VIGOR
PROGRAMMABLE CONTROLLER

VH Series
PROGRAMMABLE CONTROLLER

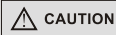## User's Manual

VIGOR ELECTRIC CORP.

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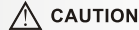
Keep this manual properly for reference whenever necessary and distribute it to the end users.

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.

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.

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
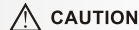
- When wiring AC supplies, it must be connected to correct input terminal, for if it is connected to DC (Direct Current) input/output terminal or DC power terminal, the PLC will be damaged.
- DO NOT connect the 24 V OUT⊞ terminal of a PLC main unit to the 24 V OUT⊟ terminal of an extension unit, or to the ⊞ terminal of an external power supply, for it may damage the PLC.
- DO NOT do external wiring for the empty terminal 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)

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
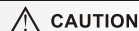
- Switch off the power supply before assemble or overhaul the selected optional units, to avoid damage to the expansion or main units.
- Switch off the power supply before assemble or overhaul the connection cable, to avoid damage or misoperation.
- DO NOT assemble or overhaul the product cage, or alter 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.

1. VH Series PLC Introductions

1-1 System Configuration

Programming Tools	Main Unit	Extension Unit
WINDOWS based tool Ladder Master	VH-10MR (6X+4Y) VH-14MR (8X+6Y) VH-20MR (12X+8Y) VH-24MR (14X+10Y) VH-28MR (16X+12Y) VH-32MR (16X+16Y) VH-40MR (24X+16Y) VH-60MR (36X+24Y) VH-20AR (8X+6Y)	VH-32ER (16X+16Y)

Memory Slot Expansion Cards: VB-RTC、VB-MP1R

Communication Expansion Cards: VB-232、VB-485

Communication Expansion Module: VB-485A、VB-CADP

Extension Module:
VH-16XYR (8X+8Y)
VH-16X (16X)
VH-8X (8X)
VH-8YR (8Y)
VH-8XYR (4X+4Y)
VH-28XYR (20X+8Y)

- VH-40MR consists of a VH-32MR main unit and a VH-8X module.
- VH-60MR consists of a VH-32MR main unit and a VH-28XYR module.

1-2 Component Names

VH-10MR/14MR

VH-20MR/24MR/28MR/32MR & VH-20AR

- 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.
- The Programming Tool Auxiliary Port is used to connect to HMI or SCADA (Supervisor Control and Data Acquisition) System. This auxiliary port is parallel linked with the Programming Tool Communication Port, so they cannot be used at the same time.
- The VH-10MR/VH14MR main unit has no memory card/IO extension slots.
- 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
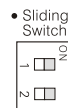
Switch Number	Function	OFF	ON
1	RUN/STOP Switch	STOP	RUN
2	I/O Display Range Switch	X0~X37 Y0~Y37	X40~X77 Y40~Y77

1-3 Model Numbering

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

```
  VIGOR ──────────────────▶ VIGOR LOGO
  PROGRAMMABLE CONTROLLER
  VH MAIN UNIT ────────────▶ Product Type
  16DI DC24V/16DO RELAY ───▶ Product Basic Standard
  MODEL : VH-32MR ─────────▶ Product Model Number
  SERIAL : V-HT050T1-0001 ─▶ Product Serial Number
  VIGOR ELECTRIC CORP. ────▶ Producer
```
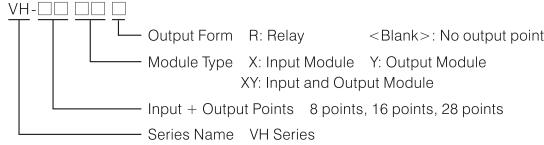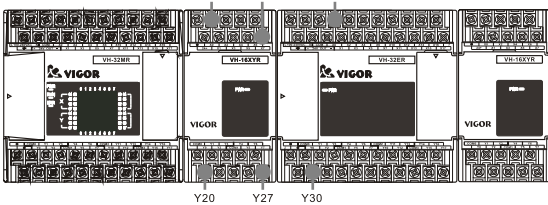
• Main Unit Model Numbering

```
VH-□□ M R
        │  └── Output Form    R: Relay
        └───── M: Main Unit
   Input + Output Points
   10~32 points  10 points, 14 points DC Power Model
                 20 points, 24 points, 28 points, 32 points AC Power Model
   Series Name   VH Series
```

• Extension Unit Model Numbering

```
VH-□□ E R
        │  └── Output Form    R: Relay
        └───── E: Extension Unit with self-supplied power
   Input + Output Points  32 points
   Series Name   VH Series
```
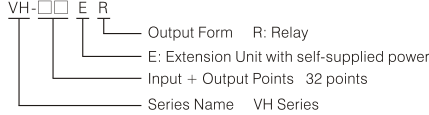
• Extension Module Model Numbering

```
VH-□□ □□ □
        │  │  └── Output Form    R: Relay    <Blank>: No output point
        │  └───── Module Type   X: Input Module   Y: Output Module
        │                       XY: Input and Output Module
        └──────── Input + Output Points   8 points, 16 points, 28 points
   Series Name   VH Series
```

1-4 Extension Units Introductions

• VH-10MR and VH-14MR do not have the I/O Extension function
• VH Series Main Unit always occupies the I/O address X0~X17/Y0~Y17, and thus the first Expansion Unit /Module will use the I/O address from X20/Y20 onwards.
• VH-8XY Extension Module occupies 8 input points and 8 output points.
• VH-28XYR Extension Module occupies 24 input points and 8 output points.
• Maximum output/input points: 128 points X0~X77 /Y0~Y77
• VH-40MR consists of a VH-32MR Main Unit and a VH-8X Module, occupies I/O addresses X0~X27/Y0~Y17.

• VH-60MR consists of a VH-32MR Main Unit and a VH-28XYR Module, occupies I/O addresses X0~X47/Y0~Y27.
• VH series Main Unit and Extension Unit have self-supply power units, but the Extension Module does not. So the Extension Module needs to get power from a Main Unit or Expansion Unit.
• 2 Conditions must be met when the Main Unit or Extension Unit connect to other modules:
  (1) The number of modules connected after the Main Unit or Extension Unit should be <= 6.
  (2) The total number of ON relays in the Main Unit or Extension Unit and the Extension Modules connected after them should be <= 32.

1-5 Error Code Display Function Introductions

The Multi-Functional Display on the Main Unit panel has an Error Code Display function besides the I/O Display function. It can display 109 error codes from 01~99 and E0~E9. This function is very practical and it makes the device maintenance work much easier than before.
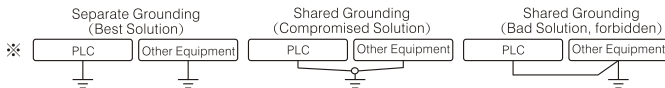
The D9080 special register controlled Multi-Functional Display of VH Series PLC has the following functions:

Value of D9080	MFD Function
0	Displays Input/Output status of PLC
1~99	Displays 01~99 numbers
100~109	Displays E0~E9 Error Code

1-6 General Specifications

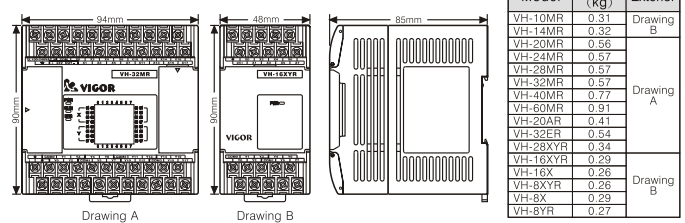| Item	Specifications
Work Ambient Temperature	0~55°C / 32~131°F
Storage Ambient Temperature	−20~70°C /−4~158°F
Work Ambient Humidity	10~90% RH, (at 25°C / 77°F, no condensation)
Storage Ambient Humidity	10~90% RH, (at 25°C / 77°F, no condensation)
Vibration Tolerance	10~55 Hz with amplitude of 0.075 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.

```
         Separate Grounding        Shared Grounding          Shared Grounding
          (Best Solution)       (Compromised Solution)   (Bad Solution, forbidden)
※    ┌─────┐ ┌───────────────┐  ┌─────┐ ┌───────────────┐  ┌─────┐ ┌───────────────┐
     │ PLC │ │Other Equipment│  │ PLC │ │Other Equipment│  │ PLC │ │Other Equipment│
     └──┬──┘ └───────┬───────┘  └──┬──┘ └───────┬───────┘  └──┬──┘ └───────┬───────┘
       ═╧═          ═╧═            └─────┬───────┘            └─────┬───────┘
                                       ═╧═                        ═╧═
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1-7 Performance Specification

Item		Specifications
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 μs — Several hundreds of μs
Number of Instructions	Basic Instruction	27 (including LDP, LDF, ANDP, ANDF, ORP, ORF, INV)
	Stepladder Instructions	2
	Applied Instructions	81
Memory Capacity	Program Capacity	Built-in 4 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: X0 ~ X77, Y0 ~ Y77
Internal Relay	Auxiliary Relay (M) — General	384 points: M0 ~ M383
	Auxiliary Relay (M) — Latched	128 points: M384 ~ M511
	Auxiliary Relay (M) — Special	256 points: M9000 ~ M9255
	State Relay (S) — Initial	10 points: S0 ~ S9 (Latched)
	State Relay (S) — Latched	118 points: S10 ~ S127
Timer (T)	100mS	63 pts when M9028 OFF: T0 ~ T62 (Timer range: 0.1 ~ 3276.7 sec.)
	10mS	31 pts when M9028 ON: T32 ~ T62 (Timer range: 0.01 ~ 327.67 sec.)
	1mS	1 point: T63 (Timer range: 0.001 ~ 32.767 sec.)
Counter (C)	16-bit Up — General	16 points: C0 ~ C15
	16-bit Up — Latched	16 points: C16 ~ C31
High Speed Counter (C)	32-bit Up/Down, Latched — 1-phase Counter	11 points: C235 ~ C245 (Signal Frequency: 10 kHz Max.)
	32-bit Up/Down, Latched — 2-phase Counter	5 points: C246 ~ C250 (Signal Frequency: 10 kHz Max.)
	32-bit Up/Down, Latched — A/B Phase Counter	4 points: C251 ~ C254 (Signal Frequency: 5 kHz Max.)
Data Register (D)	General	128 points: D0 ~ D127
	Latched	128 points: D128 ~ D255
	Special	256 points: D9000 ~ D9255
	Index	16 points: V0 ~ V7, Z0 ~ Z7
Pointer	Call Pointer (P)	64 points: P0 ~ P63
	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
	Decimal (K) — 32 Bits	−2147483648 ~ 2147483647
	Hexadecimal (H) — 16 Bits	0H ~ FFFFH
	Hexadecimal (H) — 32 Bits	0H — FFFFFFFFH
Pulse Output		1 point, Max. 7 kHz
Programming Device Link Interface CP1		RS-232C, can connect to PC, HMI or MODEM directly.
Communication Link Interface CP2 (Optional)		RS-232C or RS-485, can connect to PC or HMI
Communication Link Interface CP3 (Optional)		RS-485, can connect to PC or HMI
Real Time Clock (Optional)		Displays year, month, day, hour, min., sec. and week
Error Code Display Function		Displays 109 error codes (01~99 and E0~E9)
Analog Potentiometer		2 Analog Rotary potentiometers, each one can be setting as 0~255
Analog I/O Function (VH-20AR)	Analog Input	4 channel, 12 bits, ±10V / 4 ~ 20mA / ±20mA inputs
	Analog output	2 channel, 12 bits, ±10V / 4 ~ 20mA / ±20mA outputs

1-8 Terminal Layouts

1-9 Dimensions

Drawing A   Drawing B

Model	Weight (kg)	Exterior
VH-10MR	0.31	Drawing B
VH-14MR	0.32	
VH-20MR	0.56	
VH-24MR	0.57	
VH-28MR	0.57	Drawing A
VH-32MR	0.57	
VH-40MR	0.77	
VH-60MR	0.91	
VH-20AR	0.41	
VH-32ER	0.54	
VH-28XYR	0.34	
VH-16XYR	0.29	Drawing B
VH-16X	0.26	
VH-8XYR	0.26	
VH-8X	0.29	
VH-8YR	0.27	

2. Installation Work

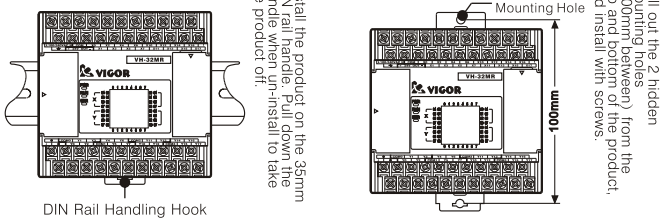### Installation Safety Guidelines ⚠ CAUTION

- 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

DIN Rail Handling Hook

Install the DIN rail handle. Pull down the handle when un-install the product off.

Pull out the product on the 35mm DIN rail and install it.

- Direct Installation

2-φ 4.5 Mounting Hole

100mm

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.
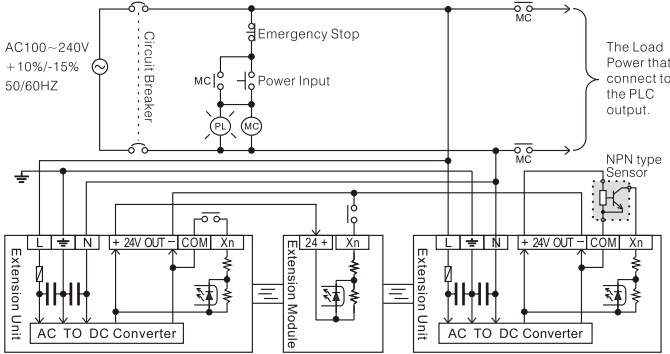
Below 6.2mm
Below 6.2mm
Used by M3
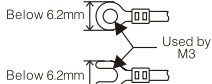
3. Power Specifications and External Wiring

3-1 Power Specifications

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

Item		AC Power	DC Power（VH-10/14MR）	DC Power（VH-20AR）
Input Voltage		AC100～240V, +10% / -15%	DC24V, +20% / -15%	DC24V, +20% / -15%
Input Frequency		50/60Hz	—	—
Keep Working Momentary Power Failure		10 ms.	1 ms.	1 ms.
Power Fuse		250V 2A	250V 0.5A	250V；0.5A
Power Consumption		30 VA	5W	5W（Main Unit Only）
Power Unit Output Current	Inner	DC5V；400mA	—	DC5V；400mA
		DC12V；530mA	—	DC12V；530mA
	Outer	DC24V，±15% 420mA；output from terminal	—	—

3-2 AC Power Wiring Example

AC100~240V +10%/-15% 50/60HZ

Emergency Stop
Power Input

The Load Power that connect to the PLC output.

NPN type Sensor

⚠ 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

DC24V -15% +20%

NPN type Sensor

VH-14MR Main Unit

DC TO DC Converter
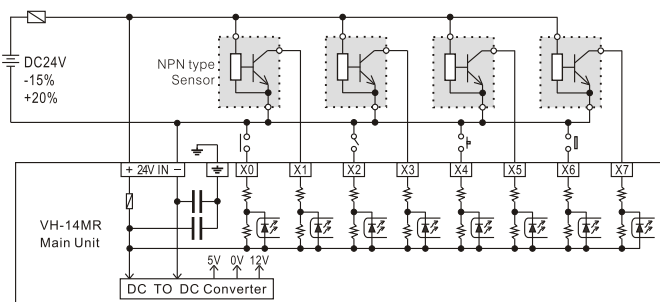
- Connect the 24V IN terminal of the Main Unit with Direct Current power of DC 24V 15%/+20%.
- Try to use Constant Voltage Power Supply if possible. Make sure a Wave Filter Capacitor is used if need to use a full-wave Rectifying Power Supply
- DO NOT do external wiring for any empty terminal or use it as a relay terminal.

4. Input Specifications and External Wiring

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 0~15mS.)
Input Signal Type	Dry Contact or NPN open collector transistor
Isolation Mode	Photocoupler Isolation
Circuit Diagram	

Output Point Specifications

| Item		Specification
Output Type		Relay Output
Switched Voltages		≤ AC 250V / DC 30V
Rated Current	Resistive Load	2 A /point, 8 A /4 points COM
	Inductive Load	80VA
	Lamp Load	100W
Open Circuit Leakage		—
Response Time		10 ms approximately
Isolation Method		Mechanic Isolation
Circuit Diagram		

4-1 Input Point Wiring Introduction

- Input Point Wiring Example

NPN type Sensor

PLC Main Unit PLC Extension Module
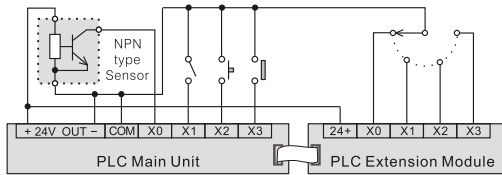
- "Sensor Power Provided by PLC" Wiring Method

NPN type Sensor
PLC
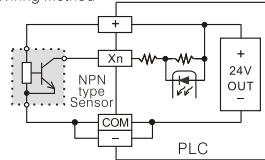
- "Sensor Power Provided by External Source" Wiring Method
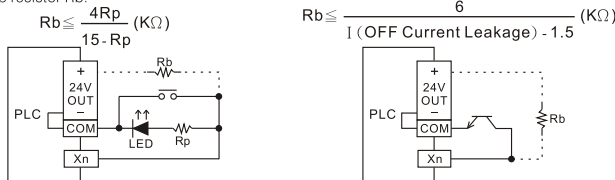

NPN type Sensor
PLC
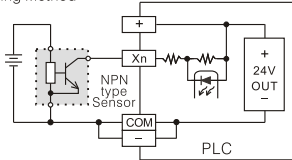
4-2 Input Wiring Notes

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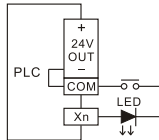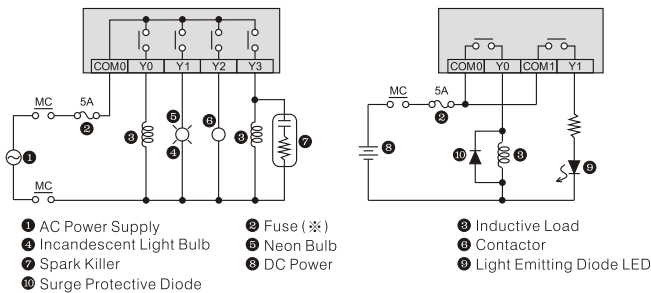
- Keep the voltage drop below 4V approximately if serial diode string is used in the input circuit, as shown in the right hand side diagram.

PLC LED

- 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.

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

4-3 Output Wiring Introduction

- Relay Output Wiring Diagram

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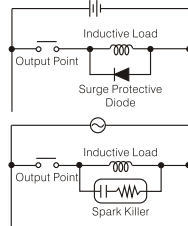❻ Contactor
❼ Spark Killer
❽ DC Power
❾ Light Emitting Diode LED
❿ Surge Protective Diode

※ 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.

4-4 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.

Inductive Load
Output Point
Surge Protective Diode

Inductive Load
Output Point
Spark Killer

- 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

Output Point
Inter-Lock
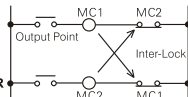
5. Analog Specification and External Wiring (VH-20AR)

Analog Input Specification

Item	Voltage Input	Current Input
	Voltage or Current Signal Inputs are Designated by D9090 and Different Terminals	
Analog Input Range	−10V ~ +10V	4 ~ 20mA / −20mA ~ +20mA
Digital Output Range	−2000 ~ +2000	0 ~ 2000 / −2000 ~ +2000
Input Resistance	200KΩ	250Ω
Resolution	5mV	20μA
Overall Accuracy	± 1% (Max.)	
Conversion Speed	Data refresh at every Scan Time	
Isolation Method	Magnetic-coupler isolation between PLC and inputs; no isolation between analog input channels	
Max. Sustainable Input Range	± 15V	± 32mA

Analog Output Specification

Item	Voltage Output	Current Output
	Voltage or Current Signal Outputs are Designated by D9095 and Different Terminals	
Analog Output Range	−10V ~ +10V	4 ~ 20mA / −20mA ~ +20mA
Digital Input Range	−2000 ~ +2000	0 ~ 2000 / −2000 ~ +2000
External Loading Resistance	500Ω ~ 1MΩ	Under 500Ω
Resolution	5mV	10μA
Overall Accuracy	± 2% (Max.)	
Conversion Speed	Data refresh at every Scan Time	
Isolation Method	Magnetic-coupler isolation between PLC and outputs; no isolation between analog output channels	

External Wiring
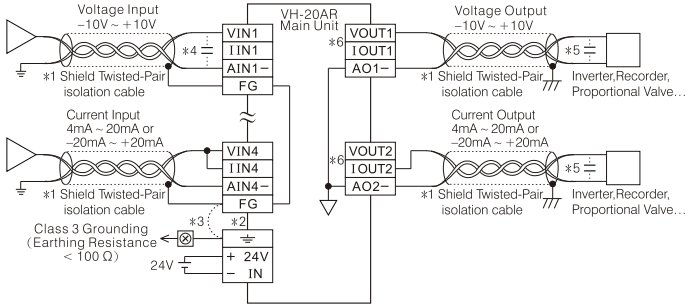
*1 : Please use the Shield Twisted-Pair isolation cable for each analog input and output channel, and keep the cable away from the electromagnetic interference source (ex. power lines or any other lines which may induce electrical noise). Apply 1-point grounding at the load side of the output cable (Class 3 Grounding: Earthing Resistance < 100 Ω).

*2 : Use both (voltage and current) outputs from a channel is not allow.

6. Optional Modules

6-1 Models of Optional Modules

The optional modules of VH 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℃. • The special register M9005 will turn ON when the battery is running out of power.
	VB-MP1R	• A memory card used by the VH and VB series PLC, to record program, component comments, 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℃. • The special register M9005 will turn ON when the battery is running out of power.

※The VH-10MR/VH-14MR Main Unit does not have memory card expansion slot.

6-2 Connection Cables

Model	Picture	Connection Illustrations	Application
VBUSB-200 (Length: 200cm/6'7")	PLC	Connect to PC — USB-RS232 Converter — USB A-Type Connector — Connect to PLC — USB A-Type Connector	• PC ↔ VB, VH or M Series PLC
MWPC-200 (Length: 200cm/6'7")		DSUB 9P Female Connector — USB A-Type Connector	• PC ↔ VB, VH or M Series PLC
MWPC25-200 (Length: 200cm/6'7")		DSUB 25P Female Connector — USB A-Type Connector	• PC ↔ VB, VH or M Series PLC • Hitech HMI ↔ VB, VH or M Series PLC
MWMD-200 (Length: 200cm/6'7")		DSUB 9P Male Connector — USB A-Type Connector	• MODEM ↔ VB, VH or M Series PLC • EASY VIEW HMI ↔ VB, VH or M Series PLC
VBPC25-200 (Length: 200cm/6'7")		DSUB 25P Female Connector — JST 4P Female Connector	• PC ↔ VB or VH Series PLC • Hitech HMI ↔ VB or VH Series PLC
VBMD09-200 (Length: 200cm/6'7")		DSUB 9P Male Connector — JST 4P Female Connector	• MODEM ↔ VB or VH Series PLC • EASY VIEW HMI ↔ VB or VH Series PLC
VBFDHMI-200 (Length: 200cm/6'7")		DSUB 25P Male Connector — JST 4P Female Connector	• FUJI HMI ↔ VB or VH Series PLC • DIGITAL HMI ↔ VB or VH Series PLC
VHEC-050 (Length: 50cm/19.7")		—	• Extended cable for a VH 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 interfered.)

7. Operation Rehearsal, Maintenance and Error Checking

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 OFF→ON, 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 OFF→ON.
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 (Upper half of the Display)
(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 (Lower 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 below for advance examinations.
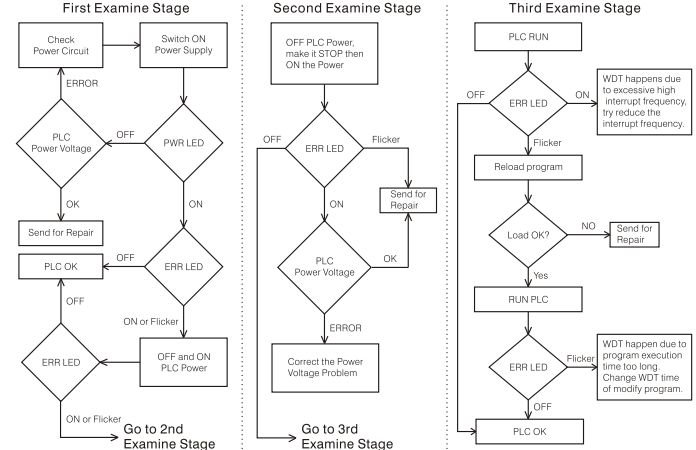
7-3 Maintenance

• 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?