

Controller

F104



User Manual

Version: Av2

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Version

Version	Date	Release	Author	Changes
Av1	2023/7/3	N	Chenmo	First Edition
Av2	2023/8/15	Y	Chenmo	Modify Pin Definition

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 F104 controller at the time of publication. However, future F104 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

Logo	Meaning	Details
	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

F104 controller is a powerful controller product applicable to most complex working conditions and specially designed and developed for the construction machinery industry. The product integrates a high-speed computing chip with port diagnostic function, which can make quick and accurate judgment on various fault types, facilitate the checking of port faults, improve the maintenance efficiency and reduce the maintenance cost.

2.2. Port Overview

Input Port	Number of Ports	Port Description
DIH/DIL	11	Defaults to a high valid switching input; Can be multiplexed to low valid switching inputs
CI/VI/DIH	16	Default is 4~20mA current type analog input; Can be multiplexed to 0~5V voltage type analog inputs Can be multiplexed as highly effective switch input
VI/DIH	1	Default is 0~36V voltage type analog input; Can be multiplexed as a highly effective switching input
RI/DIL	4	Default 0 Ω ~30K Ω resistive analog signal input; Can be multiplexed to low effective switching input
PI/DIH	4	Defaults to 1Hz~30KHz PI inputs Can be multiplexed as a highly effective switching input
Output Ports	Number of Ports	Port Description
AO	1	0~5V analog output
PWM/DOH	12	100~1000Hz PWM output, 2A, with current feedback, 12bit, can be multiplexed to 2A high side output
DOL	4	4A low side output
DOH	2	2A high side output

2.3. Technical Parameters

Technical Parameters	
Operating Voltage	8~36V DC, Rated 24V
Operating Temperature	-40℃~+85℃
Storage Temperature	-40℃~+85℃
Quiescent Current	<290mA@24V
Processor Unit	32Bit 300MHz
SRAM Capacity	2MB
Application Space	6MB FLASH
Parameter Space	32KB FRAM
Status Indicator	2
Protection class	IP66/67
Test Standards	
Low temperature test	Execution standard: GB/T2423.01/IEC60068-2-1 -40℃ low temperature start test, 10 times, start normal -40℃ low temperature working test 16h

	-40℃ low temperature storage test 72h
High temperature test	Execution standard: GB/T2423.02/IEC60068-2-2 +85℃ high temperature full load working test 16h +85℃ high temperature storage test 72h
Temperature shock test	Execution standard: GB/T2423.22/IEC60068-2-14 Low temperature -40℃, high temperature 85℃, high and low temperature conversion time 3min, cycle times 10 times
Temperature and humidity cycle test	Execution standard: GB/T2423.34/IEC60068-2-38 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°C , 24h for a cycle, for ten cycles
Vibration test	Execution standard: GB/T2423.10/IEC60068-2-6 sinusoidal vibration Vibration (sinusoidal) 30Hz, 4g, 4h vertically, 2h horizontally left and right, front and back, total 8h Executive standard: GB/T2423.56/IEC60068-2-64 Random vibration 10Hz~20Hz Amplitude 3mm 20Hz~2000Hz, peak acceleration 50m/s ² . 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	Execution standard: GB/T2423.5/IEC60068-2-27 100g/11ms, half sine wave, 100 times in each of the three axial directions
Drop test	Execution standard: GB/T2423.8/IEC60068-2-32 Transportation status (with bubble bag packaging), drop height 1000mm, 2 times
Salt spray test	Execution standard: GB/T2423.17/IEC60068-2-11 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	EN 61000-6-2:2005; EN 61000-6-4: 2011; ISO 7637 immunity; ISO 11452 immunity; ISO 16750 immunity

	Warning.
	During electrical soldering and painting operations, all plugs must be removed from the electronic components!

2.4. Order number

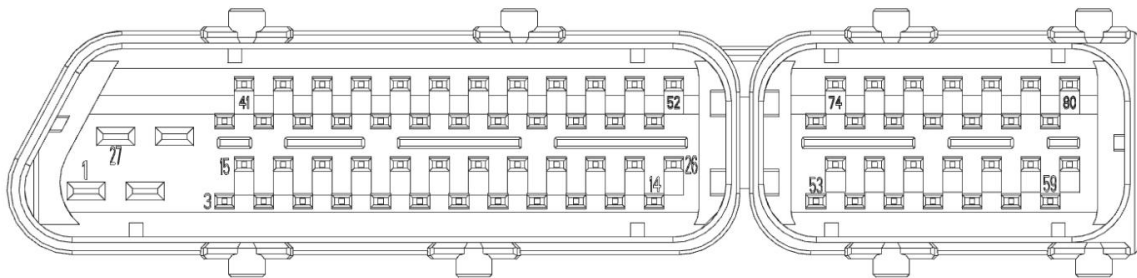
No.	Order No.	Product Name	Model No.
1	236336	controller	F104

3. Port Description

3.1. Electrical interface

- The F104 controller utilizes an 80 pole pin socket (TE 1743275-3).

3.2. Pin Definition



Pin	Port Definition	Function Description
1	UBP	Power Supply
2	UBP	Power Supply
3	AI1	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
4	AI2	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
5	AI3	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
6	AI4	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
7	DI1	Switching input, DIH/L, software programmable
8	DI2	Switching input, DIH/L, software programmable
9	DI3	Switching input, DIH/L, software programmable
10	DI4	Switching input, DIH/L, software programmable
11	DI5	Switching input, DIH/L, software programmable
12	DI6	Switching input, DIH/L, software programmable
13	DI7	Switching input, DIH/L, software programmable
14	DI8	Switching input, DIH/L, software programmable
15	DI9	Switching input, DIH/L, software programmable
16	DI10	Switching input, DIH/L, software programmable
17	DI11	Switching input, DIH/L, software programmable
18	AI5	Voltage analog input, 0~36V, 12bit, can be multiplexed to DIH
19	PI1	Pulse input, 1HZ~30KHZ, multiplexable to DIH
20	PI2	Pulse input, 1HZ~30KHZ, multiplexable to DIH
21	PI3	Pulse Input, 1HZ~30KHZ, Multiplexable to DIH
22	PI4	Pulse Input, 1HZ~30KHZ, Multiplexable to DIH
23	AI6	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
24	AI7	4~20mA current type analog input, 12bit, can be multiplexed to 0~5V VI or DIH
25	+5VOUT	5V Reference Power Output, 250mA
26	+10VOUT	10V reference power output, 250mA
27	PGND	Power Ground
28	PGND	Power Ground
29	PGND	Power Ground
30	PGND	Power Ground
31	DOUT1	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
32	DOUT2	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
33	DOUT3	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A

		DOH
34	DOUT4	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
35	DOUT5	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
36	DOUT6	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
37	DOUT7	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
38	DOUT8	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
39	DOUT9	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
40	DOUT10	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
41	KL15	Key Activated Switch
42	UBS	System Power Supply
43	DOUT11	Low Side Output 4A
44	DOUT12	Low Side Output 4A
45	DOUT13	Low Side Output 4A
46	DOUT14	Low Side Output 4A
47	AI8	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
48	AI9	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
49	AI10	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
50	AI11	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
51	AI12	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
52	AI13	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
53	CAN1_H	CAN1, High Signal
54	AGND	Analog Ground
55	CAN2_H	CAN2, High Signal
56	AI14	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
57	AI15	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
58	AI16	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
59	AI17	4~20mA current type analog input, 12bit, multiplexable to 0~5V VI or DIH
60	CAN1_L	CAN1, Low Signal
61	CAN2_L	CAN2, Low Signal
62	TXD	RS232 Serial Transmit
63	RXD	RS232 serial port receive
64	BSL	Mode Selector Switch
65	PGND	Power Ground
66	-	-
67	CAN3_L	CAN3_L
68	CAN3_H	CAN3_H
69	CAN4_L	CAN4_L
70	CAN4_H	CAN4_H
71	DOUT15	PWM (100~1000HZ) output 2A with current feedback, 12bit, multiplexable to 2A DOH
72	AO1	Analog output, 0-5V
73	DOUT16	PWM (100~1000HZ) output 2A, with current feedback, 12bit, multiplexable to 2A DOH
74	AI18	10~30K Ω resistive analog input, 12bit, multiplexable to DIL
75	AI19	10~30K Ω resistive analog input, 12bit, multiplexable to DIL
76	AI20	10~30K Ω resistive analog input, 12bit, multiplexable to DIL
77	AI21	10~30K Ω resistive analog input, 12bit, multiplexable to DIL
78	-	-
79	DOUT17	High Side Output 2A
80	DOUT18	High Side Output 2A

3.3. The list of plug-ins

Serial No.	Management No.	Description	Quantity
1	508264	Plug Boot, 28p, 1393436-2	1
2	508263	Plug Cover, 28p, 1393454-2	1
3	500470	Receptacle, 964274-2-Tab Type	76
4	504116	Large Flashing Ring, Seal for JPT, 963292-1	4
5	504115	Large Terminal, JPT, 964273-2	4
6	508261	Plug Cover, 52p, 1393454-7	1
7	508262	Plug Sheath, 52p, 1393450-3	1

3.4. Port Detailed Parameters

3.4.1. DIH/DIL

Switching Input Port number: 7~17	High and low valid switch input Threshold voltage: >4 V to be judged as high level, <1 V to be judged as low level Input impedance of high valid switching input: 6.8K Ω . Pull-up resistance of low valid switching input: 25 K Ω , pull-up to UBS
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3.4.2. CI/VI/DIH

Analog/Switch Input Port number: 3~6, 23, 24, 47~52, 56~59	Current type analog input Input range: 4~20mA Input impedance: 200 Ω Resolution: 12 bits Accuracy: 2%FS
	Voltage type analog input Input range: 0~5V Input impedance: 100.2 K Ω Resolution: 12 bits Accuracy: 2%FS
	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 Ω

3.4.3. VI/DIH

Analog/Switch Inputs Port number: 18	Voltage type analog input Input range: 0~36V Input impedance: 53.8 K Ω Resolution: 12 bits Accuracy: 2%FS
	High valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Input impedance: 53.8 K Ω

3.4.4. RI/DIL

Analog/Switch Input Port number: 74~77	Resistive analog input Input range: 10 Ω ~30K Ω Resolution: 12 bits Accuracy: 10~2K Ω : 1%FS; 2K~3K Ω : 2%FS; 3K~15K Ω : 5%FS; 15K~30K Ω : 10%FS Pull-up resistor: 2K Ω , pull-up to 5V
	Low valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Pull-up resistor: 2K Ω , pull-up to 5V

3.4.5. PI/DIH

Frequency Input/Switching Output Port number: 19~22	Frequency Input Input range: 1~30K Hz Threshold Voltage: Configurable Input impedance: 6.3K Ω
	High valid switching input Threshold voltage: >4 V to judge as high level, <1 V to judge as low level Input impedance: 6.3 K Ω

3.4.6. AO

Analog Input Port number: 72	Analog Input Output range: 0~5V
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3.4.7. PWM/DOH

PWM Output/Switching Output Port No.: 31~40, 71, 73	PWM high side output Built-in continuous current diode with current feedback Output frequency: 100~1000Hz Driving current: 2A Duty cycle: 0.... 100% adjustable
	High-side switching output Built-in continuous current diode Driving current: 2A

3.4.8. DOL

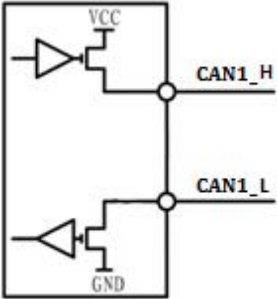
Switching Output Port number: 43~46	Low Side Output Built-in Continuity Diode Driving current: 4A
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3.4.9. DOH

Switching Output Port number: 79~80	High Side Output Built-in Continuity Diode Driving current: 2A
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3.5. Communications port

3.5.1. CAN

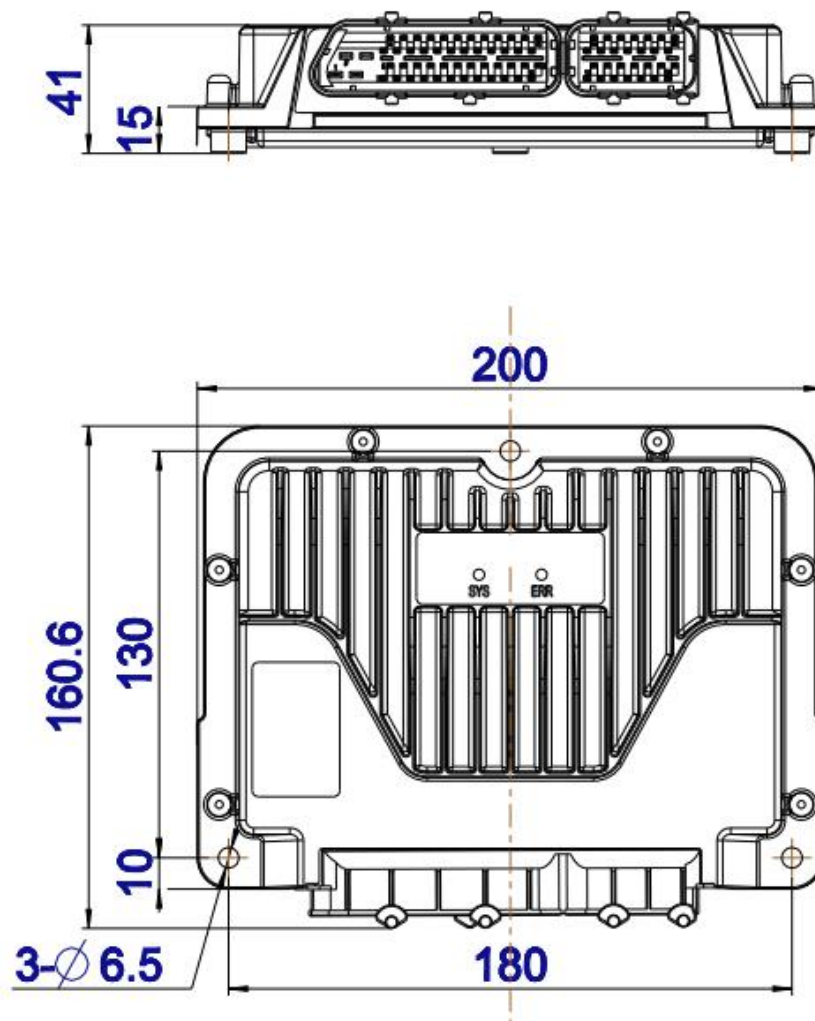
CAN	参数
schematic	
Port Protection	CAN_H and CAN_L have short circuit protection for UB and GND respectively.
Termination Resistor	No built-in termination resistor

4. Installation Instructions

4.1. Pre-installation inspection

	Tip. 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.
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4.2. Outline and Installation Dimension Drawing



4.3. Mounting accessories

Three M6 bolts/screws are used for mounting the F104 controller. For easy plugging and unplugging, it is recommended to leave at least 60mm of mounting space at the controller interface.

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 communicate and 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 connected correctly, if the connection is normal, please contact our service personnel to communicate and solve the problem.
4	CodeSys online failure	(1) Please make sure whether the CAN device or serial port driver has been installed; (2) Please make sure whether the CAN device or serial port is occupied, if it is occupied, please close the application software and restart Gateway; (3) Please replace the Gateway.cfg file in the correct path.