

# Controller

## E104



## User Manual

**Version: Av2**

Document Number: 0000346188

### Catalogs

**Security**

1

**Products**

2

**Port Description**

3

**Installation**

4

**FAQs**

5

# User Manual

## Compact Controller

### Catalogs

<b>1. Security instructions .....</b>	<b>4</b>
1.1. Copyright .....	4
1.2. Statement .....	4
1.3. Signs and meanings used in the manual .....	4
<b>2. Products .....</b>	<b>5</b>
2.1. Products .....	5
2.2. Port Overview .....	5
2.3. Technical Parameters .....	5
2.4. Order number .....	6
<b>3. Port Description .....</b>	<b>7</b>
3.1. Connectors .....	7
3.2. The list of plug-ins .....	7
3.3. Pin Definition .....	8
3.4. Port Detailed Parameters .....	10
3.4.1. Power supply .....	10
3.4.2. Ground .....	10
3.4.3. DI .....	10
3.4.4. PI .....	10
3.4.5. AI .....	12
3.4.6. AO .....	12
3.4.7. DO .....	12
3.4.8. PWM .....	13
3.5. Communications port .....	13
3.5.1. CAN1 .....	13
3.5.2. CAN2 .....	14
<b>4. Installation Instructions .....</b>	<b>15</b>
4.1. Pre-installation inspection .....	15
4.2. Outline and Installation Dimension Drawing .....	15
4.3. Installation .....	16
<b>5. Common Troubleshooting .....</b>	<b>16</b>

**Version**

Version	Date	Release	Author	Changes
Av1	2023/11/14	N	Xie Shenghao	First Edition
Av2	2023/11/15	Y	Xie Shenghao	Modify port description

## **1. Security instructions**

### **1.1. Copyright**






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### **1.2. Statement**

This manual has been verified and reviewed for accuracy. The instructions and descriptions contained in this manual are accurate for the E104 controller at the time of publication. However, future E104 controllers and their manuals are subject to change without notice. Xuzhou Mook Electro-Hydraulic Control Co.,Ltd. shall not be liable for damages arising directly or indirectly from errors, omissions, or discrepancies between the product and the manual.

### **1.3. Signs and meanings used in the manual**

<b>Logo</b>	<b>Meaning</b>	<b>Details</b>
	Danger	Predictable leading to unavoidable serious injury, death or property damage
	WARNING	Likely to result in unavoidable serious injury, death or property damage
	Caution	May result in minor injuries and damages
	Hints	Non-safety related use instructions and information
	Note	Additional instructions or recommendations for use

## 2. Products

### 2.1. Products

The E104 controller is a powerful controller suitable for most complex working conditions and specially designed and developed for the construction machinery industry.

This series of controllers is made of cast aluminum housing, robust and reliable, with excellent thermal conductivity and protection class IP66/67, which is suitable for the complex environment of the construction machinery industry.

### 2.2. Port Overview

Input Port	Number of Ports	Port Description
DIH/DIL	4	Defaults to a high valid switching input; Can be multiplexed to low valid switching inputs
DIH	4	Highly effective switching inputs
PI/DIH	4	Defaults to frequency input; Can be multiplexed as a highly effective switching input
RI/DIL	2	Default is 0~30K $\Omega$ resistive analog input; Can be multiplexed as a low effective switching input;
VI/CI/DIH	4	Default is 0~5V voltage type analog input; Multiplexable to 4~20mA current type analog input; Can be multiplexed to high effective switch input;
Output Ports	Number of Ports	Port Description
PWM(CC)/DOH	2	PWM output with current feedback; Can be multiplexed to 2A high-side output;
PWM/DOH	6	PWM output without current feedback; Can be multiplexed to 2A high-side output;
DOH	8	2A high side output;
AO	1	0~5V voltage output
+5VOUT	1	5V reference power output

### 2.3. Technical Parameters

Technical Parameters	
Operating Voltage	8~36V DC
Operating Temperature	-40℃~+85℃
Storage Temperature	-40℃~+85℃
Current Consumption	No load, <200mA@24V
Maximum Load Current	15A
Processor Unit	32Bit 180MHz
Parameter space	32KB FRAM
Protection class	IP66/67
Communication interface	CAN2.0B

Test Standards	
Low Temperature Test	<b>Execution standard: GB/T2423.01/IEC60068-2-1</b> -40℃ low temperature start test, 10 times, start normal -40℃ low temperature working test 16h -40℃ low temperature storage test 72h
High Temperature Test	<b>Execution standard: GB/T2423.02/IEC60068-2-2</b> +85℃ high temperature full load working test 16h +85℃ high temperature storage test 72h
Temperature shock test	<b>Execution standard: GB/T2423.22/IEC60068-2-14</b> Low temperature -40℃, high temperature 85℃, high and low temperature conversion time 3min, cycle times 10 times
Temperature and humidity cycle test	<b>Execution standard: GB/T2423.34/IEC60068-2-38</b> High temperature $65 \pm 2^{\circ}\text{C}$ , $93 \pm 3\%$ ; room temperature $25 \pm 2^{\circ}\text{C}$ , $93 \pm 3\%$ ; low temperature $-10^{\circ}\text{C}$ , 24h for a cycle, for ten cycles
Vibration test	<b>Execution standard: GB/T2423.10/IEC60068-2-6 sinusoidal vibration</b> Vibration (sinusoidal) 30Hz, 4g, 4h vertically, 2h horizontally left and right, front and back, total 8h <b>Executive standard: GB/T2423.56/IEC60068-2-64 Random vibration</b> 10Hz~20Hz Amplitude 3mm 20Hz~2000Hz, peak acceleration 50m/s <sup>2</sup> . Sweep frequency 1oct/min, according to the up and down direction, front and back direction, left and right direction of the number of times in order to sweep the frequency 2 times, for 24h
Shock test	<b>Execution standard: GB/T2423.5/IEC60068-2-27</b> 100g/11ms, half sine wave, 100 times in each of the three axial directions
Drop test	<b>Execution standard: GB/T2423.8/IEC60068-2-32</b> Transportation status (with bubble bag packaging), drop height 1000mm, 2 times
Salt spray test	<b>Execution standard: GB/T2423.17/IEC60068-2-11</b> Under 35℃, 5% sodium chloride salt spray environment, 96h test in uncharged state, no rust and corrosion of shell, connector and other parts after the test, and work normally after connecting to the test voltage.
EMC	<b>EN 61000-6-2:2005; EN 61000-6-4: 2011;</b> ISO 7637 immunity; ISO 11452 immunity; ISO 16750 immunity

#### 2.4. Order number

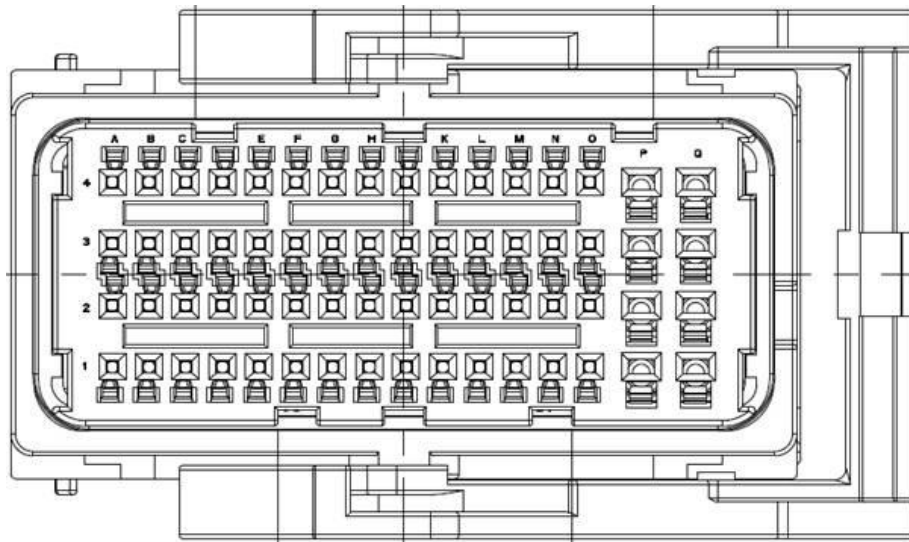
Serial No.	Material No.	Material Description
1	236260	Controller, E104

### 3. Port Description

#### 3.1. Connectors

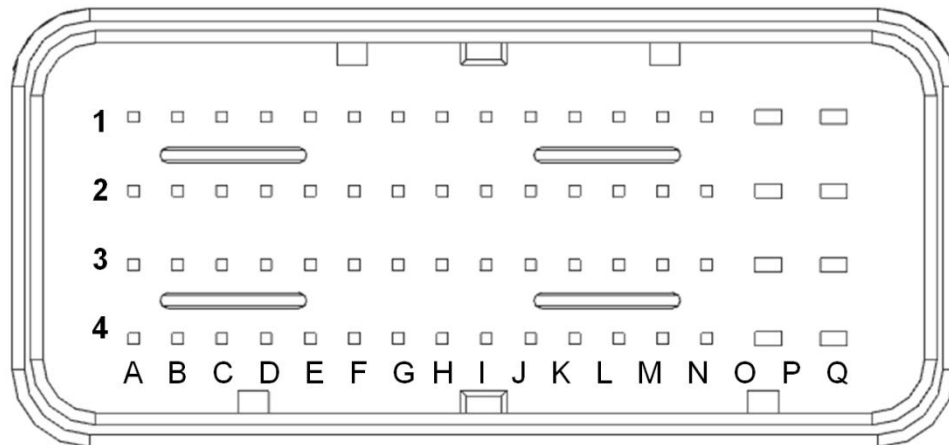
The connector for the E104 controller is a TE 2050036-1 sixty-four pole pin socket.

#### 3.2. The list of plug-ins



No.	Description	Model	Order No.	Manufacturer
1	64 pole hole plug	2050036-1	508982	TE
2	Large Terminal	638652-1	508983	TE
3	Small Terminal	968221-1	508984	TE
4	Large Blind	1670108-1	508985	TE
5	Small blind plug	1394871-1	508981	TE

### 3.3. Pin Definition



Pin	Port Definition	Function Description
A1	N.A.	
B1	PWM1	High side output 2A, or PWM (50~1000HZ) output 2A
C1	PWM2	High side output 2A, or PWM (50~1000HZ) output 2A
D1	N.A.	
E1	PWM3	High side output 2A, or PWM (50~1000HZ) output 2A
F1	PWM4	High side output 2A, or PWM (50~1000HZ) output 2A
G1	PWM5	High side output 2A, or PWM (50~1000HZ) output 2A
H1	PWM6	High side output 2A, or PWM (50~1000HZ) output 2A
J1	PWM7	High side output 2A, or PWM (50~1000HZ) output 2A, or DOCC output, 2A
K1	PWM8	High side output 2A, or PWM (50~1000HZ) output 2A, or DOCC output, 2A
L1	N.A.	
M1	N.A.	
N1	N.A.	
O1	N.A.	
P1	UBP	Power Supplies
Q1	UBP	Power Supply
A2	DOUT1	High Side Output 2A
B2	DOUT2	High Side Output 2A
C2	DOUT3	High Side Output 2A
D2	DOUT4	High Side Output 2A
E2	DI1	Switching Input, High Active
F2	DI2	Switching Input, High Valid
G2	DI3	Switching Input, High Valid
H2	DI4	Switching Input, High Valid
J2	DI5	Switching input, high/low active software programmable
K2	DI6	Switching input, high/low valid software programmable
L2	+5VOUT	+5V power output, 100mA
M2	AGND	Analog ground
N2	DOUT5	High side output 2A
O2	DOUT6	High side output 2A
P2	UBP	Power supply



(Continued from previous page)

Pin	Port Definition	Function Description
Q2	BSL	Debug/Burn serial port mode selection
A3	DOUT7	High Side Output 2A
B3	DOUT8	High Side Output 2A
C3	AO1	Analog output, 0~5V, 30mA
D3	N.A.	
E3	AI1	Analog input, 0~5V or 4~20mA (software switching) / Highly effective switching inputs
F3	AI2	Analog input, 0~5V or 4~20mA (software switching) / Highly effective switching inputs
G3	AI3	Analog input, 0~5V or 4~20mA (software switching) / Highly effective switching inputs
H3	AI4	Analog input, 0~5V or 4~20mA (software switching) / Highly effective switching inputs
J3	CAN1_H	CAN1_H
K3	CAN1_L	CAN1_L
L3	CAN2_H	CAN2_H
M3	CAN2_L	CAN2_L
N3	DI7	Switching input, high/low valid software programmable
O3	DI8	Switching input, high/low valid software programmable
P3	N.A.	
Q3	N.A.	
A4	TXDOUT	Debugging/Programming Serial Transmit
B4	RXDIN	Debug/Burn Serial Receive
C4	N.A.	
D4	N.A.	
E4	N.A.	
F4	N.A.	
G4	AI9	0~30K $\Omega$ Resistor Type Analog Input/Low Effective Switching Input
H4	AI10	0~30K $\Omega$ resistance type analog input / low effective switching input
J4	PI1	Frequency input, 10HZ~15KHZ / High effective switching input
K4	PI2	Frequency input, 10HZ~15KHZ / High effective switching input
L4	N.A.	
M4	N.A.	
N4	PGND	Power Ground
O4	PGND	Power Ground
P4	PGND	Power Ground
Q4	UBS	System Power

➤ **Cautions:**

- (1) Shorted or low resistance connection between case screw and vehicle ground.
- (2) The system power supply UBS powers the internal electronics and the power supply UBP powers the PWM outputs and switching outputs.
- (3) The CAN bus requires 120  $\Omega$  termination resistors.
- (4) The fuse size of the power output power supply matches the maximum current consumption of the PWM outputs and switching outputs and does not exceed 15A.

### 3.4. Port Detailed Parameters

#### 3.4.1. Power supply

(1) Functional description: System power supply UBS, power supply for internal electronic components; power supply UBP, power supply for PWM output and switching output.

(2) Pin number: UBS pin is Q4; UBP pins include P1, Q1, and P2.

The above power supply pins all use 1.5mm<sup>2</sup> wire diameter, single pin maximum support 10A current.

#### 3.4.2. Ground

(1) Function Description: M2 is the analog ground, the rest of the ground signals are power ground GND.

(2) Pin No.: M2, N4, O4, P4

Among the above ground pins, N4, O4, P4 use 1.5mm<sup>2</sup> wire diameter, single pin maximum support 10A current; M2 use 0.75mm<sup>2</sup> wire diameter, single pin maximum support 5A current.

#### 3.4.3. DI

➤ DIH/DIL:

Switching Input Port number: J2, K2, N3, O3	High valid switching input, can be software configured as low valid switching input Threshold voltage: >4V is judged as high level, <1V is judged as low level. Pull-down resistor for high valid switching input: 6K $\Omega$ . Pull-up resistor for low valid switching input: 25K $\Omega$ , pull-up to UBS.
--	--


➤ DIH:

Switching Input Port number: E2, F2, G2, H2	High valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Input impedance: pull-down resistor 6K $\Omega$
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#### 3.4.4. PI

➤ PI/DIH:

Frequency Input Port number: J4, K4	Frequency Input Input range: 1~15K Hz Threshold Voltage: Configurable Input impedance: Pull-down resistor 100K $\Omega$
	High valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Input impedance: pull-down resistor 100K $\Omega$

	<p><b>Caution.</b></p> <p>PI1 and PI2 are a group, and each group shares a common threshold voltage. When mixing PIs and DIs in the same group, the PI's threshold is not configurable and is fixed at 2.5V.</p>
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### 3.4.5. AI

➤ VI/CI/DIH:

Analog Input / Switch Input Port number: E3, F3, G3, H3	Voltage type analog input Input range: 0.5~4.5V Input impedance: 100.2 K $\Omega$ Resolution: 12 bits Accuracy: 2%FS
	Current type analog input Input range: 4~20mA Input impedance: 200 $\Omega$ Resolution: 12 bits Accuracy: 2%FS Port protection: When the current value exceeds 22,5 mA for more than 500 ms, it will be automatically switched to voltage type port.
	High valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Input impedance: 100.2 K $\Omega$

➤ RI/DIL:

Analog Input / Switch Input Port number: G4, H4	Resistive analog input Input range: 10 $\Omega$ ~30K $\Omega$ Resolution: 12 bits Accuracy: 10~2K $\Omega$ : 1%FS; 2K~3K $\Omega$ : 2%FS; 3K~15K $\Omega$ : 5%FS; 15K~30K $\Omega$ : 10%FS Pull-up resistor: 2K $\Omega$ , pull-up to 3.3V
	Low valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Pull-up resistor: 2K $\Omega$ , pull-up to 3.3V

### 3.4.6. AO

Analog Output Port number: C3	Analog Output Input range: 0.1V~5V output signal or 4mA~20mA output signal
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### 3.4.7. DO

Switching output Port number: A2, B2, C2, D2, N2, O2, A3, B3	High-side switching output Built-in continuous current diode Driving current: 2A Port diagnostics: short to ground
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### 3.4.8. PWM

#### ➤ PWM(CC)/DOH:

Switching Output/PWM Output Port No.: J1, K1	PWM high side output Built-in continuous current diode with current feedback Output frequency: 50~1000Hz Driving current: 2A Duty cycle: 0....100% adjustable Port diagnostics: short circuit to ground; load overrun (4.5A, 10s); disconnection in ON state.
	High-side switching output Built-in continuous current diode Driving current: 2A Port diagnostics: short to ground

#### ➤ PWM/DOH:

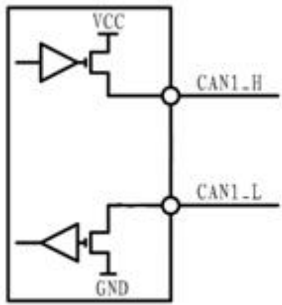
Switching Output/PWM Output Port number: B1, C1, E1, F1, G1, H1	PWM high side output Built-in continuous current diode, without current feedback Output frequency: 50~1000Hz Driving current: 2A Duty cycle: 0....100% adjustable Port diagnostics: short circuit to ground
	High-side switching output Built-in continuous current diode Driving current: 2A Port diagnostics: short to ground

## 3.5. Communications port

### 3.5.1. CAN1

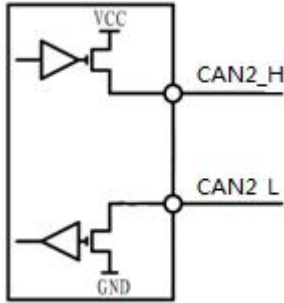
(1) Pin number: J3, K3

(2) Port Parameters:

CAN1	
Schematic	
Communication Type	CAN2.0B
Port Protection	CAN1_H and CAN1_L have short-circuit protection for UB and GND respectively.
Termination Resistor	No built-in termination resistor


3.5.2. CAN2

- (1) Pin number: L3, M3
- (2) Port Parameters:

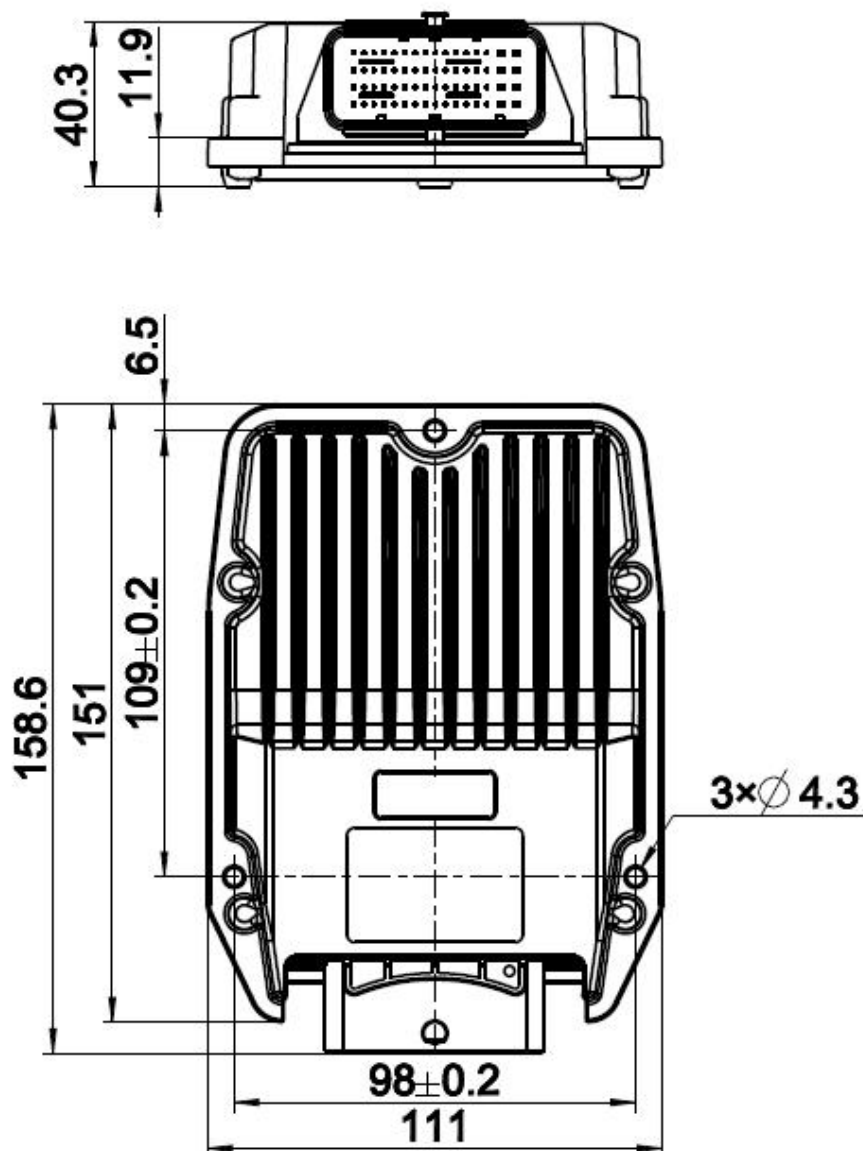
CAN2	
Schematic	
Communication Type	CAN2.0B
Port Protection	CAN2_H and CAN2_L have short-circuit protection for UB and GND respectively.
Termination Resistor	No built-in termination resistor

## 4. Installation Instructions

### 4.1. Pre-installation inspection


	<p><b>Tip.</b> Before installation, please check whether the power supply and wiring are complete and correspond to each other, and whether the product is in good condition and free of bumps.</p>
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### 4.2. Outline and Installation Dimension Drawing



### 4.3. Installation

E104 controller choose 3 × M4 screws for fixed installation, please ensure that the mounting surface is flat and free of foreign objects during installation. The mounting position should leave at least 100mm of installation space in the direction of the connector, so that it is easy to unplug the connector. If the mounting surface cannot be leveled at the site during installation, please use pads to assist the installation.

	<b>Caution.</b>
	Please use appropriate screws for installation to prevent the product from being damaged during placement and fastening.

### 5. Common Troubleshooting

No.	Frequently Asked Questions	Solution
1	No output from port after power on	First check whether the power supply is normal or not, if the power supply is normal, please contact our service personnel to solve the problem.
2	No signal acquisition from port after power on	First check whether the signal voltage is normal or not, if it is normal, please contact our service personnel to communicate and solve the problem.
3	CAN communication failure after power on	First check whether the external CAN cable is correctly connected, if the connection is normal, please contact our service personnel to solve the problem.