

IVC3 Series PLC

Quick Reference Manual

Thanks for choosing the programmable logic controllers (PLCs) developed and produced by INVT Electric Co., Ltd. Before using the PLC, read this manual carefully to understand the product features, so that you can use the product properly and make full use of its functions.

This manual briefly describes the hardware specification, features, and application methods of IVC3 series PLCs. It is a quick-start guide for the design, installation, connection, and maintenance of IVC3 series PLCs. Users can handily refer to this manual for the required information on site.

Item	General-purpose IVC3
Program capacity	64 ksteps
High-speed input	200 kHz
High-speed output	200 kHz
Power-outage memory	64 kB
CAN	The CANopen DS301 protocol (master) supports a maximum of 31 stations, 64 TxPDOs, and 64 RxPDOs. The CANopen DS301 protocol (slave) supports 4 TxPDOs and 4 RxPDOs. Terminal resistor: Equipped with a built-in DIP switch. Station number setting: Set by using a DIP switch or program.
Modbus TCP	Supporting master and slave stations. IP address setting: Set by using a DIP switch or program.
Serial communication	Communication mode: RS485. Max. baud rate of PORT1 and PORT2: 115200. Terminal resistor: Equipped with a built-in DIP switch.
USB communication	Standard: USB2.0 Full Speed and MiniB interface. Function: Program upload and download, monitoring, and upgrade of underlying systems.
Interpolation	Two-axis linear and arc interpolation (supported by board software V2.0 or later).
Electronic cam	Supported by board software V2.0 or later.
Special extension module	Max. total number of special extension modules: 8.



Customer service center
Shenzhen INVT Electric Co., Ltd.

Product quality feedback sheet

User name	Telephone
User address	Postal code
Product name and model	Installation date
Machine No.	
Product appearance or structure	
Product performance	
Product package	
Product material	
Quality in use	
Improvement comments or suggestions	

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1 Product introduction

1.1 Model description

Figure 1-1 describes the product model.

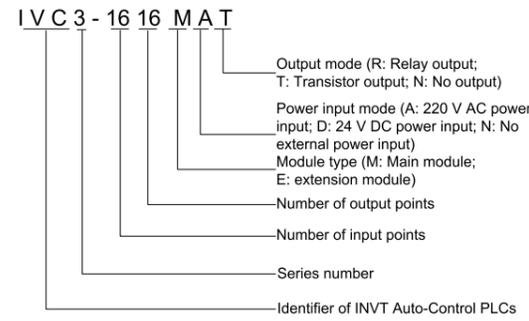


Figure 1-1 Product model description

1.2 Appearance and structure

Figure 1-2 shows the appearance and structure of an IVC3 series main module (using IVC3-1616MAT as an example).

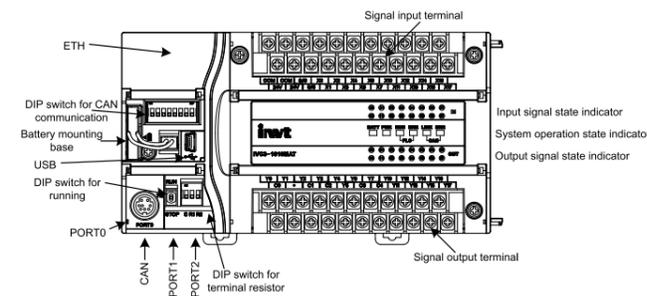
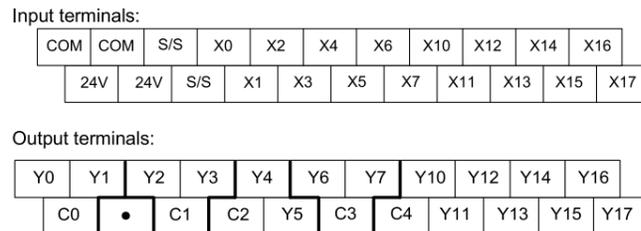


Figure 1-2 Appearance and structure

The bus socket is used to connect extension modules. The mode selection switch provides three options: ON, TM, and OFF.

1.3 Terminal introduction

The following figures show the terminal arrangement of IVC3-1616MAT.



2 Power supply specifications

Table 2-1 describes the specifications of the built-in power supply of the main module and those of the power that the main module can supply to extension modules.

Table 2-1 Power supply specifications

Item	Unit	Min. value	Typical value	Max. value	Remarks
Input voltage range	V AC	85	220	264	Voltage range for proper start and operation
Input current	A	/	/	1.5	90 V AC input, full-load output
Rated output current	5V/GND	mA	/	1000	The capacity is the sum of the internal consumption of the main module and the load of the extension modules. The maximum output power is the sum of the full load of all modules, that is, 35 W. The natural cooling mode is adopted for the module.
	24V/GND	mA	/	650	
	24V/COM	mA	/	600	

3 Digital input/output characteristics

3.1 Input characteristics and signal specifications

Table 3-1 describes the input characteristics and signal specifications.

Table 3-1 Input characteristics and signal specifications

Item	High-speed input terminals X0 to X7	Common input terminal	
Signal input mode	Source-type or sink-type mode. You can select the mode through the "S/S" terminal.		
Electrical parameters	Detection voltage	24V DC	
	Input impedance	1 kΩ	5.7 kΩ
	Input switched on	The resistance of the external circuit is lower than 400 Ω.	The resistance of the external circuit is lower than 400 Ω.
	Input switched off	The resistance of the external circuit is higher than 24 kΩ.	The resistance of the external circuit is higher than 24 kΩ.
Filtering function	Digital filtering	X0–X7: The filtering time can be set through programming, and the allowable range is 0 to 60 ms.	
	Hardware filtering	Hardware filtering is adopted for ports except the X0 to X7, and the filtering time is about 10 ms.	
High-speed function	Ports X0 to X7 can implement multiple functions including high-speed counting, interrupting, and pulse capture. The maximum counting frequency of X0 to X7 is 200 kHz.		

The maximum frequency of the high-speed input port is limited. If the input frequency exceeds the limit, the counting may be incorrect or the system fails to run properly. You need to select a proper external sensor.

The PLC provides the "S/S" port for selecting the signal input mode. You can select the source-type or sink-type mode. Connecting "S/S" to "+24V" indicates that you select the sink-type input mode, and then an NPN-type sensor can be connected. If "S/S" is not connected to "+24V", it indicates that the source-type input mode is selected. See Figure 3-1 and Figure 3-2.

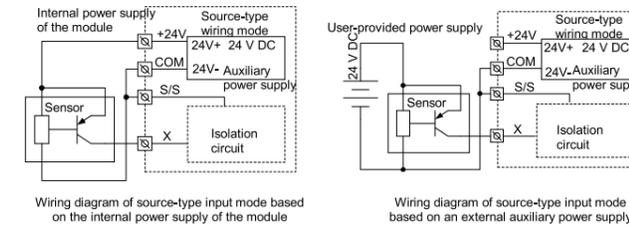


Figure 3-1 Source-type input wiring diagram

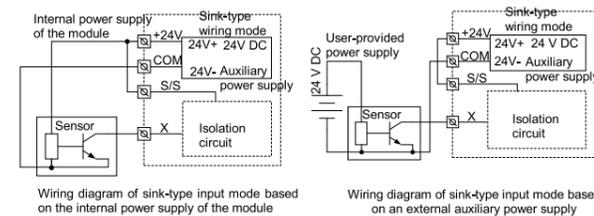


Figure 3-2 Sink-type input wiring diagram

3.2 Output characteristics and signal specifications

Table 3-2 describes the output electrical specifications.

Table 3-2 Output electrical specifications

Item	Output specification
Output mode	Transistor output. The output is connected when the output state is ON, and it is disconnected when the output state is OFF.
Circuit insulation	Optocoupler insulation
Action indication	The indicator is on when the optocoupler is driven.
Circuit power supply voltage	5–24 V DC. The polarities are differentiated.
Open-circuit leakage current	Lower than 0.1 mA/30 V DC

Item	Output specification	
Min. load	5 mA (5–24 V DC)	
Max. output current	Resistive load	Total load of the common terminals: Common terminal of the 0.3 A/1-point group; Common terminal of the 0.8 A/4-point group; Common terminal of the 1.6 A/8-point group.
	Inductive load	7.2 W/24 V DC
	Lamp load	0.9 W/24 V DC
Response time	OFF→ON	Y0–Y7: ≤1 μs/higher than 10 mA
	ON→OFF	Others: ≤0.5 ms/higher than 100mA
Max. output frequency	Y0–Y7: 200 kHz (maximum)	
Common output terminal	One common terminal can be shared by a maximum of 8 ports, and all the common terminals are isolated from each other. For details about common terminals of different models, see the terminal arrangement.	
Fuse protection	No	

(1) The transistor output circuit is equipped with a built-in voltage-stabilizing tube to prevent the counter-electromotive force caused when the inductive load is disconnected. If the capacity of the load exceeds the specification requirement, you need to add an external freewheeling diode.

(2) High-speed transistor output involves distributed capacitance. Therefore, if the machine runs at 200 kHz, you need to ensure that the conducted current is larger than 15 mA to improve the output characteristic curve, and the device connected to it can be connected to a resistor in parallel mode to increase the load current.

3.3 Input/output connection instances

Input connection instance

Figure 3-3 shows the connection of IVC3-1616MAT and IVC-EH-0808ENR, which is an instance of implementing simple positioning control. The position signals obtained by the encoder can be detected by the X0 and X1 high-speed counting terminals. The position switch signals that require quick response can be connected to the high-speed terminals X2 to X7. Other user signals can be distributed among the input terminals.

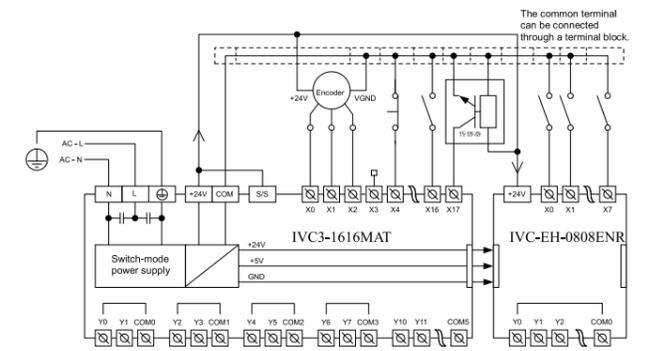


Figure 3-3 Input connection instance

Output connection instance

Figure 3-4 shows the connection of IVC3-1616MAT and IVC-EH-0808ENR. The output groups can be connected to different signal voltage circuits, that is, the output groups can operate in circuits of different voltage classes. They can be connected only to DC circuits. Pay attention to the direction of the current when connecting them.

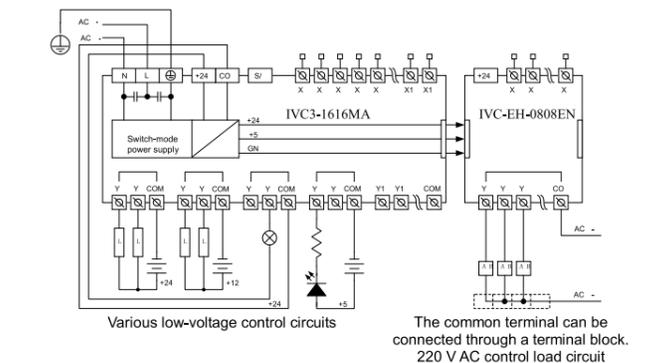


Figure 3-4 Output connection instance

4 Communication guide

4.1 Serial communication

The IVC3 series main module provides three asynchronous serial communication ports, namely PORT0, PORT1, and PORT2. They support the baud rates of 115200, 57600, 38400, 19200, 9600, 4800, 2400, and 1200 bps. PORT0 adopts the RS232 level and the Mini DIN8 socket. Figure 4-1 describes the pin definition of PORT0.

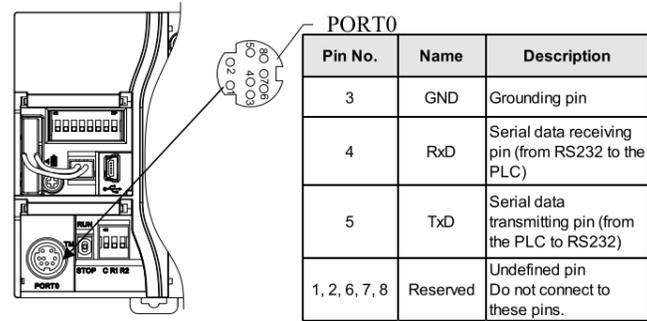


Figure 4-1 Position of the mode selection switch and definition of PORT0 pins. As a specialized interface for user programming, PORT0 can be forcibly switched to the programming port protocol through the mode selection switch. Table 4-1 describes the mapping between PLC running states and PORT0 running protocols.

Table 4-1 Mapping between PLC running states and PORT0 running protocols

Mode selection switch setting	State	PORT0 running protocol
ON	Running	Depend on the user program and its system configuration. It can be the programming port, Modbus, free-port, or N:N network protocol.
TM (ON→TM)	Running	Forcibly switched to the programming port protocol.
TM (OFF→TM)	Stopped	protocol.
OFF	Stopped	If the free-port protocol is used in the system configuration of the user program, PORT0 is automatically switched to the programming port protocol after the PLC is stopped. Otherwise, the protocol set in the system is not switched.

4.2 RS485 communication

Both PORT1 and PORT2 are RS485 ports that can be connected to devices with communication functions, such as inverters or HMIs. These ports can be used to control multiple devices in networking mode through the Modbus, N:N, or free-port protocol. They are terminals fastened with screws. You can make the communication signal cables by yourself. It is recommended that you use shielded twisted pairs (STPs) to connect the ports.

Table 4-2 RS485 communication characteristics

Item	Characteristic
Communication port	2
Socket mode	PORT1, PORT2
Baud rate	115200, 57600, 38400, 19200, 9600, 4800, 2400, 1200bps
Signal level	RS485, half duplex, non-isolation
Supported protocol	Modbus master/slave station protocol, free communication protocol, N:N protocol
Terminal resistor	Equipped with a built-in DIP switch

4.3 CANopen communication

Table 4-3 CAN communication characteristics

Item	Characteristic
Protocol	Standard CANopen protocol DS301v4.02 that can be applied for master and slave stations, supporting the NMT service, Error Control protocol, SDO protocol, SYNC, Emergency, and EDS file configuration
Master station	Supporting 64 TxPDOs, 64 RxPDOs, and a maximum of 31 stations. The data exchange area (D component) is configurable.
Slave station	Supporting 4 TxPDOs and 4 RxPDOs. Data exchange area: SD500–SD531
Socket mode	Pluggable terminal of 3.81 mm

Item	Characteristic
Terminal resistor	Equipped with a built-in DIP switch
Station No.	Set through bits 1 to 6 of the DIP switch or through the setting program
Baud rate	Set through bits 7 to 8 of the DIP switch or through the program

Use STPs for CAN communication. If multiple devices are involved in communication, ensure that the GND terminals of all the devices are connected and the terminal resistors are set to ON.

4.4 Ethernet communication

Table 4-4 Ethernet communication characteristics

Item	Characteristic
Protocol	Supporting the Modbus TCP and programming port protocols
IP address setting	The last segment of the IP address can be set through the DIP switch or an upper computer
Slave station connection	A maximum of 16 slave stations can be connected simultaneously.
Master station connection	A maximum of 4 master stations can be connected simultaneously.
Socket mode	RJ45
Function	Program upload/download, monitoring, and user program upgrade
Default IP address	192.168.1.10
MAC address	Set in factory. See SD565 to SD570.

5 Installation

IVC3 Series PLCs are applicable to scenarios with installation environments of standard II and pollution level of 2.

5.1 Dimensions and specifications

Table 5-1 describes the dimensions and specifications of IVC3 series main modules.

Table 5-1 Dimensions and specifications

Model	Width	Depth	Height	Net weight
IVC3-1616MAT	167 mm	90 mm	90 mm	740 g
IVC3-1616MAR				

5.2 Installation modes

Using DIN slots

Generally, the PLCs are installed by using DIN slots with a width of 35 mm, as shown in Figure 5-1.

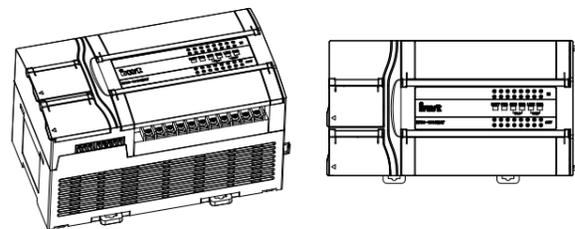


Figure 5-1 Diagram of installation by using a DIN slot

The specific installation steps are as follows:

- Fix the DIN slot horizontally on the installation backplate.
- Pull out the DIN slot clamping buckle from the bottom of the module.
- Mount the module onto the DIN slot.
- Press the clamping buckle back to where it was to lock the fix the module.
- Use the stoppers of the DIN slot to fix the two ends of the module, preventing it from sliding.

These steps can also be used to install other PLCs of the IVC3 series by using DIN slots.

Using screws

For scenarios where large impact may occur, you can install the PLCs by using screws. Put the fastening screws (M3) through the two screw holes on the housing of the PLC and fix them on the backplate of the electrical cabinet, as shown in Figure 5-2.

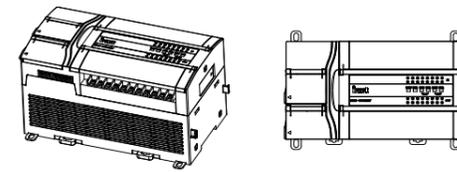


Figure 5-2 Diagram of installation by using screws

5.3 Cable connection and specifications

Power cable and grounding cable connection

Figure 5-3 shows the connection of the AC and auxiliary power supplies.

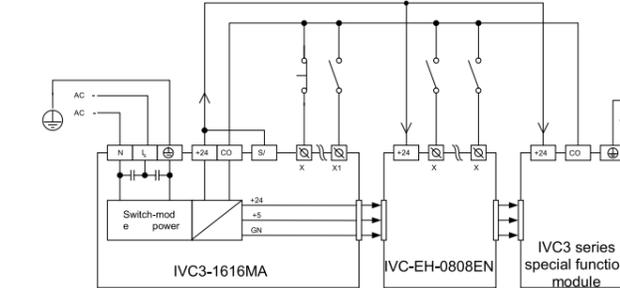


Figure 5-3 Connection diagram of the AC and auxiliary power supplies

The anti-electromagnetic interference capability of the PLCs can be improved by configuring reliable grounding cables. When installing a PLC, connect the power supply terminal to the ground. It is recommended that you use connection wires of AWG12 to AWG16 and try to shorten the wires, and that you configure independent grounding and keep the grounding cables away from those of other devices (especially those generating strong interference), as shown in Figure 5-4.

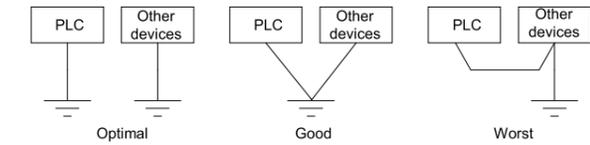


Figure 5-4 Grounding diagram

Cable specifications

For the wiring of the PLC, it is recommended that you use multi-stranded copper wire and prepare insulated terminals to ensure the wiring quality. Table 5-2 describes the recommended wire cross-sectional areas and models.

Table 5-2 Recommended cross-sectional areas and models

Cable	Cross-sectional area of wire	Recommended wire model	Compatible wiring terminals and heat-shrinkable tubing
AC power cable (L, N)	1.0–2.0mm ²	AWG12, 18	H1.5/14 preinsulated tube-like terminal, or hot tin-coated cable terminal
Grounding cable (⊕)	2.0mm ²	AWG12	H2.0/14 preinsulated tube-like terminal, or hot tin-coated cable terminal
Input signal cable (X)	0.8–1.0mm ²	AWG18, 20	UT1-3 or OT1-3 cold-pressed terminal, Φ3 or Φ4 heat-shrinkable tubing
Output signal cable (Y)	0.8–1.0mm ²	AWG18, 20	

Fix the processed cable terminals onto the wiring terminals of the PLC by using screws. Pay attention to the positions of the screws. The tightening torque for the screws is 0.5 to 0.8 Nm, which can be used to complete reliable connection without damaging the screws.

Figure 5-5 shows the recommended cable preparation mode.

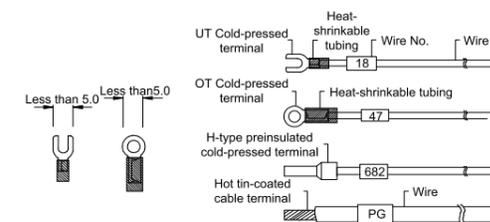


Figure 5-5 Cable preparation diagram



Warning

Do not connect transistor output to AC circuits, such as a circuit of 220 V AC. Strictly follow the electrical parameters to design the output circuits. Ensure that no overvoltage or overcurrent occurs.

6 Power-on, operation, and routine maintenance

6.1 Power-on and operation

After the wiring is complete, check all the connections. Ensure that no foreign matters have dropped inside the housing and heat dissipation is in good conditions.

- Power on the PLC. The POWER indicator of the PLC is on.
- Start the Auto Station software on the PC and download the compiled user program to the PLC.
- After the program is downloaded and verified, set the mode selection switch to ON. The RUN indicator is on. If the ERR indicator is on, it indicates that errors occur on the user program or the system. In this case, rectify the errors by referring to the instructions in the *IVC Series Small-sized PLC Programming Manual*.
- Power on the PLC external system to perform commissioning on the system.

6.2 Routine maintenance

Pay attention to the following aspects when performing routine maintenance and inspection:

- Ensure that the PLC operates in a clean environment, preventing foreign matters or dust from dropping into the machine.
- Keep the PLC in good ventilation and heat dissipation conditions.
- Ensure that the wiring is properly performed and all the wiring terminals are well fastened.

Notice

- The warranty covers only the PLC machine.
- The warranty period is 18 months.** We provide free-of-charge maintenance and repairs for the product if it is faulty or damaged during proper operation within the warranty period.
- The warranty period starts from the ex-factory date of the product.** The machine No. is the only basis for determining whether the machine is within the warranty period. A device without the machine No. is deemed out-of-warranty.
- Maintenance and repair fees are charged in the following scenarios even the product is within the warranty period:
 - Faults are caused due to misoperations. Operations are not performed following the instructions provided in the manual.
 - The machine is damaged due to causes such as fire, flood, or voltage exceptions.
 - The machine is damaged due to improper use. You use the machine to perform some unsupported functions.
- The service fees are calculated based on the actual fees. If there is a contract, the provisions stated in the contract prevail.
- Keep this warranty card. Show it to the maintenance unit when you seek maintenance services.
- Contact the local dealer or directly contact our company if you have any questions.

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