



**User Guide**

**IoT Integrated Display Controller**

**for Air Compressor**

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19010801

**1**

**Preface**

Thank you for purchasing the IoT Integrated Display Controller for Air Compressor independently developed and manufactured by Inovance Technology. This product integrates the HMI+PLC functions. With control functions integrated in the product, pressure and temperature signals are directly connected to the product. System parameter running conditions are displayed, monitored, and recorded on the HMI touchscreen. When any abnormality is detected, the protection mechanism is activated in real time to maintain normal system running. In addition, the Ethernet and 2G functions are added to implement IoT applications. This product features high integration, low cost, user-friendly interface and strong anti-interference performance, compared with the previous air compressor control system.

Before using this product, please read this guide carefully to fully understand characteristics of the product and use the product safely. This guide describes the product's specifications, mounting dimensions, definitions of ports, performance parameters, wiring, and typical applications.

**Acquisition**

The information in this document is subject to change without notice. Please acquire the latest document version by the following means:

- ◆ Contact your product distributor.
- ◆ Download from our official website: <http://www.inovance.cn/es/>.

**1. Safety Instructions**

**Design**

**Danger**

- ◆ Interlock circuits and other circuits for emergency stop, conventional protection, and forward/reverse rotation as well as devices for preventing equipment damage (for example, upper/lower limit positioning and reciprocating movement) must be provided on the exterior of this product.
- ◆ A fault protection circuit must be provided on the exterior of this product to prevent any unintended unsafe mechanical movement. (When an error occurs in undetectable input/output control areas of this product, unintended movement may occur in these areas.)
- ◆ Make sure to design a user program to ensure user system safety in case of any display, control, communication, and power faults of this product.
- ◆ Ensure that a communication fault between this product and its host controller will not lead to device function abnormality. This is to avoid personal injury or equipment damage.

**Caution**

- ◆ Do not create switches that may result in personal injury of the operator or equipment damage on the touchscreen. Design independent switches for important operations. Otherwise, wrong outputs or fault may result in an accident.
- ◆ Do not create switches used for control device safety operations on the touch screen, such as emergency stop switches. Set independent hardware switches for performing such operations; otherwise, it may result in severe personal injury or equipment damage.
- ◆ Do not use this product as the alarm device to report important alarms that may cause severe personal injury, equipment damage, or system stop. Use an independent hardware and/or mechanical interlock for designing the important alarm prompts and the related control/triggering devices.

**2**

**Installation**

**Danger**

- ◆ Install this product correctly. This product is for indoor use only. Ensure that the operating environment meets the requirements in "Basic Parameters: General Specifications".
- ◆ Do not install this product in any place exposed to the strong magnetic field, direct sunshine, high temperature, inflammable gases, steam, or dust. Failure to comply may result in explosion hazard.
- ◆ Do not use this product in any environment with fast temperature variation and high humidity; otherwise, condensation may occur inside the product and result in product damage.
- ◆ Ensure that all cable connectors are securely connected to this product. If the connection becomes loose, wrong input or output signals may be caused.

**Caution**

- ◆ Install this product in the storage temperature range recommended in this guide. Failure to comply may result in LCD display faults.

**Wiring**

**Danger**

- ◆ Perform installation, wiring, and other operations only after all power supplies are cut off. Do not perform wiring or plug/remove the cable connector in energized state. Failure to comply may result in electric shock or damage to the circuit.
- ◆ Connect DC power wiring to special terminals as described in this guide.
- ◆ During screw hole processing and wiring, ensure that no metal filings or cable end drops into the integrated display controller. Failure to comply may result in a fault, electronic component damage, or fire.
- ◆ Check cable connections carefully and ensure that the working pressure and positions of the terminals are correct. Failure to comply may result in a fire or accident.

**Caution**

- ◆ Cut off the power supply before connecting the power cable to the product. Failure to comply may result in electric shock.
- ◆ The input power of this product is 19 to 28 VAC/VDC. If the power input is not within this range, this product may be damaged severely. Therefore, check regularly whether the voltage provided by the switching-mode power supply is stable.

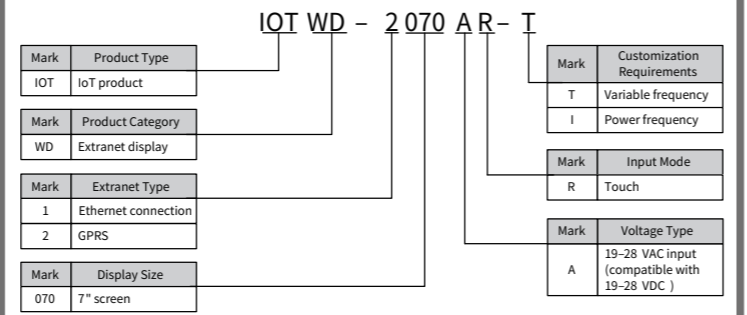
**Operation & Maintenance**

**Caution**

- ◆ Pay attention to protecting the panel of the integrated display controller during use. Touch the display panel by hand only. Users shall be held accountable for any damage to the panel due to excessive external force.
- ◆ The lithium battery, LCD screen, and capacitor may contain health harming and environment polluting compositions. Treat them as industrial wastes during product abandonment.

**2. Product Information**

**1) Model Definition**



**2) Basic Parameters**

Parameter	Specifications	Parameter	Specifications	Parameter	Specifications
<b>Hardware Specifications</b>					
Display Size	7.0"	Resolution	800 x 480	Brightness (cd/m <sup>2</sup> )	300
Display color	24-bit true color	Backlight source	LED	Backlight service life	30000 h
CPU	Cortex A8 600 Mhz	Flash	128 MB	DRAM	128 MB DDR3
Recipe storage	256 KB	SD card interface	√	USB device	√
USB client	√	Ethernet port	√	Serial port	COM2(RS485) COM3(RS485)
RTC	√	Wireless type	GPRS	Battery	√
<b>Electrical Specifications</b>					
Input voltage	19 to 28 VAC/VDC	Maximum input current	2 A	Power failure inspection threshold	17 V

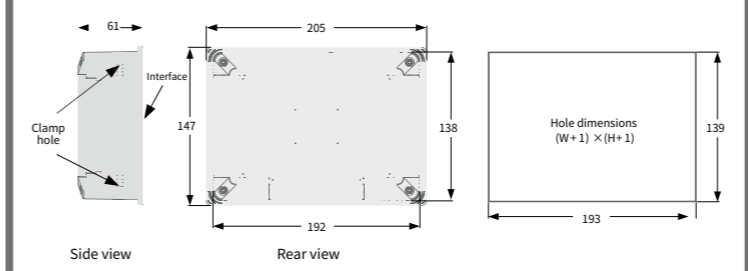
**3**

Parameter	Specifications	Parameter	Specifications	Parameter	Specifications
<b>Structure Specifications</b>					
Housing color	Metal grey	Housing material	ABS+PC engineering plastics	Hole dimensions (mm)	193 x 139 (mm)
<b>General Specifications</b>					
Operating temperature	-5°C to 55°C	Storage temperature	-20°C to 70°C	Operating humidity	10% to 95% RH (non-condensing)
Cooling mode	Natural air cooling	EMC	CE standard	Panel IP level	IP54
Installation mode	In accordance with the NEMA-4 standard				

Type	Parameter	Specifications	Parameter	Specifications
<b>Communication Specifications</b>				
GPRS	RF frequency band	Automatic search and manual setting of GSM900 and DCS1800 frequency bands; compliance with GSM Phase 2/2+.	Transmitting power	Class 4 (2 W): GSM900 Class 1 (1 W): DCS1800
	Data characteristics	GPRS data downlink transmission: 30 kbps maximum GPRS data uplink transmission: 30 kbps maximum	Receiver sensitivity	< -100 dBm
	Certification standard	CCC		
RS485	Transmission rate	Baud rate: ≤ 115200 bps		
USB (DEVICE)	USB 2.0	Compatible with USB 2.0 full-speed transmission, Micro USB		

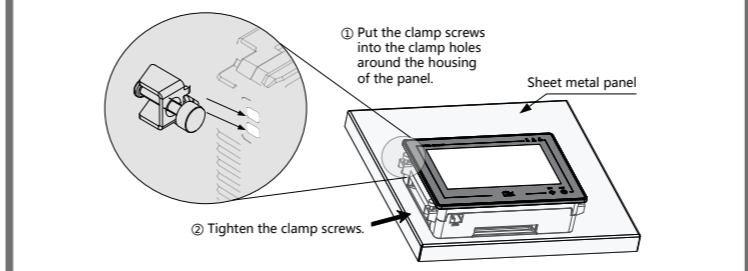
**3. Installation**

**1) Installation dimensions diagram (in mm)**



**2) Installation mode**

This product supports the NEMA-4 installation standard. The following figure shows the installation diagram:

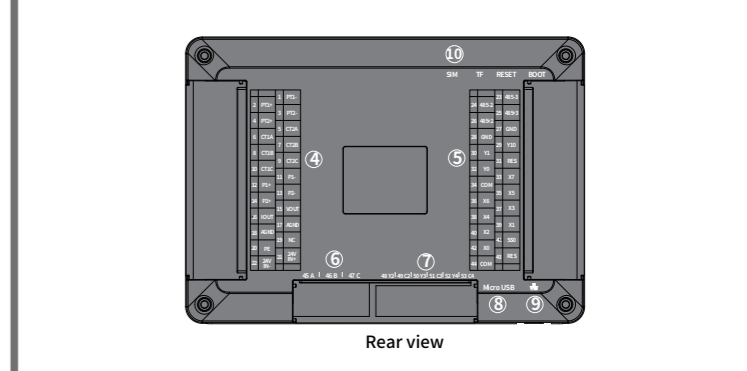
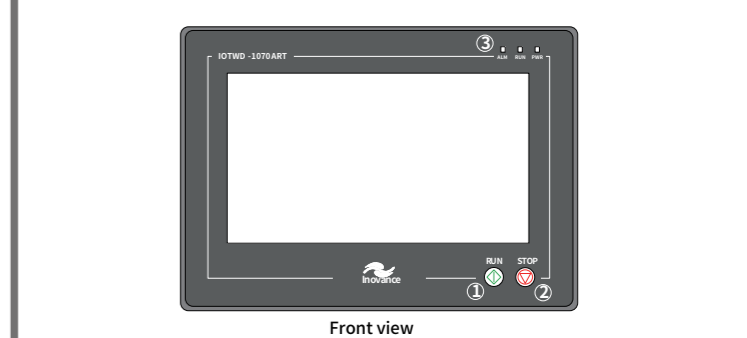


- Step 1: Put the product into the mounting hole of the panel that has been cut out.
- Step 2: Put the clamp screws into the clamp holes around the housing of the panel.
- Step 3: Tighten the clamp screws with a recommended torque of 6.0 +/- 0.5 kgf·cm.

**NOTE** To satisfy the NEMA-4 seal regulation, all delivered installation accessories (Inovance accessories, code: 20140061) must be used. Do not tighten the mounting screws with too much force to keep the bending degree of the panel lower than 0.010°.

**4**

**4. User Interface Description**



Port No.	Terminal Name	Terminal ID	Terminal Function Description
①	Start running	RUN	It starts the running of the air compressor and is controlled by an M8300 element value. When RUN is pressed, M8300 is ON, which is controlled by a user program.
②	Stop running	STOP	It stops the running of the air compressor and is controlled by an M8300 element value. When STOP is pressed, M8300 is OFF, which is controlled by a user program.
③	State indicator	POWER	The power supply of the integrated display controller is normal (red indicator).
		RUN	The air compressor runs normally (green indicator). It is controlled by an M8300 element value. When M8300 is ON, the indicator is on. When M8300 is OFF, the indicator is off.
		ALARM	Alarm indicator (red). It is controlled by an M8301 element value. When M8301 is ON, the indicator is on. When M8301 is OFF, the indicator is off. The value is controlled by a user program.
④	Temperature sensor signal input	PT1+/PT1- PT2+/PT2-	It is used to detect the air compressor temperature with a PT100 sensor. The precision is ±1°C. Temperature detection range: -50°C to 350°C
	Motor current signal input	CT1A/CT1B/ CT1C CT2A/CT2B/ CT2C	It is used to perform current and phase loss detection on two three-phase AC motor at a precision of ±5%, respectively. It is connected to secondary current signals of the current transformer and cannot be used for current detection of AC drive I/O cables. Effective value of current input: 0 mA to 100 mA, frequency input range: 45 Hz to 65 Hz
④	Pressure sensor signal input	P1+/P1- P2+/P2-	It is used to detect pressure with a standard 4 mA to 20 mA pressure sensor. The precision is ±1%.
		IOUT	Analog current output signal terminal (0 mA to 20 mA), element value: D8420, range: 0 to 2000
		AOUT	Analog voltage output signal terminal (0 V to 10 V), element value: D8419, range: 0 to 10000
④	Analog output	AGND	Analog output signal common terminal
		24VIN+/24VIN-	24 V power input range: 19–28 VAC/VDC; maximum input current 2 A, no distinguishment between positive and negative electrodes
		PE	Protective earthing
④	Power input	NC	Unconnected

Port No.	Terminal Name	Terminal ID	Terminal Function Description
⑤	RS485 communication port	485-2/485+2	COM2: Communication type configurable (Modbus master/slave/n: n protocol supported) It is recommended to connect to an air end/cooling blower AC drive.
		485-3/485+3	COM3: Communication type configurable (Modbus master/slave/n: n protocol supported) It is recommended to cascade or connect to the third party's equipment.
	Digital output	Y1/Y10	Ordinary output, output frequency ≤ 10 Hz, output current ≤ 150 mA
		Y0	High-speed output, output frequency ≤ 30 kHz, output current ≤ 150 mA
		COM	Negative output terminal
	Reserved	RES	Reserved and unconnected
PTC protection	X6/X7	PTC resistance detection, in on state for less than 800 Ω and in off state for more than 2 KΩ Both X6 and X7 can be used as ordinary digital input.	
Digital input	X0-X5	Multi-functional input terminal for isolated source input Input voltage: 15 V to 30 V; Input frequency < 10 Hz	
	COM	Digital input common terminal	
Reserved	SS0	Reserved and unconnected	
⑥	Phase sequence detection of three-phase AC power supply	A, B, C	It is used to detect the phase sequence of three-phase AC voltages A, B, and C. It is connected to the AC power supply using voltage attenuation sampling resistors or isolated transformers <sup>[1]</sup> . Voltage input range: 80 VAC to 380 VAC, frequency input range: 45 Hz to 65 Hz
		Y2-C2	Voltage range: Less than 250 VAC or 30 VDC; minimum load: 5 mA/5 VDC
⑦	Relay output	Y3-C3	Maximum load: 5 A AC per point, 5 A DC per point (resistive load); 16-28 V/2 A, AC/DC, 100 W (electronic lamp load); 16-28 V/2 A, AC/DC, 80 VA (inductive load)
		Y4-C4	
⑧	USB communication	Micro USB	Interface standards: USB 2.0 device, used to update and monitor a PLC program Communication rate ≥ 100 Mbps (1 m cable)
⑨	Ethernet communication		RJ45 port that supports 10 M/100 M adaptive Ethernet communication
⑩	SIM card slot	SIM	It is used for 2G networking GPRS. (Built-in chip SIM card is used by default. If this port is used, it must be customized.)
	SD card	TF	Interface standards: SD/SDIO 2.0, up to 16 GB supported, hot plug not supported
	Reset to factory defaults	RESET	Short press this key to reset to factory defaults upon power-on.
	Burning	BOOT	Burn an HMI core. Press and hold this key to enter the burning mode upon power-on.

**NOTE** [1] Do not directly connect any 380 V AC power supply to terminals A, B, and C at any condition without attenuation sampling resistors or isolation transformers. COM0 and COM1 on the AutoShop software interface are internal communication ports of the integrated display controller and shall not be configured.

### 5. HMI Programming Requirements

1) To program the integrated display controller HMI, you must prepare:

Hardware	Description
One computer	Install InoTouch Editor V266 or a later version developed by Inovance Technology. This software is available from the HMI supplier and <a href="http://www.inovance.cn/es/">http://www.inovance.cn/es/</a>
One network cable	A standard RJ45 network cable must be used. This cable (option) with order model C45590-GNCN-C250015 and order No. 01040017 is available from Inovance.
Integrated display controller	Model: IOTWD-1070ART or IOTWD-2070ART

2) Computer configuration requirements (Recommended configurations)

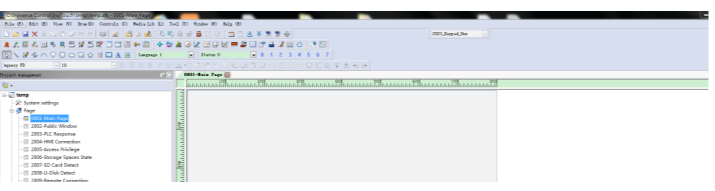
Configurations	Specifications
CPU	Intel or AMD product with a main frequency of more than 2 G
Memory	1 GB or more
Hardware	Free disk space of at least 1 GB
Display	Color display with a resolution of more than 1024 x 768
Ethernet port	Used for uploading and downloading page programs
OS	Windows XP/Windows 7

3) Description of HMI programming resources:

- The integrated display controller HMI model is IT6070E-IOTWD.
- The user program of the integrated display controller HMI must be downloaded with a network cable. By default, an IP address is obtained automatically. If your PC does not support automatic IP address obtaining, you must manually modify an IP address before downloading the program by referring to the following method.
- Press and hold the touch screen upon power-on to enter the setting interface. Functions such as IP address modification, backlight, and touch calibration can be set. The login password is 111111.

**NOTE**

- The computer IP address must be changed to an IP address in the same network segment.  
For example, the IP address of the integrated display controller is 192.168.1.100 and the gateway is 255.255.255.0. Accordingly, the computer IP address must be set to 192.168.1.XX (any value other than 100) and the gateway must be 255.255.255.0.
- Configurations of communication state judgment register (mandatory)
  - LW9875(1Word): Number of connected target devices (RS485 devices). Set this register to 1 in the user program.
  - LW9876(1Word): Connection state of target devices (RS485 devices). 0: Disconnected, 1: Connected.
 (This register is modified by a PLC user program. The PLC judges the connection state to the integrated display controller and the target device and writes this value to LW9876. According to the LW9876 value, the server will judge whether the connection is successful.)



Programming interface of HMI user program

### 6. PLC Software Specifications and Programming Requirements

#### Software Specifications

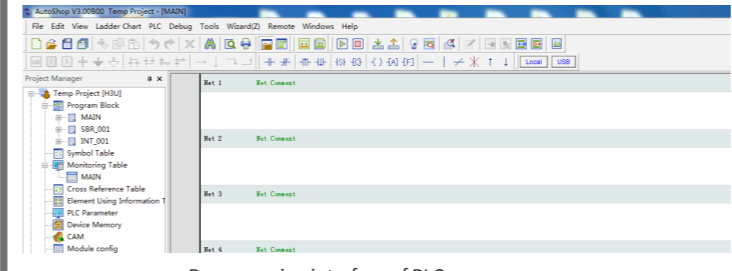
For soft element configurations of the controller, refer to the Inovance Mini-PLC Commands and Programming Manual. Detection ports on temperature, pressure, motor current, and three-phase phase sequence are added in the PLC of the integrated display controller, compared with the general-purpose H<sub>2</sub>U-XP PLC. Data collection at these ports is automatically finished by the PLC system software. The user program needs only to read and monitor special software after D8000 and M8000. The following table describes these variable definitions:

Variable Address	Variable Definition	Variable Address	Variable Definition
Pressure Input			
D8400	P1 transmitter range (MPa)	D8401	P2 transmitter range (MPa)
M8402	P1 cable breaking flag; 1 = Cable breaking	M8403	P2 cable breaking flag; 1 = Cable breaking
D8402	P1 pressure sampling value (0 to 10000)	D8403	P2 pressure sampling value (0 to 10000)
D8404	Conversion of P1 pressure physical quantity	D8405	Conversion of P2 pressure physical quantity
Temperature Input			
M8406	PT1 cable breaking flag	D8406	PT1 temperature result
M8407	PT2 cable breaking flag	D8407	PT2 temperature result
Three-phase Motor Current Input			
D8408	CT1 IA current value	D8412	CT2 IA current value
D8409	CT1 IB current value	D8413	CT2 IB current value
D8410	CT1 IC current value	D8414	CT2 IC current value
M8411	CT1 current phase loss flag	M8415	CT2 current phase loss flag
D8411	CT1 transformer ratio setting	D8415	CT2 transformer ratio setting
Detection Input of Three-phase Power Supply Voltages A, B, and C			
D8416	Sampling value of negative sequence component	D8417	Negative sequence judgment threshold of power supply
M8418	Three-phase phase sequence reversal flag		

Variable Address	Variable Definition	Variable Address	Variable Definition
Analog Voltage Output			
D8419	The DA output value (0 to 10000) corresponds to 0 V to 10 V.	D8420	The current output value (0 to 2000) corresponds to 0 mA to 20 mA.
Indicators and Keys			
M8300	Key detection control. M8300 = ON when RUN is pressed	M8301	Key detection control. M8301 = ON when STOP is pressed
M8302	"ALM" indicator control. In the case of M8302 = ON, the alarm indicator is on. In the case of M8302 = OFF, the alarm indicator is off. The value is controlled by a user program.	M8303	"RUN" indicator control. In the case of M8303 = ON, the "RUN" indicator is on. In the case of M8303 = OFF, the "RUN" indicator is off. The value is controlled by a user program.

#### Programming Requirements

- One PC with Windows OS;
- Inovance AutoShop software environment for control program design and downloading;
- One micro USB cable.

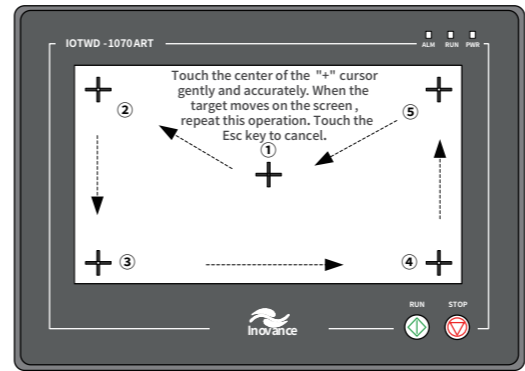


Programming interface of PLC user program

### 7. Touch Calibration

Calibrate the HMI using a touch calibration procedure in the case that insensitive or abnormal touch occurs in the use of the integrated display controller.

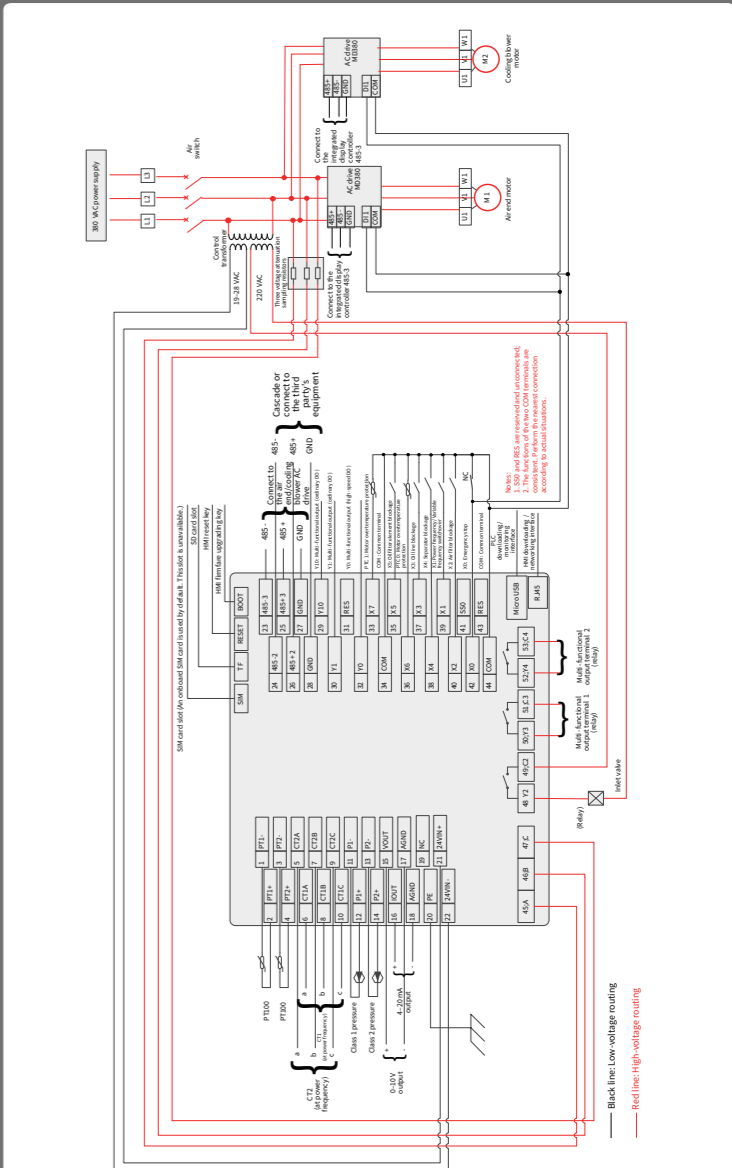
- Entering the touch calibration procedure
  - Entry using the system setting menu: Press and hold the screen gently in the process of power-on and startup of the integrated display controller, and the HMI enters the password input box interface for system setting. A 20 seconds countdown is performed for the password input box interface. If you do not touch the password input box within 20 seconds, the system automatically enters the calibration procedure. Alternatively, directly enter a system setting password, and touch "Touch Calibration" in the displayed system setting menu.
- Specific touch calibration operations:
  - In calibration mode, one "+" cursor appears in the middle of the screen (as shown in the right figure).
  - Touch the middle of "+" with a touch pen or finger. After the touch is successful, "+" moves in the arrow direction as shown in the figure. (Touch the center of the "+" cursor gently and accurately. When the target moves on the screen, repeat this operation.)
  - After the touch calibration of the preceding five points is complete, the "+" cursor disappears. Touch any blank of the screen to exit. If the calibration fails, the cursor returns to the center of the screen. Repeat the calibration of the preceding five points.



Calibration operation process

### 8. System Wiring of Typical Applications

The following figure shows the wiring of the integrated display controller applied to the air end/cooling blower AC drive:



### 9. Options

For information about options, refer to the following table:

Name	Model	Function	Order Code
Current transformer CT1	CT-038	Rated primary current 80 A to 400 A, applied power 55 kW to 160 kW, current transformer ratio 4000:1	13050003
	CT-032	Rated primary current 40 A to 200 A, applied power 11 kW to 55 kW, current transformer ratio 2000:1	13050002
Current transformer CT2	CT-033	Rated primary current 20 A to 80 A, applied power 0.7 kW to 5.5 kW, current transformer ratio 1000:1	13050001
RJ45 network cable	C45590-GNCN-C250015	1500 mm long network cable	01040017

### 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:
  - Improper use or uninstallation/repair/modification without prior permission
  - Fire, flood, abnormal voltage, other disasters, and secondary disasters
  - Hardware damage caused by dropping or transportation after procurement
  - Failure to operate the product by observing the User Manual provided by Inovance
  - 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.