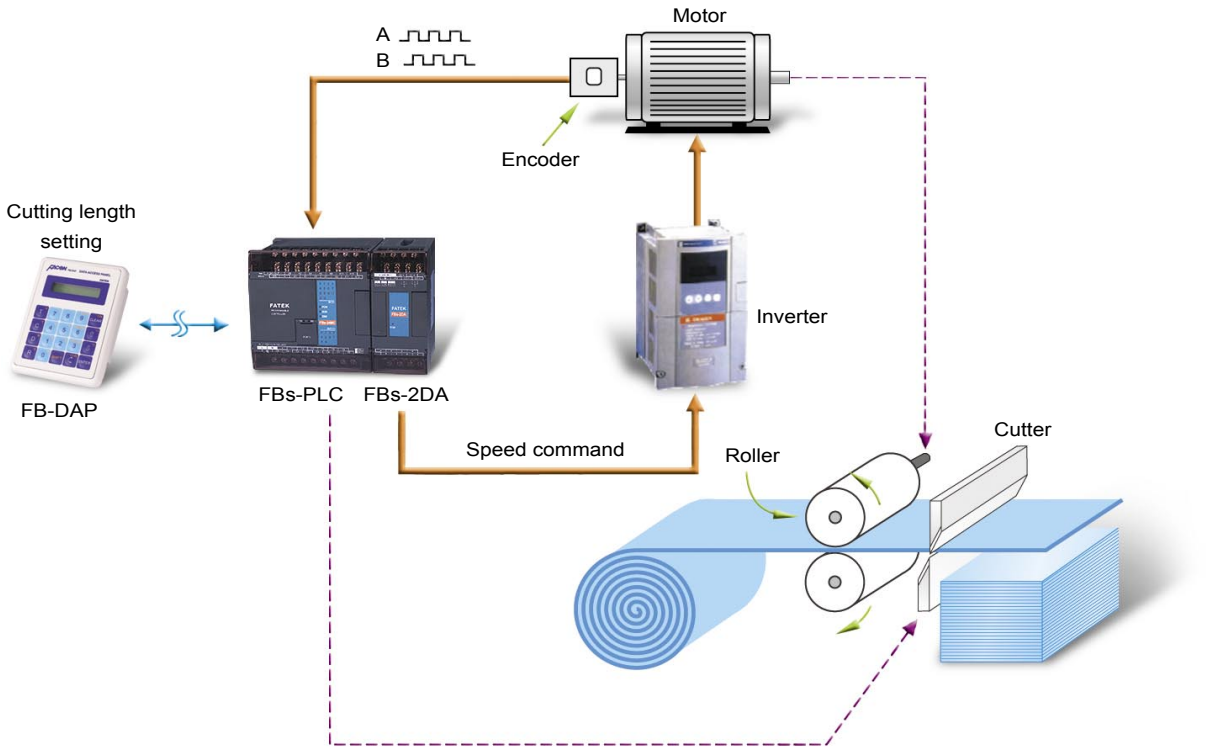
■ High-speed counter (HSC)

A FBs-PLC can have up to 8 sets of 32bits high-speed counter. Among which, 4 sets are hardware high-speed counter (HHSC) whose counting frequency can reach 120KHz (MC)or 920KHz (MN) and can operate with 8 counting modes. The other 4 sets are software high-speed counter (SHSC) whose total input frequency can reach 10KHz and can operate with three counting modes. The high-speed counters can be used in the applications required high-speed processing and precision control.

Counting (MODE)			HHSC (HSC0 ~ 3)	SHSC (HSC4 ~ 7)	Operation Waveform	
					Up count (+1)	Down count (-1)
Up/Down pulse	MD 0	U/D	O	O	U D	
	MD 1	U/Dx2	O		U D	
Pulse-Direction	MD 2	K/R	O	O	K R	
	MD 3	K/Rx2	O		K R	
A/B phase	MD 4	A/B	O	O	A B	
	MD 5	A/Bx2	O		A B	
	MD 6	A/Bx3	O		A B	
	MD 7	A/Bx4	O		A B	

Sample application

The control of cutting machine with variable length



High-speed timer (HST) / NC position control

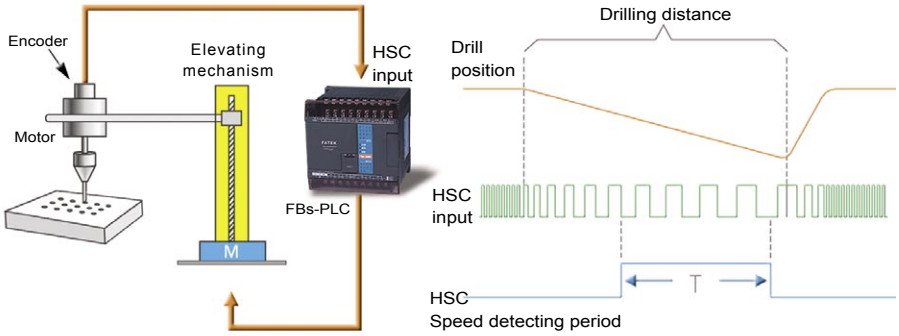
■ High-speed timer (HST)

FBs-PLC has a special design 0.1mS time base high-speed timer that can provide a timer with 0.1mS resolution and real-time time-up interrupt capability. Compared with ordinary PLC, whose best resolution is 1mS, including error of scan time, FBs-PLC is more than 10 times as precise as ordinary PLC. So FBs-PLC can easily handles precise timing or speed detection that can not be handled with other PLCs. FBs-PLC has one 16-bit 0.1mS high-speed timer. Besides that, four sets of 32-bit hardware high-speed counter(HHSC) all have software switch, can be configured as 32-bit 0.1mS high-speed timer. Therefore, FBs-PLC has maximum of 4 sets of 32-bit HST.

If a drill is running without loading, its rotating speed is 6000RPM. When drill is in normal drilling, rotating speed will be reduced to 5500RPM. When drill becomes blunt then friction force is increased, rotating speed will be further reduced to 5200RPM. When drill is broken, rotating speed is equal to the speed running without loading. When drill is pressed down, the change of rotating speed can be detected. So, the break and blunting of drill can be disposed immediately.

Sample application

Combine HSC and HST to detect the break or blunting of drill.

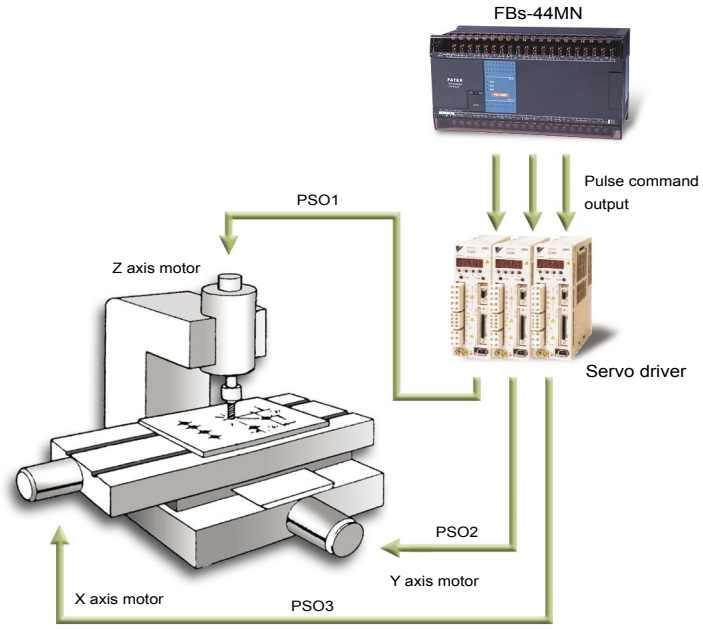


■ NC position control

High-speed pulse output (HSPSO) built in FBs-PLC can perform up to 4 axes NC servo or stepping position control. With the accelerating and decelerating function, it is easy to achieve smooth and precise multi-zone position control. If coordinating with built-in HHSC feedback, FBs-PLC can perform closed loop control to compensate the wear, aging and unconformity of component thus can obtain more precise control. Besides, FBs-PLC provides a position control language, which cooperates with the convenient instruction of ladder diagram, can facilitate the implementation of your precise position control.

Sample application

Use one PLC to perform 3 axes position control.

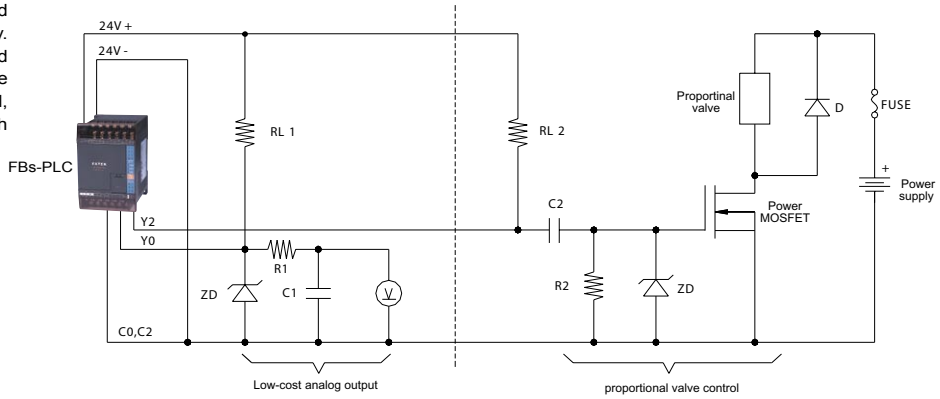


PSO2, PSO3 are used for X,Y table two dimensions position control. PSO1 is used for position control of drilling depth.

■ High-speed pulse width modulation (HSPWM)

FBs-PLC provides 4 points of hardware high-speed pulse width modulation output, with resolution as good as 0.1% (for frequency 72Hz~18.432KHz) and 1% (for frequency 720Hz~184.32KHz), respectively. Because of the high speed of hardware circuits and precision and stability, FBs-PLC can easily achieve fine temperature control, proportional valve control, or simple and yet practical D/A output made with external integration circuits.

Sample application

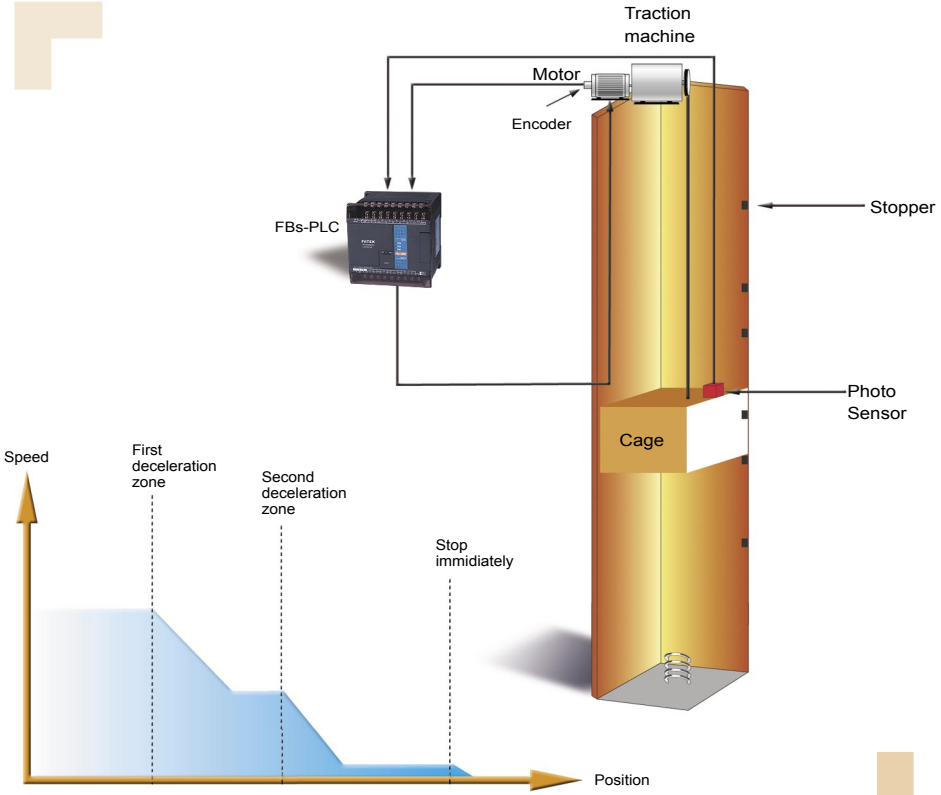


■ High-speed interrupt

A FBs-PLC can have up to 16 points of external interrupt input. The interrupt can be activated by the change of input status which can be positive edge/negative edge or both edges. When using the input interrupt function can avoid the false operation that caused by the PLC can't detect the status change of the fast input signal with normal scan.

Sample Application: Elevator position control
Incremental encoder can detect the position and the floor where the box of cage locating to do multiple sections of deceleration. Then, use photo sensor and stop plate to detect cage stop signal and issue a high-speed interrupt to immediate stop the cage precisely.

Sample application

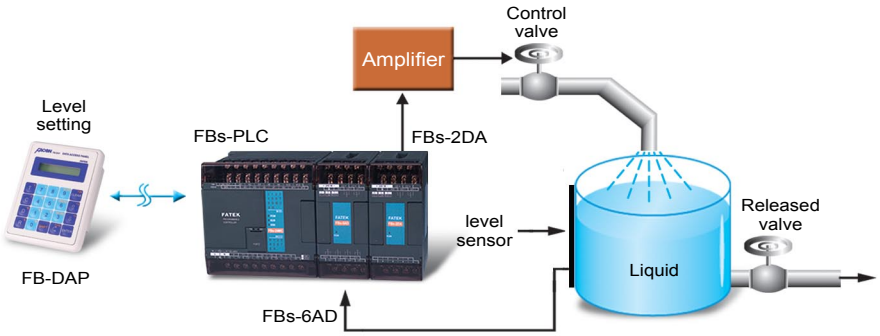


General purpose PID control / Temperature measurement and PID control

General purpose PID control

FBs-PLC provides the general purpose PID control function which compares the process variables, read from analog input (AI), with the setting value, defined by user, and perform PID calculation according to the proportional band (P), integral constant (I) and derivative constant (D). A proper output control value obtained from above execution is output through analog output (AO) to control process to stay within the range specified by user. The feature can be applied to smooth, precise control such as flow, pressure and level control

Sample application

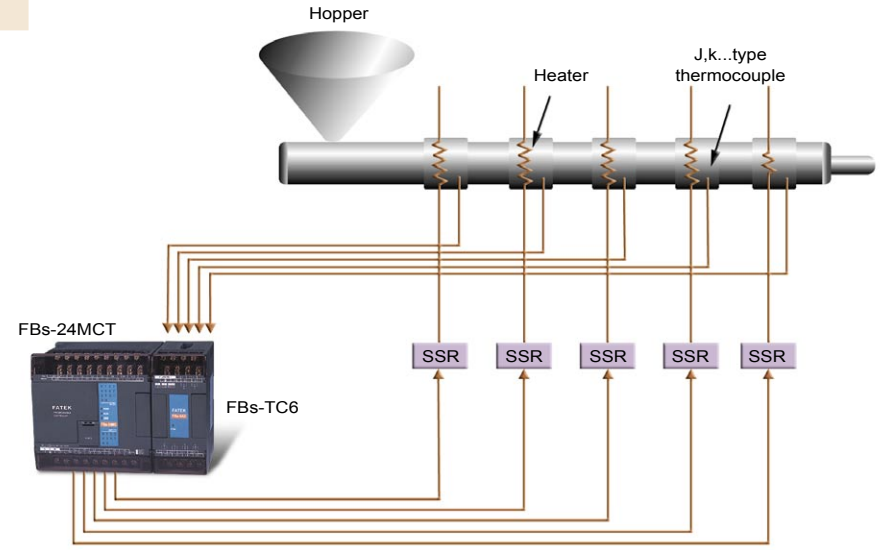


Temperature measurement and PID control

FBs-PLC provides a 8 types (J,K,R,S,E,T,B,N) of thermocouple temperature module as well as Pt-100 and Pt-1000 RTD temperature module. Thermocouple is suitable for the measurement of large temperature range such as boiler process. RTD is good for the measurement of low temperature, smaller range of temperature and higher resolution such as refrigeration and air condition application. Because of the characteristic of temperature changing slowly, adopting multiplexing scan measurement and multiple loops PID control make single FBs-PLC be able to perform up to 32 loops PID temperature control. So, can get the best cost to performance ratio. With the convenient instruction of temperature measurement and temperature PID control will drastically reduce the difficulties, cost and time for developing and testing program.

Sample application:
Injection molding machine temperature control
As shown in the right figure, FBs-TC6 can connect with 8 types (J,K,R,S,E,T,B,N) of thermocouple directly. Through the execution of temperature measurement and PID control instruction, output the control output through SSR to control heater to maintain the temperature of each zone within specified range.

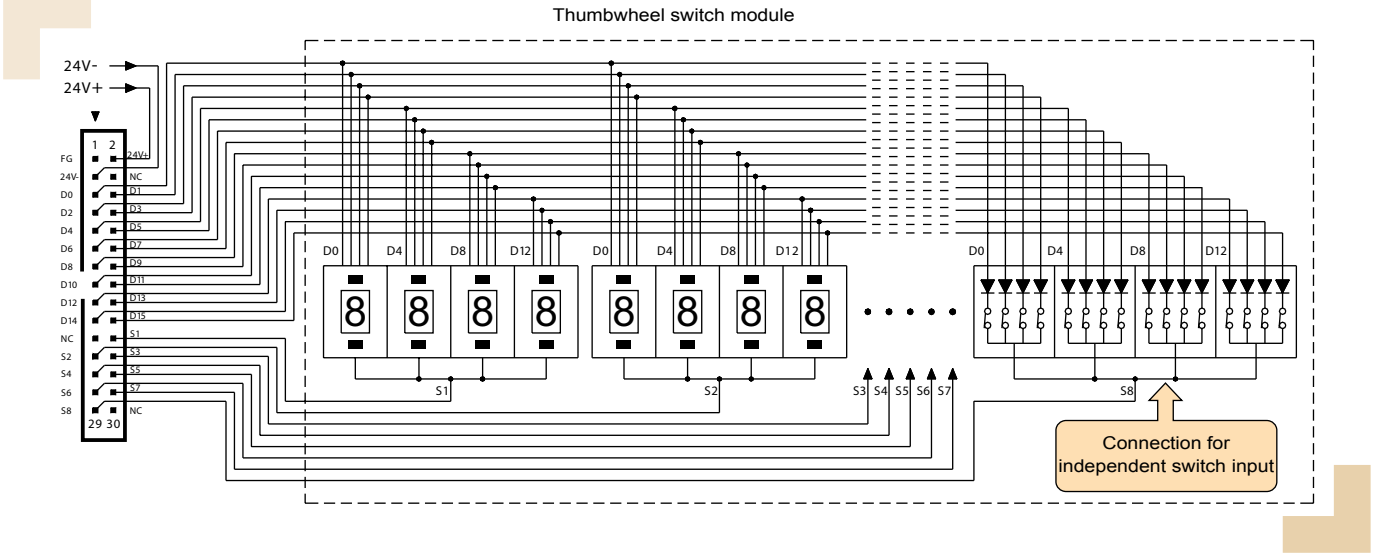
Sample application



■ Thumbwheel switch multiplex input

The FBs-32DGI thumbwheel switch multiplex input module provided in FBs-PLC conduct multiplexing input scan of the eight sets of 4 digit numbers (or 128 independent ON/OFF status) via the embedded I/O ASIC chips (special chips for the FBs-PLC I/O module). It does not occupy any CPU time and the multiplexing scan rate is about 10ms. In addition, because only 24 wires are required by multiplexing input to achieve 32 digits (or 128bit ON/OFF) input, plus that the FBs-32DGI is only 4cm in width, it turn out to be an ultra high density, lowest cost, and most labor saving solution.

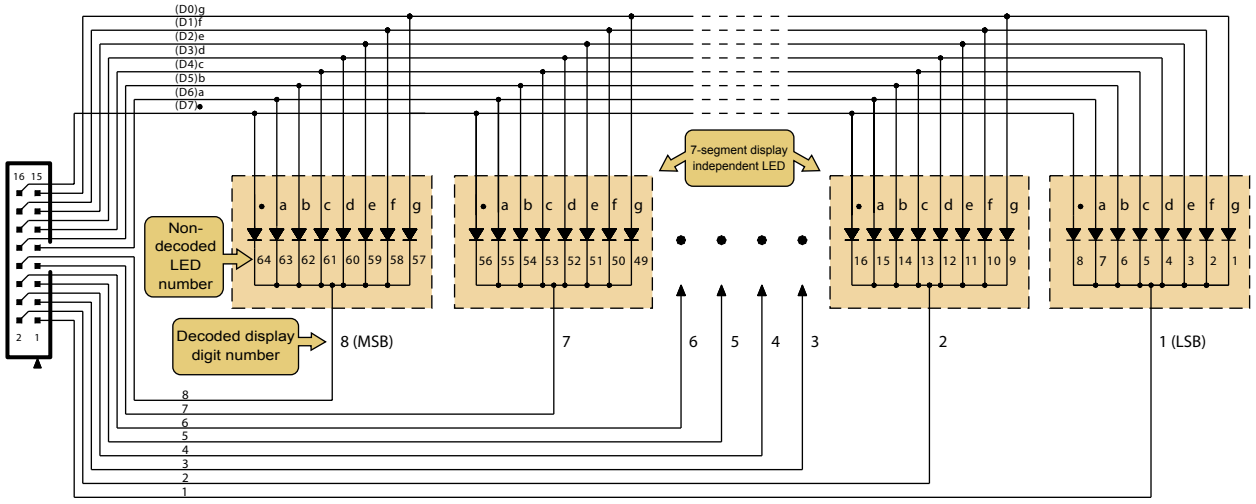
Sample application



■ 7/16-segment LED display module

The FBs-7SG is a 7/16-segment LED display module with only 4cm width. The embedded I/O ASIC chips will automatically conduct the multiplexing scan display of two sets of 8 digits (a total of 16 digits) 7-segment LED display or 8 sets of 16-segment LED display without occuping CPU time. The multiplexing scan time is 10ms. Furthermore, because of multiplexing scan, each set of 8 digits (64bit LED) only requires the 16pins ribbon cables for connection. Three different driving voltages and three voltage fine tuning are available in this module, which are capable of driving most of existing 7-segment LED displays of which the driving voltage is various. The installation distance of display can even reach up to one hundred meters. FATEK also provides 4(.56", .8", 2.3", and 4.0") 7-segment LED display boards and 2(.8 ", 2.3") 16-segment alphanumeric LED display for the choice of users.

Sample application



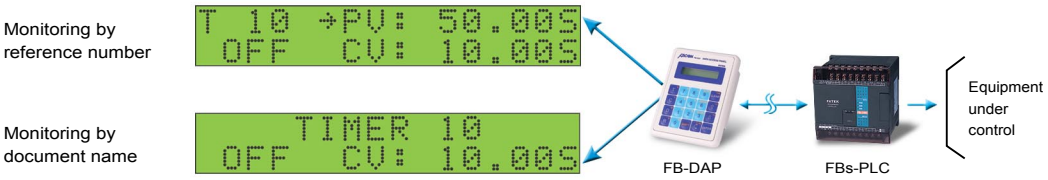
Simple human-machine interface and RFID card

■ Simple human-machine interface and RFID card

FB-DAP can be used for setting Timer/Counter and displaying NC position. It also can be used for simple human-machine interface by using the features of user definable key and display message. The FB-DAP with -R option is equipped with wireless card reader module and can be used for the application of entrance , elevator, security control and calling car in parking tower. Besides, FB-DAP uses extra-large membrane keypad, which is easy to be distinguished and operated.

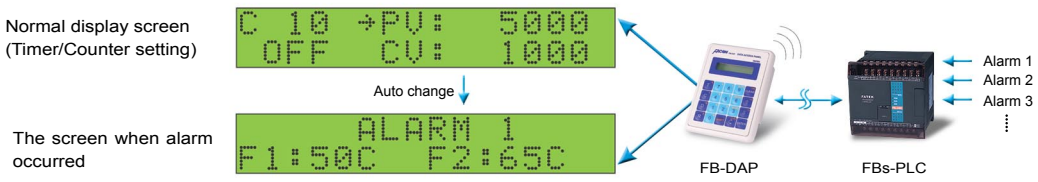
Example 1

To set Timer/Counter and to display NC position
Use reference number (T, C, R) or document name (1~16 English characters or numbers)to specify monitoring object



Example 2

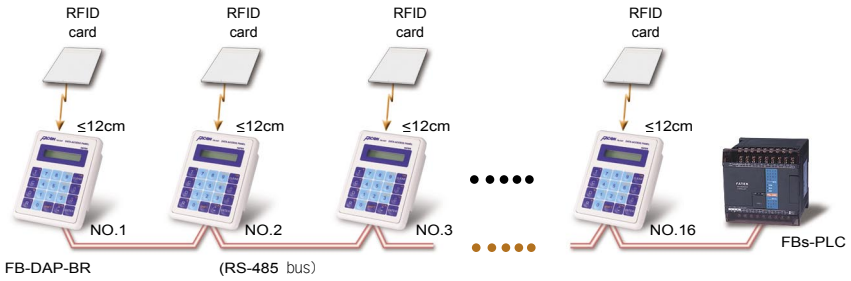
Used as alarm or message display
This mode can be as dedicated mode or a background mode. In dedicated mode, FB-DAP is only for displaying. In background mode, FB-DAP works in pre-defined working mode (such as T/C setting and entrance control etc.) while in normal situation. FB-DAP will display alarm message (predefined in program) or display event message(the message can be changed by user without modifying the program) only when alarm or special event happens. The buzzer alarm is optional.



Can set 10 grades of alarm and event display message. When the length of event display message exceeds 16 characters, FB-DAP will display the message with slow scroll.

Example 3

The application of entrance and parking control with multi-DAP link and RFID card



One FBs-PLC can connect up to 16 FB-DAPs. If the number of FB-DAP is exceeded, can use the CPU-LINK for expansion. With one PLC, can support 16 FB-DAPs. Maximum number of linked DAP station is 254x16

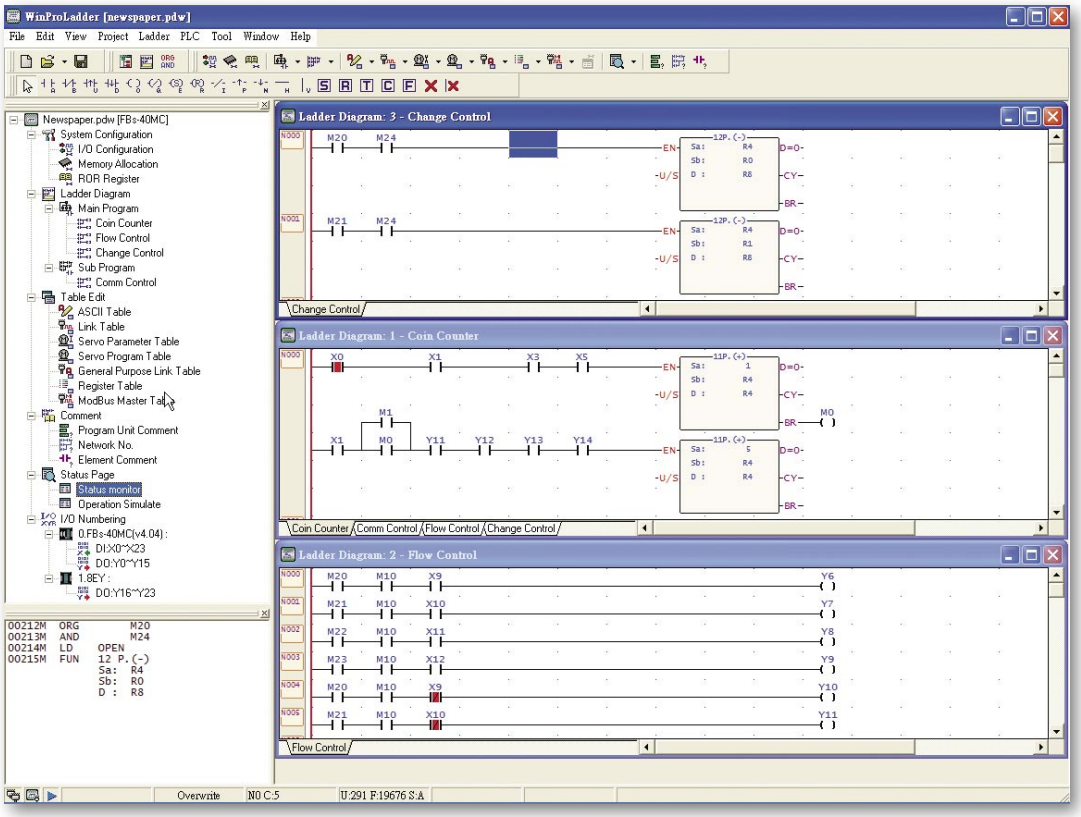
WinProladder software package

FATEK FBs-PLC Ladder Program Programming Software

■ General Feature

- Windows based application program, all the operating follow the convention of windows environment, easy for learning and operating. No matter beginner or Pro can operate with great efficient.
- Adopt project concept, which category the whole tasks of program to be developed with hierarchy tree. Through the visual effect the user can see through the whole project at first glance. No matter at program or maintenance stage all the jobs need to do can perform with intuitive.
- Thoughtful and considerate entry method design, incorporate both the keyboard and mouse for entry device. No matter at field site or office environment can operate with ease and efficient.
- Provides the connection for PLC and PC with varieties. Among the connections, there are hardware connection, Modem connection and Internet connection. For every different connection, WinProladder provide a session name to associate the setting of the communication parameters, such as port no., baud rate, IP address, phone number, etc.. With this feature can alleviate the user from the burden of the memorizing.

WinProladder



■ Program editing

- Provides the on-line program editing capability. After modify the ladder program can send the RUN command immediately without to re-download the program to PLC. With this feature can reduce the application development time dramatically comparing with other PLC without this feature.
- Ladder program can be edited without stop the PLC from running (Run time editing).
- Multiple ladder program windows, can show different fragmentation of ladder program at one time and perform the copy, paste and compare operation between these windows.
- Provides the flexible ladder network editing capability. With the help of copy, paste and delete highly efficient operation can complete a complex program with few keystrokes.
- Provides the capability to divide the whole program into many program units. User can at will partition the whole development task into many independent program units according to the functionality or other classify methodology and perform the entry, editing, testing and documentation independently. With this feature can greatly ease the maintenance of the whole application.
- Provides an individual window for mnemonic instruction display. Immediately display the equivalent mnemonic code corresponding to the ladder network pointed by the cursor.
- Provides the flexible program search capability, can search contact, register or function. Also can set a filter to narrow down the search object to ease the user from picking up the desire results among the whole bunches of search result. Most of all, just double click the interested message line can bring out the corresponding ladder program to the user.
- Provides a powerful syntax check tool. With this tool can parse the user's program and generate a parsing message in one window. In this window all the warning or error messages regard the program will be listed line by line. User just double click the interested line then the ladder program will be shown on the window with the cursor stay on the question part.

WinProladder software package

■ Program testing

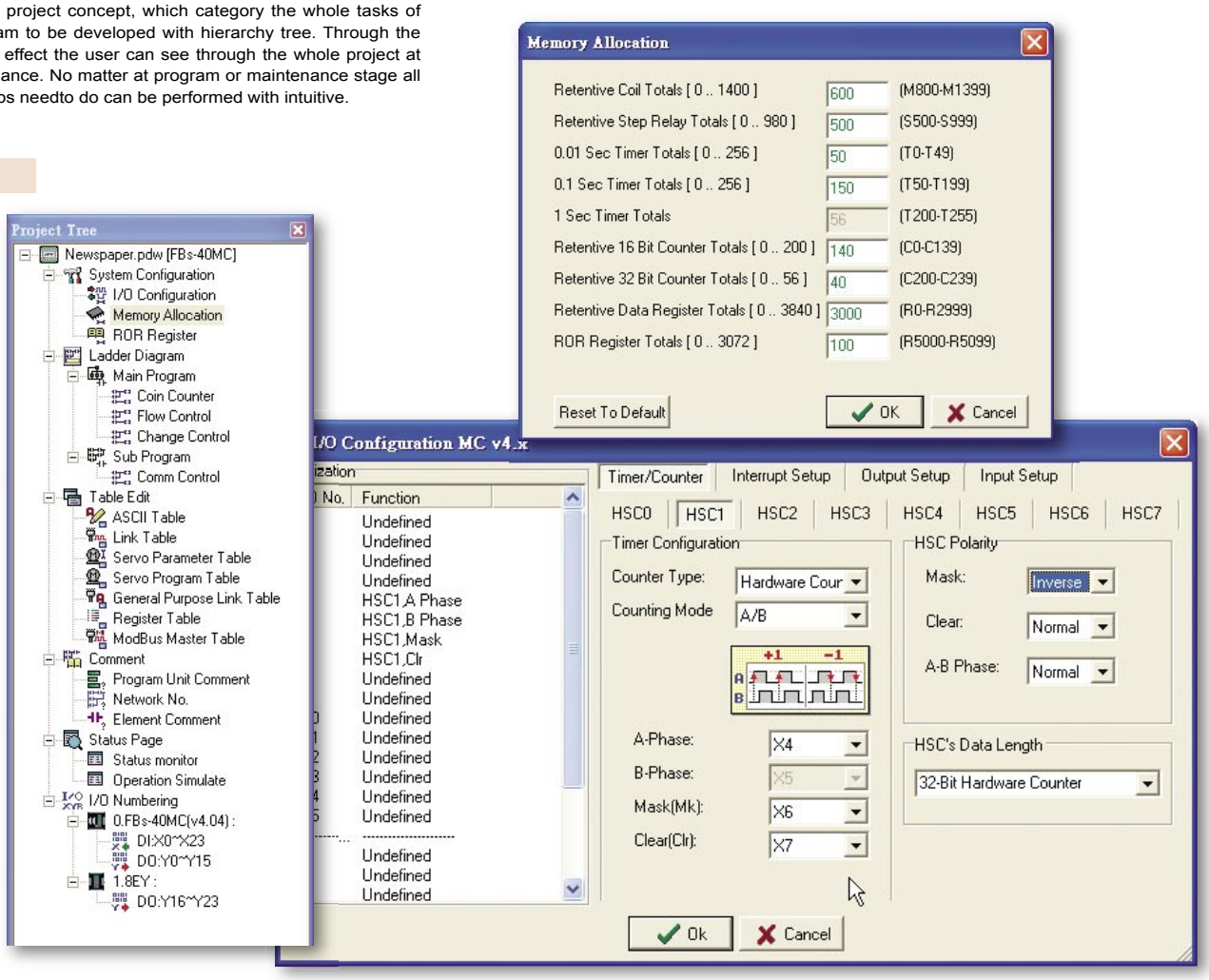
- Provides multiple pages of status monitoring. User can monitor and modify the status of discrete contacts and registers on the status page. Each discrete input and output (include the internal relay) can be disabled and forced on or off. Each register can be selected individually to show with different format such as hexadecimal, decimal and binary. Best of all, all the layout of the status pages can be stored in the project and there is no need for user to re-define the page each time when he/she wants to monitor the status.
- Multiple high lighted ladder program display windows. The conducting condition of each contact element can be revealed by the color of the element drawing. The register value embedded with the function block also can be shown currently with ladder diagram. The discrete element can be easily disabled and forced on or off directly from the ladder diagram.

■ Program documentation

- Provides discrete element, register, network, and program unit and project comment. Besides the project comment all other comments can be displayed with ladder diagram. With this feature the user can easily realize how the ladder program is working.
- Provides following report printout function:
  Ladder diagram printout can select the scope and detail level of the ladder diagram for different kind of reporting requirements.
  Used ladder element cross-reference report can list the statistics of all ladder elements used in the project.
- The comment of the contact and register can be created by this software or by using text editor that were familiar with user. Comments can be imported from the text file and also can be exported to the application software such as Excel for further processing.
- The network of ladder program can be copied to other editing software such as Word by using copy and paste function. With this feature, can facilitate the documentation of program when use the editing software.

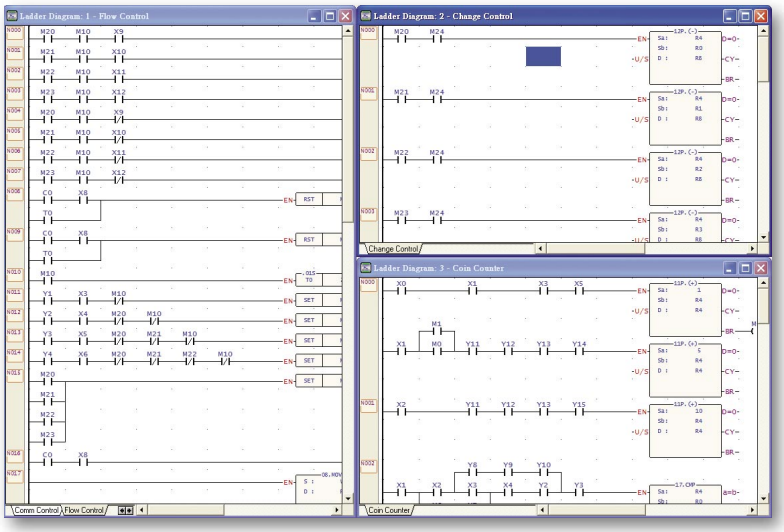
■ Project oriented program

Adopt project concept, which category the whole tasks of program to be developed with hierarchy tree. Through the visual effect the user can see through the whole project at first glance. No matter at program or maintenance stage all the jobs needto do can be performed with intuitive.



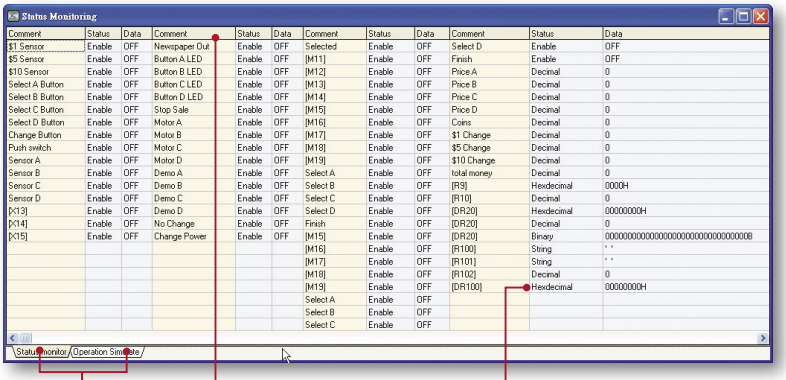
WinProladder software package

■ Ladder program editing screen

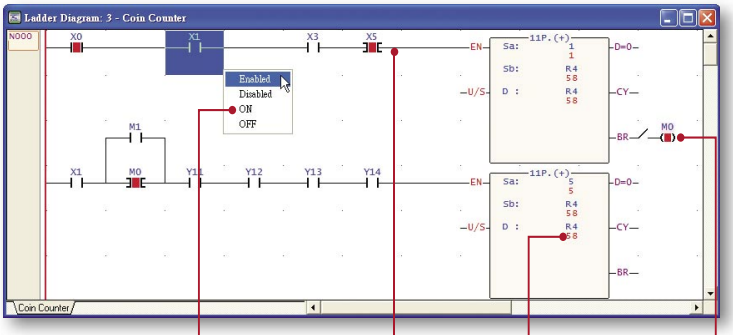


Multiple ladder windows, can perform the network copy, paste, cut and compare operations among windows.

■ Status monitor and control



Multiple status page window, can define the elements, registers to be monitoring and assign its display format. The state of the contact elements can be disabled and forced. Register value also can be entered.

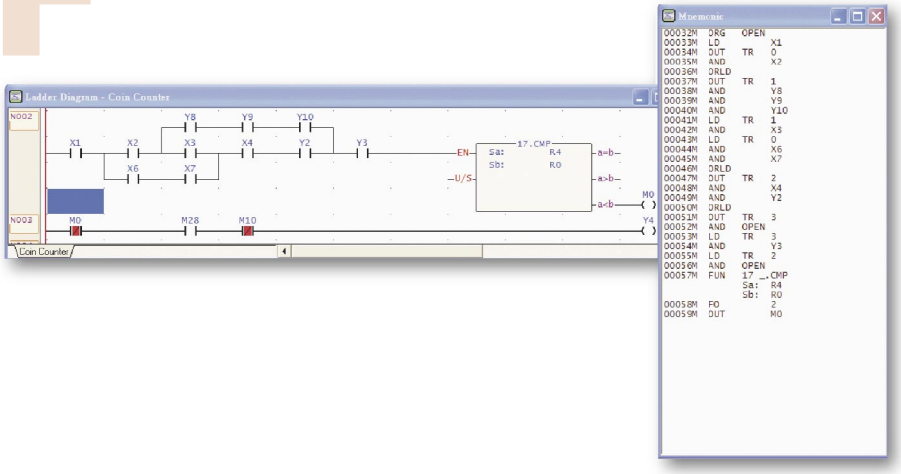


Multiple high lighted ladder program windows. The conducting condition of each contact element can be revealed by the color of the element drawing. The register value embedded with the function block also can be shown currently with ladder diagram.

WinProladder software package

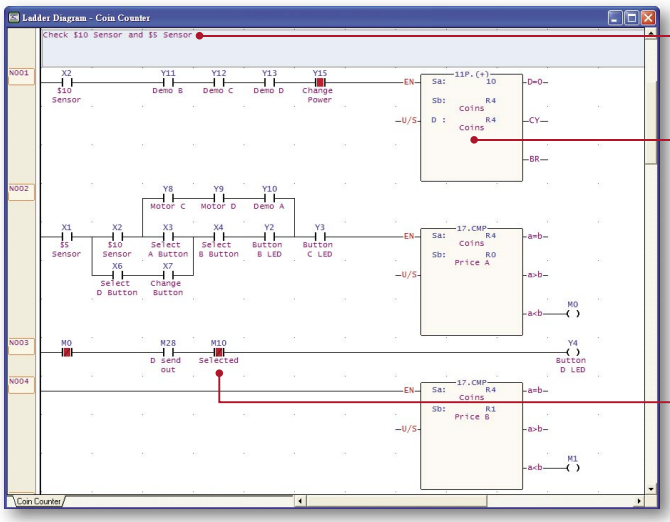
Mnemonic ladder instruction display window

Dedicate mnemonic instruction window can show the mnemonic instructions corresponding to the network pointed by the cursor. This feature can help the teaching of ladder programming by mnemonic instruction.



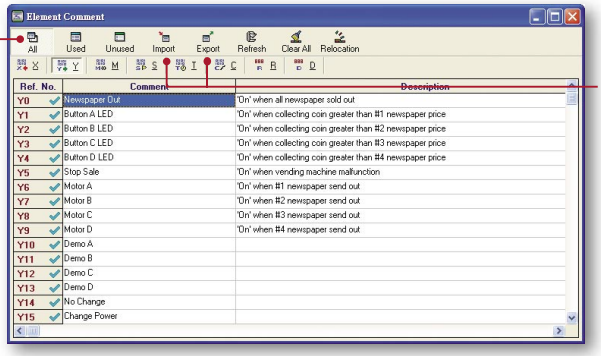
Ladder diagram with comments

Provides different detail level of comment for contact, register, network, program unit and program to facilitate the readability and maintenance of the program.



Element comment editing

With element comment window, can attach an easy for memorizing comment to the elements, detail description also can be added to facilitate the maintenance of project.



Can choose all, used, unused elements for displaying to assist the user to input the comments

The comment, through exporting and importing can be integrated with other application software.