Safety Notes

Please Read Before Use

This manual should be read and understood before attempting to install, operate, maintain or overhaul a PLC. The user should be completely familiar with all associated documentation, safety practices, guidelines and necessary device knowledge before move on accordingly.

Two symbols are used to highlight the safety notes mentioned in this manual: DANGER and CAUTION. They are listed below with brief descriptions.

DANGER	Indicates that misoperation could cause severe consequence like death or major injury.
CAUTION	Indicates that misoperation could cause physical or property damage.

In addition, the CAUTION warnings also indicate that severe consequences are possible under certain conditions. Please make sure all operations are carried out in accordance with these guidelines to avoid such consequences.

Please keep this manual properly for reference whenever necessary and distribute it to the end users.

Safety Notes

Please Read Before Use

1. Design Guidelines

⚠ DANGER	Page Ref.
• Please set up an external safety circuit for the PLC, so that if the external power fails or the PLC breaks down, the system can still operate with safety. • Any misoperation or mis-output could possibly cause accident. • External protective circuits should be designed for a PLC to avoid mechanical damage. E.g. Emergency Stop, Forward/Reverse Inter-Lock or Upper/Lower Limit Positioning. • A PLC CPU detects abnormal states through self-examine functions such as Watch Dog Timer (WDT) and will then switch off all its outputs. Anyway, it is not able to detect the state of the input/output control circuits and thus may not be able to control the output when error occurs. So in order to protect the mechanical equipment, some external safety circuits and agencies should be designed. • A PLC may not be able to control the ON/OFF state when error occurs to its output relay and transistor, etc. So for crucial output signals which could cause major accident, some external safety circuit and agencies should be designed, to make sure the mechanical devices operate with safety.	14 52 56

2. Installation Guidelines

⚠ CAUTION	Page Ref.
• The product should be used under certain conditions as stated in "1-6 General Specifications" of this manual. • The product should NOT be used under the following conditions: (1) Excessive or conductive dust, corrosive or flam. gas, or oily smoke. (2) Excessive heat, moisture or rain, condensation, regular impact shocks or excessive vibration. The above-mentioned conditions may cause electric shock, fire or misoperation and damage the product. • Take special care not to allow debris to fall inside the unit during installation e.g. making screw holes, cut wires etc, for it may cause fire, product damage or mis-reaction. • Once the installation is complete, remove the protective paper band on the PLC to prevent fire, product damage or mis-reaction caused by the overheating. • Install the connection cables and expansion modules properly, and make sure they are fixed, for loose contact may cause mis-reaction. • DO NOT install the product on the basement, top or along the vertical direction of a switchboard, to avoid overheating. • Ensure that there is a space larger than 50 mm around the installed PLC and it is kept as far as possible from high-voltage cables, high-voltage equipment and power equipment.	40

3. Wiring Guidelines

DANGER	Page Ref.
• Cut all the external power during installation or wiring, to avoid electric shock or product damage. • Close the terminal cover before switch on the power supply after installation or wiring, to avoid electric shock.	42

CAUTION	Page Ref.
• When wiring AC supplies, it must be connected to the correct input terminal, for if it is connected to DC (Direct Current) input/output terminal or DC power terminal, the PLC will be damaged.	42
• DO NOT connect the 24V OUT ⊞ terminal of a PLC main unit to the 24V OUT ⊞ terminal of an extension unit, or to the ⊞ terminal of an external power supply, for it may damage the PLC.	44
• DO NOT do any external wiring for the empty terminals ⊡ of a PLC, for it may damage the product.	46
• Connect the grounding terminal of the main unit using the class 3 grounding standard, but DO NOT ground it with major power systems. (Refer to 1-6)	52

4. Operation and Maintenance Guidelines

DANGER	Page Ref.
• DO NOT contact the terminal when the power supply switched on, to avoid electric shock or product mis-reaction. • Switch off the power supply before clean or tighten the terminal, to avoid electric shock. • Carry program-change-in-operation (force output, RUN, STOP, etc) ONLY after carefully read and understand this manual and safety is ensured, for misoperation may cause equipment damage or accident.	66

CAUTION	Page Ref.
• Switch off the power supply before assemble or overhaul the selected optional units, to avoid damage to the expansion or main units. • Switch off the power supply before assemble or overhaul the connection cable, to avoid damage or misoperation. • DO NOT assemble or overhaul the product cage, or alter it by yourself, for it may cause product damage, mis-reaction or fire. • Contact the nearest distributor or Vigor Electric Corp directly for any product repairing matters.	66

5. Recycling Guidelines

⚠ CAUTION	Page Ref.
• Dispose the product as industrial waste when it is to be discarded as worthless.	71

About the Manual

When purchasing VB series PLC main unit, a copy of this hardware manual will be attached. For programming tutorial or instruction tables, please refer to the "Programming Manual for M, VB and VH Series PLC".

Manual Name	Content
Hardware Manual for VB Series PLC (This manual)	• Introduction to the VB series PLC • Specification and guidelines for the operation environment, wiring and installation of the VB series PLC • Specification and instructions for the installation and operation of the selected optional units. • Instructions for the operation, maintenance and fault repair of the PLC.
Programming Manual for M, VB and VH Series PLC	• Introduction to the various components of the M, VB and VH series PLC. • Introduction to the basic and applied instructions. • Programming guidelines.

About the Trademark

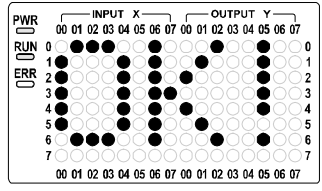
- The VIGOR trademark belongs to the VIGOR ELECTRIC CORP. of Taiwan.
- WINDOWS is a registered trademark under Microsoft Corporation of United States.
- Any other product or service names mentioned in this manual are all intelligent property of their respective owners.

Patented MFD Function, Creating Add-On Product Value

The First PLC Multi-Functional Display
It Helps to Enhance the Product Add-On Value Effectively

All mechanical equipments can have malfunction, and when it happens, the operator should be informed immediately with the error code, as wished by the designer, to enable just-in-time repair and so to reduce loss. But due to budget limit, this important feature has been forgotten or rejected in the past. Only until VIGOR realized this request and designed the Multi-Functional LED Display on the VB series main units, users nowadays can view the operation status and error codes immediately at ease, without increasing the purchase budget.

The MFD displays graphics as well as text messages, and can be used as interface for data accessing unit, if it is used together with button operations.
This creative and practical design has won a patent license for VIGOR. And it is indeed an add-on advantage of the product to improve production quality and efficiency.



Innovative Design, Reducing Labor Costs Effectively

The widely used barrier style PLC wire terminal is usually stable and reliable, but sometimes too time-consuming, error prone and hard to maintain, creating a dilemma to the users.

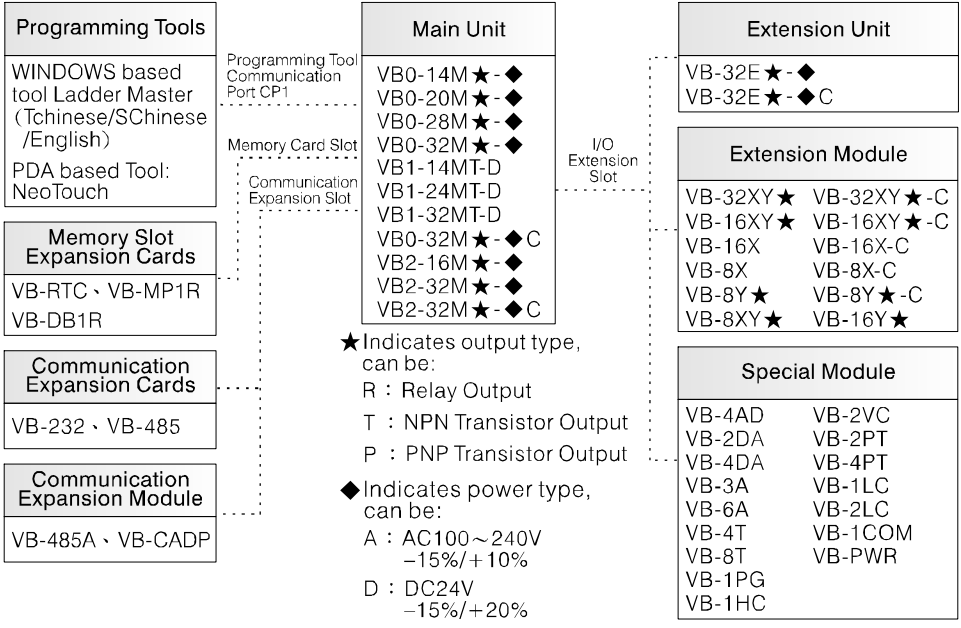
VIGOR has heard such request and came out with a solution for the VB Series PLC, to provide a series of barrier terminals or ATX connectors, including Main Units, Extension Units and Extension Modules. This solution satisfies various needs and expectations of the users.

To save the trouble of making connection wires, all the connector-type VB Series PLC has attached with ATX connectors and 2-meter wires.

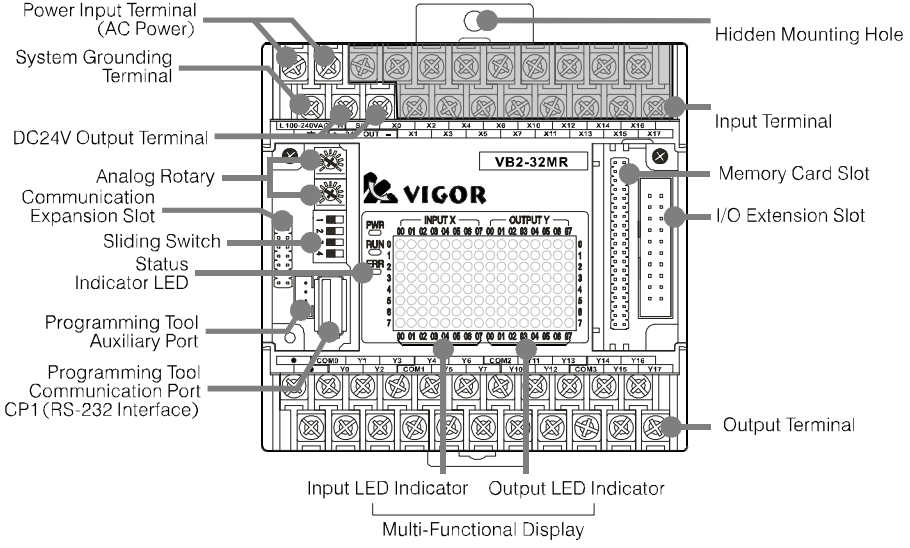
The quick-and-easy assembling characteristic of the connector-type PLC units saves a lot of wiring labor; it can also reduce errors and make the maintenance work easier, especially for mass-production industries.

http : //www.vigorplc.com.tw

1-1 System Configuration



1-2 Component Names

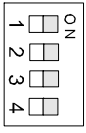


CAUTION DO NOT connect any PC USB interface to the programming tool communication port for the comm. Interface is RS-232 although it is an USB A-type connector. Use the MWPC-200 cable to connect the programming tool communication port to PC RS-232 interface. Use VBUSB-200 cable instead if the PC has no RS-232 interface.

- Status Indicator LED

LED	Action	Status
PWR (GREEN)	ON	Power in Supply
	OFF	Power Cut
RUN (GREEN)	ON	RUN
	OFF	STOP
ERR (RED)	ON	System Error (Stop Running)
	FLICKERING	Abnormal State (Stop Running)
	OFF	Normal State

- Sliding Switch



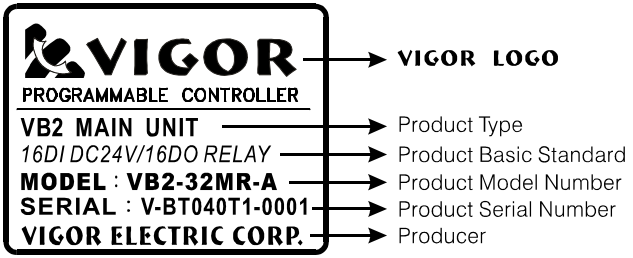
Switch Number	Function	OFF	ON
1	RUN/STOP Switch	STOP	RUN
2	Display Function Switch	I/O Status Display	Multi-Functional Display
3	I/O Display Range Switch	X0~X77 Y0~Y77	X100~X177 Y100~Y177
4	M9082	M9082=OFF	M9082=ON

The ON/OFF status of sliding switch 2~4 is indicated by special relays M9080~M9082

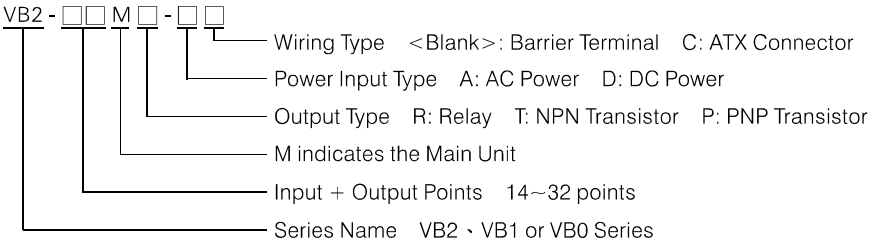
- ATX connectors wiring solution is provided for this product series to save wiring time.
- The Programming Tool Auxiliary Port is used to connect to HMI or SCADA (Supervisor Control and Data Acquisition) System. The auxiliary port is parallel linked with the Programming Tool Communication Port, so they cannot be used at the same time.

1-3 Model Numbering

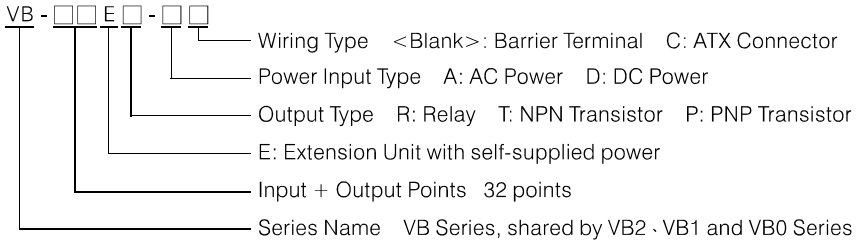
- Model Numbering Tag (Pasted on the right side of a PLC)



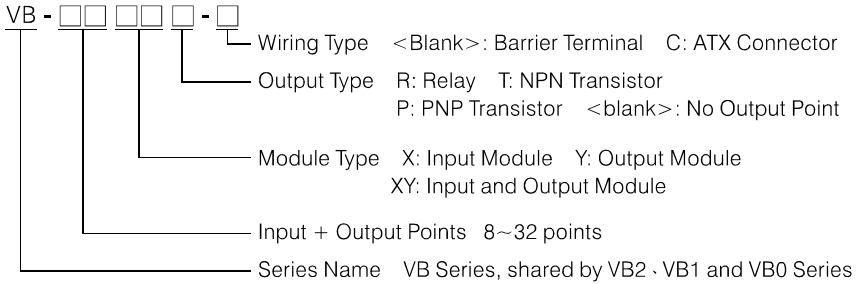
- Main Unit Model Numbering



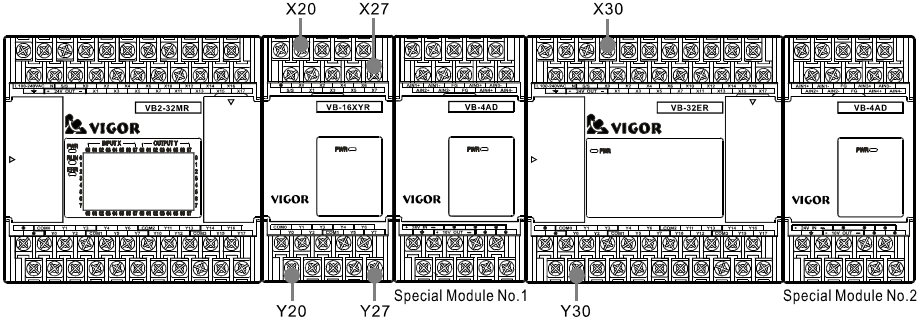
- Extension Unit Model Numbering



- Extension Module Model Numbering



1-4 Extension Units Introductions



- VB Series Main Unit always occupies I/O addresses X0～X17/Y0～Y17, so the first Extension Unit/ Module uses I/O address from X20/Y20 onwards.
- VB Series Special Module is numbered from K1～K16, and does not occupy I/O address
- All the modules exchange data with the Main Unit using BFM are named Special Modules. The VB-PWR is a power relay module, which does not occupy any Special Module numbering.
- VB-8XY Extension Module occupies 8 input points and 8 output points.
- Maximum output/input points: VB0 Series 128 points X0～X77, Y0～Y77
  VB1 Series 256 points X0～X177, Y0～Y177
  VB2 Series 512 points X0～X377, Y0～Y377
- Maximum Special Modules to be connected: VB0 Series 4 Special Modules
  VB1 Series 8 Special Modules
  VB2 Series 16 Special Modules

- I/O Extension Conditions Introduction

  VB series Main Units and Extension Units have self-supplied power circuits, but the Extension Modules and Special Modules have not, so they need to depend on the Main Units, Expansion Units or VB-PWR Power Extension Modules to get power

  The number of modules can be extended from the Main/Extension Unit and VB-PWR is stated below:

  2 Conditions must be met for extending modules from the Main Unit:

  (1) 【(Number of Extension Modules) + (Number of Special Modules × 2)】≤ 4

  (2) The Output points of the Main Unit and those extended after the Main Unit
  【(Number of ON Relays × 6) + (Number of ON Transistors)】≤ 192

  2 Conditions must be met for extending modules from the Extension Unit:

  (1) 【(Number of Extension Modules) + (Number of Special Modules × 2)】≤ 12

  (2) The Output points of the Extension Unit and those extended after the Extension Unit
  【(Number of ON Relays × 6) + (Number of ON Transistors)】≤ 192

  2 Conditions must be met for extending modules from the VB-PWR Power Extension Module:

  (1) 【(Number of Extension Modules) + (Number of Special Modules × 2)】≤ 12

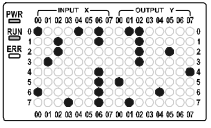
  (2) The Output points of the VB-PWR and those extended after the VB-PWR
  【(Number of ON Relays × 6) + (Number of ON Transistors)】≤ 288

1-5 Multi-Functional Display

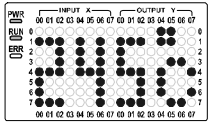
When the sliding switch No.2 is at ON side, the PLC display screen will be used as a Multi-Functional Display. The Multi-Functional Display has 8 working modes (Modes 0~7), decided by the value of special register D9080. During the program run, the display working mode can be changed by changing the value of D9080.

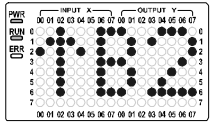
Mode	D9080	D9081	Function	Display Content
Mode 0	K0	Not Used	Displays input/output status	ON/OFF status of input/output points
Mode 1	K1	Pointer(Kn)	Displays numbers, texts or graphics	The bit ON/OFF status of Dn~Dn+7
Mode 2	K2	Pointer(Kn)	Displays error code	"E"+Dn 3-digit number
Mode 3	K3	Pointer(Kn)	Displays 4-digit number (0000~9999)	Dn 4-digit number
Mode 4	K4	Pointer(Kn)	Displays 2-digit number (00~99)	Dn+1 2-digit number, Dn 2-digit number
Mode 5	K5	Pointer(Kn)	Displays a letter and a 3-digit number	Dn+1 1 letter+Dn 3-digit number
Mode 6	K6	Ref. Programm. Manual	Data Access Mode	1 letter+3-digit number
Mode 7	K7	Pointer(Kn)	Displays a 5-digit number (0~32,767)	Dn 5-digit number

- Display examples for each mode:

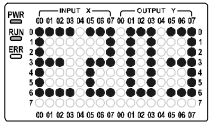


Mode 0: Displays the input /output status



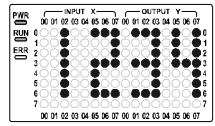


Mode 1: Displays numeric values, texts or graphics. User can control the ON/OFF status of each of the 128 LEDs on screen, to display numbers, cycling texts or graphics.



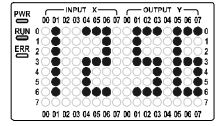
Mode 2: Displays an error code

It displays a register value as error code when machine malfunctions, and helps to make the repair work easier.



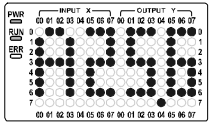
Mode 3: Displays a four-digit number (0000~9999)

It shows the appointed register value on screen, often used as product counter or working hour display.



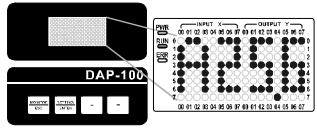
Mode 4: Displays 2 two-digit numbers (00~99)

It displays the value of 2 registers on screen, enabling the user to watch and compare two data simultaneously.



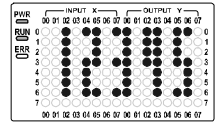
Mode 5: Displays a letter and a three-digit number (000~999)

It displays a register value as error code when machine malfunctions, and helps to make the repair work easier.



Mode 6: Data access mode.

The screen becomes a data access monitor when used together with the DAP-100 setting panel. It can be used for monitoring and setting values for multiple registers.



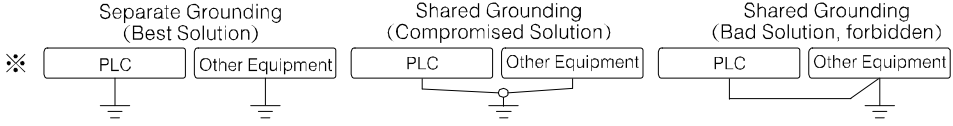
Mode 7: Displays a five-digit number (0~32767)

It shows the value of the appointed register on screen, often used as product counter or working hours display.

Design Guidelines ⚠ DANGER

- Please set up an external safety circuit for the PLC, so that if the external power fails or the PLC breaks down, the system can still operate with safety.
- Any misoperation or mis-output could possibly cause accident.
- External protective circuits should be designed for a PLC to avoid mechanical damage. E.g. Emergency Stop, Forward/Reverse Inter-Lock or Upper/Lower Limit Positioning.
- A PLC CPU detects abnormal states through self-examine functions such as Watch Dog Timer (WDT) and will then switch off all its outputs. Anyway, it is not able to detect the state of the input/output control circuits and thus may not be able to control the output when error occurs. So in order to protect the mechanical equipment, some external safety circuits and agencies should be designed.
- A PLC may not be able to control the ON/OFF state when error occurs to its output relay and transistor, etc. So for crucial output signals which could cause major accident, some external safety circuit and agencies should be designed, to make sure the mechanical devices operate with safety.

Item	Specifications
Work Ambient Temperature	0~55°C / 32~131°F
Storage Ambient Temperature	-20~70°C /-4~158°F
Work Ambient Humidity	10~90% RH, (at 25°C / 77°F, no condensation)
Storage Ambient Humidity	10~90% RH, (at 25°C / 77°F, no condensation)
Vibration Tolerance	10~55 Hz with amplitude of 0.075 mm / 0.30 inch and acceleration along X, Y and Z axes each for 80 min (8 min/Cycle × 10 times = 80 min) at 55 ~ 150 Hz with 1G.
Shock Tolerance	10 G along X, Y and Z axes each for three times
Noise Immunity	Noise Simulator 1500 Vp-p, 1μS Pulse Width and 25~60Hz Frequency
Dielectric Strength	1500VAC 1 min between AC terminal and rack panel or 500VAC 1 min between DC terminal and rack panel
Insulation Resistance	5 MΩ or above at DC 500V between AC terminal and rack panel
Grounding	Class-3 Grounding (DO NOT ground with major power supply equipment.) ※
Environmental Condition	Keep away from corrosive gas or excessive dust.



1-7 Performance Specification

Item			VB0 Series	VB1 Series	VB2 Series
Operation Control Method			Cyclic Operation by Stored Program		
Programming Language			Electric Ladder Diagram + SFC		
I/O Control Method			Batch Processing		
Operation Processing Rate	Basic Instruction		0.375~12.56 μs		
	Applied Instruction		Several ~ Several hundreds of μs		
Number of Instructions	Basic Instruction		27 (including LDP, LDF, ANDP, ANDF, ORP, ORF, INV)		
	Stepladder Instructions		2		
	Applied Instructions		138		
Memory Capacity	Program Capacity		8 K Steps Flash ROM	16 K Steps Flash ROM	16 K Steps Flash ROM
	Component Comment Capacity		2730 comments (16 characters or 8 double-byte characters for each)		
	Program Comment Capacity		20,000 characters or 10,000 double-byte characters		
Max. Input / Output Points			128 points	256 points	512 points
Internal Relay	Auxiliary Relay (M)	General	3120 points: M0 ~ M1999, M4000~M5119		
		Latched	2000 points: M2000 ~ M3999		
		Special	256 points: M9000 ~ M9255		
	State Relay (S)	Initial	10 points: S0 ~ S9		
		General	490 points: S10 ~ S499		
		Latched	400 points: S500 ~ S899		
		Warning	100 points: S900 ~ S999 (Latched)		
Timer (T)		100 ms	200 points: T0 ~ T199 (Range: 0.1~3276.7 Sec.)		
		10 ms	46 points: T200 ~ T245 (Range: 0.01~327.67 Sec.)		
		1 ms (Retentive)	4 points: T246 ~ T249 (Range: 0.001~32.767 Sec.)		
		100 ms (Retentive)	6 points: T250 ~ T255 (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		

Item			VB0 Series	VB1 Series	VB2 Series
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~DD7999		
		Special	256 points: D9000 ~ D9255		
		Index	16 points: V0 ~ V7, Z0 ~ Z7		
Pointer		Call Pointer (P)	256 points: P0 ~ P255		
		Interrupt Pointer (I)	15 points: 6 points for external interrupt, 3 points for timer interrupt, and 6 points for counter interrupt		
		Nest Pointer (N)	8 points: N0 ~ N7		
Constants Range	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 point, Max. 7 kHz	2 points 20 kHz; 2 points 200 kHz	2 point, Max. 7 kHz
Programming Device Link Interface			RS-232C, can connect to PC, HMI or MODEM directly.		
Communication Link Interface (Optional)			RS-232C or RS-422 / RS-485		
Real Time Clock (Optional)			Displays year, month, day, hour, min., sec. and week		
No. of Special Modules can connect			Max. 4 special modules	Max. 8 special modules	Max. 16 special modules
Multi-Functional Display			128 points to display I/O status and various info.		
Analog Rotary			2 analog rotaries, shows 0~255		

1-8 Instruction Tables

Basic Instruction Table

Inst.	Function	Devices
LD	LoaD	X,Y,M,S,T,C
LDI	LoaD Inverse	X,Y,M,S,T,C
AND	AND	X,Y,M,S,T,C
ANI	ANd Inverse	X,Y,M,S,T,C
OR	OR	X,Y,M,S,T,C
ORI	OR Inverse	X,Y,M,S,T,C
ANB	ANd Block	—
ORB	OR Block	—
OUT	OUT	Y,M,S,T,C
SET	SET	Y,M,S
RST	ReSeT	X,Y,M,S,T,C,D

Inst.	Function	Devices
PLS	PuLSe	Y,M
PLF	PuLSe Falling	Y,M
LDP	LoaD Pulse	X,Y,M,S,T,C
LDF	LoaD Falling Pulse	X,Y,M,S,T,C
ANDP	AND Pulse	X,Y,M,S,T,C
ANDF	AND Falling Pulse	X,Y,M,S,T,C
ORP	OR Pulse	X,Y,M,S,T,C
ORF	OR Falling Pulse	X,Y,M,S,T,C
INV	IN Verse	—
MC	Master Control	N0 ~ N7
MCR	Master Control Reset	N0 ~ N7

Inst.	Function	Devices
MPS	Point Store	—
MRD	ReaD	—
MPP	PoP	—
NOP	No OPeration	—
END	END	—

Stepladder Instruction Table

Inst.	Function	Devices
STL	STep Ladder	S
RET	RETurning to standard ladder	—

Extension Unit Model Numbering

Type	FNC NO.	Title* D		Title* P	Function
Program Flow	00		CJ	P	Conditional Jump
	01		CALL	P	CALL subroutine
	02		SRET		Subroutine RETurn
	03		IRET		Interrupt RETurn
	04		EI		Enable Interrupt
	05		DI		Disable Interrupt
	06		FEND		First END
	07		WDT	P	Watch Dog Timer refresh
	08		FOR		Start of a FOR-NEXT loop
	09		NEXT		End of a FOR-NEXT loop
Compare and Move	10	D	CMP	P	CoMPare
	11	D	ZCP	P	Zone ComPare
	12	D	MOV	P	Move
	13		SMOV	P	Shift MOVe
	14	D	CML	P	CoMpLiment
	15		BMOV	P	Block MOVe n → n
	16	D	FMOV	P	Fill MOVe 1 → n
	17	D	XCH	P	EXCHange
	18	D	BCD	P	Converts BIN → BCD
	19	D	BIN	P	Converts BCD → BIN

Type	FNC NO.	Title* D		Title* P	Function
Arithmetic and Logical Operations	20	D	ADD	P	ADDition (S1) + (S2) → (D)
	21	D	SUB	P	SUBtraction (S1) − (S2) → (D)
	22	D	MUL	P	MULtiplication (S1) × (S2) → (D+1 , D)
	23	D	DIV	P	DIVision (S1) ÷ (S2) → (D) , (D+1)
	24	D	INC	P	INCrement (D) +1 → (D)
	25	D	DEC	P	DECrement (D) −1 → (D)
	26	D	WAND	P	Logic Word AND (S1) ∧ (S2) → (D)
	27	D	WOR	P	Logic Word OR (S1) ∨ (S2) → (D)
	28	D	WXOR	P	Logic Word XOR (S1) ⊽ (S2) → (D)
	29	D	NEG	P	NEGation ($\overline{D}$) +1 → (D)
Rotary and Shift	30	D	ROR	P	ROtation Right
	31	D	ROL	P	ROtation Left
	32	D	RCR	P	Rotation Right with Carry
	33	D	RCL	P	Rotation Left with Carry
	34		SFTR	P	Bit ShiFT Right
	35		SFTL	P	Bit ShiFT Left
	36		WSFR	P	Word ShiFt Right
	37		WSFL	P	Word ShiFt Left
	38		SFWR	P	ShiFt register WRite (FIFO)
	39		SFRD	P	ShiFt register ReaD (FIFO)

Type	FNC NO.	Title*			Function
		D		P	
Data Processing	40		ZRST	P	Zone ReSeT
	41		DECO	P	DECOde
	42		ENCO	P	ENCOde
	43	D	SUM	P	SUM of active bits
	44	D	BON	P	Check specified Bit is ON
	45	D	MEAN	P	MEAN
	46		ANS		Timed ANnunciator Set
	47		ANR	P	ANnunciator Reset
	48	D	SQR	P	SQuare Root
	49	D	FLT	P	BIN FLoaTing point format
High-speed Processing	50		REF	P	REFresh I/O
	51		REFF	P	REFresh I/O and Filter adjust
	52		MTR		MaTRix input
	53	D	HSCS		High Speed Counter Set
	54	D	HSCR		High Speed Counter Reset
	55	D	HSZ		High Speed counter Zone compare
	56		SPD		SPeed Detection
	57	D	PLSY		PuLSe Y output
	58		PWM		Pulse Width Modulation
	59	D	PLSR		PuLSe Ramp output

Type	FNC NO.	Title*			Function
		D		P	
Handy Instruction	61	D	SER	P	SEaRch
	62	D	ABSD		ABSolute Drum sequencer
	63		INCD		INCremental Drum sequencer
	64		TTMR		Teaching TiMeR
	65		STMR		Special TiMeR
	66		ALT	P	ALTernate state
	67		RAMP		RAMP variable value
	69		SORT		SORT data
External Setting and Display	70	D	TKY		Ten KeY input
	71	D	HKY		Hexadecimal KeY input
	72		DSW		Digital SWitch (Thumbwheel input)
	73		SEGD	P	Seven SEGment Decoder
	74		SEGL		Seven SEGment with Latch
	76		ASC		ASCII code Conversion
	77		PR		PRint ASCII code
	78	D	FROM	P	Read buffer FROM a special unit
	79	D	TO	P	Write buffer TO a special unit

Type	FNC NO.	Title* D		Title* P	Function
Serial Communication	80		RS		RS communications
	81	D	PRUN	P	Parallel RUN
	82		ASCI	P	Converts HEX→ASCII
	83		HEX	P	Converts ASCII→HEX
	84		CCD	P	Check CoDe
	85		VRRD	P	VR volume ReaD
	86		VRSC	P	VR volume Scale
	88		PID		PID control loop
	89		LINK		Easy LINK communication
	149		MBUS		MODBUS communication
Floating Point Operation	110	D	ECMP	P	Float CoMPare
	111	D	EZCP	P	Float Zone ComPare
	118	D	EBCD	P	Float format BIN→DEC
	119	D	EBIN	P	Float format DEC→BIN
	120	D	EADD	P	Float ADD
	121	D	ESUB	P	Float SUBtract
	122	D	EMUL	P	Float MULtiplication
	123	D	EDIV	P	Float Division
	127	D	ESQR	P	Float SQuaRe root
	129	D	INT	P	BIN float→INTeger
	130	D	SIN	P	SINe
	131	D	COS	P	COSine
	132	D	TAN	P	TANgent

Type	FNC NO.	Title* D		Title* P	Function
Other	90		DBRD	P	ReaDs from the Data Bank
	91		DBWR	P	ReWrites the Data Bank
	147	D	SWAP	P	SWAPs high/low byte
	169	D	HOUR	P	Operational Hour meter
	176		TFT		Timer (10 ms)
	177		TFH		Timer (100 ms)
	178		TFK		Timer (1 sec.)
Positioning Control	155	D	ABS		ABSolute current value read
	156	D	ZRN		Zero ReturN
	157	D	PLSV		PuLSe V
	158	D	DRVI		DRiVe to Increment
	159	D	DRVA		DRiVe to Absolute
Time & Convert	160		TCMP	P	Times CoMPare
	161		TZCP	P	Time Zones ComPare
	162		TADD	P	Times ADD
	163		TSUB	P	Times SUBtract
	166		TRD	P	Time ReaDs from RTC
	167		TWR	P	Time WRites to RTC
	170	D	GRY	P	BIN→GRaY code
	171	D	GBIN	P	Gray code→BIN

Type	FNC NO.	Title* D		P	Function
In-line Comparisons	224	D	LD=		LoaD when (S1) = (S2)
	225	D	LD>		LoaD when (S1) > (S2)
	226	D	LD<		LoaD when (S1) < (S2)
	228	D	LD<>		LoaD when (S1) ≠ (S2)
	229	D	LD<=		LoaD when (S1) ≤ (S2)
	230	D	LD>=		LoaD when (S1) ≥ (S2)
	232	D	AND=		AND when (S1) = (S2)
	233	D	AND>		AND when (S1) > (S2)
	234	D	AND<		AND when (S1) < (S2)
	236	D	AND<>		AND when (S1) ≠ (S2)
	237	D	AND<=		AND when (S1) ≤ (S2)
	238	D	AND>=		AND when (S1) ≥ (S2)
	240	D	OR=		OR when (S1) = (S2)
	241	D	OR>		OR when (S1) > (S2)
	242	D	OR<		OR when (S1) < (S2)
	244	D	OR<>		OR when (S1) ≠ (S2)
	245	D	OR<=		OR when (S1) ≤ (S2)
	246	D	OR>=		OR when (S1) ≥ (S2)

Type	FNC NO.	Title* D		P	Function

1-9 Special Components and Error Messages

In the tables below, the symbol "■" represents that the component cannot be driven by instructions and no data can be written into it. And for any component that is not listed below, it is reserved for system use, and cannot be driven by instructions and no data can be written into either.

Coil No.	Function
PLC Operation Status.	
■ M9000	Always-ON A Contact during RUN period
■ M9001	Always-OFF A Contact during RUN period
■ M9002	Initial Pulse A Contact, ON for a scan time
■ M9003	Initial Pulse B Contact, OFF for a scan time
■ M9004	Error occurs
Clock Pulse	
■ M9011	10ms cycles pulse. ON 5ms/OFF 5ms
■ M9012	100ms cycles pulse. ON 50ms/OFF 50ms
■ M9013	1sec. cycles pulse. ON 0.5Sec/OFF 0.5Sec
■ M9014	1min. cycles pulse. ON 30Sec/OFF 30Sec
System Status	
■ M9005	ON when battery of the RTC is low
■ M9018	ON when RTC installed in the Main Unit
M9031	Clear the Non-Latched area memory
M9032	Clear the Latched area memory
M9033	Not clear data memory when RUN → STOP.
M9034	All the outputs are disabled
M9039	Constant Scan Time set by D9039
M9083	For VB2 series only, to select the display range of I/O status. When M9083="OFF", shows the first 256 points; M9083="ON" shows the last 256 points.

Coil No.	Function
Flag	
■ M9020	Zero Flag. Result of ADD or SUB is "0"
■ M9021	Borrow Flag. Borrow occurred to ADD or SUB
M9022	Carry Flag. Carry occurred to ADD or SUB
■ M9029	Execution complete flag for some instructions
■ M9131	Exe. complete flag for HSZ multi-points comparison
■ M9133	Exe. complete flag for HSZ and PLSY speed change
■ M9199	Exe. complete flag for LINK instruction
Assigned Operation Mode of Applied Instructions	
M9024	Assign BMOV moving directions
M9025	Assign external HSC reset mode
M9026	Assign RAMP hold mode
M9027	Assign PR working mode
M9130	Assign HSZ exe. multi-point comparison
M9132	Assign HSZ and PLSY exe. speed change
M9161	Assign 8/16 bits procession mode
M9167	Assign HKY working mode
M9168	Assign SMOV operation mode
Stepladder Instruction Flags	
M9040	Step Ladder move prevented
■ M9046	STL step is working
M9047	STL monitoring is enabled
■ M9048	Warning in action
M9049	Warning effective

Coil No.	Function
Interrupt Prevented	
M9050	Input interrupt I00□ is prevented.
M9051	Input interrupt I10□ is prevented.
M9052	Input interrupt I20□ is prevented.
M9053	Input interrupt I30□ is prevented.
M9054	Input interrupt I40□ is prevented.
M9055	Input interrupt I50□ is prevented.
M9056	Input interrupt I6□ is prevented.
M9057	Input interrupt I7□ is prevented.
M9058	Input interrupt I8□□ is prevented.
M9059	HSCounter interrupt I010~I060 disallow
Error Message	
■M9019	Real Time Clock setting error.
■M9063	Parallel Operation or RS comm. Error
■M9066	Program CHECK SUM error.
■M9067	Operation error. PLC will keep running.
M9068	Operation error latch.
Parallel Operation	
■M9070	M9070=ON indicates this Unit is master
■M9071	M9071=ON indicates this Unit is slave
■M9072	M9072=ON indicates operation in normal
■M9162	M9162=ON indicates high speed transfer
Sliding Switch Status	
■M9080	Status of the No.2 switch on main unit
■M9081	Status of the No.3 switch on main unit
■M9082	Status of the No.4 switch on main unit

Coil No.	Function
MFD Data Access Mode	
M9084	MONITOR function
M9085	SETTING function
M9086	Increase(+) function
M9087	Decrease(-) function
■M9088	Error Signal
CP2 MODEM Dialing	
M9100	CP2 Dialing Start
■M9101	CP2 Dialing Failed
Parallel Operation	
M9122	RS Instruction Send Flag
M9123	RS Instruction Receive Done
■M9124	CD Signal when CP2 connects with MODEM
M9129	Time out during RS
CPU Link Related	
■M9183	CPU Link Comm. Failed (Master)
■M9184	CPU Link Comm. Failed (Slave 1)
■M9185	CPU Link Comm. Failed (Slave 2)
■M9186	CPU Link Comm. Failed (Slave 3)
■M9187	CPU Link Comm. Failed (Slave 4)
■M9188	CPU Link Comm. Failed (Slave 5)
■M9189	CPU Link Comm. Failed (Slave 6)
■M9190	CPU Link Comm. Failed (Slave 7)
32 bits Counter Direction Assignment	
M9200 ~ M9234	When M92□□="OFF", C2□□ is up counter When M92□□="ON", C2□□ is down counter

Coil No.	Function
Control and Monitor High Speed Counter Count. Direction	
M9235 ~ M9245	When M92□□="OFF", C2□□ is up counter When M92□□="ON", C2□□ is down counter
■M9246 ~ ■M9255	When C2□□ is up counter, M92□□=OFF When C2□□ is down counter, M92□□=ON
The VB1 series position control instructions' flags (for VB1 only)	
M9140	If M9140="ON", the clear signal is sent to the servo motor when the return to zero point is complete.
M9145	Y0 pulse output stop immediately.
M9146	Y1 pulse output stop immediately.
M9147	Y2 pulse output stop immediately.
M9148	Y3 pulse output stop immediately.
■M9149	Y0 pulse output monitor, "ON"=busy.
■M9150	Y1 pulse output monitor, "ON"=busy.
■M9151	Y2 pulse output monitor, "ON"=busy.
■M9152	Y3 pulse output monitor, "ON"=busy.
The VB1 series hardware high speed counters' flags (for VB1 only)	
M9194	To activate the interrupt I050 for HHSC1. When (present value)=(setting value) of the HHSC1, no interrupt if M9194="OFF"; otherwise the interrupt routine will process immediately if M9194="ON".
M9195	To activate the interrupt I060 for HHSC2. When (present value)=(setting value) of the HHSC2, no interrupt if M9195="OFF"; otherwise the interrupt routine will process immediately if M9195="ON".
■M9196	The counting direction of HHSC1, M9196="OFF"=counts up; M9196="ON"=counts down.
■M9197	The counting direction of HHSC2, M9197="OFF"=counts up; M9197="ON"=counts down.

Table for Special Registers

Coil No.	Function
PLC Operation Status	
D9000	Time Setting of Watch Dog Timer. (unit: 1ms)
■D9004	Error coil ID shows the source of the error.
■D9010	Current operation scan time (unit: 1ms)
■D9011	Min. scan time (unit: 1ms)
■D9012	Max. scan time (unit: 1ms)
System Status	
■D9001	Displays the PLC model and version. (※1)
■D9002	Capacity size of Memory. 2 for 2000 steps.
■D9003	Type of Memory. (※2)
D9020	X0~X7 input response time setting: 0~15ms.
D9039	Constant Scan Time setting.
Real Time Clock Data	
D9013	Second value. (0~59)
D9014	Minute value. (0~59)
D9015	Hour value. (0~23)
D9016	Day value. (1~31)
D9017	Month value. (1~12)
D9018	Year value: 1990~2089 (4 digits)
D9019	Weekday value: 0 (Sun.) ~ 6 (Sat.)

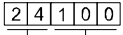
Coil No.	Function	
Step Ladder Instructions		
■D9040	1st active STL step	When M9047 ON, the step point ID which are in action is stored in D9040—D9047. Where the smallest one is stored in D9040, the second smallest one is stored in D9041 and so forth.
■D9041	2nd active STL step	
■D9042	3rd active STL step	
■D9043	4th active STL step	
■D9044	5th active STL step	
■D9045	6th active STL step	
■D9046	7th active STL step	
■D9047	8th active STL step	
■D9049	Smallest warning point number in action	
Error Message		
■D9063	Error code identifying RS comm. error	
■D9067	Error code identifying Operation error.	
D9068	Latched the step address number of opr. Error	
■D9069	Step address number of Operation error.	
Multi-Functional Display		
D9080	Displays mode setting	
D9081	Auxiliary MFD registers. For details please refer to the Multi-Functional Display working specifications in Programming Manual.	
D9082		
D9083		
D9084		
CP2 Communication Related		
D9110 ~ D9113	Store the dialing number when executing MODEM dialing function.	
D9121	Comm. Station No. when CP2 does Computer Link	
■D9122	Comm. Station No. when CP2 does Computer Link	

Coil No.	Function	
CP2 Communication Related		
■D9123	Data No. received by RS	
D9124	RS starting point setting	
D9125	RS ending point setting	
D9129	RS time out setting	
High Speed Process Instruction		
■D9130	Table counter when HSZ does multi-point comparison	
■D9131	Table counter when exe. speed change mode	
■D9132	Lower 16 bits	Current frequency register when HSZ and PLSY do speed change
■D9133	Upper 16 bits	
■D9134	Lower 16 bits	Target pulse number register when HSZ and PLSY do speed change
■D9135	Upper 16 bits	
■D9136	Lower 16 bits	Total number of output pulses using PLSY instruction.(NOT for VB1)
■D9137	Upper 16 bits	
■D9140	Lower 16 bits	Total number of output pulses using PLSY instruction by Y0(NOT for VB1)
■D9141	Upper 16 bits	
■D9142	Lower 16 bits	Total number of output pulses using PLSY instruction by Y1(NOT for VB1)
■D9143	Upper 16 bits	
CPU Link Related		
■D9172	Comm. Time Out time	
■D9177	Number of network slave stations	
■D9178	Range of send component	
■D9179	Time of comm. Retry	
■D9201	Current network scan time	
■D9202	Max. network scan time	
■D9203	Time of comm. errors happen to master	
■D9204	Time of comm. errors happen to slave1	

Coil No.	Function
CPU Link Related	
■ D9205	Time of comm. errors happen to slave2
■ D9206	Time of comm. errors happen to slave3
■ D9207	Time of comm. errors happen to slave4
■ D9208	Time of comm. errors happen to slave5
■ D9209	Time of comm. errors happen to slave6
■ D9210	Time of comm. errors happen to slave7
■ D9212	Comm. error code of slave1
■ D9213	Comm. error code of slave2
■ D9214	Comm. error code of slave3
■ D9215	Comm. error code of slave4
■ D9216	Comm. error code of slave5
■ D9217	Comm. error code of slave6
■ D9218	Comm. error code of slave7
Index Register V, Z	
D9180	Z0 Index Register
D9181	V0 Index Register
D9182	Z1 Index Register
D9183	V1 Index Register
D9184	Z2 Index Register
D9185	V2 Index Register
D9186	Z3 Index Register
D9187	V3 Index Register
D9188	Z4 Index Register
D9189	V4 Index Register
D9190	Z5 Index Register
D9191	V5 Index Register

Coil No.	Function	
Index Register V, Z		
D9192	Z6 Index Register	
D9193	V6 Index Register	
D9194	Z7 Index Register	
D9195	V7 Index Register	
The VB1 series position control special registers (for VB1 only)		
D9140	Lower 16 bits	Current value registers of output pulse number (32-bit) from Y0
D9141	Upper 16 bits	
D9142	Lower 16 bits	Current value registers of output pulse number (32-bit) from Y1
D9143	Upper 16 bits	
D9144	Lower 16 bits	Current value registers of output pulse number (32-bit) from Y2
D9145	Upper 16 bits	
D9146	Lower 16 bits	Current value registers of output pulse number (32-bit) from Y3
D9147	Upper 16 bits	
D9149	Bias speed setting for the ZRN, DRVI or DRVA instruction is operating. If the setting value > (D9151, D9150) / 10, then D9149 = (D9151,D9150) / 10	
D9150	Lower 16 bits	Maximum speed setting for ZRN, DRVI and DRVA instructions are operating, the default value = 200,000 Hz, the available range is 10~200,000 Hz. When the setting value exceeds acceptable value, it will equal to the largest acceptable value.
D9151	Upper 16 bits	
D9152	Acceleration/Deceleration time setting for ZRN, DRVI or DRVA instruction is operating, the default value = 100 mS, the available range is 50~5,000 mS.	

Coil No.	Function	
The VB1 series HHSC special registers (for VB1 only)		
D9224	The operating type of HHSC1. T0 input "0" = disable the function of HHSC1, "1"~"18" are 18 different counting modes.	
D9225	The operating type of HHSC2. To input "0" = disable the function of HHSC2, "1"~"18" are 18 different counting modes.	
D9226	Lower 16 bits	The present value of HHSC1.
D9227	Upper 16 bits	
D9228	Lower 16 bits	The present value of HHSC2.
D9229	Upper 16 bits	
D9230	Lower 16 bits	The setting value of HHSC1.
D9231	Upper 16 bits	
D9232	Lower 16 bits	The setting value of HHSC2.
D9233	Upper 16 bits	

※1 

Version: V1.00
Model: 20 for VB0/24 for Vb2

※2 00H indicates a built-in Flash Memory of PLC.
01H indicates an expanded VB-MP1R Memory Card.

Error Message Specifications

RS Communication Error Code (the value of D9063)

Error Code	Detail
0	No Error
6301	Parity, framing error

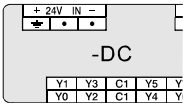
Operation Error Code (the value of D9067)

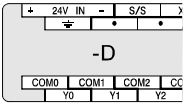
Error Code	Detail
0	No Error
6702	More than 5 layers of Call instruction have been nested together.
6703	More than 2 layers of Interrupt Insert have been nested together.
6704	More than 5 layers FOR / NEXT have been nested together.
6705	Incompatible device assigned as operand of applied instruction.
6706	Allowable range of applied instruction operand exceeded.
6708	FROM/TO error

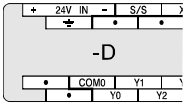
CPU Link Communication Error Code (the value of D9212~D9218)

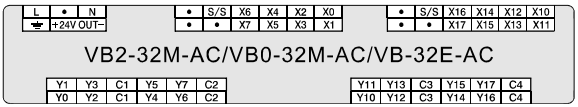
Error Code	Detail
00H	No Error
01H	Communication Time Out error
05H	Communication Check Sum error

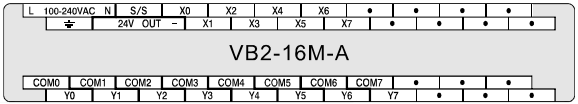
1-10 Terminal Layouts

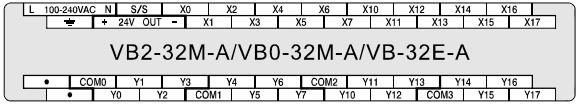


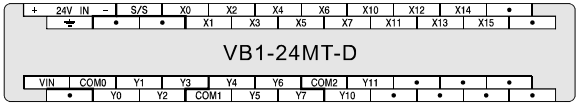


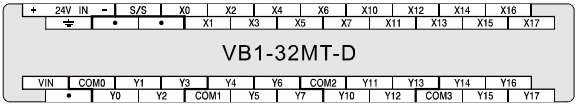


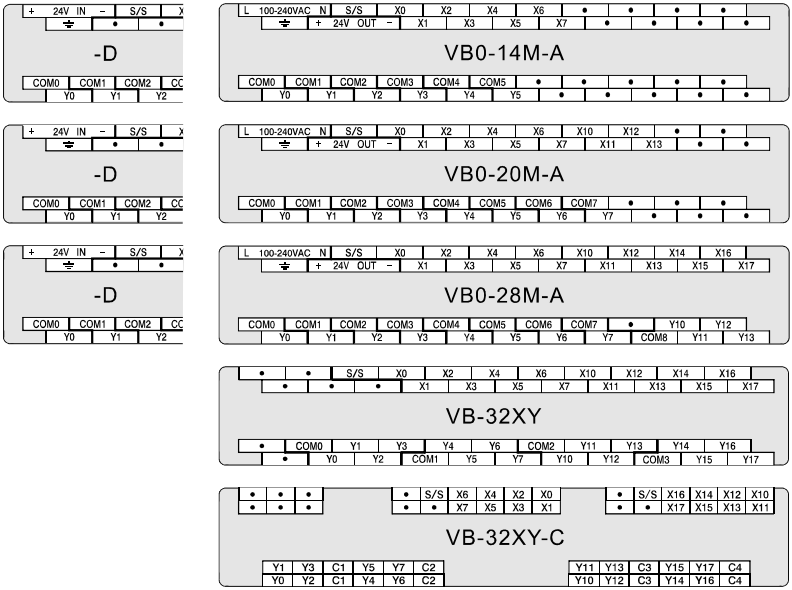


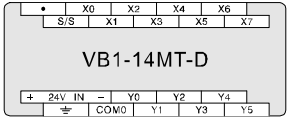


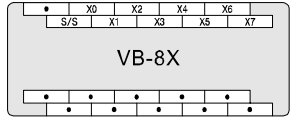


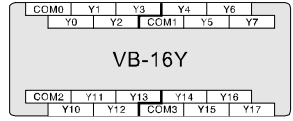


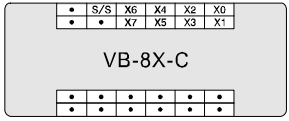


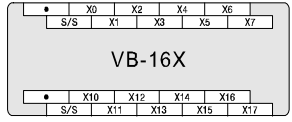

+ 24V IN − S/S
-D
COM0 COM1 COM2
Y0 Y1 Y2
L 100-240VAC N S/S X0 X2 X4 X6
+ 24V OUT − X1 X3 X5 X7
VB0-14M-A
COM0 COM1 COM2 COM3 COM4 COM5
Y0 Y1 Y2 Y3 Y4 Y5
X10 X12
VB0-20M-A
COM6 COM7
Y6 Y7
X11 X13
VB0-28M-A
X14 X16
X15 X17
COM8
Y10 Y12
Y11 Y13
VB-32XY
COM1 COM2 COM3
Y14 Y16
Y15 Y17
S/S X6 X4 X2 X0
X7 X5 X3 X1
VB-32XY-C
Y1 Y3 C1 Y5 Y7 C2
Y0 Y2 C1 Y4 Y6 C2
S/S X16 X14 X12 X10
X17 X15 X13 X11
Y11 Y13 C3 Y15 Y17 C4
Y10 Y12 C3 Y14 Y16 C4

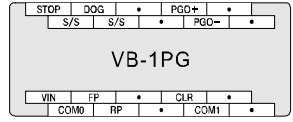

X0 X2 X4 X6
S/S X1 X3 X5 X7
VB1-14MT-D
+ 24V IN − Y0 Y2 Y4
COM0 Y1 Y3 Y5


X0 X2 X4 X6
S/S X1 X3 X5 X7
VB-8X

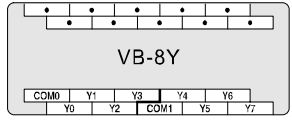

COM0 Y1 Y3 Y4 Y6
Y0 Y2 COM1 Y5 Y7
VB-16Y
COM2 Y11 Y13 Y14 Y16
Y10 Y12 COM3 Y15 Y17

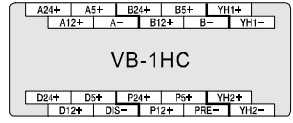

S/S X6 X4 X2 X0
X7 X5 X3 X1
VB-8X-C

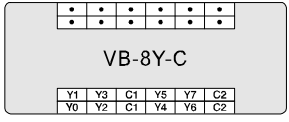

X0 X2 X4 X6
S/S X1 X3 X5 X7
VB-16X
X10 X12 X14 X16
S/S X11 X13 X15 X17

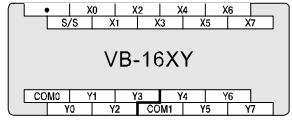

STOP DOG PGO+
S/S S/S PGO−
VB-1PG
VIN FP CLR
COM0 RP COM1

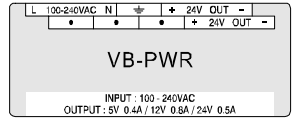

S/S X6 X4 X2 X0
X7 X5 X3 X1
VB-16X-C
X11 X13 X15 X17
X10 X12 X14 X16 S/S

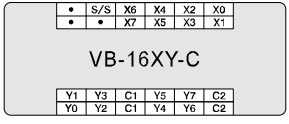

COM0 Y1 Y3 Y4 Y6
Y0 Y2 COM1 Y5 Y7
VB-8Y

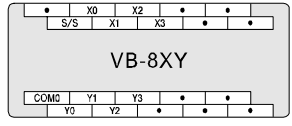

A24+ A5+ B24+ B5+ YH1+
A12+ A− B12+ B− YH1−
VB-1HC
D24+ D5+ P24+ P5+ YH2+
D12+ D/S− P12+ PRE− YH2−

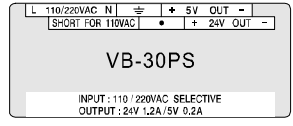

VB-8Y-C
Y1 Y3 C1 Y5 Y7 C2
Y0 Y2 C1 Y4 Y6 C2


X0 X2 X4 X6
S/S X1 X3 X5 X7
VB-16XY
COM0 Y1 Y3 Y4 Y6
Y0 Y2 COM1 Y5 Y7

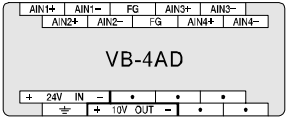

L 100-240VAC N + 24V OUT −
+ 24V OUT −
VB-PWR
INPUT : 100 - 240VAC
OUTPUT : 5V 0.4A / 12V 0.8A / 24V 0.5A

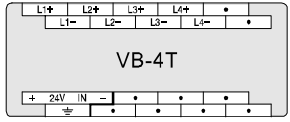

S/S X6 X4 X2 X0
X7 X5 X3 X1
VB-16XY-C
Y1 Y3 C1 Y5 Y7 C2
Y0 Y2 C1 Y4 Y6 C2

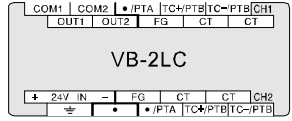

X0 X2
S/S X1 X3
VB-8XY
COM0 Y1 Y3
Y0 Y2

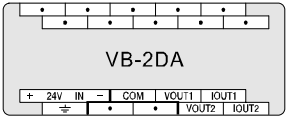

L 110/220VAC N + 5V OUT −
SHORT FOR 110VAC + 24V OUT −
VB-30PS
INPUT : 110 / 220VAC SELECTIVE
OUTPUT : 24V 1.2A / 5V 0.2A

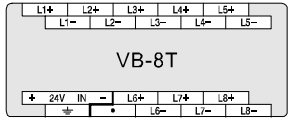
1. VB Series PLC Introductions

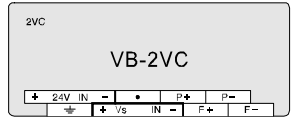


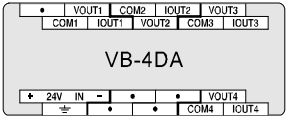


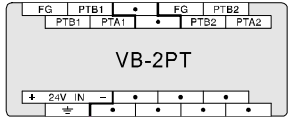


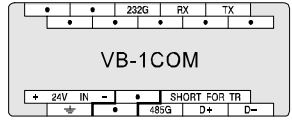


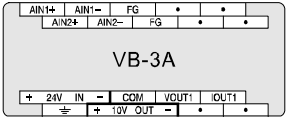


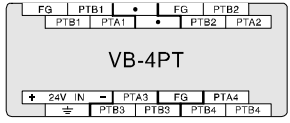


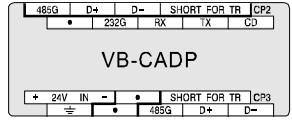


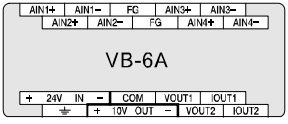


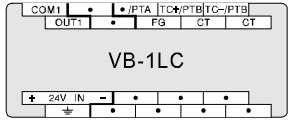


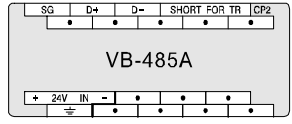












1-11 Product List

Item	Model	Main Specification	
VB0 Series Main Unit	VB0-14M★-◆	8 points DC24V input, 6 points output, DC24V output 420mA, barrier terminal I/O	
	VB0-20M★-◆	12 points DC24V input, 8 points output, DC24V output 420mA, barrier terminal I/O	
	VB0-28M★-◆	16 points DC24V input, 12 points output, DC24V output 420mA, barrier terminal I/O	
	VB0-32M★-◆	16 points DC24V input, 16 points output, DC24V output 420mA, barrier terminal I/O	
	VB0-32M★-◆C	16 points DC24V input, 16 points output, DC24V output 420mA, ATX connector I/O (with wire)	
VB1 Series Main Unit	VB1-14MT-D	DC 24V Power Input; 8 points, DC 24V Signal Input; 6 points NPN Output	the barrier terminal style I/O
	VB1-24MT-D	DC 24V Power Input; 14 points, DC 24V Signal Input; 10 points NPN Output	
	VB1-32MT-D	DC 24V Power Input; 16 points, DC 24V Signal Input; 16 points NPN Output	
VB2 Series Main Unit	VB2-16M★-◆	8 points DC24V input, 8 points output, DC24V output 420mA, barrier terminal I/O	
	VB2-32M★-◆	16 points DC24V input, 16 points output, DC24V output 420mA, barrier terminal I/O	
	VB2-32M★-◆C	16 points DC24V input, 16 points output, DC24V output 420mA, ATX connector I/O (with wire)	
Extension Unit	VB-32E★-◆	16 points DC24V input, 16 points output, DC24V output 420mA, barrier terminal I/O	
	VB-32E★-◆C	16 points DC24V input, 16 points output, DC24V output 420mA, ATX connector I/O (with wire)	
Extension 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 I/O	
	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 I/O	
	VB-8Y★	8 points output, barrier terminal I/O	
	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 wire)	
	VB-16X-C	16 points DC24V input, ATX connector I/O (with wire)	
	VB-8X-C	8 points DC24V input, ATX connector I/O (with wire)	
	VB-8Y★-C	8 points output, ATX connector I/O (with wire)	
Special Module	VB-4AD	Analog Input, 4 points 12 bits, free-choose voltage or current type	
	VB-2DA	Analog Output, 2 points 12 bits, free-choose voltage or current type	
	VB-4DA	Analog Output, 4 points 8 bits output, free-choose voltage or current type	
	VB-3A	Analog I/O, 2 points 12 bits input, 1 point 12 bits output, free-choose voltage or current type	
	VB-6A	Analog I/O, 4 points 12 bits input, 2 point 12 bits output, free-choose voltage or current type	

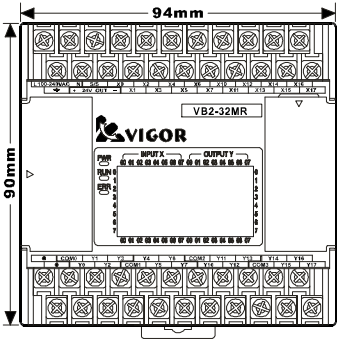
1. VB Series PLC Introductions

Item	Model	Main Specification	
Special Module	VB-4T	4 channels Temperature Input Module	J/K Thermocouple Inputs; 0.1℃/0.18℉ resolution; With the cold junction compensation, open circuit detection and digital filter
	VB-8T	8 channels Temperature Input Modul	
	VB-2PT	2 channels Temperature Input Module	PT-100, 3850 PPM/℃, 3 wire type Inputs; 0.1℃/0.18℉ resolution; With the open circuit detection and digital filter
	VB-4PT	4 channels Temperature Input Module	
	VB-1LC	1 channel Temperature Control Module	J/K Thermocouple or PT-100, 3850 PPM/℃, 3 wire Inputs; 0.1℃/0.18℉ resolution; With the open collector transistor PID controls, Auto-Turning functions, CT monitors and 14 Alarms
	VB-2LC	2 channels Temperature Control Module	
	VB-1PG	Single Axis Pulse Output positioning, output frequency 10～100Kpps	
	VB-1HC	High Speed Counter, 1 point 45KHz high speed count input, 2 hardware comparator output	
	VB-2VC	2 channels Valve Control Modules ; 12 bit DAC, up to 1.111A/Ch	
	VB-1COM	Serial Comm., RS-232/RS-485 interface, Photocoupler isolated, RS-485 Comm. distance 1000m	
	VB-PWR	Power Ext., AC85～264V input,DC5V0.4A/DC12V0.8A PLC output,DC24V0.5A Sensor output	
Communication Module	VB-485A	RS-485 Communication Module; Photocoupler Isolated; Max. Distance: 1000M/3280'	
	VB-CADP	One Isolated RS-232 / RS-485 Port and one Isolated RS-485 Port; Max. Distance: 1000M/3280'	
Communication Card	VB-232	RS-232C Communication Expansion Card	
	VB-485	RS-422 / RS-485 Communication Expansion Card	
Memory Card Slot Expansion Card	VB-MP1R	8K steps Flash ROM Memory Card (2.5K Steps for VB0 main unit); including RTC function	
	VB-RTC	RTC (Real Time Clock) Expansion Card	
	VB-DB1R	128K Words data storage expansion card with RTC	
Connection Cables	VBUSB-200	Cable between a PLC (CP1) and Computer (USB A-type female connector); Length: 2 M/6'7"	
	MWPC-200	Cable between a PLC (CP1 A-type USB) and Computer (9-pin female connector); Length: 2 M/6'7"	
	MWMD-200	Cable between a PLC (CP1 A-type USB) and MODEM (9-pin male connector); Length of 2 M/6'7"	
	MWPC25-200	Cable between a PLC (CP1 A-type USB) and Computer (25-pin female connector); Length: 2 M/6'7"	
	VBMD09-200	Cable between a PLC (CP1 JST 4P) and MODEM (9-pin male connector); Length: 2 M/6'7"	
	VBPC25-200	Cable between a PLC (CP1 JST 4P) and Computer (25-pin female connector); Length: 2 M/6'7"	
	VBEC-050	VB Series PLC Expansion Extended cable; Length: 50cm/19.7"	
	VBEC-100	VB Series PLC Expansion Extended cable; Length: 100cm/39.4"	
Setting Panel	DAP-100	4 buttons data setting panel, used with MFD to set multiple data parameter	

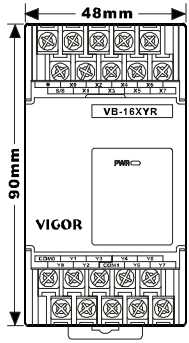
★For output type, can be: R : Relay Output T: NPN Transistor Output P: PNP Transistor Output

◆For power type, can be: A : AC100～240V -15% / + 10% D: DC 24V -15% / + 20%

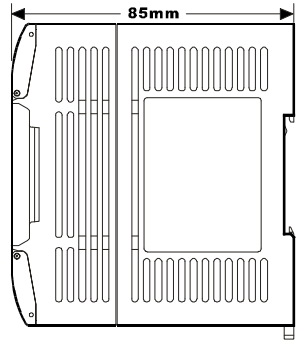
1-12 Dimensions



Main Unit/Extension Unit



Extension Module



Model	Weight (kg)
VB0-14M★-◆	0.57
VB0-20M★-◆	0.58
VB0-28M★-◆	0.60
VB0-32M★-◆	0.62
VB0-32M★-◆C	1.70
VB1-14MT-D	0.26
VB1-24MT-D	0.41
VB1-32MT-D	0.43
VB2-16M★-◆	0.58

Model	Weight (kg)
VB2-32M★-◆	0.62
VB2-32M★-◆C	1.70
VB-32E★-◆	0.55
VB-32E★-◆C	1.61
VB-32XY★	0.43
VB-32XY★-C	1.39
VB-16XY★	0.29
VB-16X	0.26
VB-8XY★	0.27

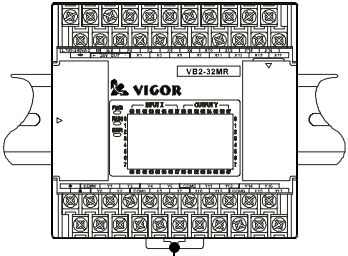
Model	Weight (kg)
VB-8X	0.26
VB-8Y★	0.28
VB-16Y★	0.26
VB-16XY★-C	0.72
VB-16X-★	0.46
VB-8X-C	0.42
VB-8Y★-C	0.52

Installation Safety Guidelines ⚠ CAUTION

- The product should be used under certain conditions as stated in "1-6 General Specifications" of this manual.
- The product should NOT be used under the following conditions:
  (1) Excessive or conductive dust, corrosive or flam. gas, or oily smoke.
  (2) Excessive heat, moisture or rain, condensation, regular impact shocks or excessive vibration. The above-mentioned conditions may cause electric shock, fire or misoperation and damage the product.
- Take special care not to allow debris to fall inside the unit during installation e.g. making screw holes, cut wires etc, for it may cause fire, product damage or mis-reaction.
- Once the installation is complete, remove the protective paper band on the PLC to prevent fire, product damage or mis-reaction caused by the overheating.
- Install the connection cables and expansion modules properly, and make sure they are fixed, for loose contact may cause mis-reaction.
- DO NOT install the product on the basement, top or along the vertical direction of a switchboard, to avoid overheating.
- Ensure that there is a space larger than 50 mm around the installed PLC and it is kept as far as possible from high-voltage cables, high-voltage equipment and power equipment.

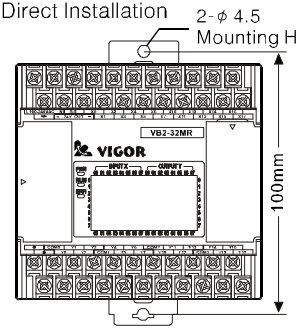
2-1 Installation Guides

- DIN Rail Installation



Install the product on the 35mm DIN rail handle. Pull down the handle when un-install to take the product off.

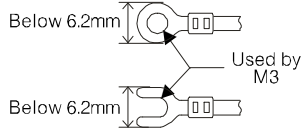
- Direct Installation



Pull out the 2 hidden mounting holes (100mm between) from the top and bottom of the product, and install with screws.

2-2 Wiring Guidelines

- DO NOT pass PLC's Input Signal and Output signal through the same cable.
- DO NOT tie the Input Signal cable/Output Signal Cable together with other power cables.
- Limit the cable length to be within 20 meters for safety reasons.
- Use O or Y type terminal when wiring as specified on the right hand side diagram.
- Tighten the screw properly to avoid misoperation. The proper strength used to turn the terminal screw is 5~8kg-cm.



Wiring Safety Guidelines ⚠ DANGER

- Cut all the external power during installation or wiring, to avoid electric shock or product damage.
- Close the terminal cover before switch on the power supply after installation or wiring, to avoid electric shock.

Wiring Safety Guidelines ⚠ CAUTION

- When wiring AC supplies, it must be connected to correct input terminal, for if it is connected to DC (Direct Current) input/output terminal or DC power terminal, the PLC will be damaged.
- DO NOT connect the 24 V OUT ⊞ terminal of a PLC main unit to the 24 V OUT ⊞ terminal of an extension unit, or to the ⊞ terminal of an external power supply, for it may damage the PLC.
- DO NOT do any external wiring for the empty terminals ⊡ of a PLC, for it may damage the product.
- Connect the grounding terminal of the main unit using the class 3 grounding standard, but DO NOT ground it with major power systems. (Refer to 1-6)

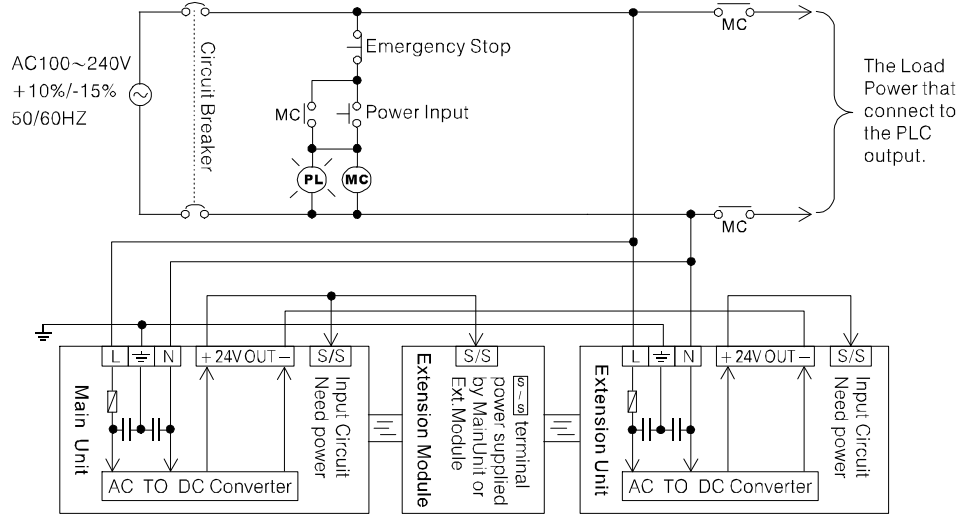
3-1 Power Specifications

Power Specifications (Including All VB Series Main Units and Extension Units)

Item	AC Power	DC Power
Input Voltage	AC100～240V +10%/-15%	DC24V +20%/-15%
Input Frequency	50/60Hz	—
Max. allowable momentary power failure period	Within 10 ms.	Within 1 ms.
Power Fuse	250V 2A	250V 5A
Power Consumption	30 VA	12W
Power Unit Output Current	DC5V 400mA	DC5V 400mA
	DC12V 530mA	DC12V 530mA
	DC24V ±15% 420mA; output from terminal	—

3. Power Specifications and External Wiring

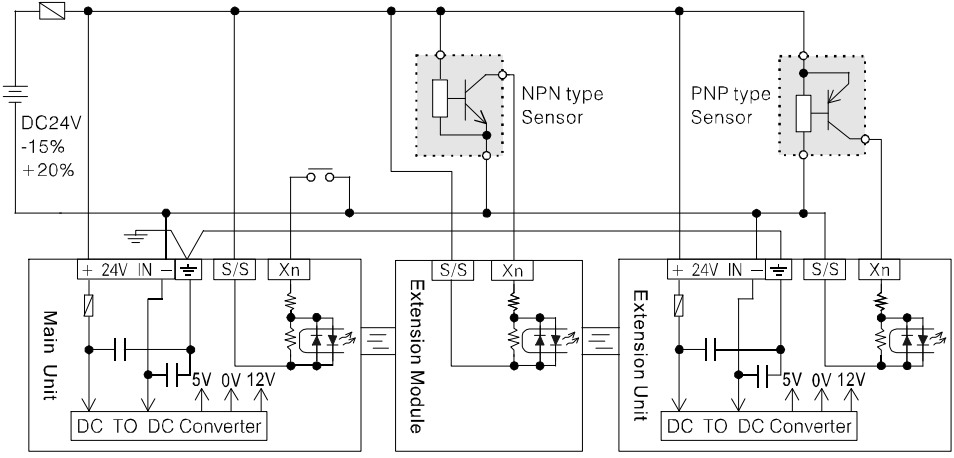
3-2 AC Power Wiring Example



CAUTION

- 24V OUT can be used as sensor power but DO NOT send external power to it.
- DO NOT do external wiring for any empty terminal or use it as a relay terminal.
- DO NOT connect the positive terminal of the Main Unit and Extension Unit together, but please connect their negative terminals together.

3-3 DC Power Wiring Example



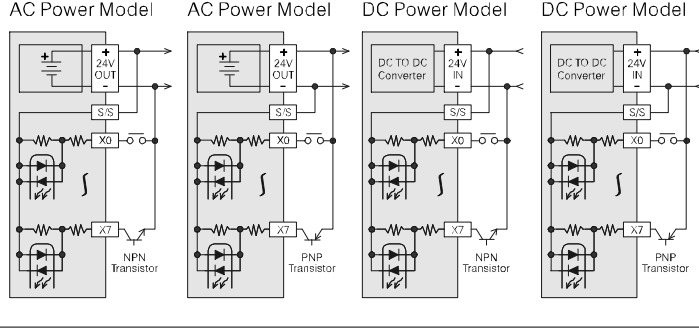
- Connect the 24V IN terminal of the Main Unit with Direct Current power of DC 24V −15%/+20%. Try to use Constant Voltage Power Supply if possible. Make sure a Wave Filter Capacitor is used if need to use a full-wave Rectifying Power Supply

- DO NOT do external wiring for empty terminal or use it as a relay terminal.

Wiring Safety Guidelines ⚠ CAUTION

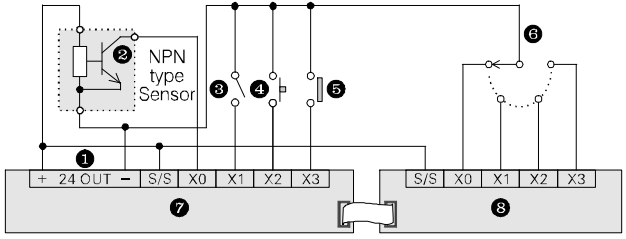
- When wiring AC supplies, it must be connected to correct input terminal, for if it is connected to DC (Direct Current) input/output terminal or DC power terminal, the PLC will be damaged.
- DO NOT connect the 24 V OUT ⊞ terminal of a PLC main unit to the 24 V OUT ⊞ terminal of an extension unit, or to the ⊞ terminal of an external power supply, for it may damage the PLC.
- DO NOT do any external wiring for the empty terminals ⊡ of a PLC, for it may damage the product.
- Connect the grounding terminal of the main unit using the class 3 grounding standard, but DO NOT ground it with major power systems. (Refer to 1-6)

4-1 Input Point Specifications

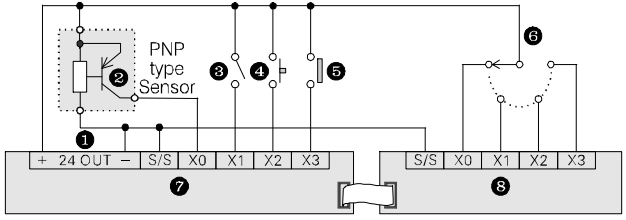
Item	Specification
Input Activating Voltage	DC24V±15%
Input Signal Circuit	7 mA / DC 24V
Input ON Circuit	Above 3.5 mA
Input OFF Circuit	Below 1.7 mA
Input Resistance	3.3 KΩ approximately
Input Response Time	10 ms approximately, X0~X7 are variable, can be set between 0~60 mS.
Input Signal Type	Dry Contact or NPN/PNP open collector transistor
Isolation Mode	Photocoupler Isolation
Circuit Diagram	

4-2 Input Point Wiring Introduction

- Input Point Wiring Example with NPN Sensor



- Input Point Wiring Example with PNP Sensor



❶ DC24V

❷ NPN/PNP Close Contact Photoelectric Switch

❸ Switch

❹ Button Switch

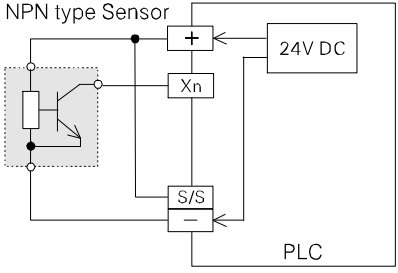
❺ Limit (Micro) Switch

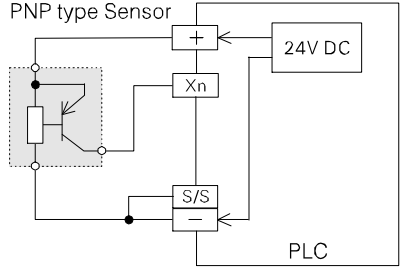
❻ Option Switch

❼ PLC Main Unit

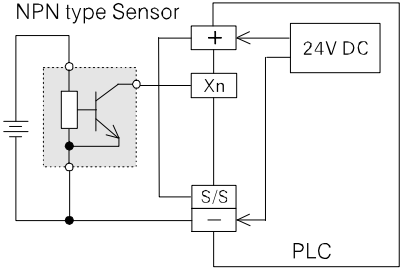
❽ PLC Extension Module

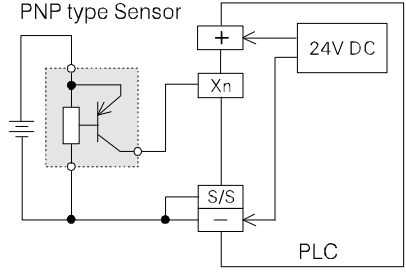
- "Sensor Power Provided by PLC" Wiring





- "Sensor Power Provided by External Source" Wiring



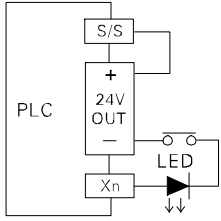


4. Input Specifications and External Wiring

4-3 Input Wiring Notes

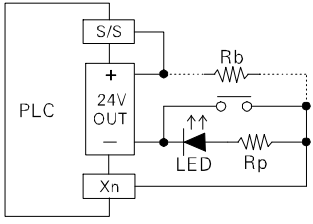
- The input point current of this product is 7mA/DC24V. So please choose a mini switch as input device, which suits such micro-current. Loose contact problem may occur if macro-current switch is used.

- Keep the voltage drop below 4V approximately if serial diode string is used in the input circuit, as shown in the right hand side diagram.



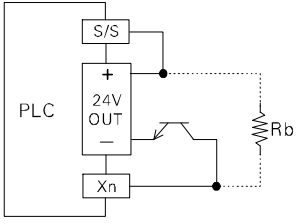
- Make sure the Parallel Resistor has more than 15KΩ Rp if used in the input circuit, as shown in the diagram below. And if the resistor Rp is less than 15KΩ, please install a pull up resistor Rb.

$$Rb \leqq \frac{4Rp}{15 - Rp} (K\Omega)$$



- Install a pull up resistor Rb if the OFF current leakage of the 2-wire-close-contact switch used is more than 1.5mA, as shown in the diagram below.

$$Rb \leqq \frac{6}{I\,(\text{OFF Current Leakage}) - 1.5} (K\Omega)$$



4-4 About the X0~X7 Input Points

There are 8 input points (X0~X7) in the VB Series Main Unit. These 8 points have high speed input function such as High Speed Counter, External Interrupt Insertion and Speed Detection, etc. When X0~X7 are not used as high speed inputs, they can still be used as common input points.

The corresponding relations of X0~X7 input terminals and their high speed applications are listed below:

Input	1-Phase Counter											2-Phases Counter					A/B-Phase Counter					External Interrupt Insertion	Speed Detect
	C235	C236	C237	C238	C239	C240	C241	C242	C243	C244	C245	C246	C247	C248	C249	C250	C251	C252	C253	C254	C255		
X0	U/D						U/D			U/D		U	U		U		A	A		A		I00□	○
X1		U/D					R			R		D	D		D		B	B		B		I10□	○
X2			U/D					U/D			U/D		R		R			R		R		I20□	○
X3				U/D				R			R			U		U			A		A	I30□	○
X4					U/D				U/D					D		D			B		B	I40□	○
X5						U/D			R					R		R			R		R	I50□	○
X6										S					S					S			○
X7											S					S					S		○

U: Up Counter Input; D: Down Counter input; A: A-Phase Counter Input; B: B-Phase Counter Input
U/D: Up / Down Count Input; R: Reset Counter Input; S: Start-up Counter Input

- X0~X7 cannot be repeatly used. Each point can only choose 1 function from table above to execute.
- All high speed input function can complete the counting by interrupt insertion, and the total frequency of the interrupt inserting should not be more than 10KHz.

Calculation Method of the Total Interrupt Insertion Frequency

(Total of 1-Phrase Counter Frequency) + (Total of 2-Phrases Counter Frequency) +
(Total of A/B-Phrase Counter Frequency x 2) + Input Pulse Frequency of Speed Detection (SPD)
Instruction = Total Frequency of Interrupt Insertion *This value should not be more than 10KHz.

Design Safety Guidelines

DANGER

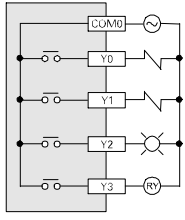
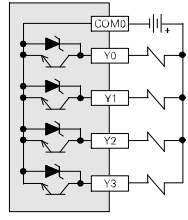
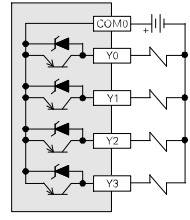
- External protective circuits should be designed for a PLC to avoid mechanical damage. E.g. Emergency Stop, Forward/Reverse Inter-Lock or Upper/Lower Limit Positioning.
- A PLC may not be able to control the ON/OFF state when error occurs to its output relay and transistor, etc. So for crucial output signals which could cause major accident, some external safety circuit and agencies should be designed, to make sure the mechanical devices operate with safety.

Wiring Safety Guidelines

CAUTION

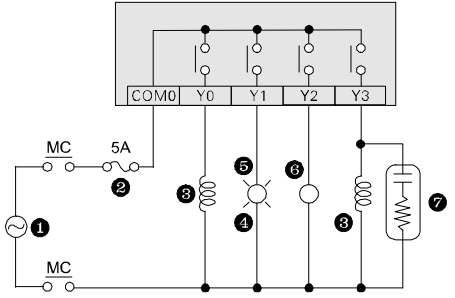
- When wiring AC supplies, it must be connected to correct input terminal, for if it is connected to DC (Direct Current) input/output terminal or DC power terminal, the PLC will be damaged.
- DO NOT connect the 24 V OUT ⊞ terminal of a PLC main unit to the 24 V OUT ⊞ terminal of an extension unit, or to the ⊞ terminal of an external power supply, for it may damage the PLC.
- DO NOT do any external wiring for the empty terminals ⊡ of a PLC, for it may damage the product.
- Connect the grounding terminal of the main unit using the class 3 grounding standard, but DO NOT ground it with major power systems. (Refer to 1-6)

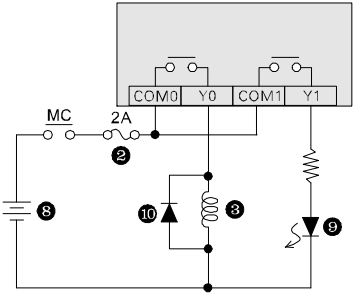
5-1 Output Point Specifications

Item		Specification		
Output Type		Relay Output	NPN Transistor Output	PNP Transistor Output
Switched Voltages		≤ AC 250V / DC 30V	DC5V~30V	DC5V~30V
Rated Current	Resistive Load	2 A /point, 8 A /4 points COM	0.5A/point, 0.8A/4points COM	0.5A/point, 0.8A/4points COM
	Inductive Load	80VA	12W/DC24V	12W/DC24V
	Lamp Load	100W	1.5W/DC24V	1.5W/DC24V
Open Circuit Leakage		—	Below 0.1mA	Below 0.1mA
Output Response Time		10 ms approximately	OFF→ ON: below 20uS ON→ OFF: below 100uS	OFF→ ON: below 20uS ON→ OFF: below 100uS
Isolation Method		Mechanic Isolation	Photocoupler Isolation	Photocoupler Isolation
Circuit Diagram				

5-2 Output Wiring Introduction

- Relay Output Wiring Diagram

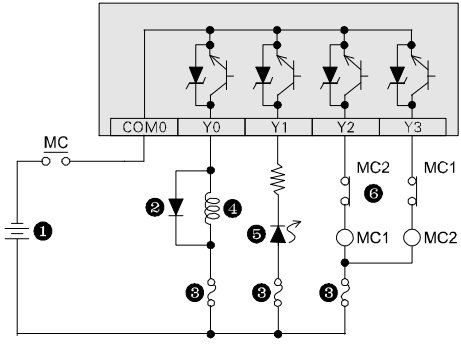




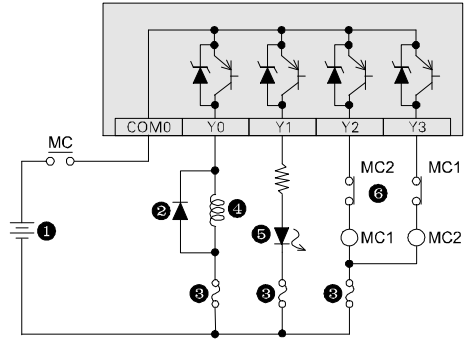
❶ AC Power Supply
❷ Fuse (※)
❸ Inductive Load
❹ Incandescent Light Bulb
❺ Neon Bulb
❻ Contactor
❼ Spark Killer
❽ DC Power
❾ Light Emitting Diode LED
❿ Surge Protective Diode

※ No fuse installed within the PLC's internal output circuit. Please install external fuse to avoid board circuit damage caused by short circuit of the load.
Install 2~3A fuse for single point COM circuit.
Install 5~10A fuse for 4 points COM circuit.

• NPN Transistor Output Wiring Example



• PNP Transistor Output Wiring Example



❶ DC Power Supply (※1) ❷ Surge Protective Diode ❸ Fuse (※2)

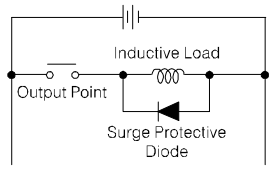
❹ Inductive Load ❺ Light Emitting Diode LED ❻ Electric Interlock

※1 Please use 5~30V Constant Voltage Power Supply for load driving.

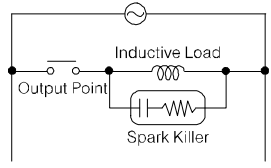
※2 There is no fuse installed within the PLC internal output circuit. Please install external fuse to avoid board circuit damage caused by short circuit of the load.

5-3 Output Wiring Notes

- Please add parallel connected Surge Protective Diode to the 2 ends of the DC Inductive Load, as shown in the right hand side diagram, otherwise the pointer life time will be reduced significantly. When choose the Surge Protective Diode, note that the reverse voltage (VR) must be more than 5~10 times of the forward voltage (FR), and the forward current (IF) must be greater than the load current.

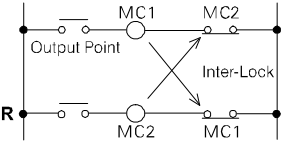


- Please add parallel connected Spark Killer to the 2 ends of the AC Inductive Load, as shown in the right hand side diagram, to reduce noise. A Spark Killer is made by serial connected resistor and capacitor (0.1μF+120Ω), and can be purchased from the producer.



- IT IS DANGEROUS to close the contactors used as the forward(FP)/reverse(RP) control at the same time. For such a load, an external inter-lock circuit should be set up as well as the inter-lock that controlled by the program within the PLC, as demonstrated in the right hand side diagram.

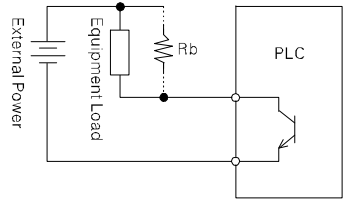
⚠ **DANGER**



5-4 About the Y0 and Y1 Output Points

The Y0 and Y1 output points of VB series PLC have high speed output functions like pulse output, pulse width modulation, etc. They can be used as general output points when they are not used for high speed output.

- Use transistor output form when Y0 and Y1 are used as high speed output points.
- The output point assigned by PLSY and PWM should not overlap with each other.
- The pulse frequency sent by Y0 and Y1 of VB series PLC using PLSY instruction can NOT > 7KHz.
- Since the PLSY and PWM instructions output need to have high speed reaction, please connect a parallel Rb resistor as demonstrated in the right hand side diagram and make the total load current to be 100 mA approximately, for the PLC output wave shape will be twisted by the longer OFF time of the transistor under light load. Calculate the power needed by the Rb resistor carefully, to avoid Rb resistor damage caused by overheats.



External Power	50mA Rb of the Load Current	100mA Rb of the Load Current
5V	100Ω 1W	50Ω 2W
12V	240Ω 2W	120Ω 3W
24V	480Ω 3W	240Ω 5W

6. Optional Modules

6-1 Models of Optional Modules

The optional modules of VB series PLC are listed in the table below:

Slot	Model	Function
Communication Expansion Slot	VB-232	RS-232 Communication Expansion Card, extend the second communication port (CP2)
	VB-485	RS-422/RS-485 Communication Expansion Card, extend the second communication port (CP2)
Memory Card Expansion Slot	VB-RTC	• Install the RTC (Real Time Clock) Expansion Card for PLC, to do automatic Date and Time control. • Displays Year, Month, Day, Hour, Minute, Second and Week. • Battery life is 5 years approximately @ 25°C. • The special register M9005 will turn ON when the battery is running out of power.
	VB-MP1R	• Memory card used by the VB series PLC to record program, component/program comments and data registers. • Flash ROM Memory that can be written for more than 10,000 times. • The program downloading/uploading function makes the program copy and device maintenance work easier. • Built-in RTC (Real Time Clock) function, battery life is 5 years approximately @ 25°C. • The special register M9005 will turn ON when the battery is running out of power.
	VB-DB1R	• 128K words Data Storage Capacity using SRAM. Lithium batteries are used for latched data. • Providing big capacity for latched data storage. The VB-DB1R is usually used for storing formula data or long-time data collection. • Use DBWR and DBRD instructions to access data in VB-DB1R. • The programming software Ladder Master is available to modify, archive and upload /download the data in VB-DB1R. • Including RTC function, the battery life is around 5 years at 25℃ / 77℉. • When battery power is low, the special relay M9005 will turn ON.

6-2 Communication Expansion Board

- VB-232 and VB-485 are the expansion cards for VB series PLC's second communication port（CP2）.
- The CP2 of VB series PLC is a multi-usage port which can execute many communication functions like Computer Link, CPU Link, Parallel Link, Easy Link, MODBUS, MODEM and Non Protocol.
- Please install the communication expansion board when the power supply is OFF.

Install VB-232

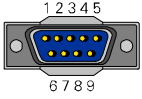
① Switch off the PLC power
② Open the left side cover of the PLC Main Unit.
③ Take off the black screw in the upper left corner inside the left cover.
④ Install the base plug of VB-232 into the communication expansion slot.
⑤ Install the black screw in the upper left corner inside the left cover.
⑥ Lock the M3 self-tapping screw of the VB-232 into the mounting hole in the upper left corner inside the left cover

Install VB-485

① Switch off the PLC power
② Open the left side cover of the PLC Main Unit.
③ Take off the left side ⊏ shape plastic piece.
④ Take off the black screw in the upper left corner inside the left cover.
⑤ Install the base plug of VB-485 into the communication expansion slot.
⑥ Install the black screw in the upper left corner inside the left cover.
⑦ Lock the M3 self-tapping screw of the VB-485 into the mounting hole in the upper eft corner inside the left cover

- There is a white-color JST4P outlet for both VB-232 and VB-485. It has the same functions as the white-color JST4P outlet on the main unit, since installing the communication expansion card will block the white-color JST4P outlet on the main unit.

6. Optional Modules

Item	VB-232	VB-485
Communication Interface	RS-232C	RS-422/RS-485
Isolation Method	No Isolation	
LED Indicator	RXD 、TXD	
Max. Communication Distance	15 Meters	50 Meters
Communication Method	Half-duplex	
Communication Speed	300/600/1200/2400/4800/9600/19200/38400 bps	
Communication Protocol	Computer Link Easy Link MODEM } Protocol of M, VB Series PLC Parallel Link : Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction.	Computer Link Easy Link } Protocol of M, VB Series PLC CPU Link Parallel Link } Dedicated Protocol MODBUS : Protocol by other producer Non Protocol : User customized and complete using PLC program, then communicate with other equipment through RS instruction.
Power Supply	DC5V 10mA (from PLC Power Supply)	DC5V 60mA (from PLC Power Supply)
Wiring Method	 D-Sub Connector 9Pin Male Connector 1 : CD 2 : RXD 3 : TXD 5 : SG 7 : RTS 8 : CTS 4,6,9 : Not Use	PCB Style Terminal Block  Remarks: 1. RS-485 Wiring Method  2. SW1 is the terminal resistance switch. (Terminal resistance 120Ω)
Parameter Configuration	For CP2 relevant parameter configuration settings please use the "System CPU Expansion Card's Communication Port Setting" function of the programming software Ladder Master.	

6-3 VB-MP1R/VB-RTC Memory Card Slot Expansion Card

- Install the Memory Card Slot Expansion Card

  ① Switch off the PLC power

  ② Open the right side cover of the PLC Main Unit.

  ③ Confirm the expansion card position, make sure the battery on the card is at the left hand side.

  ④ Plant the card into the slot on the cover with proper strength; be careful not to damage the main unit circuit.

  ⑤ Make sure the connector of the expansion card binds with the slot connector tightly, to finish the installation.

- Un-install Memory Card Slot Expansion Card

  Switch off the PLC power when un-install the expansion card. Use the attached dedicated tool for this card or the IC clip to clip the cut notchs and take out the expansion card.

- About the reading and configuration of the RTC (Real Time Clock) time.

Reading the RTC Time

The PLC program will automatically read the RTC time after the RTC installed to the Main Unit, and store it in D9013~D9019 for user reference.
User can also use FNC166 TRD to read RTC time and store in register.
Please refer to vigor plc programming manual for M VB and VH series

Configure the RTC Time

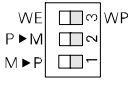
The user can configure the RTC time in 2 ways:

1. Use the "System-RTC Settings" function in Ladder Master to configure.
2. Use instruction (FNC167 TWR) to set the RTC time. This method can be used with supplementary devices like the HMI to change the RTC time.

Please refer to vigor plc programming manual for M VB and VH series

6-4 Use the VB-MP1R

- There are 3 switches on the VB-MP1R expansion card and their functions are described below:



WE/WP Write Protect SwitchWE: Write allowed/WP: Write forbidden

P ► M Program Upload SwitchPLC program upload to MP1R enabled when it slides to the left.

M ► P Program Download SwitchMP1R program download to PLC enabled when it slides to the left.

- Operation flow of uploading/downloading program using VB-MP1R

① Put the switch on the VB-MP1R to the right position as listed in the table below:

Function	WE/WP	P►M	M►P
Upload Program	WE(Left)	ON(Left)	OFF(Right)
Download Program	WP(Right)	OFF(Right)	ON(Left)

② Switch off the PLC power and install the VB-MP1R in the correct direction.

③ Open left cover on Main Unit top and put the 1st STOP/RUN switch to left STOP position. (Refer to VB Series left cover back or instructions on VH Series unit board.)

④ Switch power on and start upload/download program. First the ERR LED on Main Unit flickers 3 times then goes off. Then it will be ON during the whole U/D process; taking less than 1 min. (Duration differs for program size). It keeps flickering if error happens.

⑤ Switch off power and take out the VB-MP1R expansion card.

- Operate with the memory within VB-MP1R:
  ① Put the No.1 and No.2 switches on card to: P ▶ M=OFF(right); M ▶ P=OFF(right)
  ② Put the No.3 switch (WE/WP) on card to the correct position as usage required.
  ③ Switch OFF PLC power, install the VB-MP1R in correct direction, then switch ON PLC power and use.

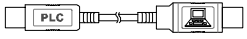
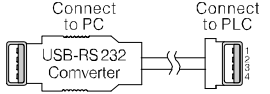
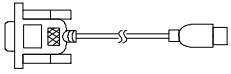
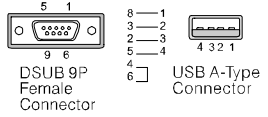
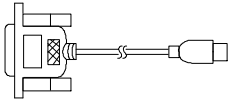
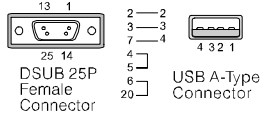
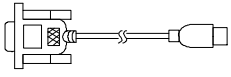
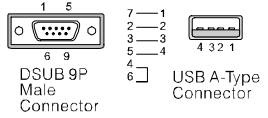
NOTICE

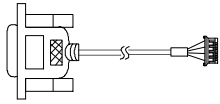
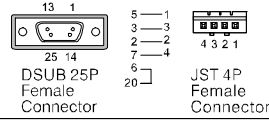
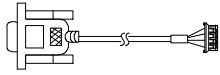
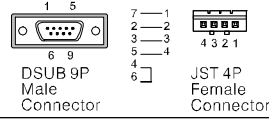
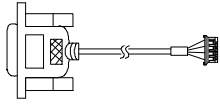
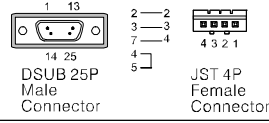
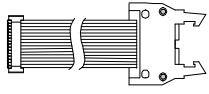
- Always put the WE/WP switch to WP when the VB-MP1R is not used for program uploading.
- Error occurs when executing uploading/downloading for the following reasons:
  ① Password has been set for the source program
  ② WE/WP switch is at WP when uploading.
  ③ P ▶ M and M ▶ P switches are both at the ON (Left) side.
  ④ Improper installation of the VB-MP1R expansion card.
  ⑤ VB-MP1R or the PLC malfunctions.
- When VB-MP1R card installed on PLC, the program in it will be executed first. And if so, when programming tool (e.g. Ladder Master) does upload/download, it acts for the memory in VB-MP1R only too.
- When WE/WP switch is at WP (OFF. Right), actions like writing, downloading or PWD changing are forbidden.

Contact grounding metal to remove the static electricity on user body or clothes before touching the expansion card.

6. Optional Modules

6-5 Connection Cables

Model	Picture	Connection Illustrations	Application
VBUSB-200 (Length: 200cm/67")			● PC ‹ ›VB and M Series PLC
MWPC-200 (Length: 200cm/67")			● PC↔VB and M Series PLC
MWPC25-200 (Length: 200cm/67")			● PC↔VB and M Series PLC ● Hitech HMI‹ ›VB and M Series PLC
MWMD-200 (Length: 200cm/67")			● MODEM↔VB and M Series PLC ● EASY VIEW HMI↔VB and M Series PLC

Model	Picture	Connection Illustrations	Application
VBPC25-200 (Length: 200cm/67")			● PC↔VB Series PLC ● Hitech HMI‹ ›VB Series PLC
VBMD09-200 (Length: 200cm/67")			● MODEM↔VB Series PLC ● EASY VIEW HMI↔VB Series PLC
VBFDHMI-200 (Length: 200cm/67")			● FUJI HMI↔VB Series PLC ● DIGITAL HMI↔VB Series PLC ● PROFACE HMI↔VB系列PLC
VBEC-050 (Length: 50cm/19.7") VBEC-100 (Length: 100cm/39.4")		—	● Extended cable for a VB Series PLC Extension Unit/Module. (Keep away from interference during wiring job for the data transferred in this extended cable is unprotected and easy to get interferred.)

Operation and Maintenance Safety Notes ⚠ DANGER

- DO NOT contact the terminal when the power supply switched on, to avoid electric shock or product mis-reaction.
- Switch off the power supply before clean or tighten the terminal, to avoid electric shock.
- Carry program-change-in-operation (force output, RUN, STOP, etc) ONLY after carefully read and understand this manual and safety is ensured, for misoperation may cause equipment damage or accident.

Operation and Maintenance Safety Notes ⚠ CAUTION

- Switch off the power supply before assemble or overhaul the selected optional units, to avoid damage to the expansion or main units.
- Switch off the power supply before assemble or overhaul the connection cable, to avoid damage or misoperation.
- DO NOT assemble or overhaul the product cage, or alter it by yourself, for it may cause product damage, mis-reaction or fire.
- Contact the nearest distributor or Vigor Electric Corp directly for any product repairing matters.

7-1 Operation Rehearsal

- Perform the pre-rehearsal examination with the power supply switched OFF.
  Incorrect power terminal connection, short circuit of DC input and power supply wirings or short circuit of output wirings will cause severe damage to the PLC. So DO check the power and input /output wirings before switch on the power, to make sure everything correct.
- Perform the program examination when the power supply ON and PLC STOP.
  Upload the program within the PLC using programming tool and make sure it is correct. The user can also use the "compile program" function of the programming tool to make sure the circuit and grammar are correct.
- RUN/STOP Switch of the PLC
  There is a RUN/STOP switch on the PLC. When the PLC power goes from OFFON, the PLC will enter RUN/STOP mode according to the setting of the RUN/STOP switch. And then the RUN/STOP status can be controlled by the RUN/STOP switch and the programming tool.
- Perform the operation rehearsal test when the power is ON and PLC is RUN.
  The CPU will execute self-examine function once the PLC power goes from OFFON.
  If there is no exception, the PLC enters operation mode. (RUN LED is ON.)
  If there is program error (grammar or circuit error), the ERR LED will flicker, and PLC stop running.
  If there WDT triggered, the ERR LED will flicker, and PLC stop running.
  Force ON/OFF action can be performed on many components during the program operation.

7-2 Determine Exceptional Behavior through the LED Indicator

When problem occurs during PLC operation, check the power supply voltage, the terminal screw and connection cable (may be loose), and the I/O component (may be faulty). Then check the PLC LED indicator. These indicators help to analyze the error is caused by PLC or external components.

- PWR Power Indicator LED (Green)
  When power supplied, the PWR indicator LED on main unit panel will be ON. If it is not, check the power circuit wiring and make sure correct voltage is used. Else, may send PLC back for repairing.
- RUN Operation Indicator LED (Green)
  When the PLC operates well, the RUN indicator LED on the Main Unit panel will be ON. If the PLC is at STOP status or any error occurs, the RUN LED will be OFF.
- ERR Error Indicator LED (Red)
  When error occurs to the PLC, the error indicator LED ERR on main unit panel will be ON or flickering.

<ERR LED Flicker>
ERR LED flickers when program changed by improper use, broken circuit, exceptional interruption, and invasion by conductive materials, PLC will STOP and all outputs turn OFF. When this happens, please double-check the program, and whether there is powerful interruption source or conductive materials invasion.

<ERR LED ON>
ERR LED turns ON when the CPU out of control and WDT occurs caused by PLC circuit broken or exceptional external interruption, PLC will STOP and all outputs turn OFF. When this happens, please switch off the PLC power supply and switch it on again. If this recovers the PLC normal operation, please double-check whether there is powerful interruption source and whether the PLC grounding is fine. If the ERR LED is still ON, the PLC may be faulty, consider sending it back for overhauling.

- INPUT X Input Status Indicator LED (Left half of the Display)

  Put the No.2 sliding switch inside the left cover of the Main Unit to OFF (Left) to make the Display show I/O status.

  (1) If the input status indicator LED is not as expectation, please make sure the external input switch status is fine.

  (2) Loose switch contact may be caused by over-strong input switch current or invasion of oily dirt.

  (3) When parallel LED circuit included in the input switch, the input signal of the PLC may be ON even when the switch is OFF.

  (4) The sensitivity of photoelectric switches might be affected by dirt-stuck, and cause it failed to switch to ON mode.

  (5) The PLC may not be able to judge the input status accurately if the input switch ON/OFF time is shorter than the PLC scanning time.

  (6) The PLC input circuit may not be able to work well when the DC24V power supply used by it is excessively used or has short circuit.

  (7) The input circuit might be damaged if the voltage put on it exceeds the appointed limit.

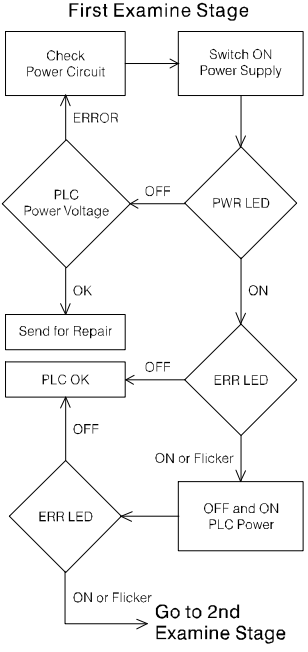
- OUTPUT Y Output Status Indicator LED (Right half of the Display)

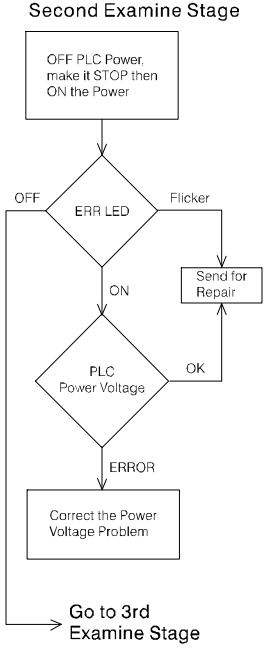
  (1) If the load doesn't work as the output indicator LED status, please check whether the external load function is fine.

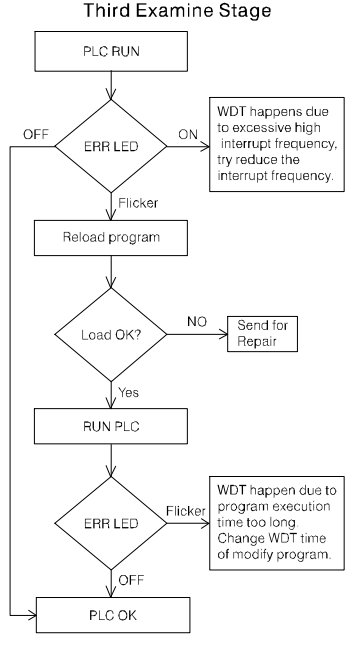
  (2) Melting or short circuit of the PLC output point may be caused by overload, short circuit load or surge current of the capacitor load.

  (3) Relay point loose contact may be caused by the excessively frequent action of the PLC output point.

- Refer to the Error Examination Flow Chart on the next page for advance examinations.


First Examine Stage
Check Power Circuit
Switch ON Power Supply
ERROR
PLC Power Voltage
OFF
PWR LED
OK
ON
Send for Repair
PLC OK
OFF
ERR LED
OFF
ON or Flicker
ERR LED
OFF and ON PLC Power
ON or Flicker
Go to 2nd Examine Stage


Second Examine Stage
OFF PLC Power, make it STOP then ON the Power
OFF
ERR LED
Flicker
Send for Repair
ON
PLC Power Voltage
OK
ERROR
Correct the Power Voltage Problem
Go to 3rd Examine Stage


Third Examine Stage
PLC RUN
OFF
ERR LED
ON
WDT happens due to excessive high interrupt frequency, try reduce the interrupt frequency.
Flicker
Reload program
Load OK?
NO
Send for Repair
Yes
RUN PLC
ERR LED
Flicker
WDT happen due to program execution time too long. Change WDT time of modify program.
OFF
PLC OK

7-3 Maintenance

Recycling Safety Notes ⚠ CAUTION
• Dispose the product as industrial waste when it is to be discarded as worthless.

- The product does not include short-life consumptive parts, so there is usually no need to change parts.
- If the output relay works frequently, or is used to drive big capacity load, please perform constant check on it.
- Perform the following general checks constantly:
  (1) Does other heat source or direct sunlight cause the internal temperature of PLC raise abnormally?
  (2) Is there dust or conductive dust invasion into the PLC?
  (3) Do any of the connection cables or connection terminals, etc, become loose?