INOVANCE

User Guide

H₂ᵤ-8A91G-XP Series PLC

Specialized for Air Compressor

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19010790

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Preface

Thank you for purchasing the H₂ᵤ-8A91G-XP series PLC specialized for air compressor developed by Inovance. The PLC provides the users with the secondary programming function. Besides general-purpose H2U series PLC functions such as high-speed pulse input & output and digital input & output, it adds detection of temperature, pressure, three-phase current and phase sequence, and programmable communication port.
It can be used in industrial equipments including screw compressor, constant pressure water supply and wire drawing machine. Especially when it is used together with Inovance HMI, MD380 AC drive and Inovance IOT communication module, the control system will be more simple and powerful in functions. Use the latest Autoshop version above to develop user programs of this product.
The instructions are subject to change, without notice, due to product upgrade, specification modification as well as efforts to increase the accuracy and convenience of the manual.
Visit Inovance's website www.inovance.com.

Safety Information and Precautions

The matters in ⚠WARNING and ⚠CAUTION do not include all safety precautions that should be complied with but are only
supplements to safety information on various operations.
Air compressor is a pressure-type production equipment. Improper use or operation may result in personal injury. Obey related industry safety specifications in design and only allow personnel who have been strictly trained to perform various operations according to correct operation methods.

⚠WARNING A Warning contains information, which is essential for avoiding a safety hazard.

⚠CAUTION A Caution contains information, which is necessary for avoiding a risk of damage to the product or other machine.

Design

Provide a safety circuit outside the PLC so that the control system can still work safely once external power failure or PLC fault occurs.
- In the external circuit of the PLC, an emergency stop circuit and a protection circuit are necessary to prevent equipment damage.
- For power switchover circuit of Y-△ start, mechanical interlock and electrical interlock circuit are required, and meanwhile contactor must be configured with mechanical main lock to prevent malfunction.
- The 220 VAC used by the PLC is obtained through isolation transformer. The AC power supply is isolated to improve capacity of resisting interference of the control system.
- When the PLC adopts mains frequency power supply to directly drive the compressor host or fan, phase sequence of three-phase AC power supply needs to be monitored. The PLC has built-in phase sequence detection circuit. The A, B, C terminals can receive 100 to 250 VAC power supply. If the power supply exceeds 250 VAC, the phase sequence detection power resistor (standard configuration) is required to attenuate the power, preventing damaging the PLC internal circuit. The maximum AC power supply is 380 VAC.

Installation and Wiring

- Installation and wiring can be performed only after all external power supplies are disconnected. Failure to comply may result in electric shock or damage to the equipment; Separate high-voltage lines such as power cables and signal wirings from low-voltage lines to prevent interference and coupling.
- Install and wire the PLC securely and reliably, and insert the terminal block in place. Poor contact may result in malfunction.
- In applications where the PLC is used together with large power AC drive, use twisted pair cable for RS485 communication and connect corresponding GND wire to enhance capacity of resisting interference.
- AI/AO wire, sensor connecting cable and AC drive connecting cable must not be longer than 10 m.
- Immediately clear foreign matters after installation and wiring are completed.

Maintenance & Inspection

- Do not touch the terminals while the power is on. Failure to comply may result in electric shock or malfunction.
- Disconnect all external power supplies before cleaning or re-tightening terminal. Failure to comply may result in electric shock.
- Disconnect all external power supplies of the system before connecting/removing signal wirings. Failure to comply may result in personal injury or damage to the equipment.
- Do not disassemble the PLC to prevent damaging internal electrical components.

Product Type Identification

H₂ᵤ-8A91G-XP
①　②③④⑤⑥　⑦

① 2nd generation of controller of Inovance

② 8-channel digital inputs　　⑤ 1-channel analog output
③ 10-channel digital outputs　⑥ Air compressor controller series
④ 9-channel analog inputs　　⑦ Auxiliary version

Installation and Wiring

■ Mounting Dimensions

(Side view)　　Mounting holes Ø5 x 4　　(Top view)　　Unit: mm
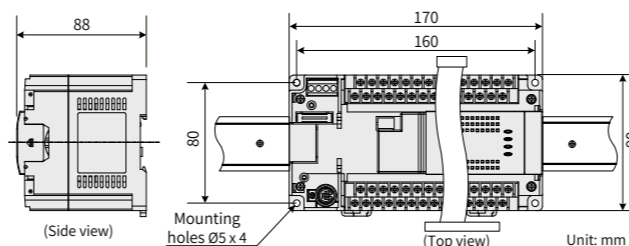
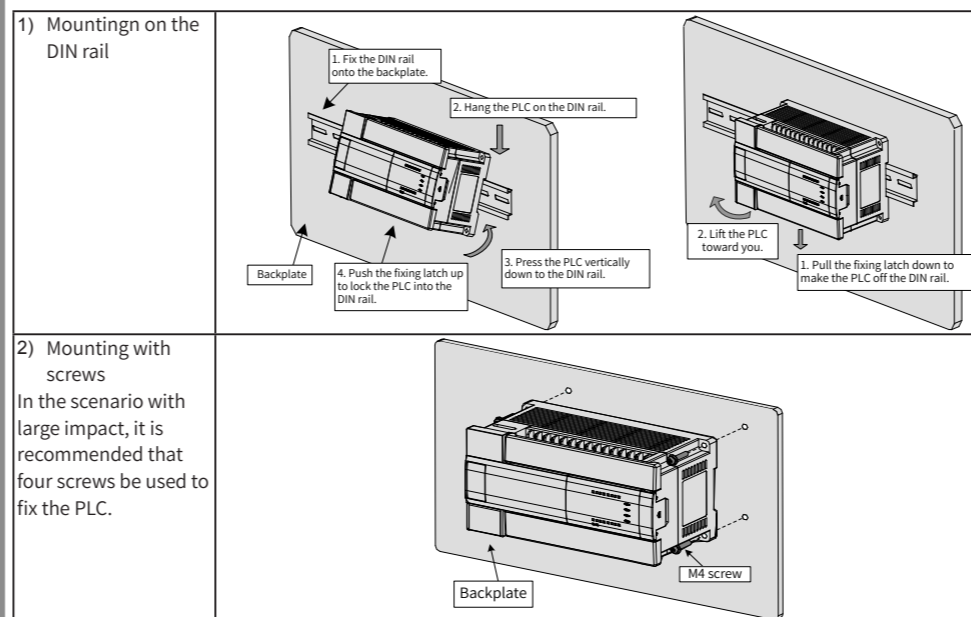### ■ Mounting Location Requirements

1) Do not remove the paper tape during installation. remember to remove it before power-on after installation is completed to prevent overheating.
2) Wall-mount the PLC with 300 mm clearance from the top and bottom to ensure good ventilation.
3) Leave 50 mm or more space between the PLC and other devices or structures. Keep PLC far away from high-voltage cables and devices, and power devices.
4) Do not lay signal cables of the PLC and power cables of the AC drive or the servo drive in the same wiring duct to prevent electromagnetic interference.

■ Mounting Methods

1) Mounting on the DIN rail

2) Mounting with screws
In the scenario with large impact, it is recommended that four screws be used to fix the PLC.

■ Operating Environment

| Item	Requirements
Mounting location	Indoors. Ensure the mounting location is away from direct sunlight, rain, salt mist, vapours, dusts, corrosive or combustible or explosive gases and oil.
Working temperature	-5°C to 55°C
Altitude	Below 1000 m
Humidity	Lower than 95% RH, no condensation
Vibration	Smaller than 5.9 m/s²
Vibration	-20°C to 60°C
Protection level	IP20 for mounting part inside the cabinet, IP55 for panels of the cabinet

■ Performance Parameters

Terminal Type	Quantity	Pin	Functions and Features	Remark
Digital input	8	X0 to X7/COM0	SINK input, built-in 24 VDC detection power	◆ X0 and X1 can count 30 kHz high-speed pulse input signal. ◆ X7 can detect status of PTC temperature sensitive resistor.
Digital output	2	Y0 and Y1/COM0	Low-voltage transistor output	Y0 and Y1 can output 30 kHz high-speed pulse signal.
	8	Y2 to Y7/COM1 Y10 and Y11/COM2	Relay output	◆ Y2 and Y7 output 5 A current or 220 VAC/30 VDC. ◆ Y10 and Y11 output 2 A current or 220 VAC/30 VDC.
Temperature sensor signal input	2	PT1+/PT1- PT2+/PT2-	Connect PT100 sensor to detect temperature of air compressor. The accuracy is +/-1°C	◆ Detected temperature range of PT1 is -5°C to 125°C. ◆ Detected temperature range of PT2 is -5°C to 255°C.
Pressure sensor signal input	2	P1+/P1- P2+/P2-	Connect standard 4 to 20 mA pressure sensor to detect pressure. The accuracy is 1%.	Detection range of P1 and P2 is 4 to 20 mA.
Motor current signal input	2	CT1A/CT1B/CT1C CT2A/CT2B/CT2C	Detect current and phase loss of two three-phase AC motors, respectively. The accuracy is 5%.	Connect secondary side current signal of current transformer. The maximum effective value is 100 mA. It cannot be used for current detection of AC drive input/output cables.
Three-phase AC power phase sequence detection	Three-phase voltage signal	A, B, C	Detect phase sequence of A, B, C.	Connect AC power through phase sequence detection device or isolating transformer[1].
Analog control signal output	1	Aout/AGND	Voltage signal output: 0 to 10 VDC	Non-isolated voltage signal, able to connect min. load resistor of 2 kΩ.
Comms. port	4 serial comms. ports and 1 mini USB	COM0, COM1, COM2, COM3	COM0: RS422, COM1: RS485, COM2: RS485, COM3: RS485	◆ COM0: (MiniDIN8) connecting HMI ◆ COM1: connecting remote wireless module ◆ COM2: connecting N:N networking ◆ COM3: connecting the AC drive ◆ MiniUSB: monitoring and downloading user program
AC power input	1	L, N, PE	100 to 240 VAC	Connect to AC power through isolation transformer to improve system reliability.
DC power output	1	24V/COM0	Provide power supply to HMI and wireless communication module.	Output maximum 650 mA.
Extension card interface	Reserved		Connect the H2U-CAN-BD extension card, through which various expansion modules can be connected to satisfy application requirements on more DI/DO and AI/AO signals.

[1] After phase sequence detection power resistor attenuates the power, wire terminals A, B, C for phase sequence detection. Do not directly connect 380 VAC power to terminals A, B, C.

■ Terminal Arrangement
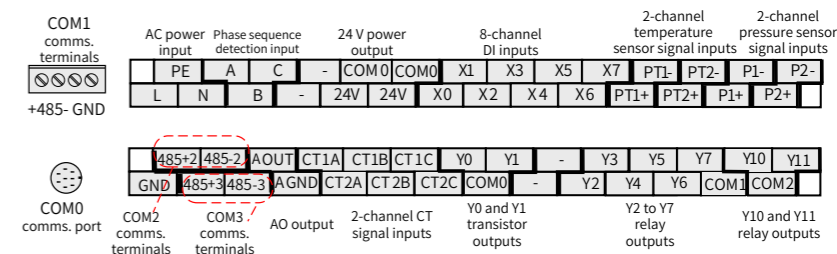
Installation and Wiring

■ Power Specifications

Item	Unit	Min. Value	Typical Value	Max. Value	Remark
Rated operating voltage	VAC	100	220	240	Normal start and operating range
Peak input voltage	VAC	85	-	264	85 to 100 VAC Derated when between 240 to 264 VAC
Input current	A	-	-	1	-
Input power	W/VA	-	-	23 W/40 VA	-
24V/COM0 output power	Voltage (V)	21.6	24	26.4	Provide power supply to IT5070T, remote module, 3G communication expansion module.
	Current (mA)	-	-	650	
Rated load voltage	VAC	100	-	240	-
Rated load frequency	Hz	50	-	60	-
Rated load power	W	-	-	26	-

■ Input Specifications

Item	High-speed Inputs X0 and X1		Common Inputs X2 to X7
Signal input mode	SINK mode, input directly connecting internal 24 VDC		
	Detected voltage	24 VDC	
Electrical parameters	Input resistance	1.9 kΩ	2 kΩ
	Input ON	Input current > 7.8 mA	Input current > 5.6 mA
	Input OFF	Input current < 2.5 mA	Input current < 1.5 mA
Filter function	Digital filter	X0 and X1 have the digital filter function. The filter time can be set in the range of 0 to 60 ms.	
	Hardware filter	The other terminals have the hardware filter function with filter time of approximately 10 ms.	
High-speed function		X0 and X1 can implement functions such as high-speed counting, interrupt and pulse capture. Max. pulse frequency of counting is 30 kHz. X7 can detect the PTC resistor status. When the resistance is smaller than 800 Ω, the PTC resistor is in energized status. When the resistance is larger than 2.3 kΩ, the PTC resistor is in de-energized status.	

■ Output Specifications

Item	Y0 and Y1 Transistor Output	Y2 to Y7 5A Relay Output	Y10 and Y11 2A Relay Output
Circuit power voltage	5 to 24 VDC	250 VAC, 30 VDC below	250 VAC, 30 VDC below
Circuit insulation	Optocoupling insulation	Relay mechanical insulation	Relay mechanical insulation
Action indication	LED lighting when optocoupler is driven.	LED lighting when relay outputs contact.	LED lighting when relay outputs contact.
Min. load	5 mA (5 to 24 VDC)	5 mA/5 VDC	5 mA/5 VDC
Max. output current — Resistive load	0.5 A/contact, 0.8 A/4 contacts, 1.6 A/8 contacts	AC 5 A/contact, DCA/contact	AC 2 A/contact, DC 0.5 A/contact
Max. output current — Inductive load	High-speed terminal: 7.2 W/24 VDC Others: 12 W/24 VDC	220 VAC, 80 VAK	220 VAC, 80 VA
Max. output current — Lamp load	High-speed terminal: 0.9 W/24 VDC Others: 1.5 W/24 VDC	220 VAC, 100 W	220 VAC, 100 W
ON response time	High-speed output: 100 us	Max. 20 ms	Max. 20 ms
OFF response time	Max. 20 ms	Max. 20 ms	Max. 20 ms
Output common	They share a common and are isolated.	They share a common and are isolated.	They share a common and are isolated.

## Software Specification and Programming Requirements

■ Software Specification

Compared with general-purpose H2U-XP PLC, the H2U-8A91G-XP adds detection terminals of temperature, pressure, motor current and three-phase phase sequence.

Data sampling of these terminals has been automatically completed by the PLC system software. User programs only need to read and monitor the special variables after D8000 and M8000. These variables are defined as follows:

| Variable Address	Variable Definition	Variable Address	Variable Definition
— Pressure Inputs			
D8400	P1 transducer range (Mpa)	D8401	P2 transducer range (Mpa)
M8402	P1 breaking indication: 1 = breaking	M8403	P2 breaking indication: 1 = breaking
D8402	P1 pressure sampling value (0 to 10000)	D8403	P2 pressure sampling value (0 to 10000)
M8404	P1 pressure physical variable conversion	M8405	P2 pressure physical variable conversion
Temperature Inputs			
M8406	PT1 breaking indication	D8406	PT1 temperature result
M8407	PT2 breaking indication	D8407	PT2 temperature result
Three-phase Motor Current Inputs			
D8408	CT1 IA current	D8412	CT2 IA current
D8409	CT1 IB current	D8413	CT2 IB current
D8410	CT1 IC current	D8414	CT2 IC current
M8411	CT1 current phase loss indication	M8415	CT2 current phase loss indication
D8411	CT1 change setting	D8415	CT2 change setting
Three-phase Power Voltage ABC Detection Inputs			
D8416	Negative sequence component sampling value	D8417	Power negative sequence judging threshold
M8418	Three-phase phase sequence reverse indication	-	-
Analog Voltage Output			
D8419	DA output value (0 to 10000) corresponds to 0 to 10 V.	-	-

■ Programming Requirements

1) One PC with Microsoft Windows operating system
2) Inovance AutoShop (version 2.0 or above) for the purpose of designing and downloading user programs
3) Inovance USB-mini download cable or mouse head download cable for PC with DB9-type RS232 port
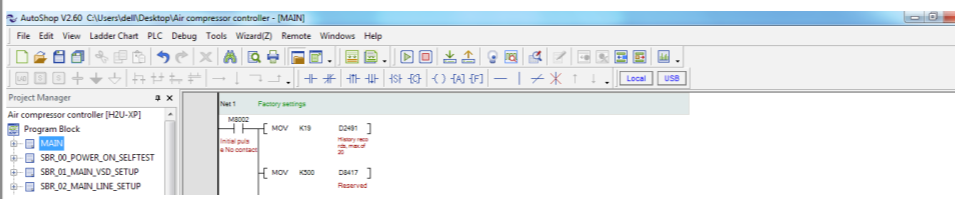
Typical Application System Wiring

When compressor head driven by mains frequency is applied in large rating screw compressor, the Y-△ start mode is usually used. The H2U-8A91G-XP PLC can operate with compressor head driven by AC drive in parallel. In such system driven by mains frequency, an isolation transformer (voltage transformer) is required to convert high voltage into low three-phase voltage input into A, B, C of the H2U-8A91G-XP to monitor phase sequence of the grid.

The current transformer provided by Inovance can implement overcurrent protection of two motors. The system wiring is as follows:
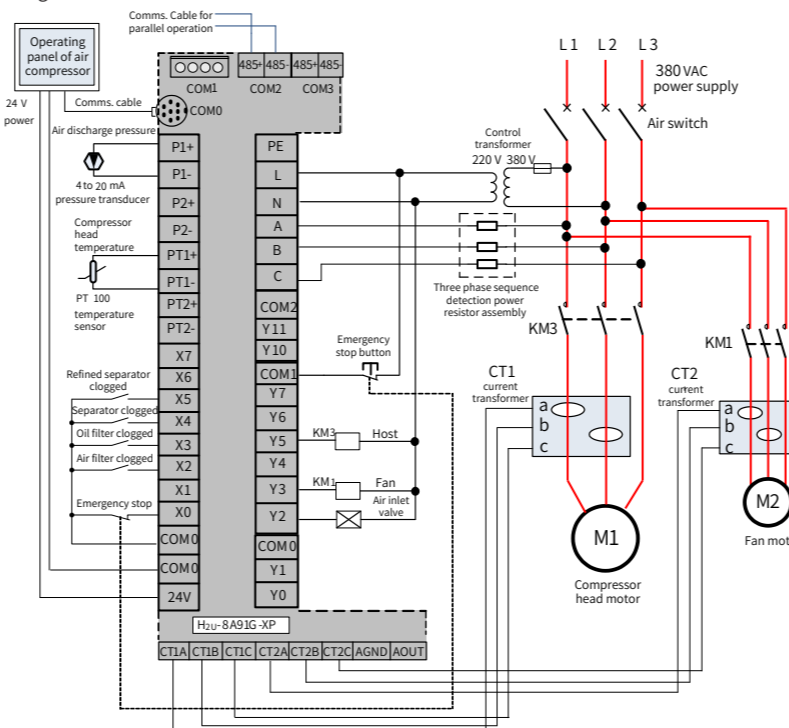
The air compressor system with host driven by AC drive and fan driven by AC drive has the following advantages:

1) Small impact on grid at startup
2) Stable air discharge pressure
3) Energy efficient
4) Accurate control of compressor head temperature
5) Quiet operation

The H2U-8A91G-XP are connected to two MD380 AC drives by adopting RS485 serial communication. The wiring diagram is as follows:
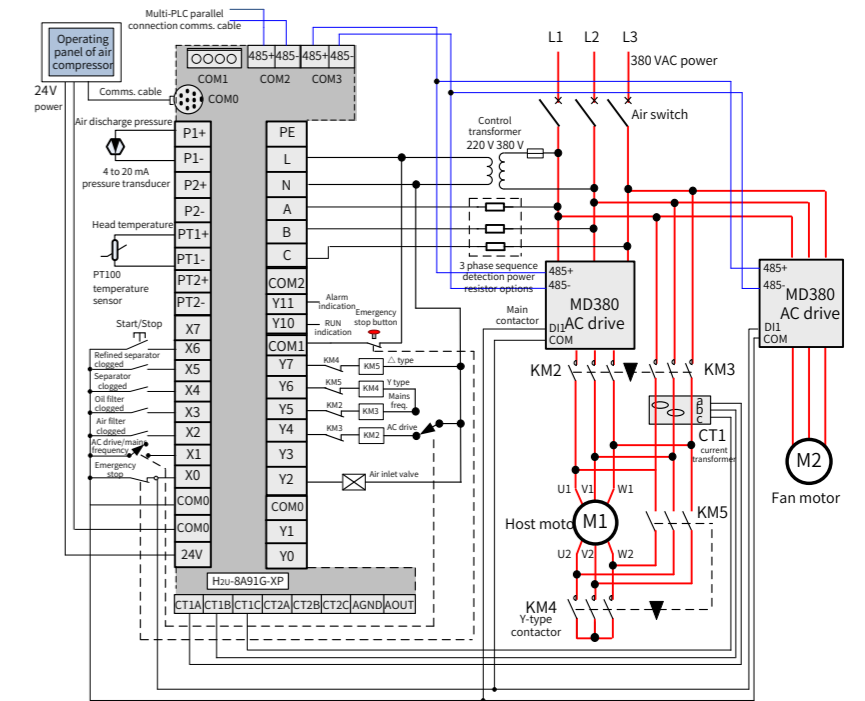
Options

The other options are described in the following table.

Name	Model	Description	Order Code
4.3-inch HMI	IT5043T	HMI-T5043TDZ-IT5000 series 4.3-inch HMI	01026007
7-inch HMI	IT5070T	HMI-T5070TDZ-IT5000 series 7-inch HMI	01026001
Current transformer CT1	CT-038	Rated primary current 80 to 400 A, applied power 55 to 160 kW, current ration 4000:1	13050003
Current transformer CT1	CT-032	Rated primary current 40 to 200 A, applied power 11 to 55 kW, current ration 2000:1	13050002
Current transformer CT2	CT-033	Rated primary current 20 to 80 A, applied power 0.7 to 5.5 kW, current ration 1000:1	13050001
PLC downloading cable	H₂U-USB-CAB	Single cable-SIT7.769.543-H₂U-USB-CAB-H₂U series PLC user program (USB mini 5-pin) communication cable (RoHS)	15041200
HMI-PLC comms. cable	IT5-H₂U-CAB	Single cable-SIT7.769.345-IT5-H₂U-CAB-HMI and PLC communication cable of (5 pins and 3 meters long (RoHS)	15041140
HMI downloading cable	IT5-USB-CAB	Single cable-SIT7.769.266-TYPE A male converted to TYPE B male-T5070TDZ using USB downloading cable	15041123
Hand-held operator	H₂U-PRO	It facilitates user program downloading and can be used to set equipment parameters and factory information.	01020324
RS485 comms. card for MD380	MF38TX1	Option-MF38TX1-MD380 series isolation RS485 communication extension card-Size B	01013112

INOVANCE   Warranty Agreement

The warranty period of the product is 18 months (subject to information indicated by the barcode on the product). During the warranty period, if the product fails or is damaged under the condition of normal use by following the instructions, Inovance will be responsible for free maintenance.

Within the warranty period, maintenance will be charged for the damages due to the following causes:

a) Improper use or uninstallation/repair/modification without prior permission
b) Fire, flood, abnormal voltage, other disasters, and secondary disasters
c) Hardware damage caused by dropping or transportation after procurement
d) Failure to operate the product by observing the User Manual provided by Inovance
e) Faults and damages caused by factors outside of the product (such as peripheral devices)

The maintenance fee is charged according to the latest Maintenance Price List of Inovance.

If there is any problem during the service, contact us or our agent directly.

You are assumed to agree on terms and conditions of this warranty agreement by purchase of the product. This agreement shall be interpreted by Suzhou Inovance Technology Co,.Ltd.