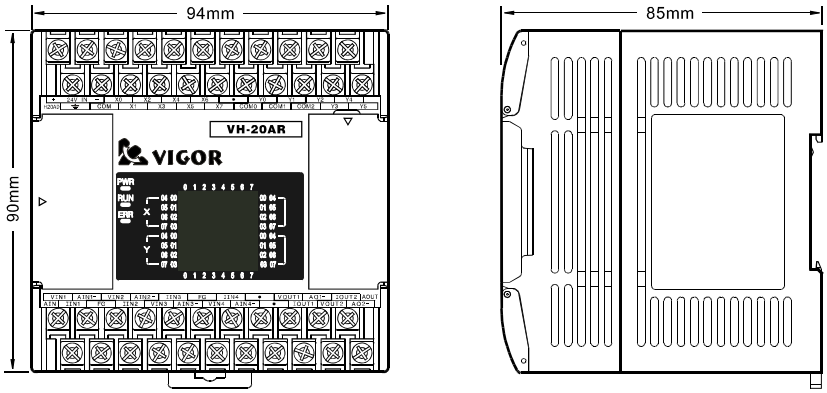
C. VH-20AR Main Unit User Manual

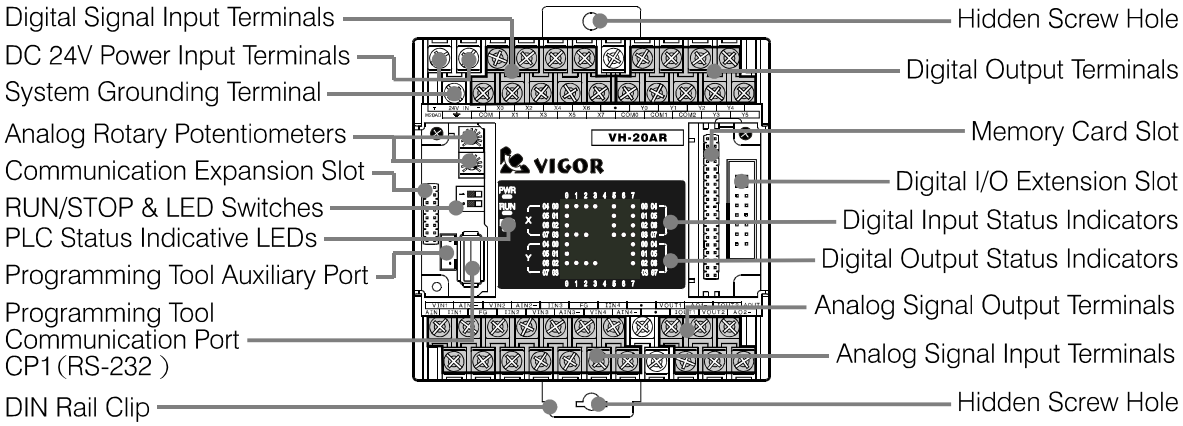
The VH-20AR Main Unit is a new model of the VH series PLC, it is not only supporting all functions of the original VH series PLC but also providing 4 channel analog inputs and 2 channel analog outputs. Which can extend the application of the VH series at analog controls.

C-1 Dimension and Component Designation

C-1-1 Dimension



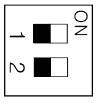
C-1-2 Component Designation



- The Programming Tool Communication Port (CP1, a USB A-type outlet) is using the RS-232 interface, that can not be directly connected with any equipment's USB port.
- Please use a VBUSB-200 adapter to connect between a PLC's Programming Tool Communication Port (CP1) and computer's USB port.
- Please use a MWPC-200 cable to connect between a PLC's Programming Tool Communication Port (CP1) and computer's RS-232 (Serial) port.
- Usually, the Programming Tool Auxiliary Port (JST 4P outlet) is for connecting with a HMI or SCADA . The circuit of Programming Tool Auxiliary Port and Programming Tool Communication Port are parallel, either one of them can be use at same time.
- PLC Status Indicative LED

LED	Status	Comment
PWR (GREEN)	ON	Power in Supply
	OFF	Power Failure
RUN (GREEN)	ON	RUN
	OFF	STOP
ERR (RED)	ON	PLC System Error (Stop Running)
	Blinking	Abnormal State (Stop Running)
	OFF	Normal

- RUN/STOP & Indicating Section Switches



Number	Function	OFF	ON
1	RUN/STOP Switch	STOP	RUN
2	I/O Indicating Range Switch	X0～X37, Y0～Y37	X40～X77,Y40～Y77

C-2 VH-20AR Specification

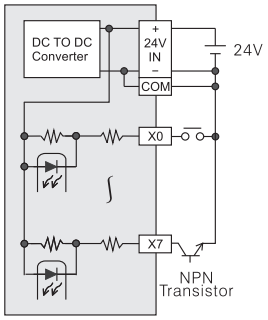
C-2-1 Performance Specification

Item			Specifications
Operation Control Method			Cyclic Operation by Stored Program
Programming Language Method			Electric Ladder Diagram + SFC
I/O Control Method			Batch Processing
Operation Processing Time	Basic Instruction		0.375 ~ 12.56 μs
	Applied Instruction		Several μs ~ Several 100 μs
Number of Instructions	Basic Instructions		27 (including: LDP,LDF, ANDP, ANDF, ORP, ORF and INV)
	Stepladder Instructions		2
	Applied Instructions		81
Operation Memory Capacity (Flash ROM)	Program Capacity		Built-in 4 K Steps Flash ROM
	Comment Capacity		2730 comments (16 words or 8 double-words for each comment)
	Program Comment Capacity		20,000 words or 10,000 double-words
Max. Input / Output Points			128 points: X0 ~ X77, Y0 ~ Y77
Internal Relay	Auxiliary Relay (M)	General	384 points: M0 ~ M383
		Latched	128 points: M384 ~ M511
		Special	256 points: M9000 ~ M9255
	State Relay (S)	Initial	10 points: S0 ~ S9 (Latched)
		Latched	118 points: S10 ~ S127
Timer (T)		100ms.	63 points: T0 ~ T62 (Timer range: 0.1 ~ 3276.7 sec.)
		10ms.	31 points: T32 ~ T62 (When M9028= "ON" Timer range: 0.01 ~ 327.67 sec.)
		1 ms.	1 points: T63 (Timer range: 0.001 ~ 32.767 sec.)
Counter (C)	16-bit Up	General	16 points: C0 ~ C15
		Latched	16 points: C16 ~ C31
High Speed Counter (C)	32-bit Bi-directional, Latched	1-phase Counter	11 points: C235 ~ C245 (Signal Frequency: 10 KHz Max.)
		2-phase Counter	5 points: C246 ~ C250 (Signal Frequency: 10 KHz Max.)
		A/B Phase Counter	4 points: C251 ~ C254 (Signal Frequency: 5 KHz Max.)
Data Register (D)		General	128 points: D0 ~ D127
		Latched	128 points: D128 ~ D255
		Special	256 points: D9000 ~ D9255
		Index	16 points: V0 ~ V7, Z0 ~ Z7
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
Range of Constants	Decimal (K)	16 Bits	-32768 ~ 32767
		32 Bits	-2147483648 ~ 2147483647
	Hexadecimal (H)	16 Bits	0H ~ FFFFH
		32 Bits	0H ~ FFFFFFFFH
Pulse Output			1 point; Max. 7 KHz
Programming Device Link Interface CP1			RS-232C, for direct connect with a computer, HMI or MODEM
Communication Link Interface CP2 (Optional)			RS-232C or RS-422 / RS-485, for connect with a computer or HMI
Communication Link Interface CP3 (Optional)			RS-485, for direct connect with a computer HMI
Real Time Clock (Optional)			To indicates year, month, day, hour, min., sec. and week
Error Code Display Function			Displays 109 error codes (01~99 or E0~E9)
Analog Potentiometer			2 Analog Rotary Potentiometers, for values input (0 ~ 255 or 0 ~ 10)
Main Unit Built-in I/O		Digital Input	8 Points, X0 ~ X7
		Digital Output	6 Points, Y0 ~ Y5
		Analog Input	4 Points, 12 bit resolution, ±10V / 4 ~ 20mA / ±20mA
		Analog Output	2 Points, 12 bit resolution, ±10V / 4 ~ 20mA / ±20mA

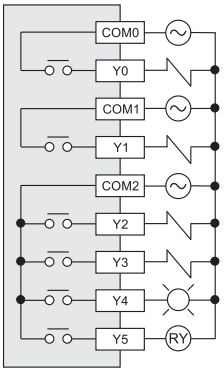
C-2-2 Power Specification

Item	Specifications
Power Input Require	DC24V, +20% / −15%
Input Frequency	—
Momentary Power Failure	Keep working at least 1 ms.
Power Fuse	250V; 0.5A
Power Consumption	5W（Main Unit Only）
Power Unit Output Current（Inner）	DC5V; 400mA
	DC12V; 530mA

C-2-3 Digital Input Specification

Item	Specifications
Power Input Require	DC24V, ± 15%
Input Signal Circuit	7mA / DC24V
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 ~ 15 ms.）
Input Signal Type	Dry Contact or NPN open collector transistor
Isolation Method	Photocoupler Isolation
Circuit Diagram	

C-2-4 Digital Output Specification

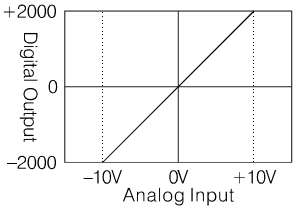
Item		Specifications
Output Type		Relay Output
Switched Voltages		≤ AC 250V / DC 30V
Rated Current	Resistive Load	2 A / point
	Inductive Load	80VA
	Lamp Load	100W
Open Circuit Leakage		—
Response Time		10 ms. approximately
Isolation Method		Mechanic Isolation（Relay）
Circuit Diagram		

C-2-5 Analog Input Specification

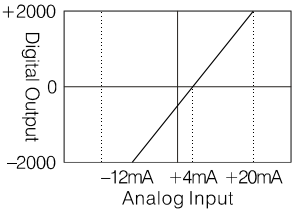
Item	Voltage Input	Current Input
	Voltage or Current Signal Inputs are Designated by D9090 and Different Terminals	
Analog Input Range	−10V ~ +10V	4 ~ 20mA / −20mA ~ +20mA
Digital Output Range	−2000 ~ +2000	0 ~ 2000 / −2000 ~ +2000
Input Resistance	200KΩ	250Ω
Resolution	5mV	20μA
Overall Accuracy	±1% (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

Curve diagram of A/D conversion characteristics

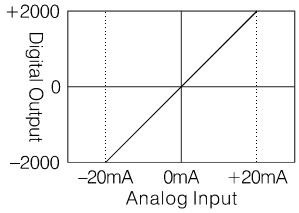
Mode 0
(Voltage Input: −10V ~ +10V)



Mode 1
(Circuit Input: +4mA ~ +20mA)



Mode 2
(Circuit Input: −20mA ~ +20mA)

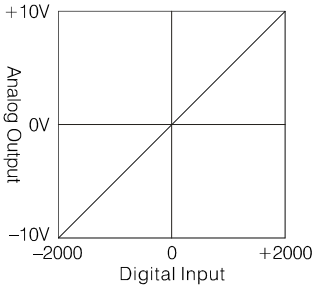


C-2-6 Analog Output Specification

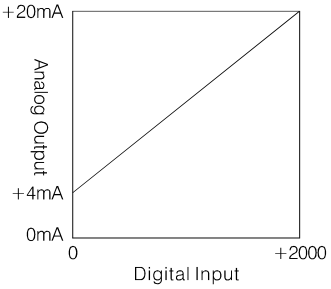
Item	Voltage Output	Current Output
	Voltage or Current Signal Outputs are Designated by D9095 and Different Terminals	
Analog Output Range	−10V ~ +10V	4 ~ 20mA / −20mA ~ +20mA
Digital Input Range	−2000 ~ +2000	0 ~ 2000 / −2000 ~ +2000
External Loading Resistance	500Ω ~ 1MΩ	Under 500Ω
Resolution	5mV	10μA
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	

Curve diagram of D/A conversion characteristics

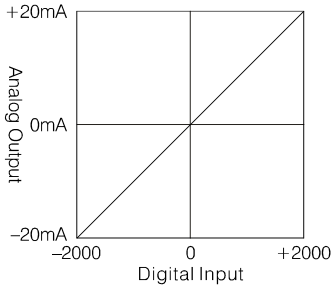
Mode 0
(Voltage Output: −10V ~ +10V)



Mode 1
(Circuit Output: +4mA ~ +20mA)



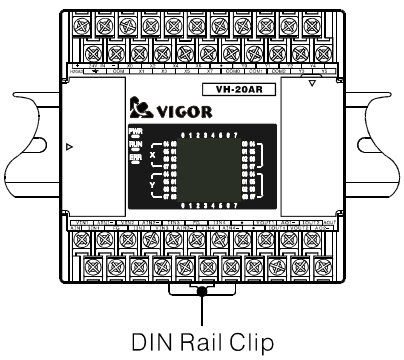
Mode 2
(Circuit Output: −20mA ~ +20mA)



C-3 Installation

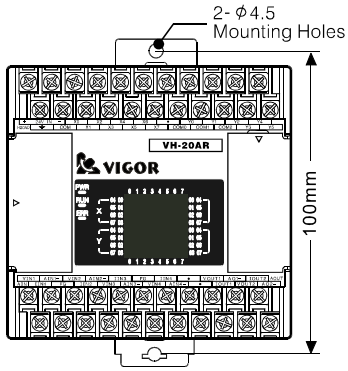
C-3-1 Installation Guides

- Din Rail Installation



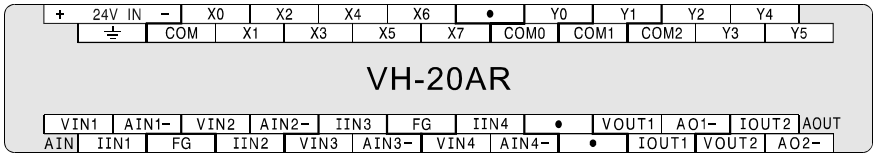
Install the PLC on a 35mm standard DIN rail; Pull the clip down can remove.

- Direct Screws Installation

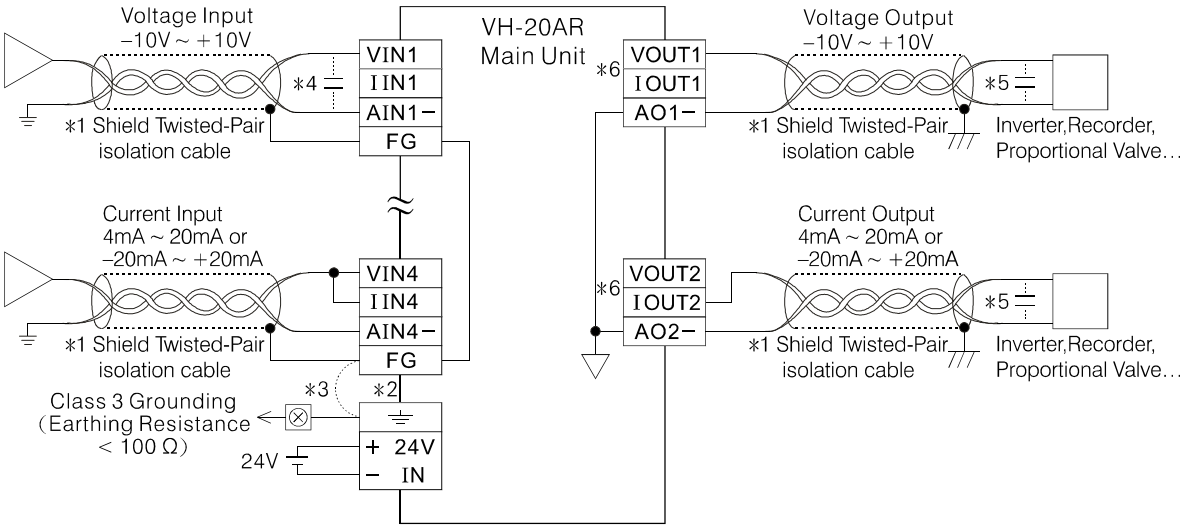


Pull out the hidden mounting holes (100mm distance) from the top and bottom of the PLC and install with screws.

C-3-2 Terminal Layouts



C-3-3 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 : Connect the ⏚ terminal to the grounding point and use the Class 3 Grounding for the system or connect it to the rack of distribution board.

∗3 : If there is excessive electrical noise, connect the FG frame ground terminal with the ⏚ terminal.

∗4 : If a voltage ripple occurs during input or there is electrically induced noise on the external wiring, please parallel connection a smoothing capacitor (0.1 ~ 0.47 μF, 25 V) between the input terminals.

∗5 : If electrical noise or a voltage ripple exists at the output signal to loader, plase parallel connection a smoothing capacitor (0.1 ~ 0.47 μF, 25 V) between the input terminals of loader.

∗6 : Use both (voltage and current) outputs from a channel is not allow.

C-4 Operating Instruction

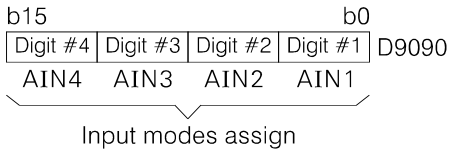
Special data registers list for analog functions. They are not latched registers.

Register #	Special data registers list for analog functions. They are not latched registers.	
D9090	To organize the input modes of AIN1 ~ AIN4	
D9091	Averaged input value from AIN1	• Data values refresh at every Scan Time. • The contain values of D9091 ~ D9094 are averaged of 8 sampling times.
D9092	Averaged input value from AIN2	
D9093	Averaged input value from AIN3	
D9094	Averaged input value from AIN4	
D9095	To organize the output modes of AO1 and AO2	
D9096	Digital value for AO1 output	• Analog outputs refresh at every Scan Time. • The digital value of analog outputs will be reset when the PLC "STOP"
D9097	Digital value for AO2 output	

- For 4 analog value inputs, the value of D9090 switches the modes between voltage or current analog input on each channel. The D9090 uses a format of 4-digit hexadecimal number. The first hexadecimal digit will be the command for AIN1, and the second digit is for AIN2, and so forth.

  The numeric value of each digit respectively represent the following definitions:
  If the value of digit = 0 : Sets the channel to voltage input mode (–10 V ~ +10 V).
  If the value of digit = 1 : Sets the channel to current input mode (+4 mA ~ +20 mA).
  If the value of digit = 2 : Sets the channel to current input mode (–20 mA ~ +20 mA).
  If the value of digit = 3 : Disables the channel.

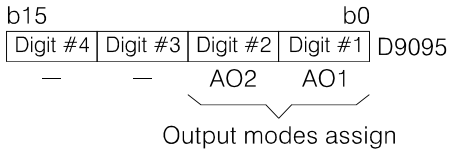
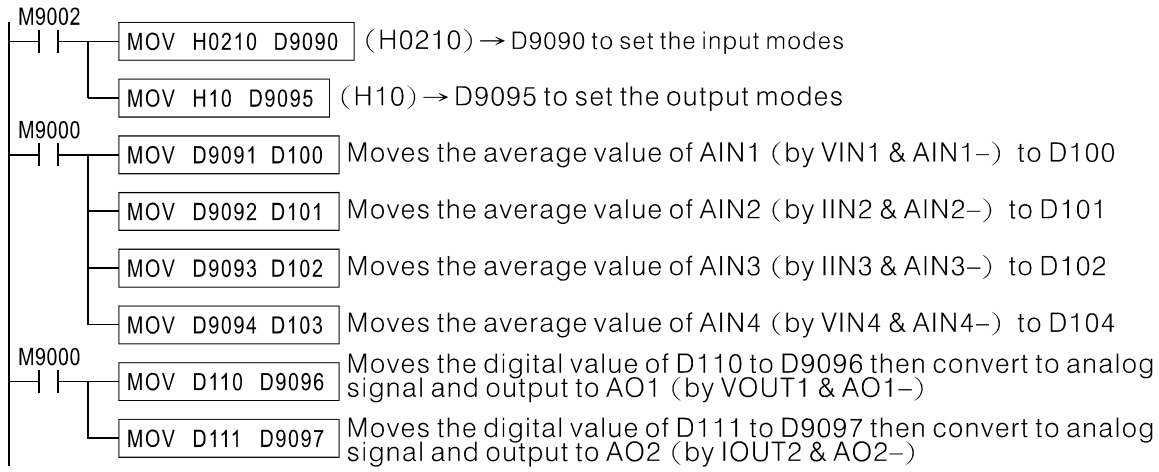
  Example: Let the D9090 = H3210
  AIN1 = 0 : Voltage output (–10 V ~ +10 V)
  AIN2 = 1 : Current output (+4 mA ~ +20 mA)
  AIN3 = 2 : Current output (–20 mA ~ +20 mA)
  AIN4 = 3 : Disabled.



- For 2 analog outputs, the value of D9095 switches the modes between voltage or current analog output on each channel. The D9095 uses a format of 2-digit hexadecimal number. The first hexadecimal digit will be the command for AO1, and the second digit is for Ao2.

  The numeric value of each digit respectively represent the following definitions:
  If the value of digit = 0 : Sets the channel to voltage output mode (–10 V ~ +10 V).
  If the value of digit = 1 : Sets the channel to current output mode (+4 mA ~ +20 mA).
  If the value of digit = 2 : Sets the channel to current output mode (–20 mA ~ +20 mA).
  If the value of digit = 3 : Disables the channel.

  Example: Let the D9095 = H10
  AO1 = 0 : Voltage output (–10 V ~ +10 V)
  AO2 = 1 : Current output (+4 mA ~ +20 mA)



- Example Program