

1. Introduction to M, VB and VH Series PLC

1-1 PLC User Guideline

1-1-1 Structure of a PLC (Programmable Logic Controller)

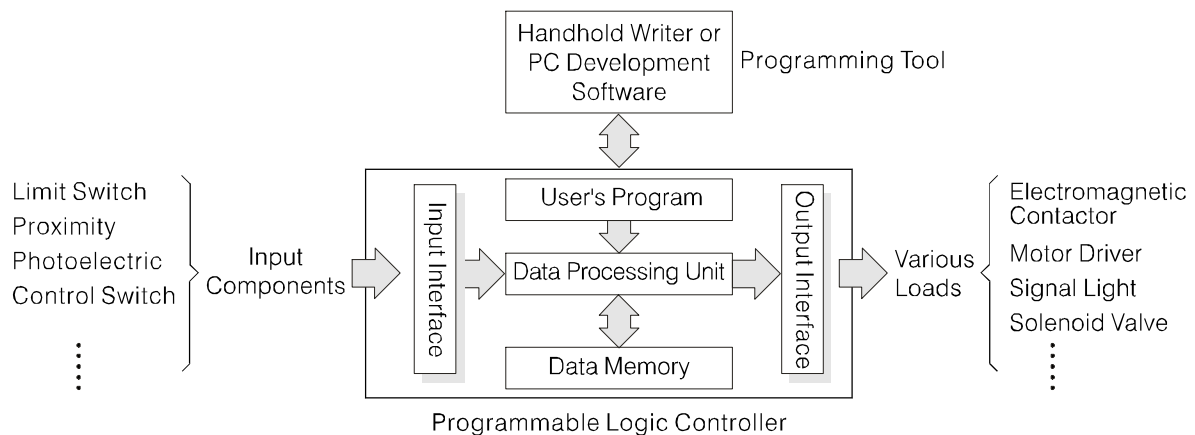


Fig. 1-2

1-1-2 Operation and Scanning Time of a PLC

The PLC operates in the Data Central Processing Unit. The operation is processed as follows:

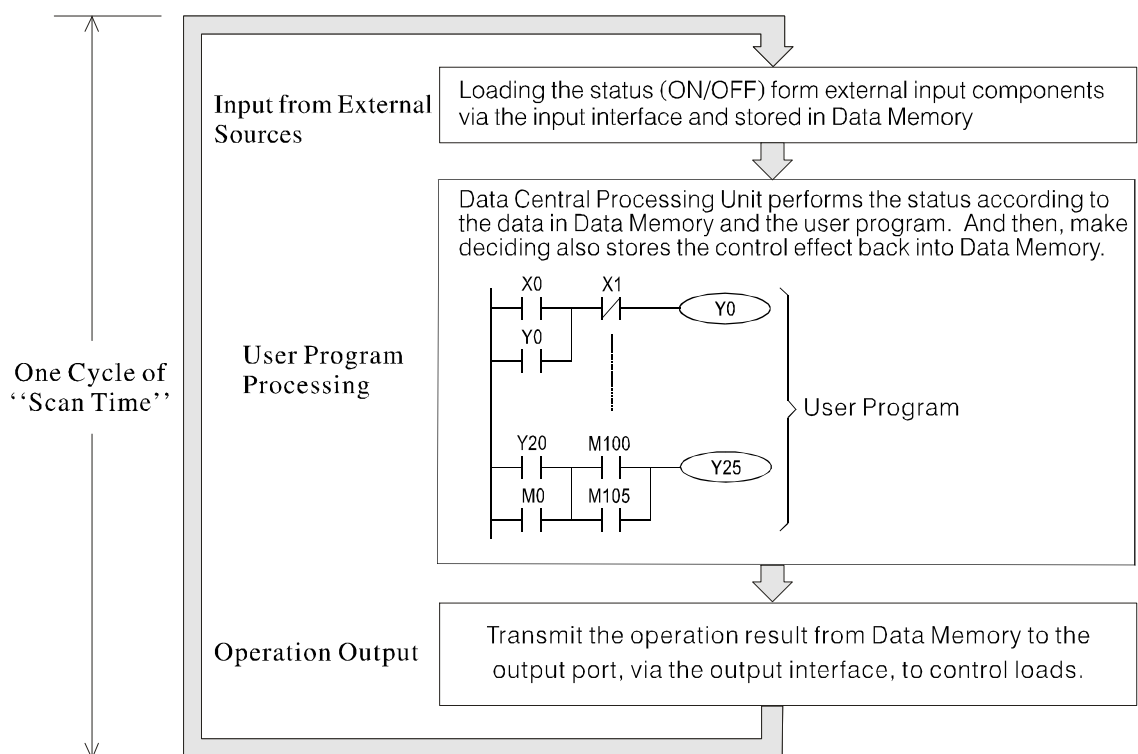


Fig. 1-2

The PLC achieves to simulation the conventional relay switchboard by using the Microcomputer technology. The Microcomputer scans all I/O status and user program to calculate the control results, and the outcome will follow the user desires. The brief process is shown as in Fig. 1-2. One cycle of "Scan Time" including spend time to handle: (① loading the input status from resources, ② to process the user program, ③ the operation result output.) An important concept about the "Scan Time" is the most significant difference between a PLC and a conventional relay switchboard, and it is a critical concept that we need to understand.

1-1-3 Input / Output Delay of a PLC

- Input Delay of a PLC

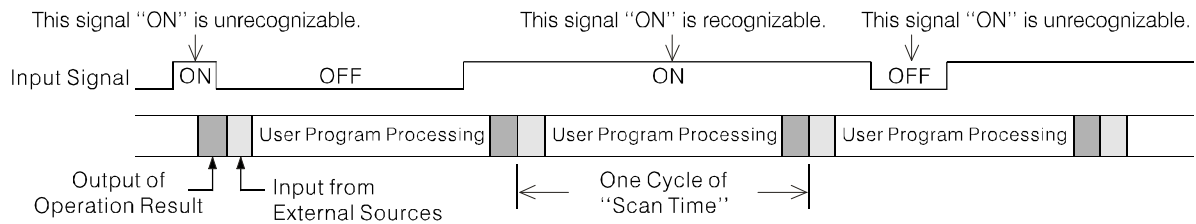
The environment of a PLC is always full of interference and noise. For protected a PLC and filtering input noise, the PLC usually uses Photo-couplers at its input ends to isolate the noise, and also adds a noise filtering circuit on the input circuit. That will cause an approximately 10 ms input signal delay. And if the input signals including some excessively narrow-short-signal-waves, that may cause those signals transmit to the PLC internal operating circuit incorrectly.

- Output Delay of a PLC

The PLC conveyed operation result usually through relays or transistors to loadings. There will be a 10 ms mechanic delay for relays or below a 1 ms delay for transistors.

- A PLC can't capture the swiftly changing input signal

The PLC input signal (ON or OFF) duration time must be longer than a cycle of Scan Time; Otherwise the PLC can't be recognized the correct signal properly.



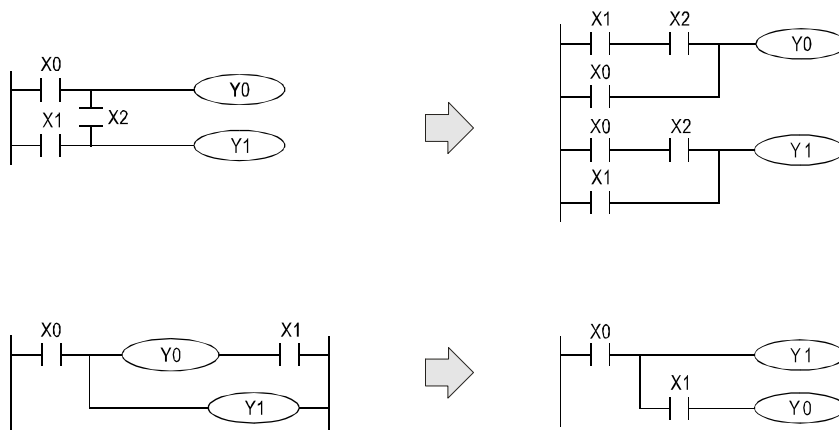
1-1-4 Memory Required for a PLC

As a result of the PLC user's program and some data must be kept, saved and updated anytime. To prevent the PLC program and data will not lost by a power failure, there are two types of data storage protect below:

- ① Using SRAM (Static Random Access Memory) plus a Lithium battery as the data storage for protect the program and data in case of power failures. Due to Limited battery life span, the battery should be changed regularly. Otherwise, the program and data will disappear after the battery out. If there is short of professionally maintenance, using SRAM is not a solution.
- ② Using Non-Volatile Memory as the data storage for protect the program and data in case of power failures. EEPROM (Electrically Erasable Programmable Read-Only Memory) and Flash ROM are two popular types of the Non-Volatile Memory. This technique using some peculiar components to keep and preserve the data more than 10 years, which is the most stable solution for a machine is lack of care.

1-1-5 The Cases a PLC Unable To Replace a Circuit Directly

Some conventional relay switchboard circuits cannot replace by PLC Ladder Circuits directly. At the left side diagrams below are Ladder Circuits for switchboard and at the right side are alternatives for PLC.

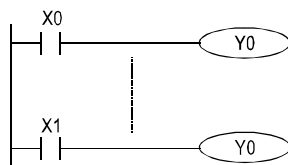


1-1-6 Double Coil Out

Please pay attention to the characteristics of PLC:

- ① PLC executes the program by orderly scanning (from top to bottom, from left to right).
- ② During the program execution, data running and changing only in the memory. The output of the operation result is only performed at the end of all execution.

The diagram shows below, the coil "Y0" has been set as OUTPUT twice, which is called "Double Coil". In the PLC program, "X1" is the only useful ("X0" is useless) input status for control the output coil "Y0".



Recommendations for solving Double Coil:

- Put output commands after execution and parallel all relative status
- Using SET, RST instructions
- Using CJ instruction
- Using SFC (Signal Function Chart).



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1-2 Product Profile of M Series PLC

1-2-1 Primary Features of M Series PLC

- ◆ **Efficient Wiring, Saves Labor And Cost**
 - M Series PLC provides the convenient connector I/O method, which will save labor and avoid errors to reduce expense.
- ◆ **Easy Maintenance Modular Structure**
 - Modular structural of M series with the wired I/O connector and conveniently dissociable base, easy for machine maintenance.
- ◆ **Flexible modular structure, available extends to 1024 points**
 - Flexible I/O modular combination easily suited to even the most complicated applications. The M series is the most competitive ability product in this class.
- ◆ **Complete System Function**
 - Built-in Flash ROM program memory (8K Steps), no back-up battery required.
 - Main programs, component annotations and program annotations can be completely loaded to the PLC, which is a very useful tool for system maintenance.
 - The password protection function can be used. It protects the copyright of the program and limited people to change the program.
 - Available install a Real Time Clock unit for time dependent applications.
- ◆ **Fully Communication Function**
 - When the main unit (CPU) using the RS-232 communication port, data can be transferred between the PLC and computer, HMI or SCADA, also available through a MODEM to remote control, edit program or data observe.
 - Multiplex communication cards and expansion modules provide RS-232 and RS-485 interfaces.
 - Support Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS, MODEM and Non Protocol communications, to satisfy diversified commutation demands.
- ◆ **Plentiful Instructions**
 - The applied instructions include: program flow, compare, move, arithmetic operation, logical operation, shift, rotation, high-speed processing and handy instructions, etc.
 - Extensive instruction set provides 16 Index Registers, which features more flexible program editing.
- ◆ **Data Bank Provide Large Data Storage**
- ◆ **High-Speed Pulse Output**
 - The CPU unit equipped two of maximum 20 kHz high-speed pulse outputs, could drive stepping motor or servomotor.
- ◆ **Interrupt Input and High-Speed Counter**
 - The CPU unit equipped 6 high-speed input points (X0 ~ X5), could be use for the interrupt inputs or high-speed counters.
- ◆ **Flexible Modular Structure With Multitudinous Models and Modules. Compact and Ingenious Design, Saves Assembling Space**
- ◆ **Advanced Windows® Based Software: Ladder Master**
 - User-friendly interface, and multi-lingual support (English, Traditional Chinese and Simple Chinese.) Function complete, easy to learn, easy to use.
- ◆ **Advanced PDA Palm® OS Based Screen Creation Software : NeoTouch Inaugurate a New Fashion.**

1-2-2 Specifications of M Series PLC

Item			Specifications
Operation Control Method			Cyclic Operation by Stored Program
Programming Language			Electric Ladder Diagram + SFC
I/O Control Method			Batch Processing
Operation Processing Time	Basic Instruction		0.125 ~ 3.25 μ s
	Applied Instruction		Several μ s ~ Several 100 μ s
Number of Instructions	Basic Instructions		27 (including: LDP, LDF, ANDP, ANDF, ORP, ORF, INV)
	Stepladder Instructions		2
	Applied Instructions		98
Program Capacity			8 K Steps (Flash ROM built into the unit)
Comment Capacity			2730 comments (16 characters or 8 Chinese characters for each comment)
Max. Input / Output Points			1024 points: X0 ~ X777, Y0 ~ Y777
Internal Relay	Auxiliary coil (M)	General	2000 points: M0 ~ M1999
		Latched	3120 points: M2000 ~ M5119
		Special	256 points: M9000 ~ M9255
	State coil (S)	Initial	10 points: S0 ~ S9
		General	490 points: S10 ~ S499
		Latched	400 points: S500 ~ S899
		Annunciaior	100 points: S900 ~ S999 (Latched)
Timer (T)		100 ms	200 points: T0 ~ T199 (Timer range: 0.1 ~ 3276.7 sec.)
		10 ms	46 points: T200 ~ T245 (Timer range: 0.01 ~ 327.67 sec.)
		1 ms (Retentive)	4 points: T246 ~ T249 (Timer range: 0.001 ~ 32.767 sec.)
		100 ms (Retentive)	6 points: T250 ~ T255 (Timer range: 0.1 ~ 3276.7 sec.)
Counter (C)	16-bit Up	General	100 points: C0 ~ C99
		Latched	100 points: C100 ~ C199
	32-bit Up/Down	General	20 points: C200 ~ C219
		Latched	15 points: C220 ~ C234
High Speed Counter (C)	32-bit Up/Down, Latched	1-phase Counter	11 points: C235 ~ C245
		2-phase Counter	5 points: C246 ~ C250
		A/B Phase Counter	5 points: C251 ~ C255
Data Register (D)		General	7000 points: D0 ~ D6999
		Latched	1192 points: D7000 ~ D8191
		File Register	7000 points: D1000 ~ D7999
		Special	256 points: D9000 ~ D9255
		Index	16 points: V0 ~ V7, Z0 ~ Z7
Level		Branch Level (P)	256 points: P0 ~ P255
		Interrupt Level (I)	15 points: 6 points for external interrupt, 3 points for timer interrupt, and 6 points for counter interrupt
		Nest Level (N)	8 points: N0 ~ N7
Constants	Decimal (K)	16 Bits	-32768 ~ 32767
		32 Bits	-2147483648 ~ 2147483647
	Hexadecimal (H)	16 Bits	0H ~ FFFFH
		32 Bits	0H ~ FFFFFFFFH
Pulse Output			2 points; Max. 20 kHz
Programming Device Link Interface			RS-232C
Communication Link Interface (Optional)			RS-232C or RS-422 / RS-485
Real Time Clock (Optional)			To indicates year, month, day, hour, min., sec. and week
Analog Potentiometer			2 Analog Potentiometers, each one can be seating as 0 ~ 255
Input Specifications (X0 ~ X7)	Power Source Require		DC24V \pm 10%, 7mA/DC24V for each point
	Input Response Time		0 ~ 60 ms, variable (Approx. 10 ms, general)
	Input Signal Type		ON/NC dry contact or NPN Open Collected Transistor
Output Specifications (Y0, Y1)	Loading Specification		DC5V ~ 30V 0.1A
	Response Time		OFF \rightarrow ON: 15 μ s ON \rightarrow OFF: 30 μ s
	Output Type		NPN Transistor Output

1-2-3 Models of M Series PLC

Item	Model No.	Specifications
CPU Module	M1	Program capacity: 8K Steps Flash ROM Build-in; 8 points DC24V input and 2 points 0.1A transistor output
Power Module	M-PSA1	AC input power supply module. Input: Ac100 ~ 240V; Output DC24V 500mA
	M-PSD1	DC24V input power supply module
Base Unit	M-3BS	3 module units mounted base board
	M-5BS	5 module units mounted base board
	M-8BS	8 module units mounted base board
I/O Module	M-8X1	8 points DC24V input (use ATX connector, cables included)
	M-16X1	16 points DC24V input (use ATX connector, cables included)
	M-32X1	32 points DC24V input (use D-SUB connector)
	M-8YR	8 points relay output (use ATX connector, cables included)
	M-16YR	16 points relay output (use ATX connector, cables included)
	M-8YT	8 points 500mA NPN transistor output (use ATX connector, cables included)
	M-16YT	16 points 500mA NPN transistor output (use ATX connector, cables included)
	M-32YT	32 points 100mA NPN transistor output (use D-SUB connector)
	M-16XY	8 points DC24V input, 8 points relay output (use ATX connector, cables included)
Special Module	M-4AD	Analog input module, 4 points voltage or current input, 14 bits resolution
	M-2DA	Analog output module, 2 points voltage or current output, 12 bits resolution
	M-1PG	Pulse output module, one axis positioning control, output pulse: 10 ~ 100Kpps
Commutation Port Expansion Card	M-RTC	RTC (Real Time Clock) expansion card, indication of year, month, day, hour, min., sec. and week.
	M-232R	RS-232 communication expansion card (including RTC function)
	M-485R	RS-485 communication expansion card (including RTC function)
Extended Memory Card	M-MP1	8K steps Flash ROM memory card
	M-DB1	64K words Flash ROM data storage extended card
Peripheral	M-32TB1	Euro feed-through style terminal block adapter for 32 points I/O module
	M-32TB2	Barrier style terminal block adapter for 32 points I/O module
	M-DUM	Dust cover null module
Connective cable	VBUSB-200	200cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (USB A-type female connector)
	MWPC-200	200cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (9 pin female connector)
	MWMD-200	200cm (6.56 ft.) length connection cable from PLC Program Writer Port to a MODEM (9 pin male connector)
	MWPC25-200	200cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (25 pin female connector)
	MWBC-030	30cm (0.98 ft.) length connection cable to connect with two Base Units
	MWBC-080	80cm (2.62 ft.) length connection cable to connect with two Base Units
	MWBC-120	120cm (3.94 ft.) length connection cable to connect with two Base Units
	MWD37-050	50cm (164.04 ft.) length connection adapter cable for 32 points I/O module
	MWD37-100	100cm (328.08 ft.) length connection adapter cable for 32 points I/O module
	MWD37-200	200cm (656.16 ft.) length connection adapter cable for 32 points I/O module
	MWD37-300	300cm (984.25 ft.) length connection adapter cable for 32 points I/O module



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1-3 Product Profile of VB Series PLC

1-3-1 Primary Features of VB Series PLC

- ◆ **Lead-In the Multi-Functional Displ, Promotion Additional Value.**
- ◆ **Complete System Function**
 - Built-in 16K (VB2, VB1) / 8K (VB0) Steps Flash ROM memories, no back-up battery required.
 - The user program, component annotations and program annotations can be completely loaded to the PLC, which is a very useful tool for system maintenance.
 - The password protection function can be used. It protects the copyright of the program and limited people to change the program.
 - Available install a Real Time Clock unit for time dependent applications.
 - The Main Unit build-in a Multi-Function Display, display information and easy to recognize.
 - Plenty of instructions, including: floating point calculations, PID and comparison instructions, etc.
- ◆ **Fully Communication Function**
 - When the Main Unit using the RS-232 communication port, data can be transferred between the PLC and a computer, HMI, or SCADA, also available through a MODEM to remote control, edit program and data observe.
 - Multiplex communication cards and expansion modules provide RS-232 and RS-485 interfaces. A system can be expanded up to 11 communications ports.
 - The VB series PLC provides communication and link functions, ex: the Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS (Master/Slave), MODEM and Non Protocol communications. The VB satisfy the most demanding communication applications.
 - Provides the MODBUS (Master/Slave) communication mode, which promotes its communication capability to other peripherals (ex. Inverters or Temperature controllers).
- ◆ **Numerous Models, Satisfy the Most Control Demanding**
 - For a different demand the Main Unit has many kind of models 14 ~ 32 I/O points can select, satisfy diversified demand.
 - The Expansion Module has 4X/4Y ~ 16X/16Y points to choose, satisfy diversified expansion.
 - Provide terminal type or connector type I/O connection.
 - Power input provide AC85 ~ 264V or DC24V power supply.
 - Provide relay, NPN transistor or PNP transistor output.
 - The input type use Sinking/Sourcing selectable mode design.
- ◆ **Diversified Special Modules, Supported Diversify Application**
 - The VB series provide special modules include: analog input modules, analog output modules, temperature sensor input modules, pulse output positioning controller modules, high-speed counter module, valve control module and communications module etc.
- ◆ **Data Bank Provide Large Data Storage**
- ◆ **High-Speed Pulse Output**
 - The VB1 main unit equipped four point high-speed pulse outputs (Y0,Y1 up to 20 kHz; Y2,Y3 up to 200kHz), could drive stepping motors or servomotors. Also, the VB1 provides some particular procession control instructions, which can procure a smooth position control easily.
 - The VB0/VB2 main unit equipped two of maximum 7 kHz high-speed pulse outputs, could drive stepping motors or servomotors.
- ◆ **Interrupt Input and High-Speed Counter**
 - The VB1 series main unit equipped 2 hardware high-speed counters, each one can catch a 200kHz signal (1, 2 or A/B phase).
 - The CPU unit equipped 6 high-speed input points (X0 ~ X5), could be use for the interrupt inputs or high-speed counters.
- ◆ **Flexible Modular Structure With Multitudinous Models and Modules**
- ◆ **Compact and Ingenious Design, Saves Assembling Space**
- ◆ **Advanced Windows® Based Software: Ladder Master**
 - User-friendly interface, and multi-lingual support (English, Traditional Chinese and Simple Chinese.) Function complete, easy to learn, easy to use.

1-3-2 Specifications of VB Series PLC

Item			VB0 Specifications	VB1 Specifications	VB2 Specifications
Operation Control Method			Cyclic Operation by Stored Program		
Programming Language			Electric Ladder Diagram + SFC		
I/O Control Method			Batch Processing		
Operation Processing Time	Basic Instruction		0.375 ~ 12.56 μs		
	Applied Instruction		Several μs ~ Several 100 μs		
Number of Instructions	Basic Instructions		27 (including: LDP,LDF, ANDP, ANDF, ORP, ORF, INV)		
	Stepladder Instructions		2		
	Applied Instructions		133	138	133
Memory Capacity (Flash ROM)	Program Capacity		8 K Steps	16 K Steps	16 K Steps
	Comment Capacity		2730 comments (16 characters or 8 Chinese characters for each comment)		
	Program Comment Capacity		20,000 characters or 10,000 Chinese characters		
Max. Input / Output Points			128 points	256 points	512 points
Internal Relay	Auxiliary coil (M)	General	3120 points: M0 ~ M1999, M4000 ~ M5119		
		Latched	2000 points: M2000 ~ M3999		
		Special	256 points: M9000 ~ M9255		
	State coil (S)	Initial	10 points: S0 ~ S9		
		General	490 points: S10 ~ S499		
		Latched	400 points: S500 ~ S899		
		Annunciaor	100 points: S900 ~ S999 (Latched)		
Timer (T)		100mS	200 points: T0 ~ T199 (Timer range: 0.1 ~ 3276.7 sec.)		
		10mS	46 points: T200 ~ T245 (Timer range: 0.01 ~ 327.67 sec.)		
		1 ms (Retentive)	4 points: T246 ~ T249 (Timer range: 0.001 ~ 32.767 sec.)		
		100 ms (Retentive)	6 points: T250 ~ T255 (Timer range: 0.1 ~ 3276.7 sec.)		
Counter (C)	16-bit Up	General	100 points: C0 ~ C99		
		Latched	100 points: C100 ~ C199		
	32-bit Up/Down	General	20 points: C200 ~ C219		
		Latched	15 points: C220 ~ C234		
High Speed Counter (C)	32-bit Up/Down, Latched	1-phase Counter	11 points: C235 ~ C245 (Signal Frequency: 10 kHz Max.)		
		2-phase Counter	5 points: C246 ~ C250 (Signal Frequency: 10 kHz Max.)		
		A/B Phase Counter	5 points: C251 ~ C255 (Signal Frequency: 5 kHz Max.)		
Data Register (D)		General	7680 points: D0 ~ D6999, D7512 ~ D8191		
		Latched	512 points: D7000 ~ D7511		
		File Register	7000 points: D1000 ~ D7999		
		Special	256 points: D9000 ~ D9255		
		Index	16 points: V0 ~ V7, Z0 ~ Z7		
Level		Branch Level (P)	256 points: P0 ~ P255		
		Interrupt Level (I)	15 points: 6 points for external interrupt, 3 points for timer interrupt, and 6 points for counter interrupt		
		Nest Level (N)	8 points: N0 ~ N7		
Constants	Decimal (K)	16 Bits	-32768 ~ 32767		
		32 Bits	-2147483648 ~ 2147483647		
	Hexadecimal (H)	16 Bits	0H ~ FFFFH		
		32 Bits	0H ~ FFFFFFFFH		
Hardware 32 Bit High Speed Counter			—	2 points 200 KHz	—
Pulse Output			2 points, 7 KHz Max.	2 points 20 kHz; 2 points 200 kHz	2 points, 7 KHz Max.
Programming Device Link Interface			RS-232C		
Communication Link Interface (Optional)			RS-232C or RS-422 / RS-485		
Real Time Clock (Optional)			To indicates year, month, day, hour, min., sec. and week		
The Number of Special Modules Limited			Limited 2 Special Modules	Limited 8 Special Modules	Limited 16 Special Modules
Multi-Functional Display			128 points (16×8 LED) display for I/O status and information		
Analog Potentiometers			2 Analog Potentiometers, each one can be seating as 0~255		

1-3-3 Models of VB Series PLC

Item	Model No.	Specifications	
VB0 Series Main Unit	VB0-14M★-◆	8 points DC24V input, 6 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB0-20M★-◆	12 points DC24V input, 8 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB0-28M★-◆	16 points DC24V input, 12 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB0-32M★-◆	16 points DC24V input, 16 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB0-32M★-◆C	16 points DC24V input, 16 points output, One set DC24V 420mA output, ATX connector I/O (W/cables)	
VB1 Series Main Unit	VB1-14MT-D	DC 24V power input, 8 points DC 24V input, 6 points NPN transistor output, Barrier terminal I/O	
	VB1-24MT-D	DC 24V power input, 14 points DC 24V input, 10 points NPN transistor output, Barrier terminal I/O	
	VB1-32MT-D	DC 24V power input, 16 points DC 24V input, 16 points NPN transistor output, Barrier terminal I/O	
VB2 Series Main Unit	VB2-16M★-◆	8 points DC24V input, 8 points output, One set DC24V 420mA output,Barrier terminal I/O	
	VB2-32M★-◆	16 points DC24V input, 16 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB2-32M★-◆C	16 points DC24V input, 16 points output, One set DC24V 420mA output, ATX connector I/O (W/cables)	
Expansion Unit	VB-32E★-◆	16 points DC24V input, 16 points output, One set DC24V 420mA output, Barrier terminal I/O	
	VB-32E★-◆C	16 points DC24V input, 16 points output, One set DC24V 420mA output,ATX connector I/O (W/cables)	
Expansion Module	VB-32XY★	16 points DC 24V input, 16 points output, Barrier terminal I/O	
	VB-16XY★	8 points DC24V input, 8 points output, Barrier terminal I/O	
	VB-16X	16 points DC24V input, Barrier terminal input	
	VB-16Y★	16 points output, Barrier terminal I/O	
	VB-8XY★	4 points DC24V input, 4 points output, Barrier terminal I/O	
	VB-8X	8 points DC24V input, Barrier terminal input	
	VB-8Y★	8 points output, Barrier terminal Output	
	VB-32XY★-C	16 points DC 24V input, 16 points output, ATX connector I/O (with cables)	
	VB-16XY★-C	8 points DC24V input, 8 points output,ATX connector I/O (with cables)	
	VB-16X-C	16 points DC24V input, ATX connector input (with cables)	
	VB-8X-C	8 points DC 24V input, ATX connector input (with cables)	
	VB-8Y★-C	8 points output, ATX connector output (with cables)	
Special Module	VB-4AD	Analog input module, 4 points voltage or current input, 12 bits resolution	
	VB-2DA	Analog output module, 2 points voltage or current output, 12 bits resolution	
	VB-4DA	Analog output module, 4 points voltage or current output, 8 bits resolution	
	VB-3A	Analog I/O module, 2 points voltage or current 12 bits resolution input, 1 points voltage or current 12 bits resolution output	
	VB-6A	Analog I/O module, 4 points voltage or current 12 bits resolution input, 2 points voltage or current 12 bits resolution output	
	VB-4T	4 channels temperature input module	K/J type thermocouple inputs, 0.1℃ (0.18°F) resolution, Equipped with the cold junction compensation, open circuit detection and digital filter
	VB-8T	8 channels temperature input module	
	VB-2PT	2 channels temperature input module	3-wire PT-100 3850PPM/℃ , 0.1℃ (0.18°F) resolution, Equipped with open circuit detection and digital filter
	VB-4PT	4 channels temperature input module	
	VB-1LC	1 channel temperature control module	K/J type thermocouple or 3-wire PT-100 3850PPM/℃ inputs, 0.1℃ (0.18°F) resolution, Support CT input for observe current, Open-collector output to perform PID control, Auto Tuning and provide 14 alarm modes
	VB-2LC	2 channels temperature control module	
	VB-1PG	1 axis pulse output positioning control module, Output pulse frequency: 10 pps ~ 100 Kpps	
	VB-1HC	1 point High-Speed Counter module, Counts pulses up to 45 kHz, 2 channels hardware compare output	
	VB-2VC	2 channels proportional Valve Control Module; 12 bit DAC, up to 1.05A/Ch, available to set the Min./Max. currents and adjust rising/falling slopes	
	VB-1COM	Serial-line communication expansion module, Photo-coupler isolating, Transmission distance: 1,000 m (3280 ft.) Max.(RS485)	
VB-PWR	Power expansion module, Input: AC 100V ~ 240V, Output: DC5V 0.4A / DC12V 0.8A / DC24V 0.5A(for sensors)		
Communication Expansion Module	VB-485A	RS 485 communication expansion module, Photo-coupler isolating, Transmission distance: 1,000 m (3280 ft.) Max.	
	VB-CADP	Dual communication ports expansion module, Includes an isolated RS-232/485 port and an isolated RS-485 port, Transmission distance: 1,000 m (3280 ft.) Max. (RS-485)	

Item	Model No.	Specifications
Communication Expansion Card	VB-232	RS-232 communication expansion card
	VB-485	RS-422/RS-485 communication expansion card, No isolation, Transmission distance: 50 m (162 ft.) Max.
Memory and RTC Expansion Card	VB-MP1R	16K Steps Flash ROM memory expansion card, Including RTC function
	VB-RTC	RTC (Real Time Clock) expansion card, Indicates of year, month, day, hour, min., sec. and week
	VB-DB1R	128 words data storage expansion card, Including RTC function
Connective Cable	VBUSB-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (USB A-type female connector)
	MWPC-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (9 pin female connector)
	MWMD-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a MODEM (9 pin male connector)
	MWPC25-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (25 pin female connector)
	VBMD09-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a MODEM (9 pin male connector)
	VBPC25-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a computer (25 pin female connector)
	VBFDHMI-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a Fuji or Digital HMI (25 pin male connector)
	VBEC-050	50 cm (6.56 ft.) length of VB series PLC expansion cable
	VBEC-100	100 cm (6.56 ft.) length of VB series PLC expansion cable
Power Supply	VB-30PS	30W power supply, Input: AC 100V ~ 240V, Output: DC 5V 0.2A / DC 24V 1.2A
Setting Board	DAP-100	4 keys data setting board, to collocating with Multi-Functional Display for seating arguments.

★ -- Output type R: relay output T: NPN transistor output P: PNP transistor output
 ◆ -- Power type A: AC 100V ~ 240V (-15% / +10%) D: DC24V (-15% / +20%)

1-4 Product Profile of VH Series PLC

1-4-1 Primary Features of VH Series PLC

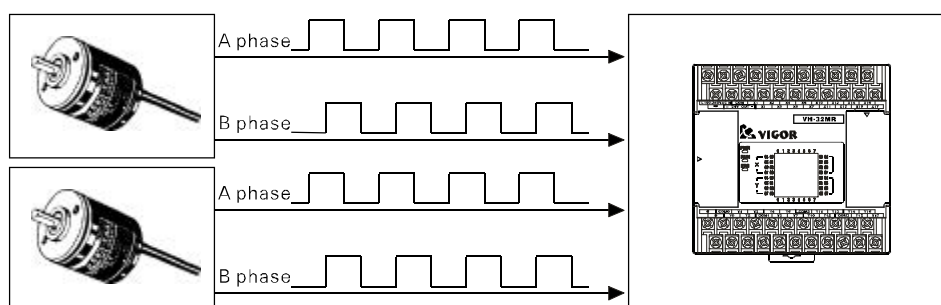
◆ Error Code Display Function *

- The LCD display screen on the Main Unit, which is not only for displaying the I/O status, but also has 109 error codes (01 ~ 99 and E0 ~ E9) display function. This very useful function will promote the machine system maintenance effecting.



◆ Interrupt Input and High Speed Counter Function

- The Main Unit contains 6 rapid points (X0 ~ X5) can be used as the external interrupt input terminal and high speed counter input terminal. It can be connected up to 6 single-phase high-speed counter input signals or 2 AB-phase rotation encoder.



◆ Complete System Function

- Built-in 4K Steps Flash ROM memories, no back-up battery required.
- The user program, component annotations and program annotations can be completely loaded to the PLC, which is a very useful tool for system maintenance.
- Plenty of instructions, including (rise/fall) pulse and in-line comparison instructions made smoothly program editing.
- The password protection function can be used. It protects the copyright of the program and limited people to change the program.
- Available install a Real Time Clock unit for time dependent applications.*
- Wide range AC input power supply, operating voltage from AC 85V to AC 264V*

◆ Flexible Modular Structure With Multitudinous Models and Modules

- The Main Unit provided 10 ~ 60 I/O points for various needs.
- The I/O expansion modules provided from 4X/4Y to 16X/16Y, fully support expansion feature needs.*

◆ Fully Communication Function

- When the Main Unit using RS-232 communication port (CP1), data can be transferred between the PLC and the computer, HMI, or SCADA, also available through a MODEM to remote control, edit program and data observe.
- Multiplex communication cards and expansion modules provide RS-232 and RS-485 interfaces. A system can be expanded up to 3 communications ports (CP1 ~ CP3).
- The VH series PLC through the Computer Link (protocol for VH, VB and the M series) or MODBUS slave communication protocol to connect with a computer, HMI or SCADA become a local area network monitor.
- The VH series PLC has the MODBUS (Master) communication function, which can be used for connect with any MODBUS peripherals to access data.
- The VH series PLC has the Non-Protocol communication function, it does not administer specific communication protocol. All the communication processes are customized and completed by PLC's user program, for connecting with various equipments which do not have the MODBUS communication protocol.

◆ Advanced Windows® Based Software: Ladder Master

- User-friendly interface, function complete, easy to learn, easy to use.

* Not available for VH-10MR and VH-14MR

1-4-2 Specifications of VH Series PLC

Item			Specifications
Operation Control Method			Cyclic Operation by Stored Program
Programming Language			Electric Ladder Diagram + SFC
I/O Control Method			Batch Processing
Operation Processing Time	Basic Instruction		0.375 ~ 12.56 μ s
	Applied Instruction		Several μ s ~ Several 100 μ s
Number of Instructions	Basic Instructions		27 (including: LDP,LDF, ANDP, ANDF, ORP, ORF, INV)
	Stepladder Instructions		2
	Applied Instructions		81
Memory Capacity (Flash ROM)	Program Capacity		Built-in 4 K Steps Flash ROM
	Comment Capacity		2730 comments (16 characters or 8 Chinese characters for each comment)
	Program Comment Capacity		20,000 characters or 10,000 Chinese characters
Max. Input / Output Points			128 points: X0 ~ X77, Y0 ~ Y77
Internal Relay	Auxiliary Coil (M)	General	384 points: M0 ~ M383
		Latched	128 points: M384 ~ M511
		Special	256 points: M9000 ~ M9255
	State Coil (S)	Initial	10 points: S0 ~ S9 (Latched)
		Latched	118 points: S10 ~ S127
Timer (T)		100mS	63 points: T0 ~ T62 (Timer range: 0.1 ~ 3276.7 sec.)
		10mS	31 points: T32 ~ T62 (Timer range: 0.01 ~ 327.67 sec.), when the coil M9028= "ON"
		1 ms	1 points: T63 (Timer range: 0.001 ~ 32.767 sec.)
Counter (C)	16-bit Up	General	16 points: C0 ~ C15
		Latched	16 points: C16 ~ C31
High Speed Counter (C)	32-bit Up/Down, Latched	1-phase Counter	11 points: C235 ~ C245 (Signal Frequency: 10 KHz Max.)
		2-phase Counter	5 points: C246 ~ C250 (Signal Frequency: 10 KHz Max.)
		A/B Phase Counter	4 points: C251 ~ C254 (Signal Frequency: 5 KHz Max.)
Data Register (D)		General	128 points: D0 ~ D127
		Latched	128 points: D128 ~ D255
		Special	256 points: D9000 ~ D9255
		Index	16 points: V0 ~ V7, Z0 ~ Z7
Level		Branch Level (P)	64 points: P0 ~ P63
		Interrupt Level (I)	15 points: 6 points for external interrupt, 3 points for timer interrupt, and 6 points for counter interrupt
		Nest Level (N)	8 points: N0 ~ N7
Constants	Decimal (K)	16 Bits	-32768 ~ 32767
		32 Bits	-2147483648 ~ 2147483647
	Hexadecimal (H)	16 Bits	0H ~ FFFFH
		32 Bits	0H ~ FFFFFFFFH
Pulse Output			1 point; Max. 7 KHz
Programming Device Link Interface CP1			RS-232C, available direct connect to a computer, HMI or MODEM
Communication Link Interface CP2 (Optional)			RS-232C or RS-422 / RS-485, available direct connect to a computer, HMI or MODEM
Communication Link Interface CP3 (Optional)			RS-485, available direct connect to a computer, HMI
Real Time Clock (Optional)			To indicates year, month, day, hour, min., sec. and week
Error Code Display Function			Displays 109 error codes (01~99 and E0~E9)
Analog Potentiometer			2 Analog Potentiometers, each one can be seating as 0~255

1-4-3 Models of VH Series PLC

Item	Model No.	Specifications
Main Unit	VH-10MR	6 points DC24V input, 4 points output, Power source: DC24V
	VH-14MR	8 points DC24V input, 6 points output, Power source: DC24V
	VH-20MR	12 points DC24V input, 8 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
	VH-24MR	14 points DC24V input, 10 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
	VH-28MR	16 points DC24V input, 12 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
	VH-32MR	16 points DC24V input, 16 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
	VH-40MR	24 points DC24V input, 16 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
	VH-60MR	36 points DC24V input, 24 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
Expansion Unit	VH-32ER	16 points DC24V input, 16 points output, Power source: AC100 ~ 240V, One set DC24V 420mA output
Expansion Module	VH-28XYR	20 points DC24V input, 8 points relay output
	VH-16XYR	8 points DC24V input, 8 points relay output
	VH-16X	16 points DC24V input
	VH-8XYR	4 points DC24V input, 4 points relay output
	VH-8X	8 points DC24V input
	VH-8YR	8 points relay output
Communication Expansion Module	VB-485A	RS 485 communication expansion module, Photocoupler isolating, Transmission distance: 1,000 m (3280 ft.) Max.
	VB-CADP	Dual communication ports expansion module, Includes an isolated RS-232/485 port and an isolated RS-485 port, Transmission distance: 1,000 m (3280 ft.) Max. (RS-485)
Communication Expansion Card	VB-232	RS-232 communication expansion card
	VB-485	RS-422/RS-485 communication expansion card, No isolation, Transmission distance: 50 m (162 ft.) Max.
Expansion Card	VB-MP1R	Flash ROM memory cartridge (Only 4 K steps programs stored for VH Series), Including RTC function
	VB-RTC	RTC (Real Time Clock) expansion card, Indicates of year, month, day, hour, min., sec. and week
Connective Cable	VBUSB-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (USB A-type female connector)
	MWPC-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (9 pin female connector)
	MWMD-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a MODEM (9 pin male connector)
	MWPC25-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Port to a computer (25 pin female connector)
	VBPC09-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a computer (9 pin female connector)
	VBMD09-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a MODEM (9 pin male connector)
	VBPC25-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a computer (25 pin female connector)
	VBFDHMI-200	200 cm (6.56 ft.) length connection cable from PLC Program Writer Auxiliary Port to a Fuji or Digital HMI (25 pin male connector)
	VHEC-050	50 cm (6.56 ft.) length of VH series PLC expansion cable
Power Supply	VB-30PS	30W power supply, Input: AC 100V ~ 240V, Output: DC 5V 0.2A / DC 24V 1.2A



MEMO

1-5 Instruction Table of M, VB, VH Series PLC

1-5-1 Basic Instruction Table

Instruction Title	Function	Devices	Applicable PLC Type			Ref. Page
			M	VB	VH	
LD	Initial logical operation contact type NO (normally open)	X, Y, M, S, T, C	○	○	○	75
LDI	Initial logical operation contact type NC (normally closed)	X, Y, M, S, T, C	○	○	○	75
AND	Serial link of NO (normally open) contacts	X, Y, M, S, T, C	○	○	○	75
ANI	Serial link of NC (normally closed) contacts	X, Y, M, S, T, C	○	○	○	75
OR	Parallel link of NO (normally open) contacts	X, Y, M, S, T, C	○	○	○	75
ORI	Parallel link of NC (normally closed) contacts	X, Y, M, S, T, C	○	○	○	75
ANB	Serial link of multiple parallel circuits	—	○	○	○	76
ORB	Parallel link of multiple contact circuits	—	○	○	○	76
OUT	Final logical operation type coil drive	Y, M, S, T, C	○	○	○	75
SET	Sets component permanently ON	Y, M, S	○	○	○	79
RST	Resets component permanently OFF	Y, M, S, T, C, D	○	○	○	79
PLS	Rising edge pulse	Y, M	○	○	○	79
PLF	Falling/trailing edge pulse	Y, M	○	○	○	79
MC	Denotes the start of a master control block	N0 ~ N7	○	○	○	78
MCR	Denotes the end of a master control block	N0 ~ N7	○	○	○	78
MPS	Stores the current result of the internal PLC operations	—	○	○	○	77
MRD	Reads the current result of the internal PLC operations	—	○	○	○	77
MPP	Pops (recalls and removes) the currently stored result	—	○	○	○	77
NOP	No operation or null step	—	○	○	○	—
END	Force the current program scan to end	—	○	○	○	75
LDP	Initial logical operation Rising edge pulse	X, Y, M, S, T, C	○	○	○	81
LDF	Initial logical operation Falling/trailing edge pulse	X, Y, M, S, T, C	○	○	○	81
ANDP	Serial link of Rising edge pulse	X, Y, M, S, T, C	○	○	○	81
ANDF	Serial link of Falling/trailing edge pulse	X, Y, M, S, T, C	○	○	○	81
ORP	Parallel link of Rising edge pulse	X, Y, M, S, T, C	○	○	○	81
ORF	Parallel link of Falling/trailing edge pulse	X, Y, M, S, T, C	○	○	○	81
INV	Invert the current result of the internal PLC operations	—	○	○	○	81

Step Ladder Instruction Table

Instruction Title	Function	Devices	Applicable PLC Type			Ref. Page
			M	VB	VH	
STL	Initiation of Stepladder	S	○	○	○	87
REL	End of Stepladder	—	○	○	○	87

1-5-2 Applied Instruction Table

Type	FNC No.	Instruction Title			Function	Applicable PLC Type			Ref. Page
		D		P		M	VB	VH	
Program Flow	00		CJ	P	Conditional jump	○	○	○	110
	01		CALL	P	Call subroutine	○	○	○	111
	02		SRET		Subroutine return	○	○	○	111
	03		IRET		Interrupt return	○	○	○	112
	04		EI		Enable interrupt	○	○	○	112
	05		DI		Disable interrupt	○	○	○	112
	06		FEND		First end	○	○	○	113
	07		WDT	P	Watch Dog Timer refresh	○	○	○	114
	08		FOR		Start of a FOR-NEXT loop	○	○	○	115
	09		NEXT		End of a FOR-NEXT loop	○	○	○	115
Compare and Move	10	D	CMP	P	Compare	○	○	○	118
	11	D	ZCP	P	Zone compare	○	○	○	119
	12	D	MOV	P	Move	○	○	○	120
	13		SMOV	P	Shift move	○	○	○	121
	14	D	CML	P	Compliment	○	○	○	122
	15		BMOV	P	Block move	○	○	○	123
	16	D	FMOV	P	Fill move	○	○	○	124
	17	D	XCH	P	Exchange	○	○	○	125
	18	D	BCD	P	Converts BIN → BCD	○	○	○	126
	19	D	BIN	P	Converts BCD → BIN	○	○	○	126
Arithmetic and Logical Operations	20	D	ADD	P	Addition (S1)+(S2) → (D)	○	○	○	128
	21	D	SUB	P	Subtraction (S1)−(S2) → (D)	○	○	○	129
	22	D	MUL	P	Multiplication (S1)×(S2) → (D+1,D)	○	○	○	130
	23	D	DIV	P	Division (S1)÷(S2) → (D), (D+1)	○	○	○	131
	24	D	INC	P	Increment (D)+1 → (D)	○	○	○	132
	25	D	DEC	P	Decrement (D)−1 → (D)	○	○	○	132
	26	D	WAND	P	Logic word AND (S1) ∧ (S2) → (D)	○	○	○	133
	27	D	WOR	P	Logic word OR (S1) ∨ (S2) → (D)	○	○	○	133
	28	D	WXOR	P	Logic word exclusive OR (S1) ⊕ (S2) → (D)	○	○	○	133
	29	D	NEG	P	Negation (\overline{D})+1 → (D)	○	○		134
Rotary and Shift	30	D	ROR	P	Rotation Right	○	○	○	136
	31	D	ROL	P	Rotation Left	○	○	○	136
	32	D	RCR	P	Rotation Right with carry	○	○	○	137
	33	D	RCL	P	Rotation Left with carry	○	○	○	137
	34		SFTR	P	Bit shift Right	○	○	○	138
	35		SFTL	P	Bit shift Left	○	○	○	138
	36		WSFR	P	Word shift Right	○	○		139
	37		WSFL	P	Word shift Left	○	○		140
	38		SFWR	P	Shift register write (FIFO Write)	○	○	○	141
	39		SFRD	P	Shift register read (FIFO Read)	○	○	○	142
Data Operation	40		ZRST	P	Zone reset	○	○	○	144
	41		DECO	P	Decode	○	○	○	145
	42		ENCO	P	Encode	○	○	○	146
	43	D	SUM	P	The sum of active bits	○	○		147
	44	D	BON	P	Check specified bit status	○	○		148
	45	D	MEAN	P	Mean	○	○		149
	46		ANS		Timed annunciator set	○	○		150
	47		ANR	P	Annunciator reset	○	○		150
	48	D	SQR	P	Square root	○	○		152
	49	D	FLT	P	BIN integer → Binary floating point format	○	○		153

* D ~ A32 bit mode instruction option.

* P ~ Pulse (signal) operation option.

* ○ ~ The applicable PLC type

Type	FNC No.	Instruction Title			Function	Applicable PLC Type			Ref. Page
		D		P		M	VB	VH	
High-speed Processing	50		REF	P	I/O refresh	○	○	○	156
	51		REFF	P	I/O refresh and filter adjust	○	○		157
	52		MTR		Input matrix	○	○		158
	53	D	HSCS		High Speed Counter set	○	○	○	159
	54	D	HSCR		High Speed Counter reset	○	○	○	161
	55	D	HSZ		High Speed Counter zone compare	○	○		162
	56		SPD		Speed detection	○	○	○	167
	57	D	PLSY		Pulse Y output	○	○	○	168
	58		PWM		Pulse width modulation	○	○	○	169
	59	D	PLSR		Variable speed of Pulse output		○	○	170
Handy Instruction	61	D	SER	P	Search	○	○		174
	62	D	ABSD		Absolute Drum sequencer	○	○	○	175
	63		INCD		Incremental Drum sequencer	○	○	○	177
	64		TTMR		Teaching Timer	○	○		178
	65		STMR		Special Timer	○	○		179
	66		ALT	P	Alternate state	○	○	○	180
	67		RAMP		Ramp variable value	○	○	○	181
	69		SORT		Sort data	○	○		183
External Setting and Display	70	D	TKY		Ten Key input	○	○		186
	71	D	HKY		Hexadecimal Key input	○	○		187
	72		DSW		Digital Switch (Thumbwheel input)	○	○		189
	73		SEGD	P	Seven Segment Decoder	○	○	○	190
	74		SEGL		Seven Segment with Latch	○	○		191
	76		ASC		ASCII code Convert	○	○		193
	77		PR		Print	○	○		194
	78	D	FROM	P	Read from a special function block	○	○		195
	79	D	TO	P	Write to a special function block	○	○		195
External Serial Communications	80		RS		Serial communication instruction	○	○	○	198
	81	D	PRUN	P	Parallel Run	○	○		202
	82		ASCI	P	Converts HEX → ASCII	○	○	○	203
	83		HEX	P	Converts ASCII → HEX	○	○	○	204
	84		CCD	P	Check Code	○	○	○	205
	85		VRRD	P	VR volume read	○	○	○	206
	86		VRSC	P	VR volume scale	○	○	○	207
	88		PID		PID control loop		○		352
	89		LINK		Easy Link communication	○	○		208
	149		MBUS		MODBUS communication		○	○	370
Floating Point	110	D	ECMP	P	Compares two BIN floating point values		○		214
	111	D	EZCP	P	Compares a BIN float range with a BIN float value		○		215
	118	D	EBCD	P	Converts BIN floating point format to DEC format		○		216
	119	D	EBIN	P	Converts DEC format to BIN floating point format		○		216
	120	D	EADD	P	Adds up two BIN floating point numbers		○		217
	121	D	ESUB	P	Subtracts one BIN floating point number from another		○		218
	122	D	EMUL	P	Multiplies two BIN floating point numbers		○		219
	123	D	EDIV	P	Divides one BIN floating point number from another		○		220
	127	D	ESQR	P	Square root of a BIN floating point value		○		221
	129	D	INT	P	BIN floating point → BIN integer format		○		222
	130	D	SIN	P	Calculates the sine of a BIN floating point value		○		223
	131	D	COS	P	Calculates the cosine of a BIN floating point value		○		224
	132	D	TAN	P	Calculates the tangent of a BIN floating point value		○		225

Type	FNC No.	Instruction Title			Function	Applicable PLC Type			Ref. Page
		D		P		M	VB	VH	
Others	90		DBRD	P	Reads data from the data bank	○	○		228
	91		DBWR	P	Writes data into the data bank	○	○		229
	147	D	SWAP	P	Swaps high/low byte	○	○		230
	169	D	HOURL		Operational Hour meter		○		376
	176		TFT		Timer (10 ms)	○	○	○	231
	177		TFH		Timer (100 ms)	○	○	○	232
	178		TFK		Timer (1 sec.)	○	○	○	233
Position Control	155	D	ABS		Absolute current value read		VB1		253
	156	D	ZRN		Zero position return		VB1		254
	157	D	PLSV		Pulse variable output		VB1		255
	158	D	DRVI		Drive to increment		VB1		256
	159	D	DRVA		Drive to absolute		VB1		257
Time & Convert	160		TCMP	P	Compare two times	○	○		236
	161		TZCP	P	Compare a time to a specified time range	○	○		237
	162		TADD	P	Adds up two time values to get a new time	○	○		238
	163		TSUB	P	Subtracts one time value from another to get a new time	○	○		239
	166		TRD	P	Reads the RTC current value to a group of registers	○	○		240
	167		TWR	P	Sets the RTC to the value stored in a group of registers	○	○	○	241
	170	D	GRY	P	Converts BIN → Gray code	○	○		242
	171	D	GBIN	P	Converts Gray code → BIN	○	○		243
In-line Comparisons	224	D	LD =		Initial comparison contact. Active when (S1)=(S2)		○	○	246
	225	D	LD >		Initial comparison contact. Active when (S1)>(S2)		○	○	246
	226	D	LD <		Initial comparison contact. Active when (S1)<(S2)		○	○	246
	228	D	LD < >		Initial comparison contact. Active when (S1)≠(S2)		○	○	246
	229	D	LD ≤		Initial comparison contact. Active when (S1)≤(S2)		○	○	246
	230	D	LD ≥		Initial comparison contact. Active when (S1)≥(S2)		○	○	246
	232	D	AND =		Serial comparison contact. Active when (S1)=(S2)		○	○	246
	233	D	AND >		Serial comparison contact. Active when (S1)>(S2)		○	○	246
	234	D	AND <		Serial comparison contact. Active when (S1)<(S2)		○	○	246
	236	D	AND < >		Serial comparison contact. Active when (S1)≠(S2)		○	○	246
	237	D	AND ≤		Serial comparison contact. Active when (S1)≤(S2)		○	○	246
	238	D	AND ≥		Serial comparison contact. Active when (S1)≥(S2)		○	○	246
	240	D	OR =		Parallel comparison contact. Active when (S1)=(S2)		○	○	246
	241	D	OR >		Parallel comparison contact. Active when (S1)>(S2)		○	○	246
	242	D	OR <		Parallel comparison contact. Active when (S1)<(S2)		○	○	246
	244	D	OR < >		Parallel comparison contact. Active when (S1)≠(S2)		○	○	246
	245	D	OR ≤		Parallel comparison contact. Active when (S1)≤(S2)		○	○	246
	246	D	OR ≥		Parallel comparison contact. Active when (S1)≥(S2)		○	○	246
Newly added instructions	92		TPID		Temperature PID Control		○		363

Type	FNC No.	Instruction Title			Function	Applicable PLC Type			Ref. Page
		D		P		M	VB	VH	
A	20	D	ADD	P	Addition (S1)+(S2) → (D)	○	○	○	128
	46		ANS		Timed annunciator set	○	○		150
	47		ANR	P	Annunciator reset	○	○		150
	62	D	ABSD		Absolute Drum sequencer	○	○	○	175
	66		ALT	P	Alternate state	○	○	○	180
	76		ASC		ASCII code Convert	○	○		193
	82		ASCI	P	Converts HEX → ASCII	○	○	○	203
	155	D	ABS		Absolute current value read		VB1		253
	232	D	AND=		Serial comparison contact. Active when (S1)=(S2)		○	○	246
	233	D	AND>		Serial comparison contact. Active when (S1)>(S2)		○	○	246
	234	D	AND<		Serial comparison contact. Active when (S1)<(S2)		○	○	246
	236	D	AND<>		Serial comparison contact. Active when (S1)≠(S2)		○	○	246
	237	D	AND≤		Serial comparison contact. Active when (S1)≤(S2)		○	○	246
	238	D	AND≥		Serial comparison contact. Active when (S1)≥(S2)		○	○	246
B	15		BMOV	P	Block move	○	○	○	123
	18	D	BCD	P	Converts BIN → BCD	○	○	○	126
	19	D	BIN	P	Converts BCD → BIN	○	○	○	126
	44	D	BON	P	Check specified bit status	○	○		148
C	00		CJ	P	Conditional jump	○	○	○	110
	01		CALL	P	Call subroutine	○	○	○	111
	10	D	CMP	P	Compare	○	○	○	118
	14	D	CML	P	Compliment	○	○	○	122
	84		CCD	P	Check Code	○	○	○	205
	131	D	COS	P	Calculates the cosine of a BIN floating point value		○		224
D	05		DI		Disable interrupt	○	○	○	112
	23	D	DIV	P	Division (S1)÷(S2) → (D), (D+1)	○	○	○	131
	25	D	DEC	P	Decrement (D)-1 → (D)	○	○	○	132
	41		DECO	P	Decode	○	○	○	145
	72		DSW		Digital Switch (Thumbwheel input)	○	○		189
	90		DBRD	P	Reads data from the data bank	○	○		228
	91		DBWR	P	Writes data into the data bank	○	○		229
	158	D	DRVI		Drive to increment		VB1		256
	159	D	DRVA		Drive to absolute		VB1		257
E	04		EI		Enable interrupt	○	○	○	112
	42		ENCO	P	Encode	○	○	○	146
	110	D	ECMP	P	Compares two BIN floating point values		○		214
	111	D	EZCP	P	Compares a BIN float range with a BIN float value		○		215
	118	D	EBCD	P	Converts BIN floating point format to DEC format		○		216
	119	D	EBIN	P	Converts DEC format to BIN floating point format		○		216
	120	D	EADD	P	Adds up two BIN floating point numbers		○		217
	121	D	ESUB	P	Subtracts one BIN floating point number from another		○		218
	122	D	EMUL	P	Multiplies two BIN floating point numbers		○		219
	123	D	EDIV	P	Divides one BIN floating point number from another		○		220
	127	D	ESQR	P	Square root of a BIN floating point value		○		221
	06		FEND		First end	○	○	○	113
F	08		FOR		Start of a FOR-NEXT loop	○	○	○	115
	16	D	FMOV	P	Fill move	○	○	○	124
	49	D	FLT	P	BIN integer → Binary floating point format	○	○		153
	78	D	FROM	P	Read from a special function block	○	○		195
	170	D	GRY	P	Converts BIN → Gray code	○	○		242
G	171	D	GBIN	P	Converts Gray code → BIN	○	○		243
H	53	D	HSCS		High Speed Counter set	○	○	○	159
	54	D	HSCR		High Speed Counter reset	○	○	○	161
	55	D	HSZ		High Speed Counter zone compare	○	○		162
	71	D	HKY		Hexadecimal Key input	○	○		187
	83		HEX	P	Converts ASCII → HEX	○	○	○	204
	169	D	HOUR		Operational Hour meter		○		376

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		D		P		M	VB	VH	
I	03		IRET		Interrupt return	○	○	○	112
	24	D	INC	P	Increment (D)+1 → (D)	○	○	○	132
	63		INCD		Incremental Drum sequencer	○	○	○	177
	129	D	INT	P	BIN floating point → BIN integer format		○		222
L	89		LINK		Easy Link communication	○	○		208
	224	D	LD=		Initial comparison contact. Active when (S1)=(S2)		○	○	246
	225	D	LD>		Initial comparison contact. Active when (S1)>(S2)		○	○	246
	226	D	LD<		Initial comparison contact. Active when (S1)<(S2)		○	○	246
	228	D	LD<>		Initial comparison contact. Active when (S1)≠(S2)		○	○	246
	229	D	LD≤		Initial comparison contact. Active when (S1)≤(S2)		○	○	246
	230	D	LD≥		Initial comparison contact. Active when (S1)≥(S2)		○	○	246
M	12	D	MOV	P	Move	○	○	○	120
	22	D	MUL	P	Multiplication (S1)×(S2) → (D+1.D)	○	○	○	130
	45	D	MEAN	P	Mean	○	○		149
	52		MTR		Input matrix	○	○		158
	149		MBUS		MODBUS communication		○	○	370
N	09		NEXT		End of a FOR-NEXT loop	○	○	○	115
	29	D	NEG	P	Negation (\overline{D})+1 → (D)	○	○		134
O	240	D	OR=		Parallel comparison contact. Active when (S1)=(S2)		○	○	246
	241	D	OR>		Parallel comparison contact. Active when (S1)>(S2)		○	○	246
	242	D	OR<		Parallel comparison contact. Active when (S1)<(S2)		○	○	246
	244	D	OR<>		Parallel comparison contact. Active when (S1)≠(S2)		○	○	246
	245	D	OR≤		Parallel comparison contact. Active when (S1)≤(S2)		○	○	246
	246	D	OR≥		Parallel comparison contact. Active when (S1)≥(S2)		○	○	246
P	57	D	PLSY		Pulse Y output	○	○	○	168
	58		PWM		Pulse width modulation	○	○	○	169
	59	D	PLSR		Variable speed of Pulse output		○	○	170
	77		PR		Print	○	○		194
	81	D	PRUN	P	Parallel Run	○	○		202
	88		PID		PID control loop		○		352
	157	D	PLSV		Pulse variable output		VB1		255
R	30	D	ROR	P	Rotation Right	○	○	○	136
	31	D	ROL	P	Rotation Left	○	○	○	136
	32	D	RCR	P	Rotation Right with carry	○	○	○	137
	33	D	RCL	P	Rotation Left with carry	○	○	○	137
	50		REF	P	I/O refresh	○	○	○	156
	51		REFF	P	I/O refresh and filter adjust	○	○		157
	67		RAMP		Ramp variable value	○	○	○	181
	80		RS		Serial communication instruction	○	○	○	198
S	02		SRET		Subroutine return	○	○	○	111
	13		SMOV	P	Shift move	○	○	○	121
	21	D	SUB	P	Subtraction (S1) – (S2) → (D)	○	○	○	129
	34		SFTR	P	Bit shift Right	○	○	○	138
	35		SFTL	P	Bit shift Left	○	○	○	138
	38		SFWR	P	Shift register write (FIFO Write)	○	○	○	141
	39		SFRD	P	Shift register read (FIFO Read)	○	○	○	142
	43	D	SUM	P	The sum of active bits	○	○		147
	48	D	SQR	P	Square root	○	○		152
	56		SPD		Speed detection	○	○	○	167
	61	D	SER	P	Search	○	○		174
	65		STMR		Special Timer	○	○		179
	69		SORT		Sort data	○	○		183
	73		SEGD	P	Seven Segment Decoder	○	○	○	190
	74		SEGL		Seven Segment with Latch	○	○		191
	130	D	SIN	P	Calculates the sine of a BIN floating point value		○		223
	147	D	SWAP	P	Swaps high/low byte	○	○		230

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		D		P		M	VB	VH	
T	64		TTMR		Teaching Timer	○	○		178
	70	D	TKY		Ten Key input	○	○		186
	79	D	TO	P	Write to a special function block	○	○		195
	92		TPID		Temperature PID Control		○		363
	132	D	TAN	P	Calculates the tangent of a BIN floating point value		○		225
	160		TCMP	P	Compare two times	○	○		236
	161		TZCP	P	Compare a time to a specified time range	○	○		237
	162		TADD	P	Adds ups two time values to get a new time	○	○		238
	163		TSUB	P	Subtracts one time value from another to get a new time	○	○		239
	166		TRD	P	Reads the RTC current value to a group of registers	○	○		240
	167		TWR	P	Sets the RTC to the value stored in a group of registers	○	○	○	241
	176		TFT		Timer (10 ms)	○	○	○	231
	177		TFH		Timer (100 ms)	○	○	○	232
	178		TFK		Timer (1 sec.)	○	○	○	233
V	85		VRRD	P	VR volume read	○	○	○	206
	86		VRSC	P	VR volume scale	○	○	○	207
W	07		WDT	P	Watch Dog Timer refresh	○	○	○	114
	26	D	WAND	P	Logic word AND (S1) \wedge (S2) \rightarrow (D)	○	○	○	133
	27	D	WOR	P	Logic word OR (S1) \vee (S2) \rightarrow (D)	○	○	○	133
	28	D	WXOR	P	Logic word exclusive OR (S1) ∇ (S2) \rightarrow (D)	○	○	○	133
	36		WSFR	P	Word shift Right	○	○		139
	37		WSFL	P	Word shift Left	○	○		140
X	17	D	XCH	P	Exchange	○	○	○	125
Z	11	D	ZCP	P	Zone compare	○	○	○	119
	40		ZRST	P	Zone reset	○	○	○	144
	156	D	ZRN		Zero position return		VB1		254



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