RIO-98x0

Redundant I/O module

Hardware User Manual

Preface

Warranty

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Warning

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Revision History

Revision	Date	Description of Change
1.20	2025/03/12	Update section 1.5.2 and 1.5.3
1.10	2025/01/15	Update Module Description and add Section 6
1.00	2024/08/14	First Release

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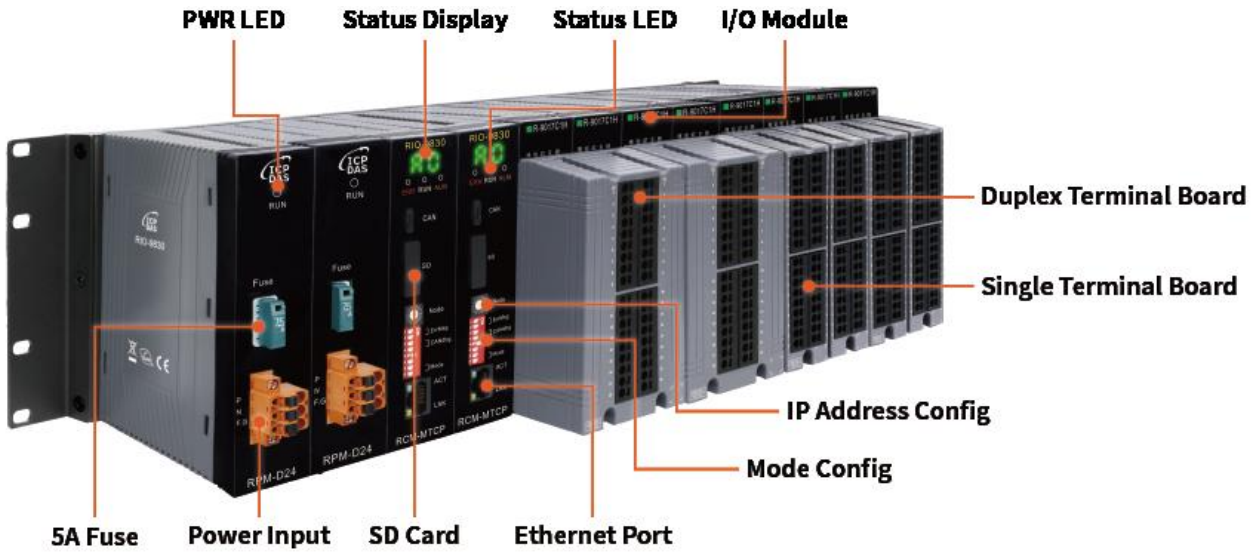
Section 1 : Introduction



RIO-98x0 is a modular remote redundant I/O system designed to enhance system monitoring stability and maintenance convenience. It supports various communication protocols (like Modbus/TCP, EtherCAT, Ethernet/IP) and can be easily integrated and widely used in various industrial applications.

The RIO-98x0 consists of the following modules:

- Power Module Duplex
  - Supports 24 VDC (+/- 10%) power input
  - Duplex design ensures stable power supply

- Communication Module Duplex
  - Support **Modbus/TCP** Server (**RIO-9830**)
  - Support **EtherCAT** Server (**RIO-9840**)
  - Support **Ethernet/IP** Server (**RIO-9850**)
  - Seven-segment display for real-time display of module operation status
  - Micro SD and RTC for real-time recording of module abnormal status

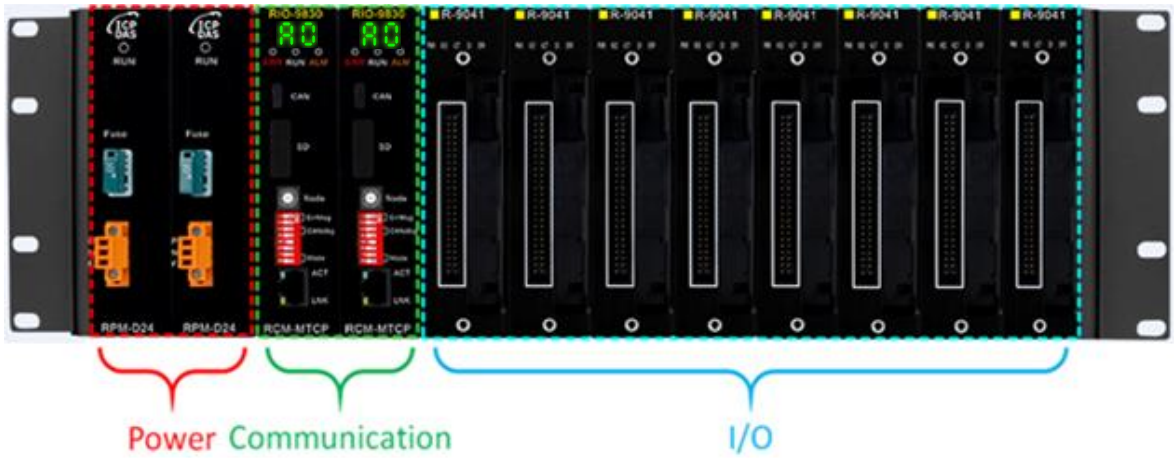
- I/O Module Duplex
  - Can be configured up to 8 sets of single or 4 sets of duplex
  - Supports multiple input/output signal types (e.g., analog current/voltage, digital signaling, TC/RTD temperature measurement, pulse counting, and HART communication) (RIO Module)

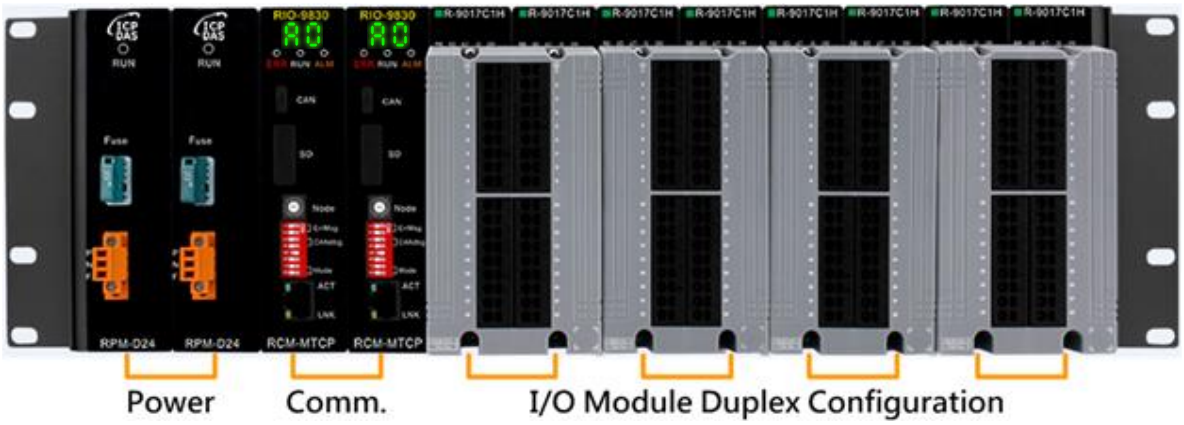
In addition, the RIO-98x0 has the following features:

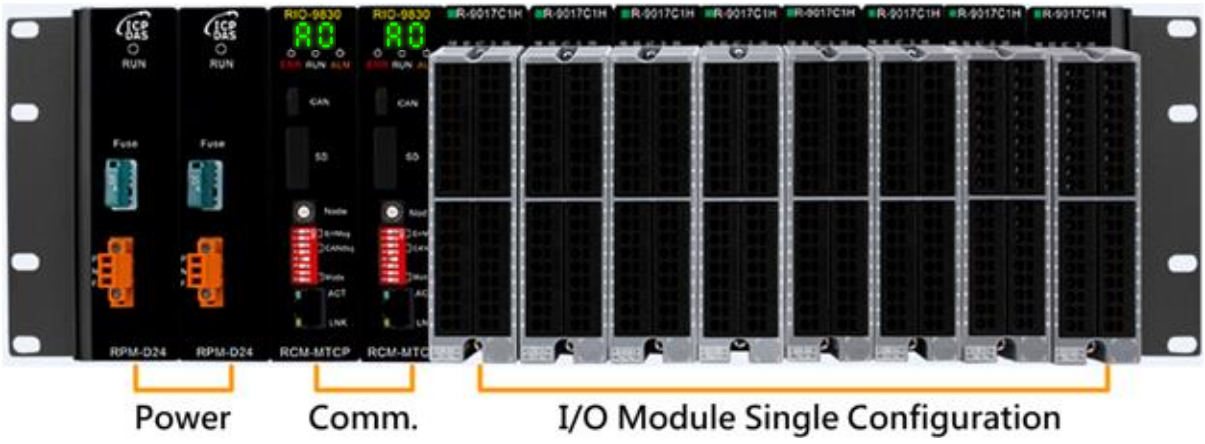
- **Hot-swap**: Allows the module to be replaced without interrupting the system operation, enhancing the convenience of system maintenance.

- **Parameter Auto-Configuration**: Reduces the complexity of manual configuration and simplifies the system maintenance process.
- **Redundant design**: Simultaneous duplex operation of power, communication and I/O modules to enhance system stability and fault tolerance.

These features make the RIO-98x0 an ideal solution for industrial applications that require high reliability and stability.







1.1 Hardware Feature :

1.1.1 Power Module Duplex

- Equipped with 5A fuse (overvoltage protection)

1.1.2 Communication Module Duplex

- SD card (module error logging)
- Seven-segment display (module error code)
- Module Status LED (Abnormal Status Indicator)
- Rotary switch (IP address configuration)
- Support multiple communication protocols

1.1.3 I/O Module Duplex

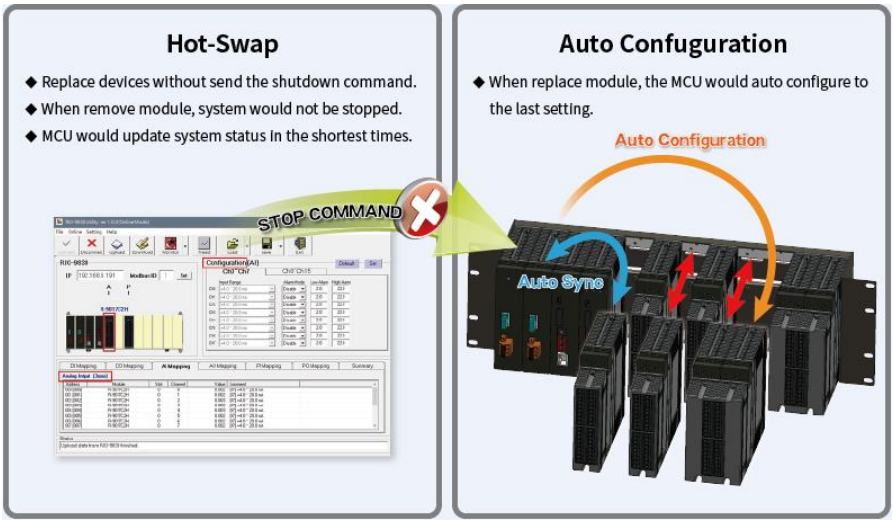
- Support analog current or voltage input/output functions.
- Support digital input/output function
- Support TC/RTD temperature measurement.
- Support pulse counter / frequency and HART communication.

1.1.4 I/O Terminal Board

- Support spring clamp terminals to simplify wiring process.
- Support terminal block drop detection to enhance wiring signal safety and stability.

1.1.5 Module Hot-Swap & Automatic Parameter Configuration

- The modules can be directly swapped to enhance the convenience of system maintenance.
- Modules can be automatically configured after swap, simplifying the system maintenance process.



1.1.6 Flexible Configuration of I/O

- I/O modules can be individually configured as single or duplex.
- Duplex I/O configuration can easily enhance the system monitoring security.

1.1.7 I/O Redundancy Switching Time < 1 ms

- The I/O redundancy switching time of the RIO-98x0 is less than 1 ms.

1.1.8 Fanless Design with Wide Operating Temperature Range

- The RIO-98x0 series features a fanless design with an operating temperature range of -25°C to +70°C. .

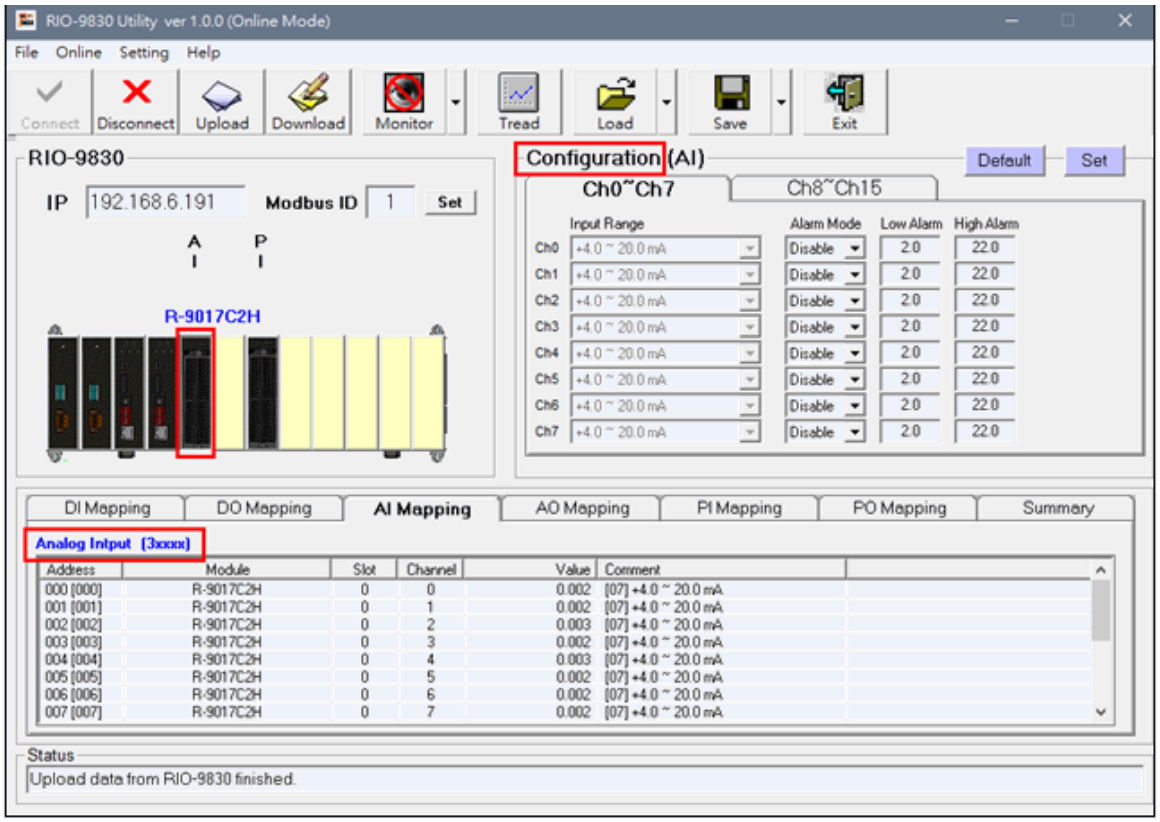
1.2 Software Feature :

1.2.1 Supports Multiple Ethernet Protocols

- The RIO-98x0 series offers a variety of industrial Ethernet protocols (e.g. Modbus TCP, EtherCAT, and Ethernet/IP), and can be fast integrated into a variety of field applications.

1.2.2 Free Tools

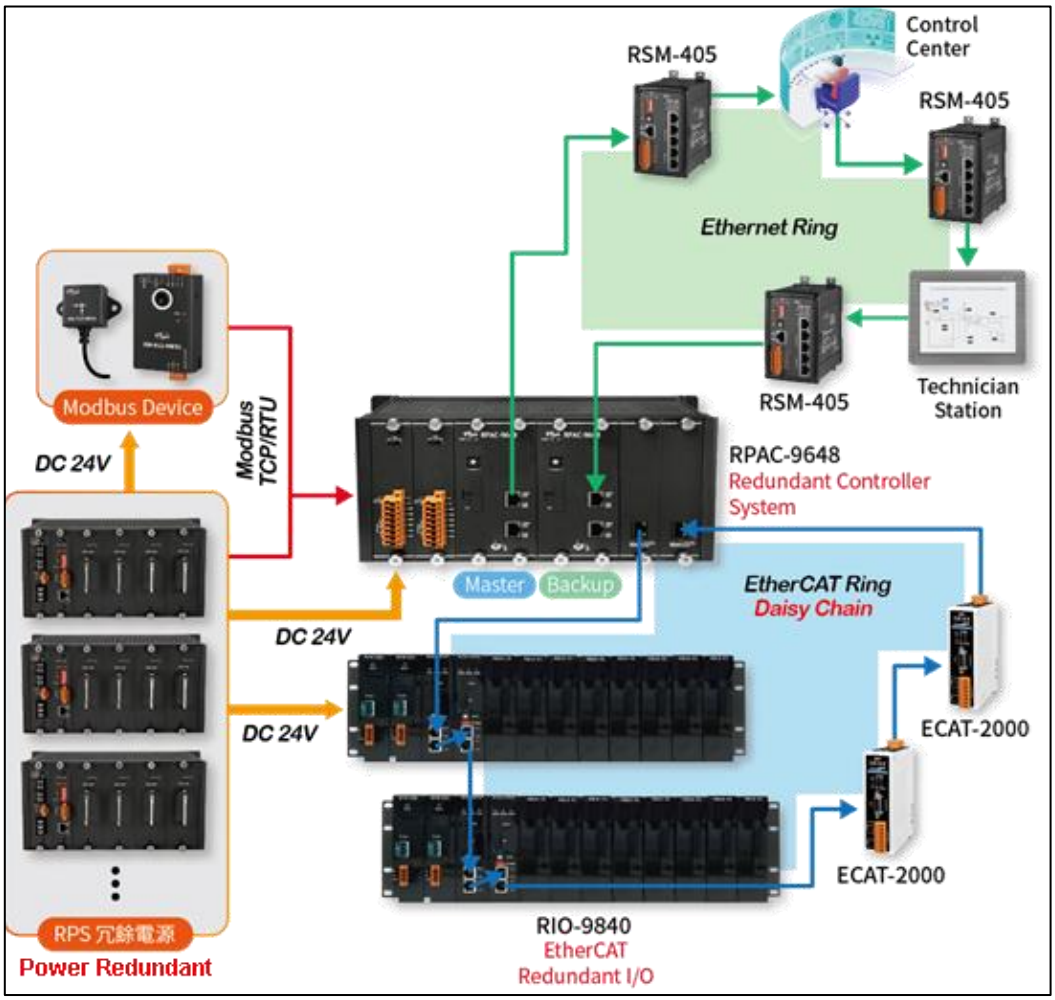
- Get and set the parameters of the module easily.
- Real-time monitoring of I/O module output/input values.
- Displays the module operation status.
- Support module firmware updates.



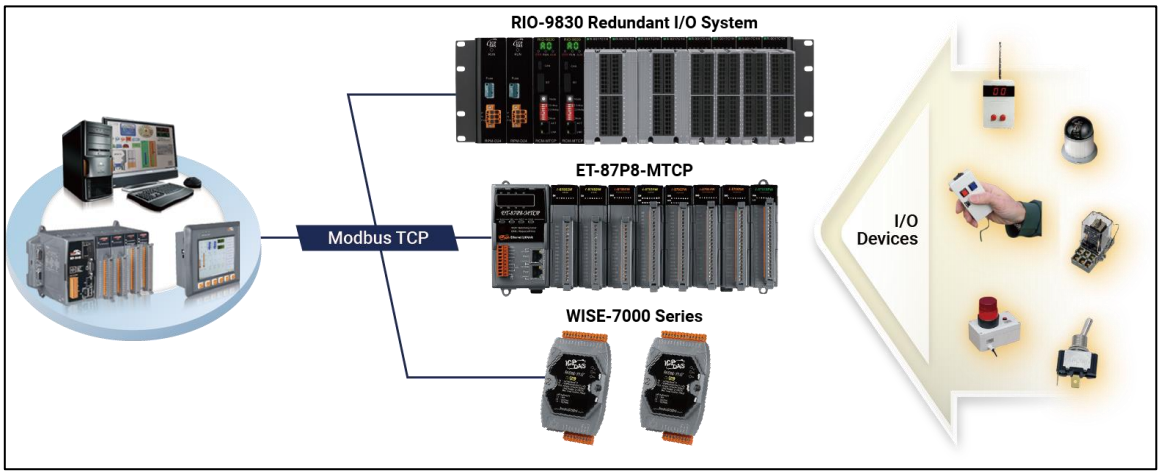
RIO-9830 Utility

1.3 Redundant Application Architecture :

- **Power Redundant :** RPS-4M
- **Controller Redundant :** RPAC-9648 / RPAC-2658M
- **I/O Redundant** : RIO-9830 / RIO-9840 (Available soon) / RIO-9850 (Available soon)
- **Ethernet Ring** : RSM-405 / RSM-408



The Redundant Total Solution with **RIO-9840** (EtherCAT)



Application of **RIO-9830** Redundant I/O System (Modbus/TCP)

1.4 Product List

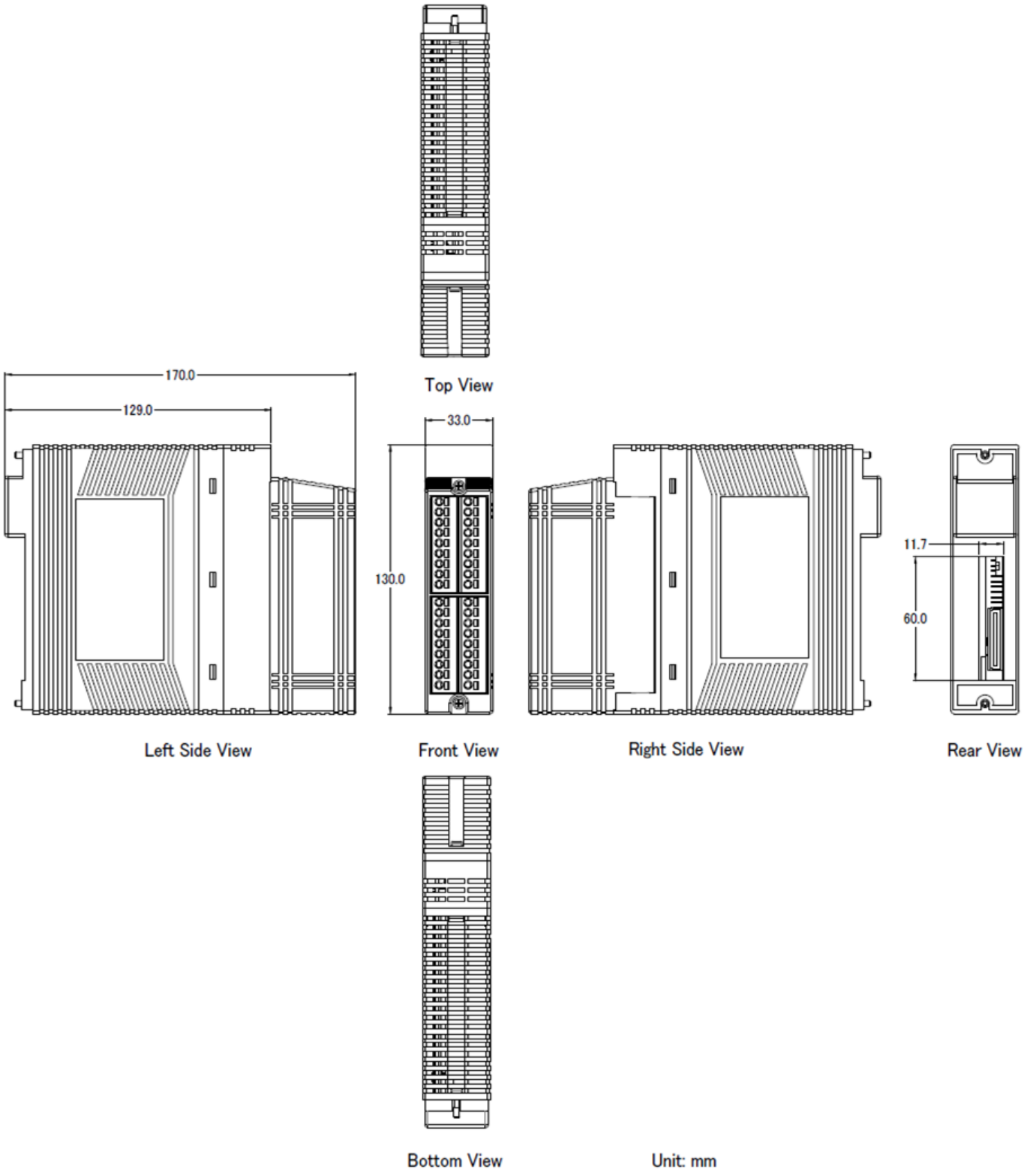
Type		Module Name	Description
Communication Module		RCM-MTCP	Modbus/TCP communication module, Redundancy
		RCM-ECAT	EtherCAT communication module, Redundancy
		RCM-EIP	Ethernet/IP communication module, Redundancy
Power Module		RPM-D24	Power module with 24V_{DC} input, Redundancy
Digital I/O	Input	R-9040	32-ch digital input, P-COM (Source) or NCOM (Sink), isolation for every 16-ch, Redundancy
	Output	R-9041	32-ch digital output, current sinking, open collector, isolation for every 16-ch, Redundancy
Analog I/O	Input	R-9015	12-ch RTD (Pt100, Pt1000, JPt100), Redundancy
		R-9017C1H	8-ch isolated 4~20mA input, HART master, loop power, Redundancy
		R-9017C2H	16-ch 4~20mA input, HART master, loop power Redundancy
		R-9019	16-ch Thermocouple (J, K, T, E, R, S, B, N, C), Redundancy
	Output	R-9028V1	8-ch isolated 1~5V or +/-10V output, Redundancy
		R-9028CH	8-ch isolated 4~20mA output, HART master, Redundancy
Pulse I/O	Input	R-9084	8-ch isolated pulse input (1Hz~10KHz), Redundancy
Termination Board	Single	RDB-S01	Termination board for single non-isolated analog modules (R-9017C2H)
		RDB-S02	Termination board for single thermocouple modules (R-9019)
		RDB-S03	Termination board for single RTD modules (R-9015)
		RDB-S05	Termination board for single digital output modules (R-9041)
		RDB-S08	Termination board for single digital input modules (R-9040)
		RDB-S09	Termination board for single isolated analog/pulse modules (R-9017C1H, R-9028V1, R-9028CH, R-9084)
	Duplex	RDB-D01	Termination board for duplex non-isolated analog modules (R-9017C2H)
		RDB-D02	Termination board for duplex thermocouple modules (R-9019)
		RDB-D03	Termination board for duplex RTD modules (R-9015)
		RDB-D05	Termination board for duplex digital output modules (R-9041)
		RDB-D08	Termination board for duplex digital input modules

			(R-9040)
		RDB-D09	Termination board for duplex isolated analog/pulse modules (R-9017C1H, R-9028V1, R-9028CH, R-9084)
Fan Module		AFAN-04	1U 4 way cooling fan module (https://www.icpdas.com/en/product/AFAN-04)

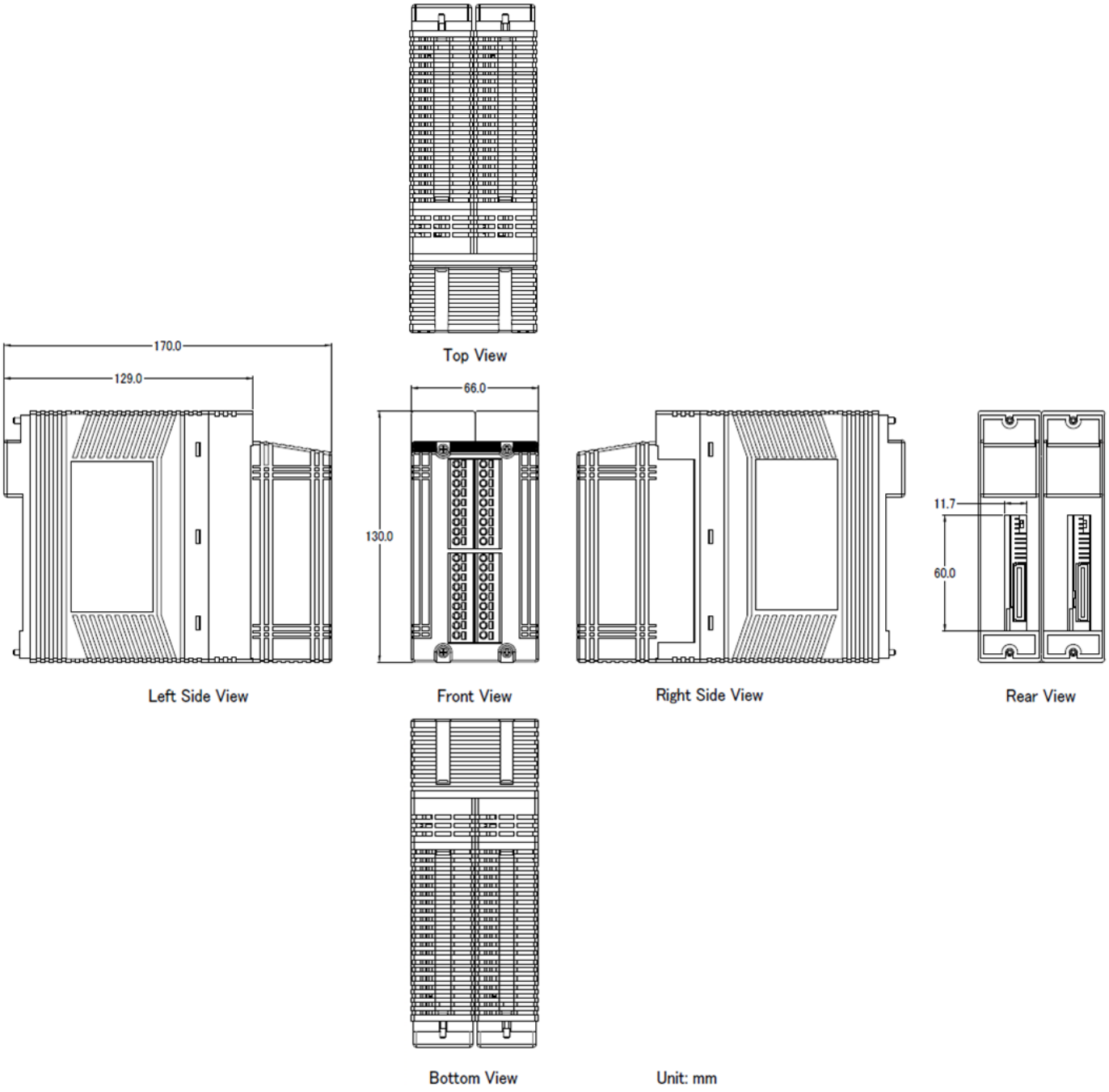
1.5 Installation

1.5.1 Dimensions

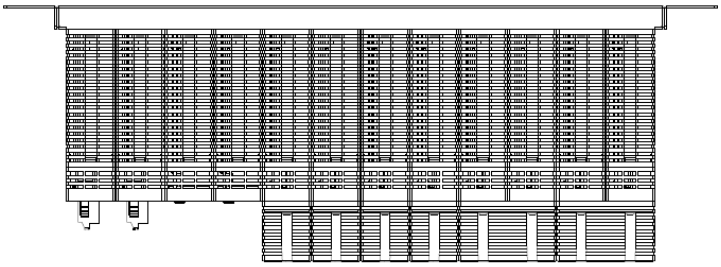
1.5.1.1 Single Mode (I/O module*1 + Single Termination Board)



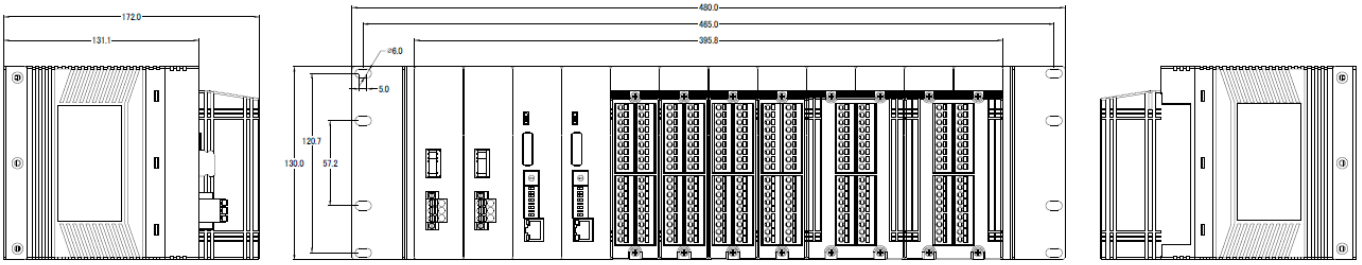
1.5.1.2 Duplex Module (I/O module*2 + Duplex Termination Board)



1.5.1.3 RIO-98x0 Body (Module Plugged)



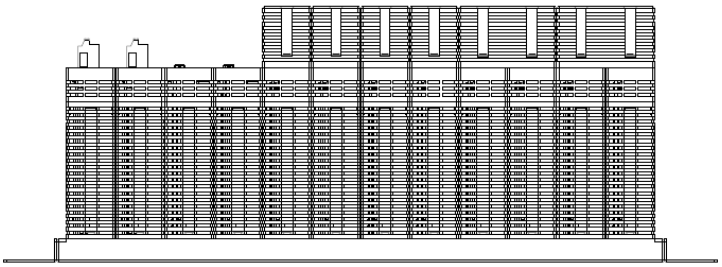
Top View



Left Side View

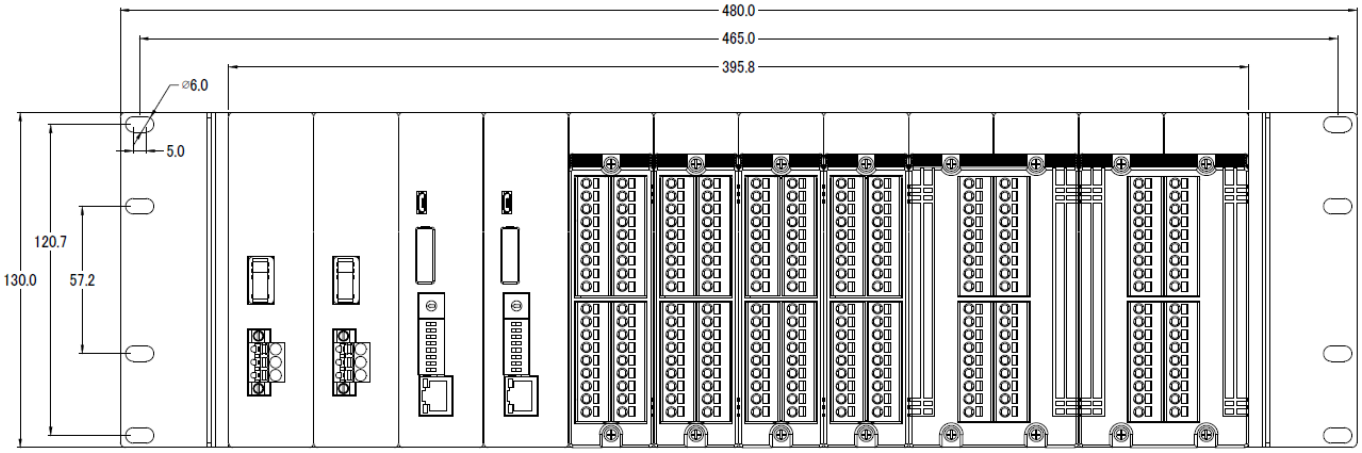
Front View

Right Side View



Bottom View

Unit: mm



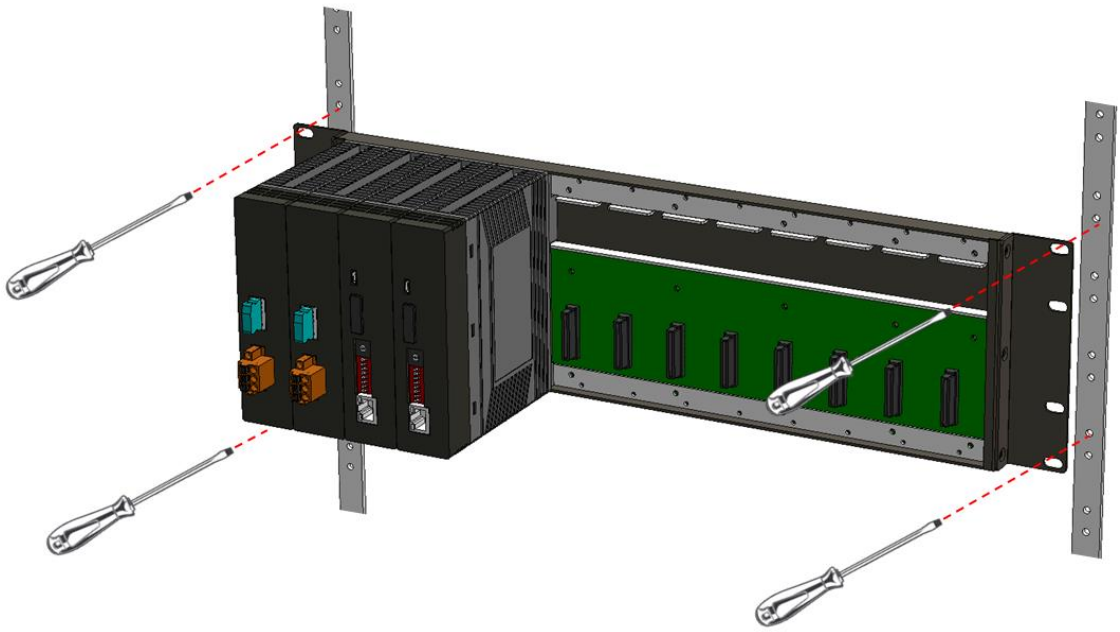
Front View

1.5.2 Mounting

RIO-98x0 can be installed in a cabinet. The following sections will introduce how to install RIO-98x0.

1.5.2.1 Panel mounting

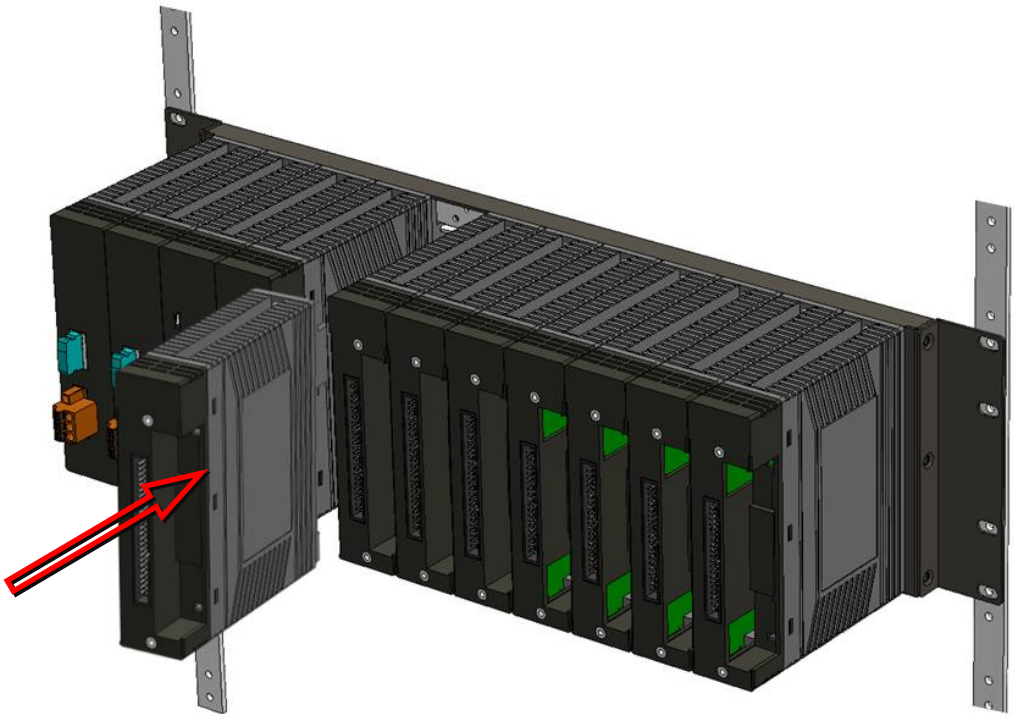
- **Use screw drive to mount the panel to the cabinet with M6 screws**



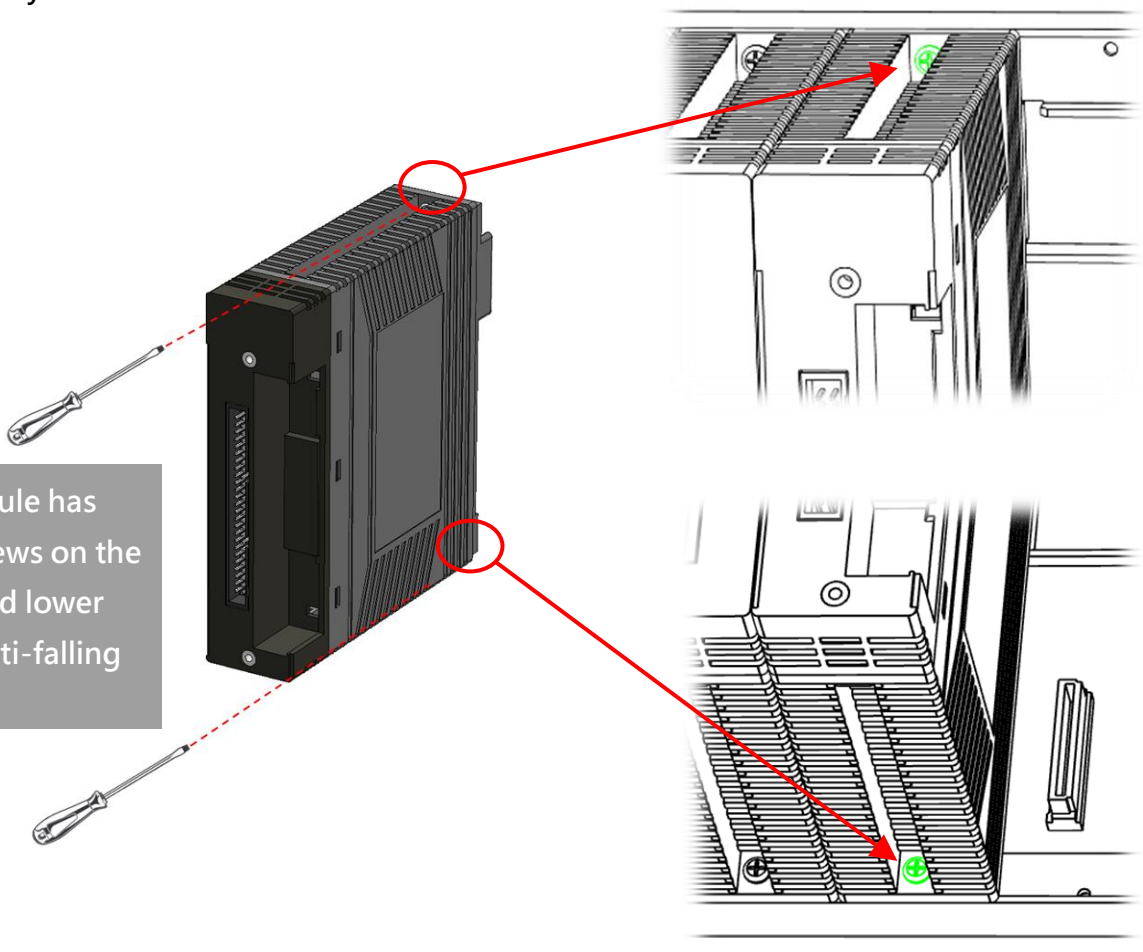
- **Successfully installed panel on the cabinet**

1.5.3 Module Installation

- **Installing along the guiding rail then pushing into the socket of backplane**



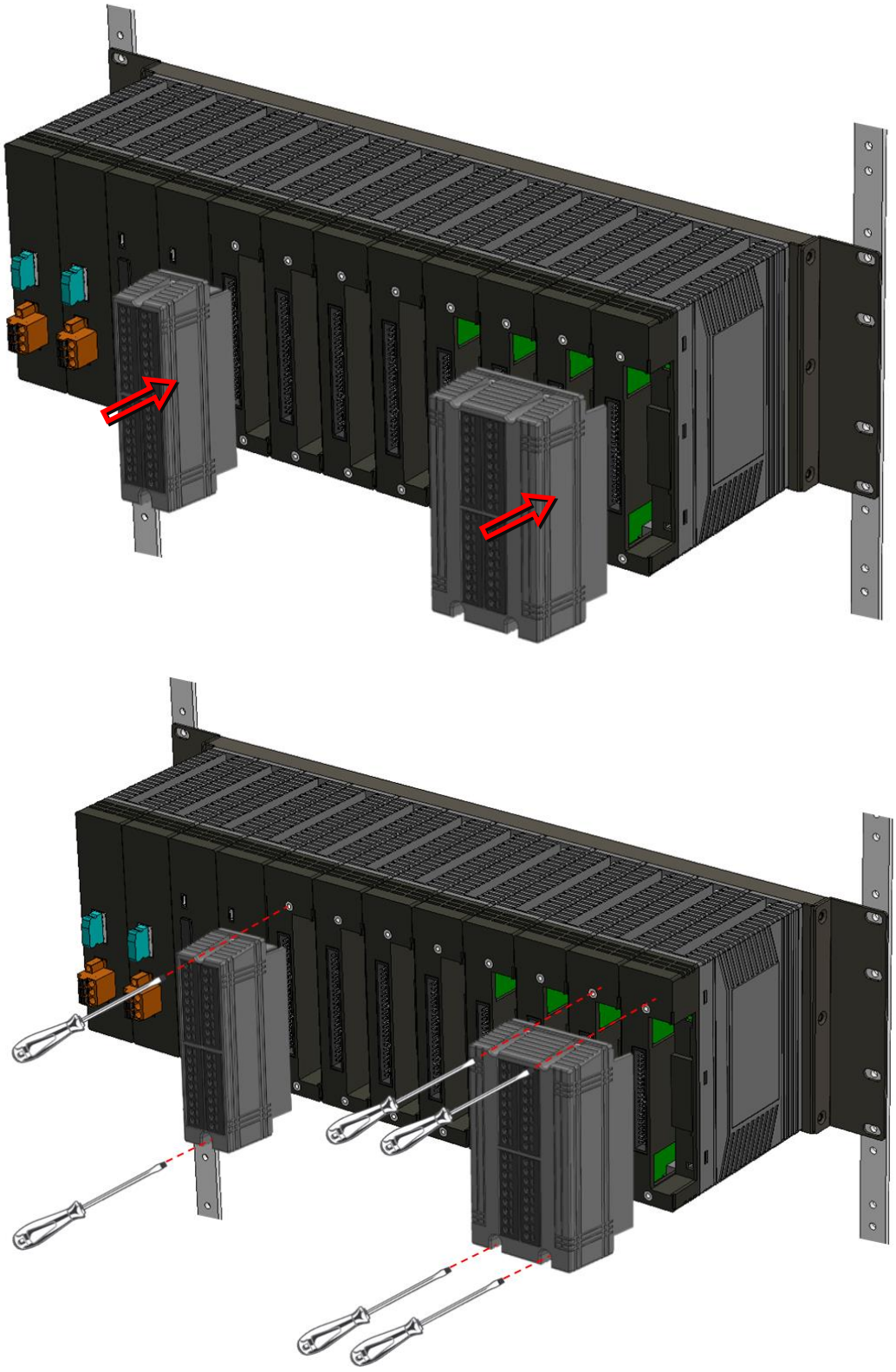
- **Fixed by screws**



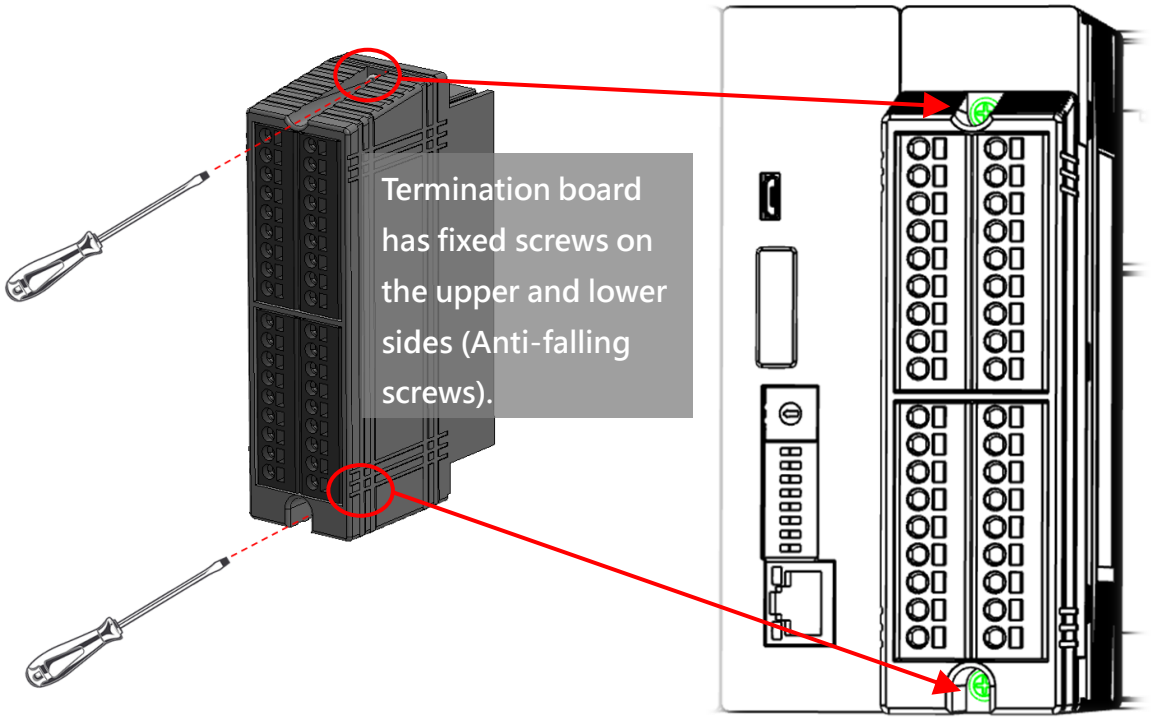
The module has fixed screws on the upper and lower sides (Anti-falling screws).

1.5.4 Termination Board Installation

- **The module provides slots on the front panel for installing corresponding model termination boards.**

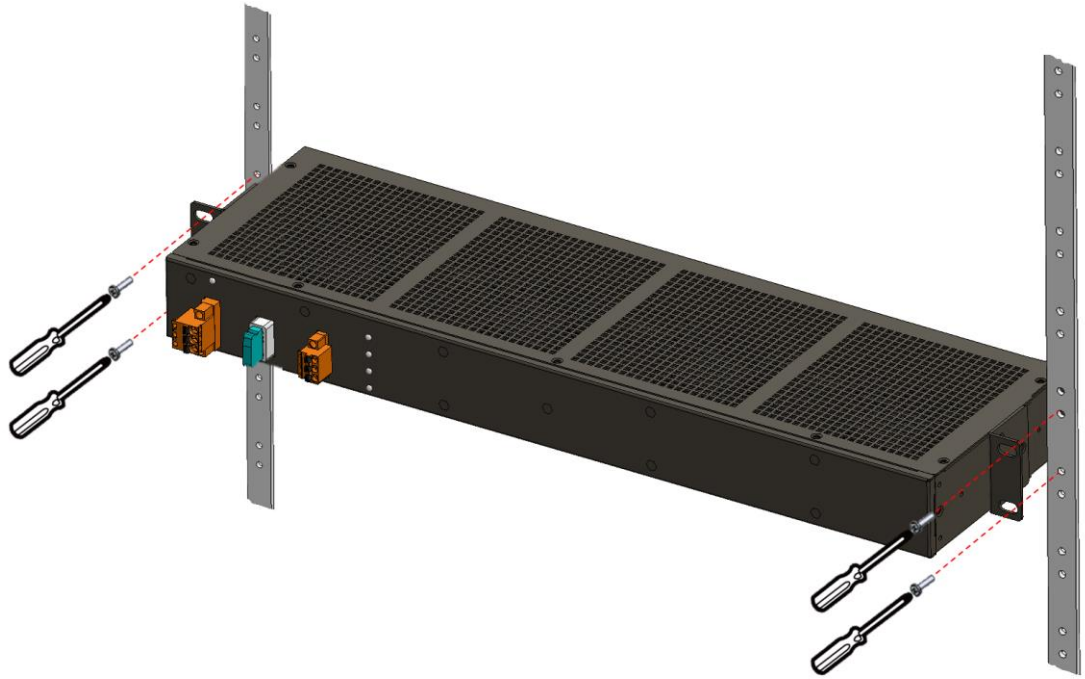


- **Fixed by screws**



1.5.5 Fan Module Installation (Optional)

- **Use screw drive to mount the 1U universal active cooling module (AFAN-04) to the cabinet with M6 screws. (https://www.icpdas.com/en/product/AFAN-04)**



Section 2 : Power Modules

2.1 RPM-D24

2.1.1 Overview

Feature

- Power redundancy
- Over-voltage protection (5A Fuse)
- Built-in LED power indicator

The RPM-D24 is a power supply module for the RIO-98x0 system with the following features:

- **24 VDC power input :** Provides stable power supply for communication modules and I/O modules of RIO-98x0 system.
- **Over-voltage protection :** Built-in 5A fuse protects the system from over-voltage damage.
- **LED indicator :** Indicates the status of the external 24 VDC voltage supply and allows users to monitor whether the power supply is normal or not.

The module supports dual design, even if a single power module fails, the RIO-98x0 can still run stably, which further enhances the reliability of the system.

2.1.2 Specification

Parameter		Value
Voltage input		$24V_{DC}$ ±10%
Short circuit protection		Fuse, 5A
Conducted emission		EN55022 Class A
Radiated emission		EN55022 Class A
Reverse Polarity Protection		Yes
Redundancy		Yes
Power consumption		0.24W (0.01A@24V)
Operating temperature		-25°C ~ +70°C
Weight		180 g
Dimensions (W x L x H)		33mm x 129mm x 130mm
EMC	Emission	IEC 61000-6-4: 2006/A1:2010 E, CISPR 11:2009/A1:2010
	Immunity	IEC 61000-6-2: 2005, IEC 61000-4-2: 2008, IEC 61000-4-3: 2006/A1:2007/A2:2010, IEC 61000-4-4: 2012, IEC 61000-4-5: 2005, IEC 61000-4-6: 2008, IEC 61000-4-8: 2009, IEC 61000-4-9: 1993/A1:2001, IEC 61000-4-10: 1993/A1:2001, IEC 61000-4-12: 2006, EN 61000-4-16: 2004

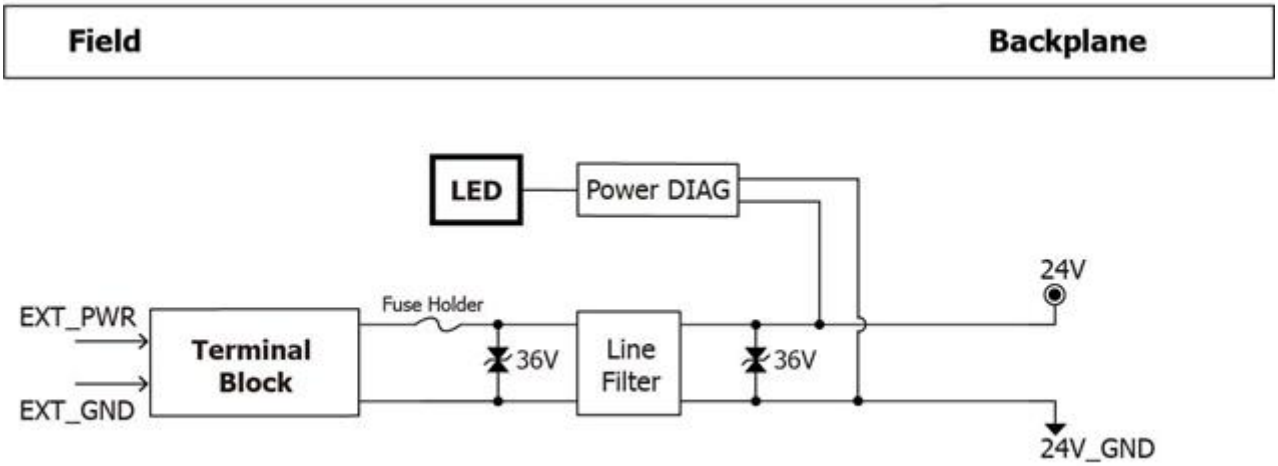
2.1.3 Pin Assignment

Pin	Description
P	24 VDC
N	Ground
F.G	Frame Ground

2.1.4 LED Indicator

LED	Status	Description
RUN	ON	Input Power is between $24V_{DC}$ ±10%
	OFF	Input Power is not between $24V_{DC}$ ±10%

2.1.5 Hardware Structure



2.1.6 The Power Consumption of Module

Model Name	Maximum Output Current
R-9040	1.7 W (0.07A@24V_{DC})
R-9041	1.7 W (0.07A@24V_{DC})
R-9017C1H	4.6 W (0.19A@24V_{DC})
R-9017C2H	2.4 W (0.1A@24V_{DC})
R-9028V1	6.3 W (0.26A@24V_{DC})
R-9028CH	5.6 W (0.23A@24V_{DC})
R-9084	6.8 W (0.28A@24V_{DC})
R-9015	2.0 W (0.08A@24V_{DC})
R-9019	2.2 W (0.09A@24V_{DC})

Section 3 : Communication Module

3.1 RCM-MTCP (RIO-9830)

3.1.1 Overview

Features

- Modbus/TCP Server
- Communication Redundancy
- 7 Segment Display (Exception code)
- Built-in LED status indicator
- Rotary switch for IP address configuration
- Micro SD (Exception logging)

RCM-MTCP is a very critical communication module in RIO-9830 system with the following features:

- **Modbus/TCP server :** Modbus/TCP client can quickly integrate and monitor all I/O information of RIO-9830.
- **Seven-segment display and LEDs :** Display all module operation status and network connection.
- **Rotary Switch :** Manually set the network IP address of RIO-9830 to simplify the network configuration process.
- **SD card :** Record all module abnormal information for system troubleshooting and future analysis.
- **DIP Switch :** Enables the seven-segment display to show the running status of all modules, and also switches the RCM-MTCP module into firmware update mode for easy system maintenance and upgrading.
- **USB connector (CAN) :** Used to communicate with the CAN bus of the backplane for debugging. Designed for engineering developers, it is convenient for troubleshooting and debugging.

The 3000 VDC isolation design provides strong interference immunity between the backplane and external signals, making it ideal for use in industrial environments. In addition, the module supports a dual design that allows the RIO-9830 to operate stably even if a single communication module fails, further enhancing system reliability.

3.1.2 Specification

Parameter		Value
LAN Port		10/100BASE-TX (Auto negotiating, Auto MDIX)
Protocol		Modbus/TCP Server
LED indicators		1 Power, 2 Fault, 1 Link/Active/Speed
Redundant		Yes
EMC	Emission	IEC 61000-6-4: 2006/A1:2010 E CISPR 11:2009/A1:2010
	Immunity	IEC 61000-6-2: 2005, IEC 61000-4-2: 2008, IEC 61000-4-3: 2006/A1:2007/A2:2010, IEC 61000-4-4: 2012, IEC 61000-4-5: 2005, IEC 61000-4-6: 2008, IEC 61000-4-8: 2009, IEC 61000-4-9: 1993/A1:2001, IEC 61000-4-10: 1993/A1:2001, IEC 61000-4-12: 2006, EN 61000-4-16: 2004
Power consumption		1.7 W
Operating temperature		-25°C ~ +70°C
Isolation		3000V_{DC} (Between LAN port and F.G) 1000V_{DC} (Between LAN port and backplane)

3.1.3 LED Indicators

LED	Status
ERR	ON：Heavy fault OFF：Normal
RUN	ON：Normal OFF：Abnormal
ALM	ON：Light fault OFF：Normal
RUN **ALM** **ERR**	Three lights flash (300ms) : Firmware Update Mode
ACT	ON：Ethernet Activity OFF：No Ethernet Activity
LNK	ON：Ethernet Link Establish OFF：No Ethernet Link

3.1.4 Seven-Segment Display

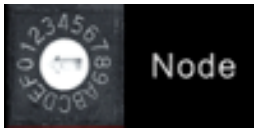
7-segment Display LED	Description	7-segment Display LED	Description
A0	Node0 Left Side	**b0**	Node0 Right Side
A1	Node1 Left Side	**b1**	Node1 Right Side
A2	Node2 Left Side	**b2**	Node2 Right Side
A3	Node3 Left Side	**b3**	Node3 Right Side
A4	Node4 Left Side	**b4**	Node4 Right Side
A5	Node5 Left Side	**b5**	Node5 Right Side
A6	Node6 Left Side	**b6**	Node6 Right Side
A7	Node7 Left Side	**b7**	Node7 Right Side
A8	Node8 Left Side	**b8**	Node8 Right Side
A9	Node9 Left Side	**b9**	Node9 Right Side
AA	Node10 Left Side	**bA**	Node10 Right Side
AB	Node11Left Side	**bB**	Node11 Right Side
AC	Node12 Left Side	**bC**	Node12 Right Side
AD	Node13 Left Side	**bD**	Node13 Right Side
AE	Node14 Left Side	**bE**	Node14 Right Side
AF	Node15 Left Side	**bF**	Node15 Right Side

7-segment Display LED	Description
bL	FW Update mode

3.1.5 Dip Switch

Number	Function	Description
1~ 2	Sw1 On & Sw2 Off	The 7-segment LED will show **the current state** of light and heavy error in MCU/IOM.
	Sw1 Off & Sw2 On	The 7-segment LED will show **the last state** of light and heavy error in MCU/IOM.
	Others	Not support and the 7-segment LED will show Ax/bx. (A/b: Left side/Right side), (x: NODE ID)
3~ 4	Sw3 On/Off	Enable/Disable **CAN1 debug** of CAN connector
	Sw4 On/Off	Enable/Disable **CAN2 debug** of CAN connector
5~ 6	Sw5 On & Sw6 Off	IP setting mode be used **hardware mode** (3.1.6 Rotary Switch)
	Sw5 Off & Sw6 Off	IP setting mode be used **User mode** (eSearch Utility)
	Others	Not support
7~ 8	Sw7 Off & Sw8 Off	**Modbus/TCP** Protocol
	Sw7 Off & Sw8 On	**FW Download** mode via Ethernet (3.1.6 Rotary Switch)
	Others	Not support

3.1.6 Rotary Switch



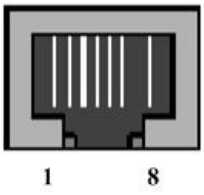
When the RCM-MTCP dip Switch is in **IP hardware setting mode** or **FW Download mode**, the rotary switche is used to set the 4th number of IP address as the below table. The first 3 number of IP address is 192.168.0 (default) and can be configured by MiniOS7 Utility.

Rotary Switch	Left Side		Right Side	
	IP	MASK	IP	MASK
0	192.168.0.16	255.255.0.0	192.168.0.144	255.255.0.0
1	192.168.0.17	255.255.0.0	192.168.0.145	255.255.0.0
2	192.168.0.18	255.255.0.0	192.168.0.146	255.255.0.0

3	192.168.0.19	255.255.0.0	192.168.0.147	255.255.0.0
4	192.168.0.20	255.255.0.0	192.168.0.148	255.255.0.0
5	192.168.0.21	255.255.0.0	192.168.0.149	255.255.0.0
6	192.168.0.22	255.255.0.0	192.168.0.150	255.255.0.0
7	192.168.0.23	255.255.0.0	192.168.0.151	255.255.0.0
8	192.168.0.24	255.255.0.0	192.168.0.152	255.255.0.0
9	192.168.0.25	255.255.0.0	192.168.0.153	255.255.0.0
10	192.168.0.26	255.255.0.0	192.168.0.154	255.255.0.0
11	192.168.0.27	255.255.0.0	192.168.0.155	255.255.0.0
12	192.168.0.28	255.255.0.0	192.168.0.156	255.255.0.0
13	192.168.0.29	255.255.0.0	192.168.0.157	255.255.0.0
14	192.168.0.30	255.255.0.0	192.168.0.158	255.255.0.0
15	192.168.0.31	255.255.0.0	192.168.0.159	255.255.0.0

3.1.7 Ethernet Port

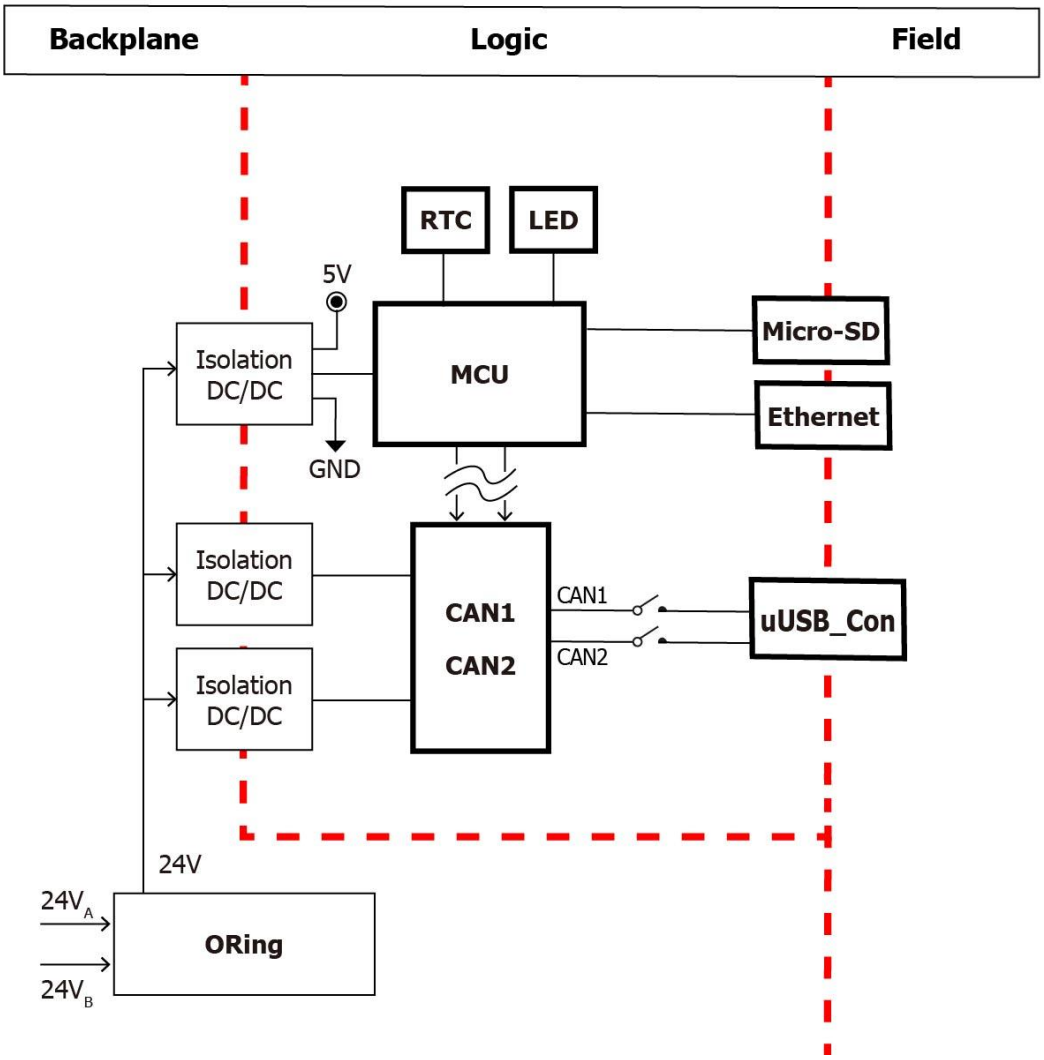
The RIO-98X0 is equipped with one Ethernet port which is fully compliant with IEEE 802.3u 10/100BASE-TX. The Ethernet port provides a standard RJ-45 with green color LED indicator on the front side showing activity (Off: No activity, Green and Flash: Activity), and orange color LED indicator showing link status (Off: No Link, Orange: Link established).



Pin	Name	Color	Description
1	TX+	Clear white	Transmit Data+
2	TX-	Clear	Transmit Data-
3	RX+	Green white	Receive Data+
4	N.C.	Blue	Not Connected
5	N.C.	Blue white	Not Connected
6	RX-	Green	Receive Data-
7	N.C.	Brown white	Not Connected
8	N.C.	Brown	Not Connected

Recommended Media
UTP/STP Cable
10Mbps：Category 3 or greater
100Mbps：Category 5 or greater

3.1.8 Hardware Structure



3.2 RCM-ECAT (RIO-9840) (Available soon)

3.2.1 Overview

Features

- EtherCAT Slave
- Communication Redundancy
- 7 Segment Display (Exception code)
- Built-in LED status indicator
- Rotary switch for ID (Station Alias) configuration
- FRAM (Exception logging)

RCM-ECAT is a very critical communication module in RIO-9840 system with the following features:

- **EtherCAT server :** EtherCAT master can quickly integrate and monitor all I/O information of RIO-9840.
- **Seven-segment display and LEDs :** Display all module operation status and network connection.
- **Rotary Switch :** Manually set the ID (Station Alias) of RIO-9840 to simplify the network configuration process.
- **DIP Switch :** Enables the seven-segment display to show the running status of all modules, and also switches the RCM-MTCP module into firmware update mode for easy system maintenance and upgrading.
- **USB connector (CAN) :** Used to communicate with the CAN bus of the backplane for debugging. Designed for engineering developers, it is convenient for troubleshooting and debugging.

The 3000 VDC isolation design provides strong interference immunity between the backplane and external signals, making it ideal for use in industrial environments. In addition, the module supports a dual design that allows the RIO-9840 to operate stably even if a single communication module fails, further enhancing system reliability.

3.3 RCM-EIP (RIO-9850) (Available soon)

3.3.1 Overview

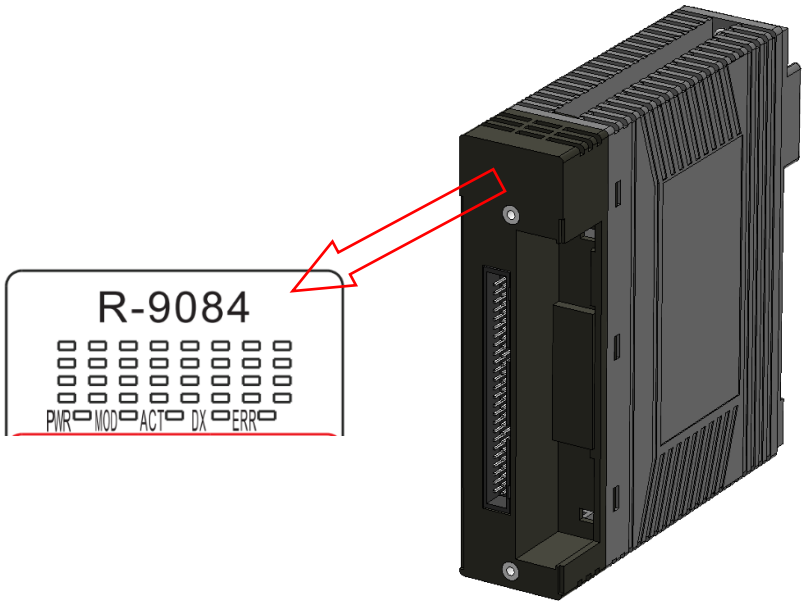
Features

- Ethernet/IP Server
- Communication Redundancy
- 7 Segment Display (Exception code)
- Built-in LED status indicator
- Rotary switch for IP address configuration
- Micro SD (Exception logging)

Section 4 : I/O Module

4.1.1 LED status

There are 5 status LED and 32 channel LED indicators in each I/O module. These indicators represent different conditions when the system is operating and also can be used to identify fault of the module.



Status		Description	
PWR	ON	Normal (Have electricity)	
	OFF	No electricity	
MOD	ON	Operating Mode	
	Blink	0.5 second period	Stop Mode
		1 second period	Pre-OP Mode
	OFF	Standby	
ACT	ON	Single	Output/Input Enable
		Duplex	Master & Output/Input Enable
	OFF	Single	Output/Input Disable
		Duplex	Slave & Output/Input Disable
DX	ON	I/O Module operates in redundant mode	
	OFF	I/O Module operates in single mode	
ERR	ON	Heavy fault (Example: Hard damage)	

	Blink	Light fault (1 flash every 500ms) (Software setting error or disconnection)
	OFF	Normal system
MOD ACT DX	Blink	Firmware Update Mode
LED0~31	ON	Digital module : I/O channel is activated Analog module : I/O channel is fault
	OFF	Digital module : I/O channel is inactivated Analog module : I/O channel is normal

4.1.2 Timing Characteristics

Parameter	Value	Description
T_1	800 ms	Hardware watchdog activated
T_2	50 ms	I/O modules lose connection to the termination board
T_3	<1 ms	Response time for analog output high/low alarm
T_4	<16 ms (8 channels)	Response time for analog input high/low alarm
	<32 ms (16 channels)	
T_5	<1.2 s	Response time for TC/RTD high/low alarm
T_6	<100 ms	Time when detect CJC broken
T_7	<1.2 s	Time when detect TC/RTD channel broken

4.2 Digital Input

4.2.1 R-9040

4.2.1.1 Overview

- 32 digital input (sink/source) channels
- Digital filter (1~32767us)
- Input channel LED indication
- Termination board disconnection detection
- Digital input diagnostic function
- Redundant switching time (< 1 ms)

The R-9040 is a 32-channel digital input module with the following features:

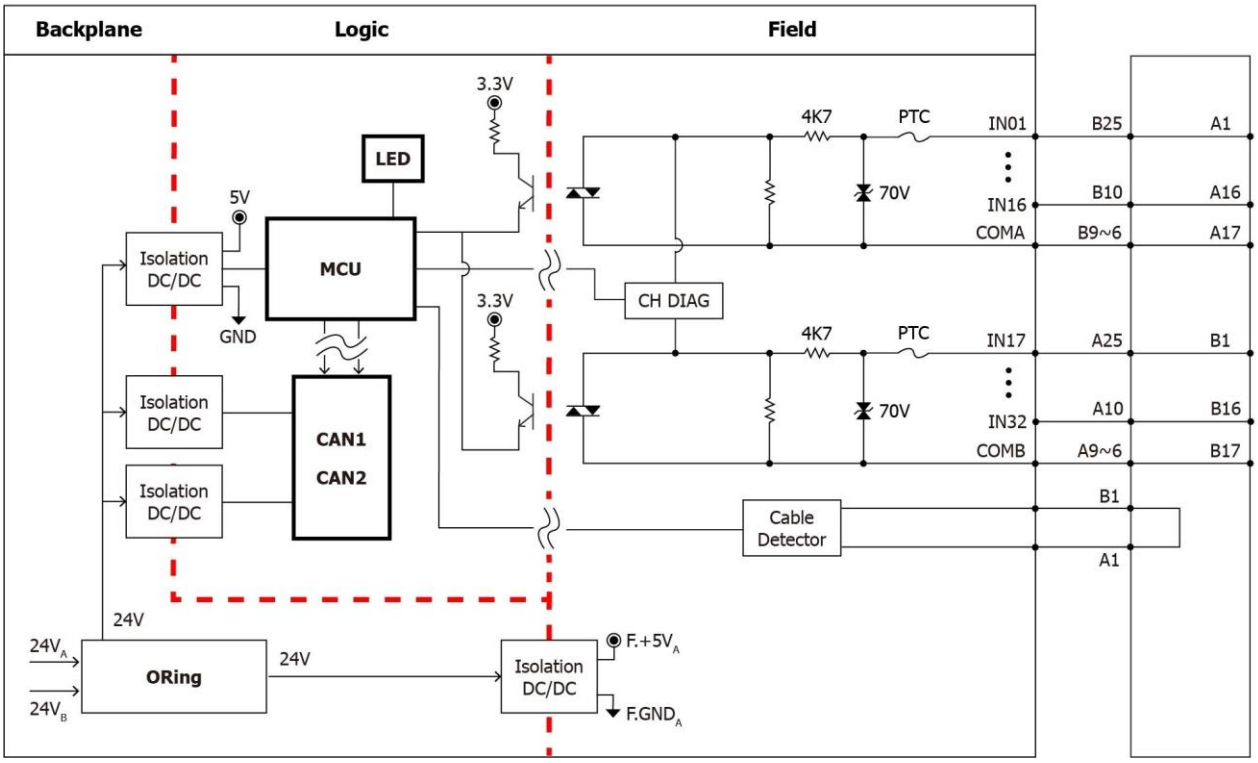
- **Channel Wiring Mode :** Supports sink/source wiring.
- **Low-pass Filter :** solves the problem of digital input signal bouncing and ensures the stability of the input signal.
- **Channel Diagnosis :** Detects abnormalities in the channel components of the module and provides fault alarms.
- **LED Indicator :** Indicates channel ON/OFF status and module operation status.

The R-9040 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

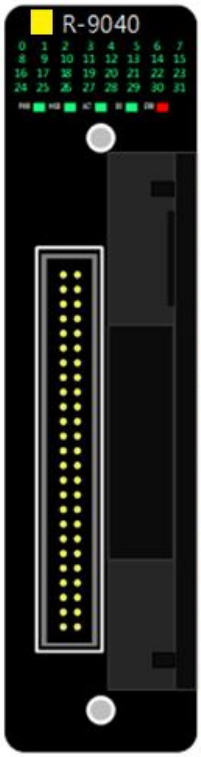
4.2.1.2 Specification

Parameter	Value
[Feature]	
Redundant	Yes (Switching time < 1ms)
Termination board disconnection detection	Yes
Digital filter	Yes (1~32767us)
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	I/O Indicator 32 as channel 0~31 status
[Digital Input]	
Channels	32 (Ch00~15 : GND_{G1} ; Ch16~31 : GND_{G2})
Type	P-COM(Source) or N-COM(Sink), Single-Ended
Rated Input voltage	24 V_{DC}
Allowable max. input voltage	30.0 V_{DC}
Input voltage range, "1"	18~30 V_{DC}
Input voltage range, "0"	<11 V_{DC}
Max. ON/OFF cycle	500 Hz
Input impedance	4.7KΩ / per channel
Input current	5.1mA@24V_{DC} (122.4mW) / per channel
Field-to-Backplane isolation	3000V_{DC}
Channel protection	110V_{AC} / 140V_{DC}
[Certification]	
EMC	EN 61000-6-2 (EMS) EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
[General]	
Termination board	RDB-S08, RDB-D08
Maximum power consumption	1.7 W (0.07A@24V_{DC})
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	200 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.2.1.3 Hardware Structure



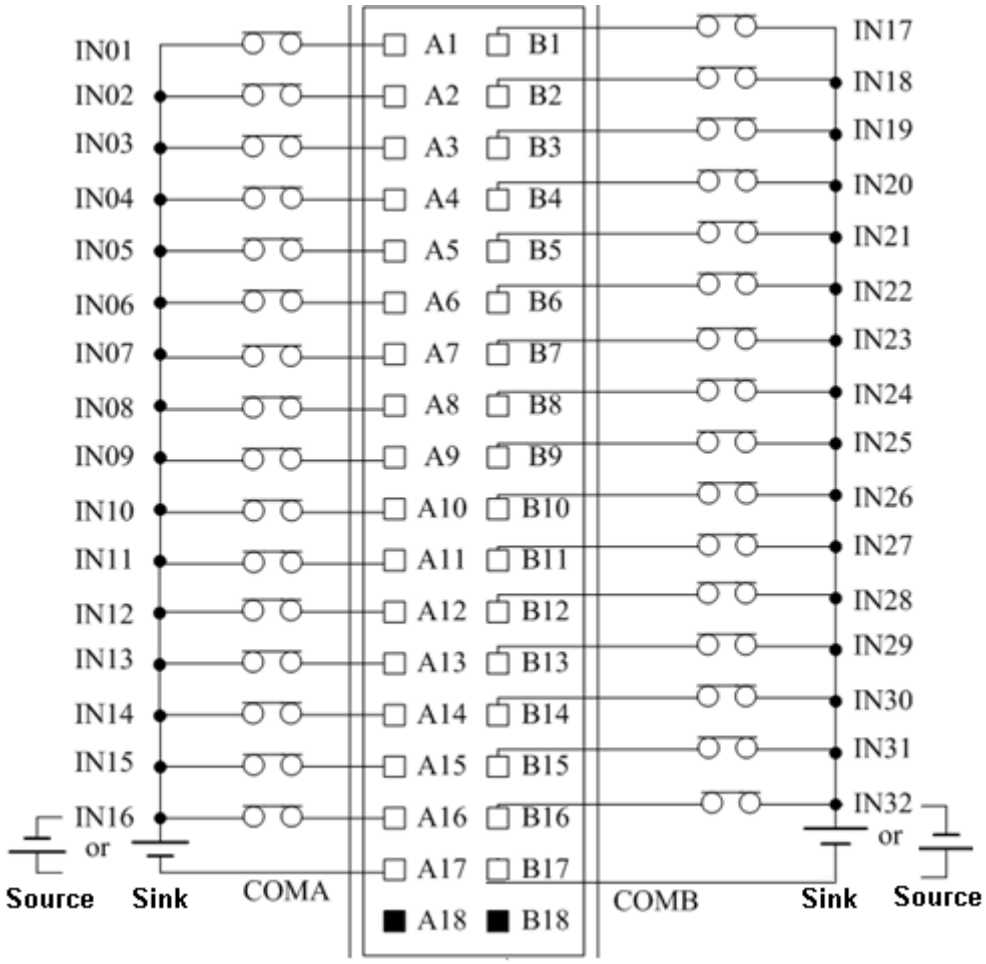
4.2.1.4 Pin Assignment



Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01	A1	B1	IN17
IN02	A2	B2	IN18
IN03	A3	B3	IN19
IN04	A4	B4	IN20
IN05	A5	B5	IN21
IN06	A6	B6	IN22
IN07	A7	B7	IN23
IN08	A8	B8	IN24
IN09	A9	B9	IN25
IN10	A10	B10	IN26
IN11	A11	B11	IN27
IN12	A12	B12	IN28
IN13	A13	B13	IN29
IN14	A14	B14	IN30
IN15	A15	B15	IN31
IN16	A16	B16	IN32
COM_A	A17	B17	COM_B
COM_A	A18	B18	COM_B
COM_A	A19	B19	COM_B
COM_A	A20	B20	COM_B
X	A21	B21	X
X	A22	B22	X
X	A23	B23	X
X	A24	B24	X
BK	A25	B25	BK

4.2.1.5 Terminal Board Wiring

(1) Terminal Board of R-9040 refers to RDB-S08, RDB-D08.



4.3 Digital Output

4.3.1 R-9041

4.3.1.1 Overview

- 32 digital output (sink) channels
- Safety value (Preset/Hold)
- Power-on(Initial) value
- Output channel LED indication
- Termination board disconnection detection
- Digital output diagnostic function
- Redundancy switching time (< 1 ms)

The R-9041 is a 32-channel NPN digital output module (sink mode) with the following features:

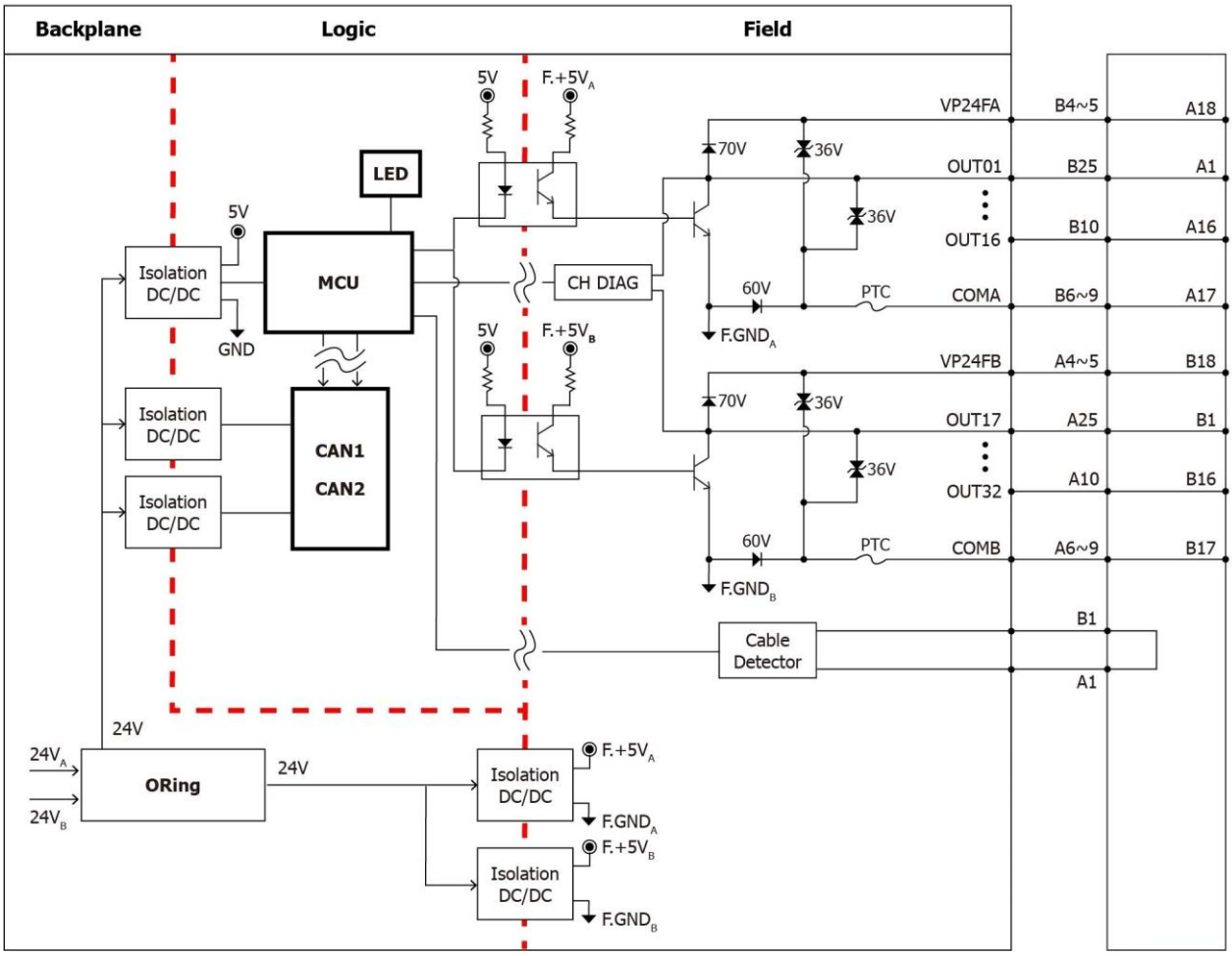
- **Channel load driving capability :** 100mA
- **Power-on value and Safety value :** Ensure that the module can output a predefined state during startup or abnormal conditions.
- **Channel Diagnosis :** Detects abnormalities in the channel components of the module and provides fault alarms.
- **LED Indicator :** Indicates channel ON/OFF status and module operation status.

The R-9041 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.3.1.2 Specification

Parameter	Value
Feature	
Redundant	Yes (Switching time < 1ms)
Termination board disconnection detection	Yes
Safety output	Yes (Preset/Hold)
Power-on (Initial) output	Yes
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	I/O Indicator 32 as channel 0~31 status
Digital Output	
Number of channels	32 (NPN) (P-COM) (Ch00~15 : GND_{G1} ; Ch16~31 : GND_{G2})
Type	Current Sinking, Open-Collector
Rated voltage	24 V_{DC}
Max. Output load current	100mA / channel @24V_{DC}
Output impedance	<1 Ω
Field-to-Backplane isolation	3000V_{DC}
Channel protection	Over current protection
Certification	
EMC	EN 61000-6-2 (EMS) EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
General	
Termination board	RDB-S05, RDB-D05
Maximum power consumption	1.7 W (0.07A@24V_{DC})
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	200 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.3.1.3 Hardware Structure

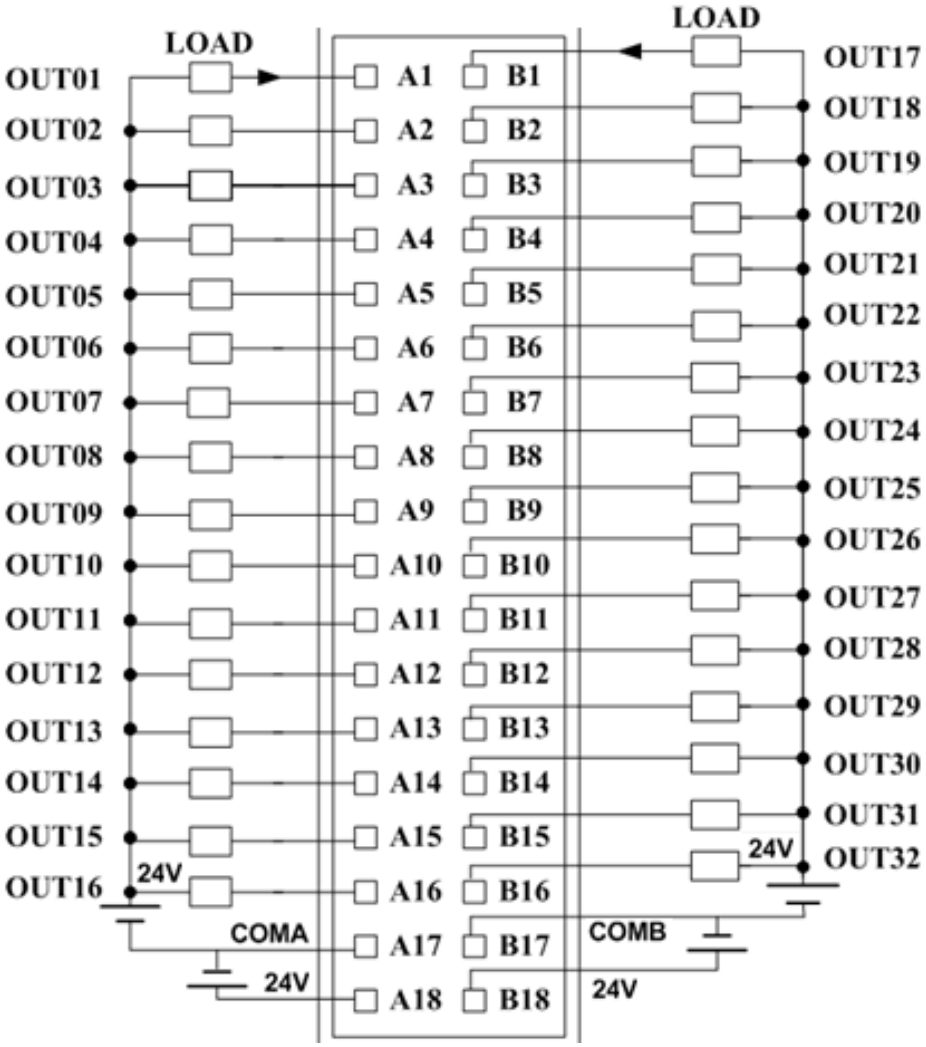


4.3.1.4 Pin assignments

Pin Assigment Name	Terminal No.		Pin Assigment Name
DO_0	A1	B1	DO_16
DO_1	A2	B2	DO_17
DO_2	A3	B3	DO_18
DO_3	A4	B4	DO_19
DO_4	A5	B5	DO_20
DO_5	A6	B6	DO_21
DO_6	A7	B7	DO_22
DO_7	A8	B8	DO_23
DO_8	A9	B9	DO_24
DO_9	A10	B10	DO_25
DO_10	A11	B11	DO_26
DO_11	A12	B12	DO_27
DO_12	A13	B13	DO_28
DO_13	A14	B14	DO_29
DO_14	A15	B15	DO_30
DO_15	A16	B16	DO_31
COM_A	A17	B17	COM_B
COM_A	A18	B18	COM_B
COM_A	A19	B19	COM_B
COM_A	A20	B20	COM_B
Ext. 24V_A	A21	B21	Ext. 24V_B
Ext. 24V_A	A22	B22	Ext. 24V_B
X	A23	B23	X
X	A24	B24	X
BK	A25	B25	BK

4.3.1.5 Terminal Board Wiring

Terminal Board of R-9041 refers to RDB-S05, RDB-D05.



4.4 Analog Input

4.4.1 R-9017C1H

4.4.1.1 Overview

- 8-channel isolated current input
- Over-Range measurement (0~24 mA)
- Built-in HART master interface
- 16 bit A/D Converter
- Channel disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9017C1H is an 8-channel, 16-bit channel-isolated analog current input module with the following features:

- **Current Input Range :** Supports 4 ~ 20mA current input and ±25% over-range measurement.。
- **High Accuracy :** Tolerance ±0.05% FSR to ensure accurate current readings。
- **Sampling Rate :** 100 Hz
- **Channel Isolation :** Complete isolation of electrical signals between channels ensures that channels do not interfere with each other.
- **High/Low Alarm :** Abnormal channel current is alerted immediately to ensure the safety of system operation.
- **Channel Break-Off Detection :** Ensures safe and stable wiring of channels.
- **Channel Loop Power :** Channels can provide 28VDC to simplify equipment wiring.
- **HART Communication :** Built-in HART master communication for accessing HART device information.
- **LED Indicator :** Displays channel abnormal status and module operation status.

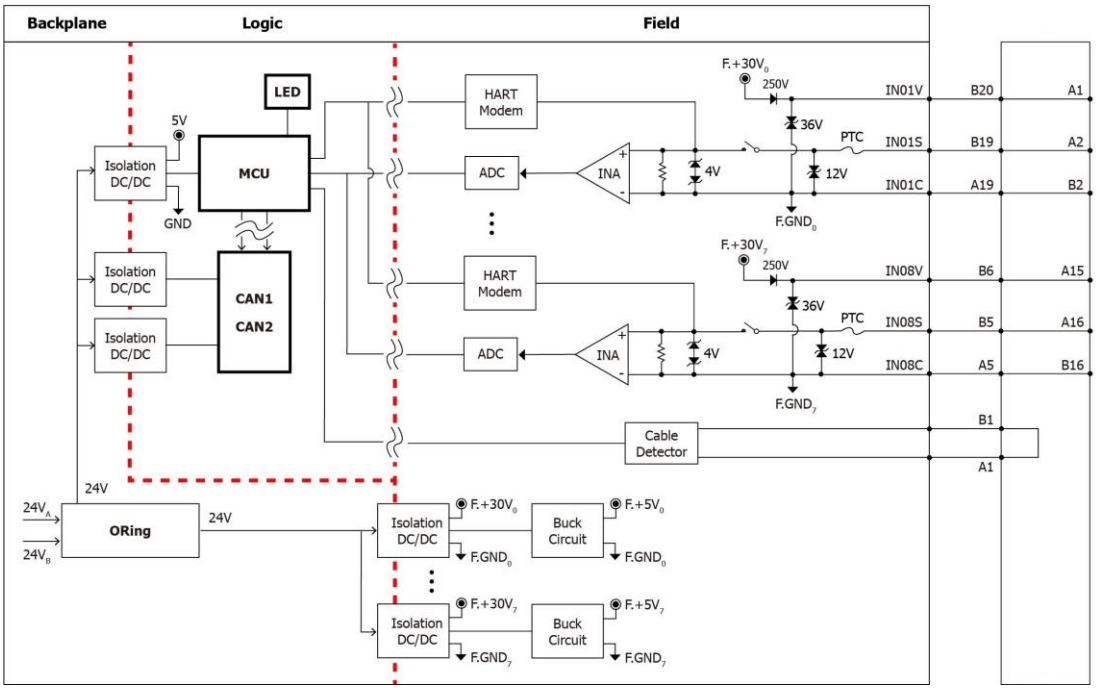
The R-9017C1H module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.4.1.2 Specification

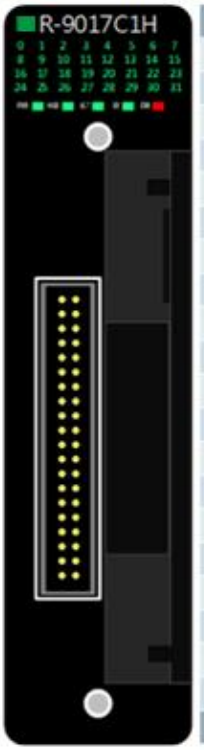
Parameter	Value
Feature	
HART interface	Yes, supports HART master
Redundant	Yes (Switching time < 1ms)
Over-Current Protection	Yes
Termination board disconnection detection	Yes
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	LED 0~7 for CH Hi/Lo alarm LED 16~23 for CH Break Line
Analog Input	
Number of channels	8 (isolation)
Type	4~20 mA (Support ±25% over-range)
Allowable Signal Range	0~24mA
Max. Rated Input	27 mA@24V_{DC}
Resolution	16 bit
Sampling Rate	100 Samples/sec (per channel)
Loop Power	Yes (28~29V_{DC})
Accuracy	±0.05% FSR
Zero Drift	±0.002 LSB/℃
Span Drift	±5 ppm/℃
Common Mode Rejection	86 dB
Normal Mode Rejection	100 dB
Input Impedance	105.3Ω ±1% (Single/Duplex)
Data Range	-2500~12500
Field-to-Backplane isolation	3000V_{DC}
HART	
Mode	Master (Point-to-Point)
Certification	
EMC	EN 61000-6-2 (EMS) / EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
General	
Termination board	RDB-S09 / RDB-D09
Maximum power consumption	4.6 W (0.19A@24V_{DC})
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing

Weight	350 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.4.1.3 Hardware Structure



4.4.1.4 Pin assignments



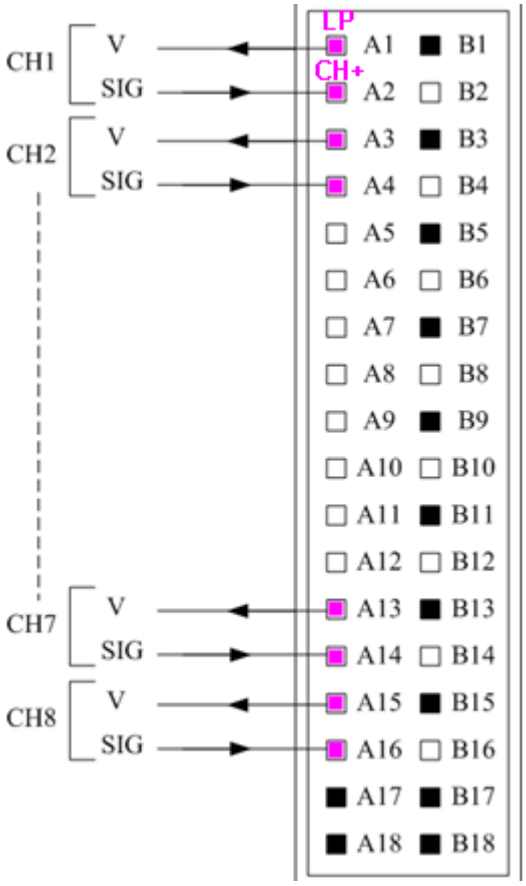
Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01_V (V)	A1	B1	X
IN01_S (S)	A2	B2	IN01_C (0V)
IN02_V (V)	A3	B3	X
IN02_S (S)	A4	B4	IN02_C (0V)
IN03_V (V)	A5	B5	X
IN03_S (S)	A6	B6	IN03_C (0V)
IN04_V (V)	A7	B7	X
IN04_S (S)	A8	B8	IN04_C (0V)
IN05_V (V)	A9	B9	X
IN05_S (S)	A10	B10	IN05_C (0V)
IN06_V (V)	A11	B11	X
IN06_S (S)	A12	B12	IN06_C (0V)
IN07_V (V)	A13	B13	X
IN07_S (S)	A14	B14	IN07_C (0V)
IN08_V (V)	A15	B15	X
IN08_S (S)	A16	B16	IN08_C (0V)
X	A17	B17	X
X	A18	B18	X
X	A19	B19	X
BK	A20	B20	BK

4.4.1.5 Termination Board Wiring

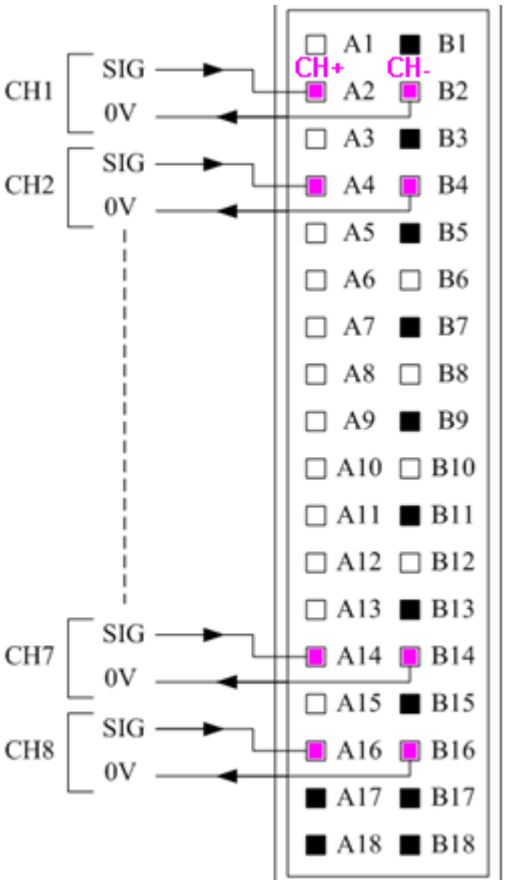
(1) Terminal Board of R-9017C1H refers to RDB-S09 / RDB-D09.

(2) **2-wire device :** The loop power of R-9017C1H is supplied to the transmitter.

(3) **4-wire device :** The Loop power of R-9017C1H is not supplied to the transmitter.



2-wire device



4-wire device

4.4.2 R-9017C2H

4.4.2.1 Overview

- 16 current input channels
- Over-Range measurement (0~24 mA)
- Built-in HART Master interface
- 16 bit A/D Converter
- Channel disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9017C2H is a 16-channel, 16-bit channel-isolated analog current input module with the following features.

- **Current Input Range :** Supports 4 ~ 20mA current input and ±25% over-range measurement.
- **High Accuracy :** Tolerance ±0.05% FSR to ensure accurate current measurement.
- **Sampling Rate :** 10 Hz
- **Channel Isolation :** Complete isolation of electrical signals between channels ensures that channels do not interfere with each other.
- **High/Low Alarm :** Abnormal channel current is alerted immediately to ensure the safety of system operation.
- **Channel Break-Off Detection :** Ensures safe and stable wiring of channels.
- **Channel Loop Power :** Channels can provide 28VDC to simplify equipment wiring.
- **HART Communication :** Built-in HART master communication for accessing HART device information.
- **LED Indicator :** Displays channel abnormal status and module operation status.

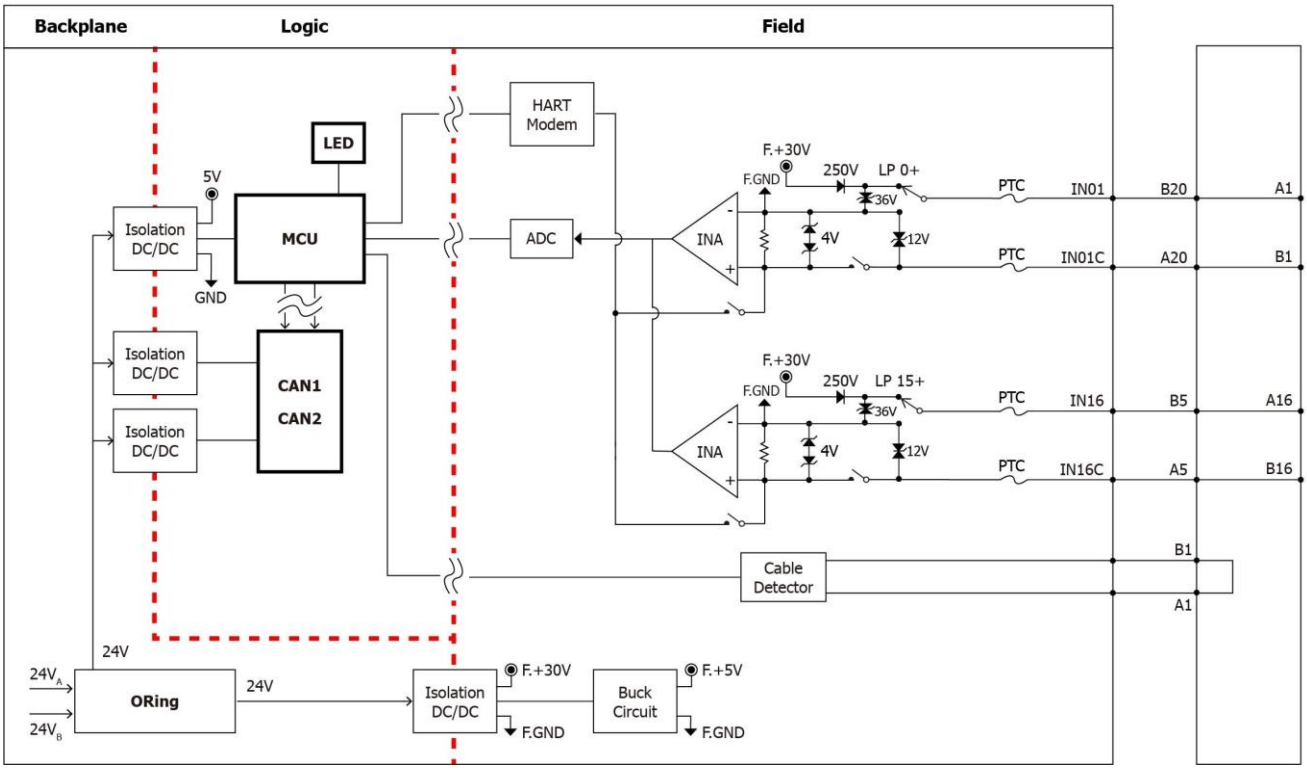
The R-9017C2H module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.4.2.2 Specification

Parameter	Value
Feature	
HART interface	Yes, supports HART master
Redundant	Yes (Switching time < 1ms)
Over-Current Protection	Yes
Termination board disconnection detection	Yes
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	LED 0~15 for CH Hi/Lo alarm LED 16~31 for CH Break Line
Analog Input	
Number of channels	16
Type	4~20 mA (Support ±25% over-range)
Allowable Signal Range	0~24mA
Max. Rated Input	27 mA@24V_{DC}
Resolution	16 bit
Sampling Rate	10 Samples/sec (per channel)
Loop Power	Yes (28~29V_{DC})
Accuracy	±0.05% FSR
Zero Drift	±0.002 LSB/℃
Span Drift	±5 ppm/℃
Common Mode Rejection	86 dB
Normal Mode Rejection	100 dB
Input Impedance	85.3Ω ±1% (Single/Duplex) (2.1V@20mA)
Data Range	-2500~12500
Field-to-Backplane isolation	3000V_{DC}
HART	
Mode	Master (Point-to-Point)
Certification	
EMC	EN 61000-6-2 (EMS) EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
General	
Termination board	RDB-S01 / RDB-D01
Maximum power consumption	2.4 W (0.1A@24V_{DC})
Operating temperature	-25℃ ~ +70℃

Humidity	5 ~ 95 % RH, Non-condensing
Weight	260 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.4.2.3 Hardware Structure



4.4.2.4 Pin assignments

Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01	A1	B1	IN01C
IN02	A2	B2	IN02C
IN03	A3	B3	IN03C
IN04	A4	B4	IN04C
IN05	A5	B5	IN05C
IN06	A6	B6	IN06C
IN07	A7	B7	IN07C
IN08	A8	B8	IN08C
IN09	A9	B9	IN09C
IN10	A10	B10	IN10C
IN11	A11	B11	IN11C
IN12	A12	B12	IN12C
IN13	A13	B13	IN13C
IN14	A14	B14	IN14C
IN15	A15	B15	IN15C
IN16	A16	B16	IN16C
X	A17	B17	X
X	A18	B18	X
X	A19	B19	X
BK	A20	B20	BK

4.4.2.5 Termination Board Wiring

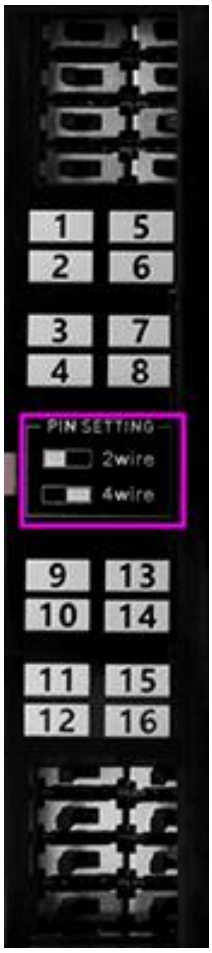
(1) Terminal Board of R-9017C2H refers to RDB-S01 / RDB-D01.

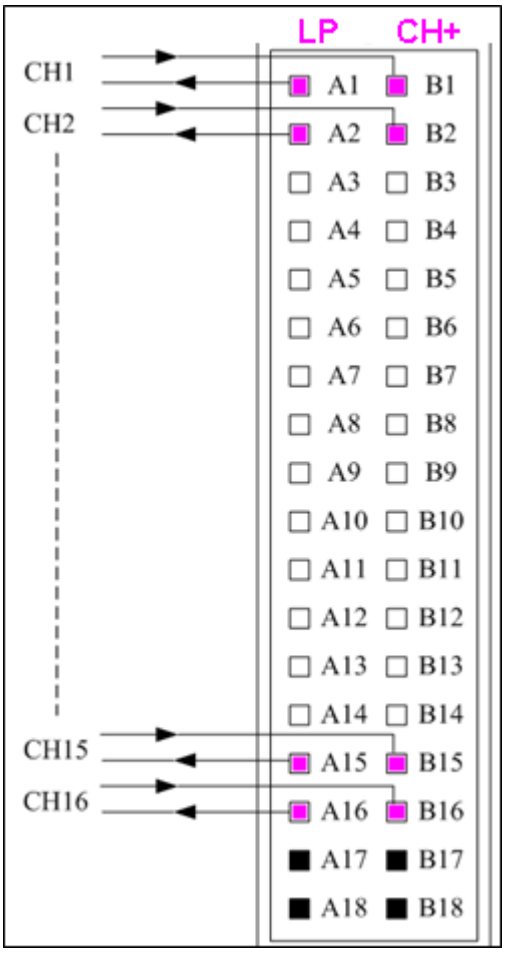
(2) **2-wire device :** The loop power of R-9017C2H is supplied to the transmitter.

<1>The dip switch of the "**PIN SETTING**" should be set to be the **"2 wire"** side.

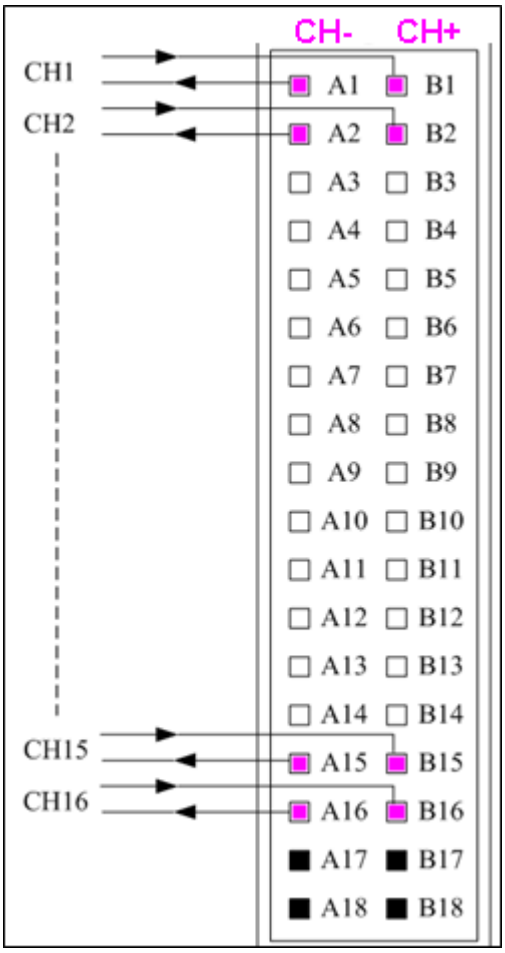
(3) **4-wire device :** The loop power of R-9017C2H is not supplied to the transmitter.

<1>The dip switch of the "**PIN SETTING**" should be set to be the **"4 wire"** side.





2-wire device



4-wire device

4.4.3 R-9015

4.4.3.1 Overview

- 12 RTD input channels
- User-defined measurement range scaling
- 16 bit A/D converter
- Channel disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9015 is a 12-channel, 16-bit RTD temperature measurement module with the following features:

- **Supports Multiple RTD Sensors:** PT-100, JPT-100 and PT-1000 temperature sensors.
- **High Accuracy:** Tolerance ±0.05% FSR to ensure accurate temperature measurement.
- **High/low Alarm:** Abnormal channel temperature is alerted immediately to ensure the safety of system operation.
- **Measurement Range & Temperature Offset:** Different measurement ranges and temperature offsets can be set according to application requirements to enhance the accuracy and reliability of the measurement results.
- **Channel Break-Off Detection:** Ensures safe and stable wiring of the channel.
- **LED Indicator:** Displays channel abnormal status and module operation status.

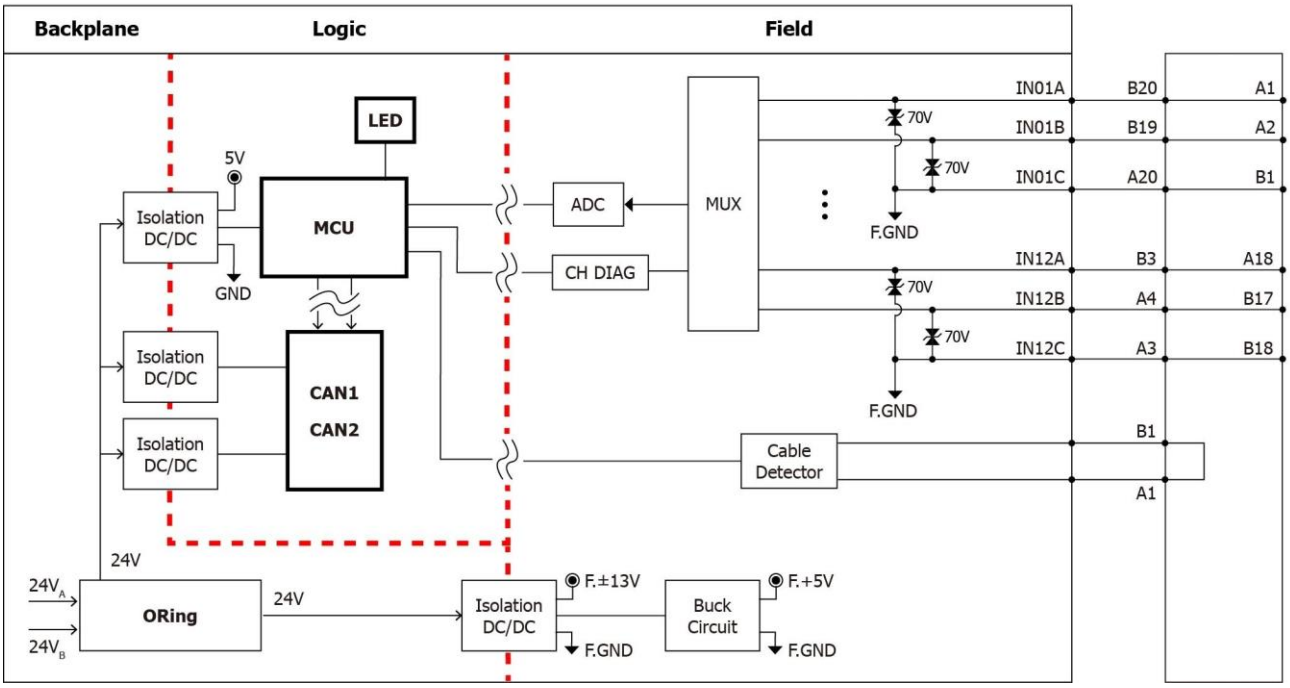
The R-9015 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.4.3.2 Specification

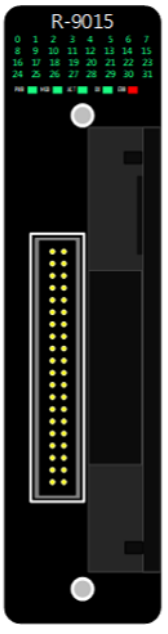
Parameter	Value	
Feature		
Redundant	Yes (Switching time < 1ms)	
Over Voltage Protection	Yes	
Termination board disconnection detection	Yes	
Open Wire Detection	Yes	
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR	
	LED 0~11 for CH Hi/Lo alarm LED 16~27 for CH Break Line	
RTD Input		
Number of channels	12 (Non-isolation)	
Wiring	3 Wire	
Type	Pt-100	IEC 60751 ITS90 (0.03851 Ω/Ω/℃)
	JPt-100	JIS C 1604 (0.03916 Ω/Ω/℃)
	Pt-1000	IEC 60751 ITS90 (0.03851 Ω/Ω/℃)
Temperature Range	Pt100	-200 ~ +850℃ (0~10000)
	JPt-100 ,Pt1000	-200 ~ +630℃ (0~10000)
Resolution	16 bit	
Sampling Rate	1 Samples/sec (per)	
Accuracy	±0.05% FSR	
Zero Drift	±0.5 μV/℃	
Span Drift	±20 μV/℃	
Common Mode Rejection	106 dB	
Normal Mode Rejection	100 dB	
Input Impedance	20 MΩ (10M+10M, between CH+/-)	
Data Range	-2500~12500	
Field-to-Backplane isolation	3000V_{DC}	
Certification		
EMC	EN 61000-6-2 (EMS) EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)	
General		
Termination board	RDB-S03 / RDB-D03	
Maximum power consumption	2 W (0.08A@24V_{DC})	

Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	200 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.4.3.3 Hardware Structure



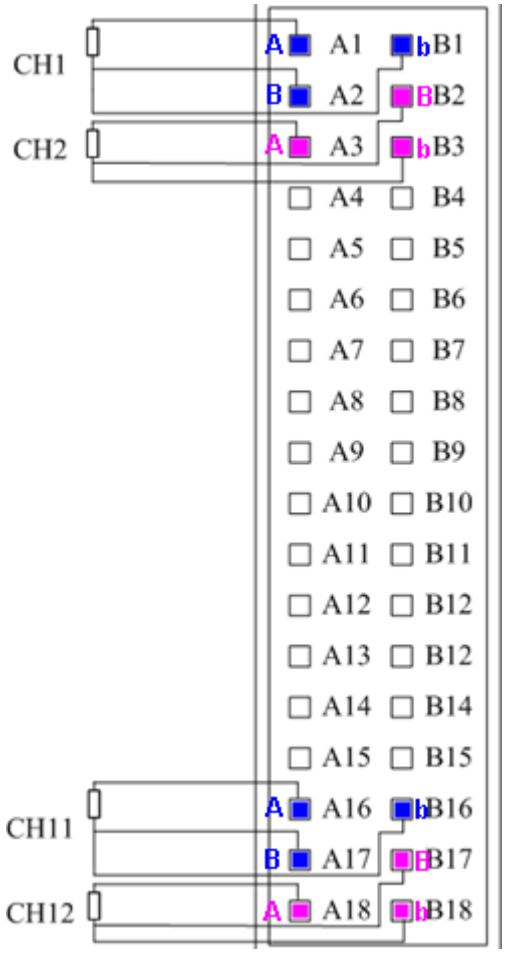
4.4.3.4 Pin assignments



Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01A	A1	B1	IN01C
IN01B	A2	B2	IN02B
IN02A	A3	B3	IN02C
IN03A	A4	B4	IN03C
IN03B	A5	B5	IN04B
IN04A	A6	B6	IN04C
IN05A	A7	B7	IN05C
IN05B	A8	B8	IN06B
IN06A	A9	B9	IN06C
IN07A	A10	B10	IN07C
IN07B	A11	B11	IN08B
IN08A	A12	B12	IN08C
IN09A	A13	B13	IN09C
IN09B	A14	B14	IN10B
IN10A	A15	B15	IN10C
IN11A	A16	B16	IN11C
IN11B	A17	B17	IN12B
IN12A	A18	B18	IN12C
X	A19	B19	X
BK	A20	B20	BK

4.4.3.5 Termination Board Wiring

(1) Terminal Board of R-9015 refers to RDB-S03 / RDB-D03.



4.4.4 R-9019

4.4.4.1 Overview

- 16 thermocouple input channels
- User-defined measurement range scaling
- 16 bit A/D Converter
- Channel disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9019 is a highly accurate 16-channel, 16-bit thermocouple temperature measurement module with the following features:

- **Supports Multiple Sensors:** J, K, T, E, R, S, B, N, C thermocouple temperature sensors.
- **High Accuracy:** Tolerance ±0.05% FSR to ensure accurate temperature measurement.
- **High/Low Alarm:** Abnormal channel temperature is alerted immediately to ensure the safety of system operation.
- **Temperature Measurement Range:** Different measurement ranges can be set according to application requirements.
- **Channel Break-Off Detection:** Ensures safe and stable wiring of the channel.
- **LED Indicator:** Displays channel abnormal status and module operation status.

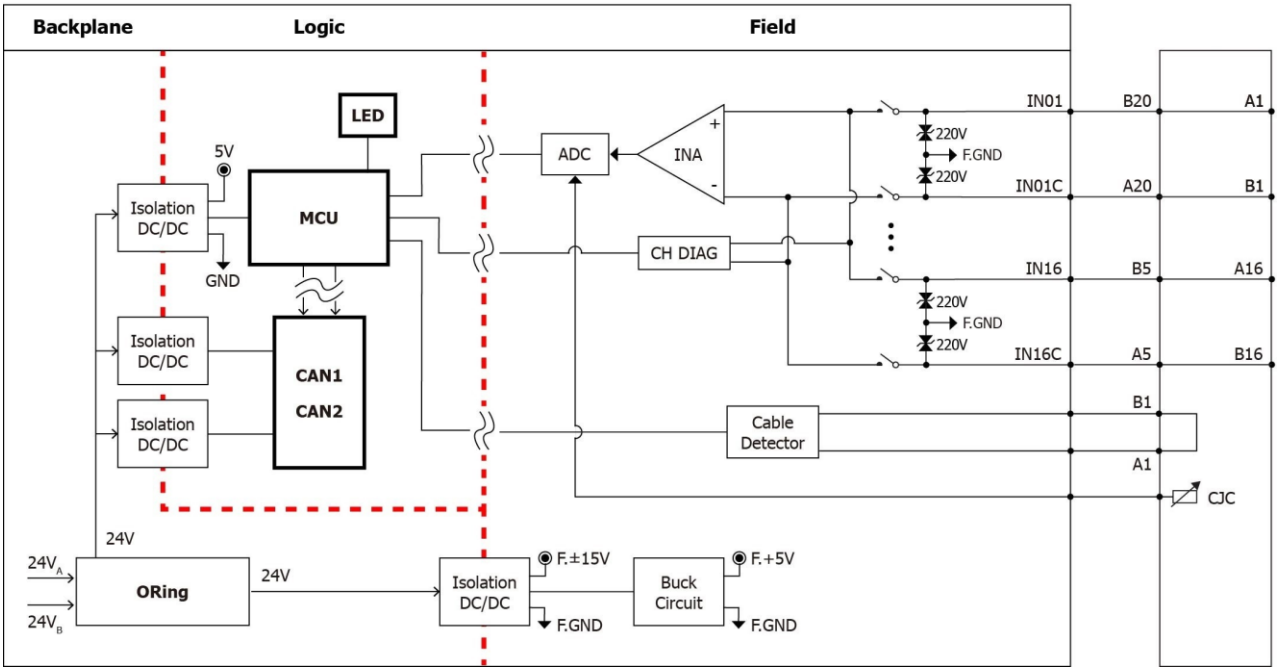
The R-9019 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.4.4.2 Specification

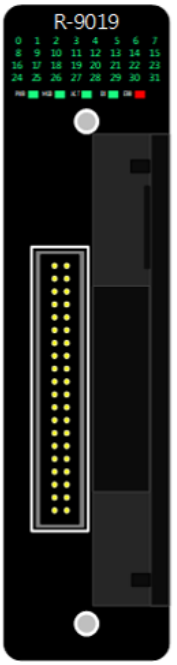
Parameter	Value	
Feature		
Redundant	Yes (Switching time < 1ms)	
Over Voltage Protection	Yes	
Termination board disconnection detection	Yes	
Open Wire Detection	Yes	
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR	
	LED 0~15 for CH Hi/Lo alarm LED 16~31 for CH Break Line	
Thermocouple Input		
Number of channels	16	
Type	Type J, K, T, E, R, S, B, N, C	
Temperature Range	J	-210 ~ +1200 ℃
	K	-270 ~ +1372 ℃
	T	-270 ~ +400 ℃
	E	-270 ~ +1000 ℃
	R	-50 ~ +1765 ℃
	S	-50 ~ +1765 ℃
	B	0 ~ +1820 ℃
	N	-270 ~ +1300 ℃
	C	0 ~ +2320 ℃
Resolution	16 bit	
Sampling Rate	1 Samples/sec (Total)	
Accuracy	±0.05% FSR (CJC<0.5℃)	
Zero Drift	±20 μV/℃	
Span Drift	±25 μV/℃	
Common Mode Rejection	106 dB	
Normal Mode Rejection	100 dB	
Input Impedance	20 MΩ (10M+10M, between CH+/-)	
Data Range	-2500~12500	
Field-to-Backplane isolation	$3000V_{DC}$	
Certification		
EMC	EN 61000-6-2 (EMS) / EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)	
General		

Termination board	RDB-S02 / RDB-D02
Maximum power consumption	2.2 W (0.09A@24V_{DC})
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	200 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.4.4.3 Hardware Structure



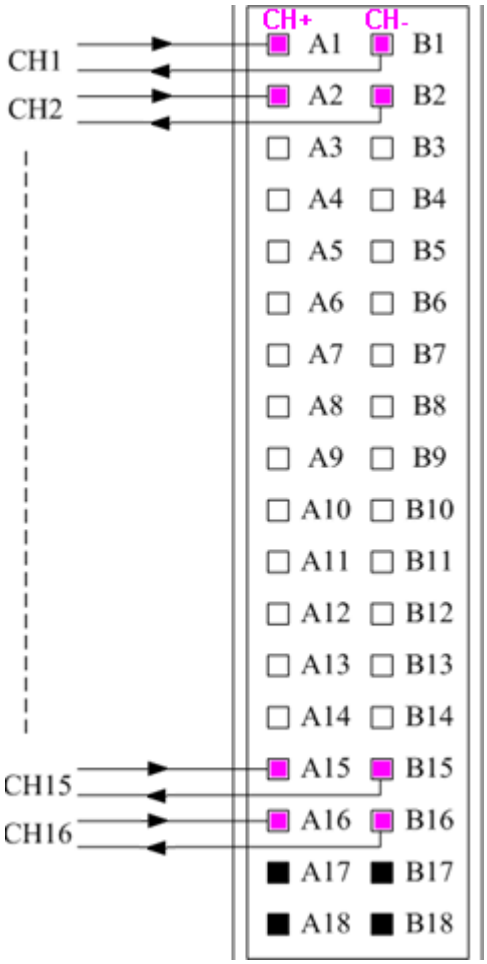
4.4.4.4 Pin assignments



Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01	A1	B1	IN01C
IN02	A2	B2	IN02C
IN03	A3	B3	IN03C
IN04	A4	B4	IN04C
IN05	A5	B5	IN05C
IN06	A6	B6	IN06C
IN07	A7	B7	IN07C
IN08	A8	B8	IN08C
IN09	A9	B9	IN09C
IN10	A10	B10	IN10C
IN11	A11	B11	IN11C
IN12	A12	B12	IN12C
IN13	A13	B13	IN13C
IN14	A14	B14	IN14C
IN15	A15	B15	IN15C
IN16	A16	B16	IN16C
CJC	A17	B17	CJC
CJC	A18	B18	AGND
CJC	A19	B19	X
BK	A20	B20	BK

4.4.4.5 Termination Board Wiring

(1) Terminal Board of R-9019 refers to RDB-S02 / RDB-D02.



4.5 Analog Output

4.5.1 R-9028V1

4.5.1.1 Overview

- 8 voltage output channels
- Power-on value & Safety value
- 16 bit D/A Converter
- Channel short-circuit protection and disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9028V1 is a high-precision 8-channel, 16-bit channel-isolated voltage output module with the following features.

- **Voltage Output Range:** 1 ~ 5V or -10V ~ +10V.
- **High Accuracy:** Tolerance ±0.05% FSR to ensure accurate voltage output.
- **Power-on value and safety value:** Ensures that the module outputs a predefined voltage during startup or abnormal conditions.
- **Channel Isolation:** Complete isolation of electrical signals between channels ensures that channels do not interfere with each other.
- **Channel short-circuit protection and disconnection detection:** Ensures safe and stable wiring of the channel.
- **LED Indicator:** Displays channel abnormal status and module operation status.

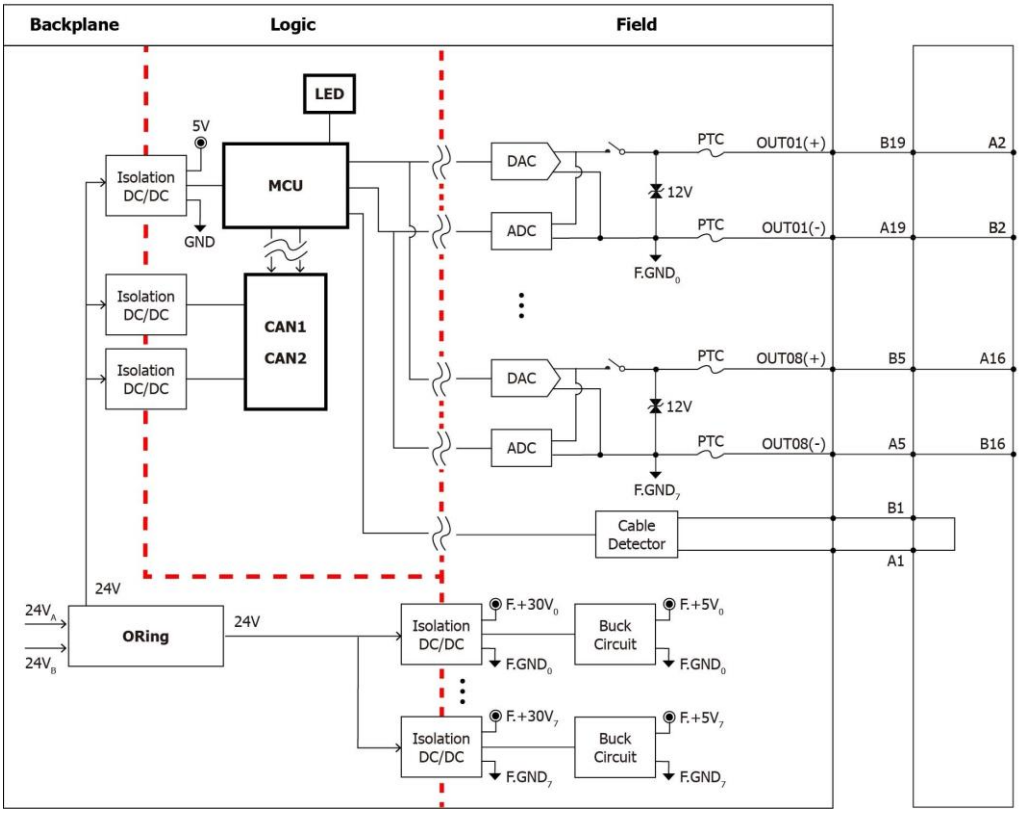
The R-9028V1 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

4.5.1.2 Specification

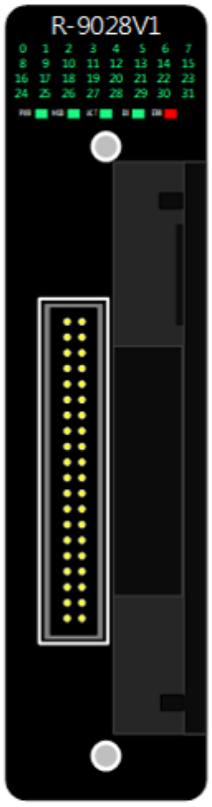
Parameter	Value	
Feature		
Redundant	Yes (Switching time < 1 ms)	
Termination board disconnection detection	Yes	
Power-On Value	Yes	
Safety Value	Yes	
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR	
	LED 0~7 for CH Hi/Lo alarm	
Analog Output		
Number of channels	8 (isolation)	
Type	1 ~ 5 V, ±10 V	
Maximum Allowable Output Range	1 ~ 5 V	+20% (0 ~ 6 V_{DC})
	±10 V	±20% (±12V_{DC})
Resolution	16 bit	
Accuracy	±0.05% FSR	
Zero Drift	±4 ppm/℃	
Span Drift	±3 ppm/℃	
Min. Load Resistance	10 KΩ	
Data Range	-2500~12500	
Field-to-Logic isolation	3000V_{DC}	
Certification		
EMC	EN 61000-6-2 (EMS) EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)	
General		
Termination board	RDB-S09 / RDB-D09	
Maximum power consumption	6.3W (0.26A@24V_{DC})	
Operating temperature	-25℃ ~ +70℃	
Humidity	5 ~ 95 % RH, Non-condensing	
Weight	270 g	
Dimensions (W x L x H)	33 x 129 x 130 mm	

1. The power consumption depends on the load.

4.5.1.3 Hardware Structure



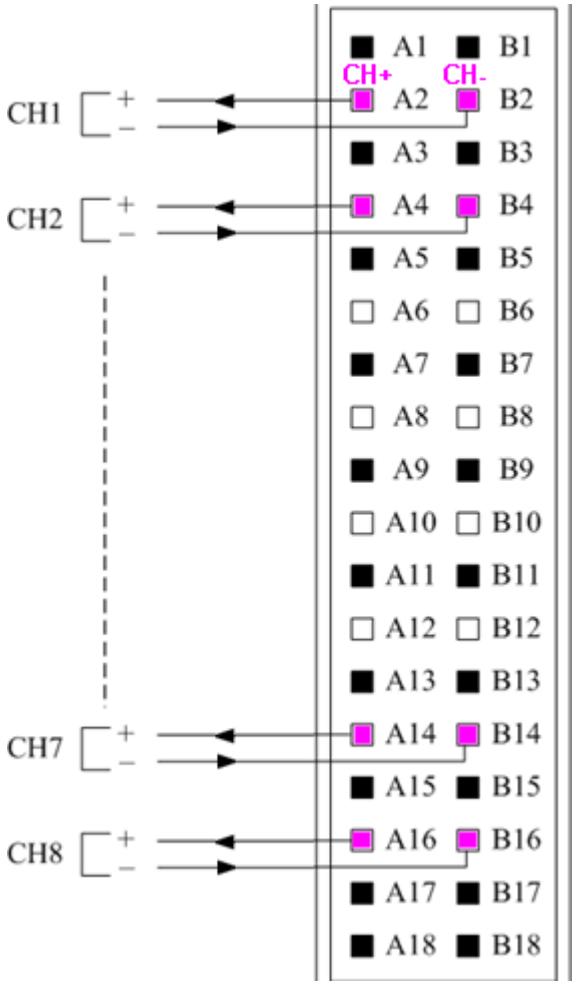
4.5.1.4 Pin assignments



Pin Assigment Name	Terminal No.		Pin Assigment Name
X	A1	B1	X
OUT01(+)	A2	B2	OUT01(-)
X	A3	B3	X
OUT02(+)	A4	B4	OUT02(-)
X	A5	B5	X
OUT03(+)	A6	B6	OUT03(-)
X	A7	B7	X
OUT04(+)	A8	B8	OUT04(-)
X	A9	B9	X
OUT05(+)	A10	B10	OUT05(-)
X	A11	B11	X
OUT06(+)	A12	B12	OUT06(-)
X	A13	B13	X
OUT07(+)	A14	B14	OUT07(-)
X	A15	B15	X
OUT08(+)	A16	B16	OUT08(-)
X	A17	B17	X
X	A18	B18	X
X	A19	B19	X
BK	A20	B20	BK

4.5.1.5 Termination Board Wiring

(1) Terminal Board of R-9028V1 refers to RDB-S09 / RDB-D09.



4.5.2 R-9028CH

4.5.2.1 Overview

- 8 current output channels
- Power-on value & Safety value
- Built-in HART master interface
- 16 bit D/A Converter
- Channel disconnection detection
- Termination board disconnection detection
- Redundant switching time (< 1 ms)
- Supports automatic detection of output current accuracy

The R-9028CH is a high-precision 8-channel, 16-bit channel-isolated current output module with the following features:

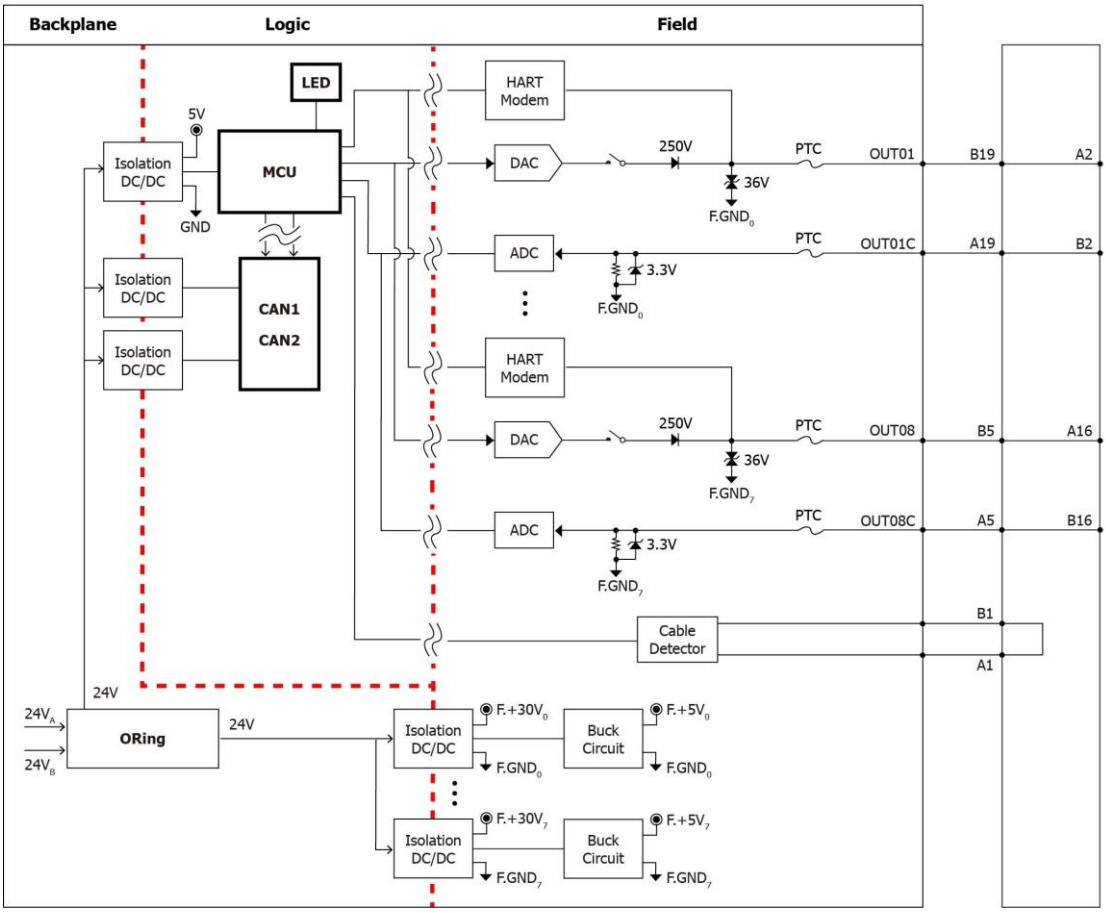
- **Current Output Range:** 4 ~20mA current output (Source Type)
- **High Accuracy:** Tolerance ±0.05% FSR to ensure accurate current output.
- **Power-on value & Safety value:** Ensures that the module outputs a predefined current during startup or abnormal conditions.
- **Channel Isolation:** The electrical signals between channels are completely isolated to ensure that the channels do not interfere with each other.
- **Channel Disconnection Detection:** Ensure the safety and stability of channel wiring.
- **HART Communications:** Built-in HART master communication for accessing HART device information.
- **LED Indicator:** Displays channel abnormal status and module operation status.

The R-9028CH module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

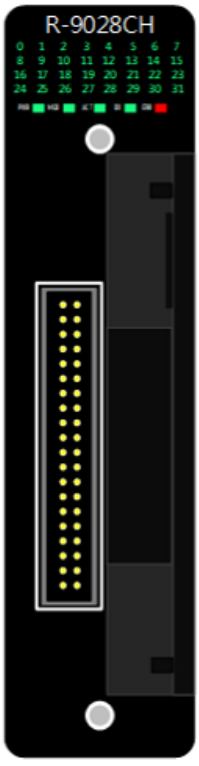
4.5.2.2 Specification

Parameter	Value
Feature	
HART interface	Yes, supports HART master
Redundant	Yes (Switching time < 1 ms)
Termination board disconnection detection	Yes
Open Wire Detection	Yes
Power-On Value	Yes
Safety Value	Yes
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	LED 0~7 for CH Hi/Lo alarm LED 16~23 for CH Break Line
Analog Output	
Number of channels	8 (isolation)
Type	4 ~ 20 mA (EU 0~1000)
Maximum Allowable Output Range	0 ~ 24 mA (EU -2500~12500)
Resolution	16 bit
Accuracy	±0.05% FSR
Zero Drift	±1.5 ppm/℃
Span Drift	±3 ppm/℃
Load Resistance	<1K Ω
Data Range	-2500~12500
Field-to-Logic isolation	3000V_{DC}
HART	
Channel	1, Multiplexer Switchable
Mode	Master (Point-to-Point)
Certification	
EMC	EN 61000-6-2 (EMS) / EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
General	
Termination board	RDB-S09 / RDB-D09
Maximum power consumption	5.6W (0.23A@24V_{DC})
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	360 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.5.2.3 Hardware Structure



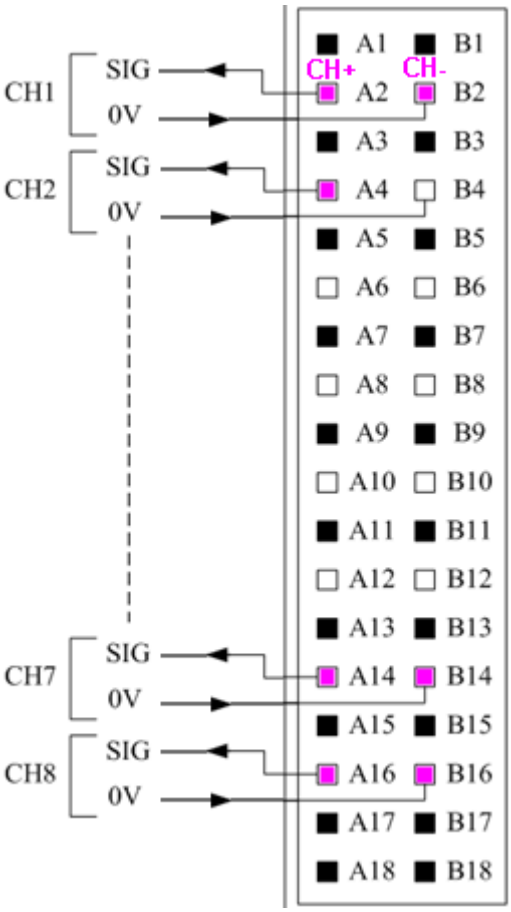
4.5.2.4 Pin assignments



Pin Assigment Name	Terminal No.		Pin Assigment Name
X	A1	B1	X
OUT01	A2	B2	OUT01C
X	A3	B3	X
OUT02	A4	B4	OUT02C
X	A5	B5	X
OUT03	A6	B6	OUT03C
X	A7	B7	X
OUT04	A8	B8	OUT04C
X	A9	B9	X
OUT05	A10	B10	OUT05C
X	A11	B11	X
OUT06	A12	B12	OUT06C
X	A13	B13	X
OUT07	A14	B14	OUT07C
X	A15	B15	X
OUT08	A16	B16	OUT08C
X	A17	B17	X
X	A18	B18	X
X	A19	B19	X
BK	A20	B20	BK

4.5.2.5 Termination Board Wiring

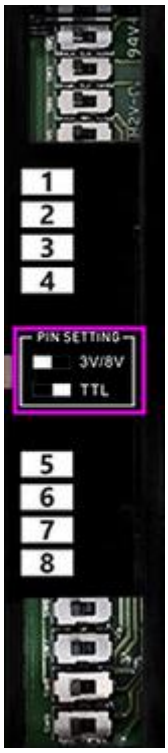
(1) Terminal Board of R-9028CH refers to RDB-S09 / RDB-D09.



4.6 Pulse Input

4.6.1 R-9084

4.6.1.1 Overview



- 32-bit counter
- 8 up-counter/frequency channels
- 1 ~ 32767 us digital filter
- Falling/Rising/Both edge trigger
- Termination board disconnection detection
- Redundant switching time (< 1 ms)

The R-9084 is an 8-channel, 32-bit high-speed counter and frequency measurement module with the following features:

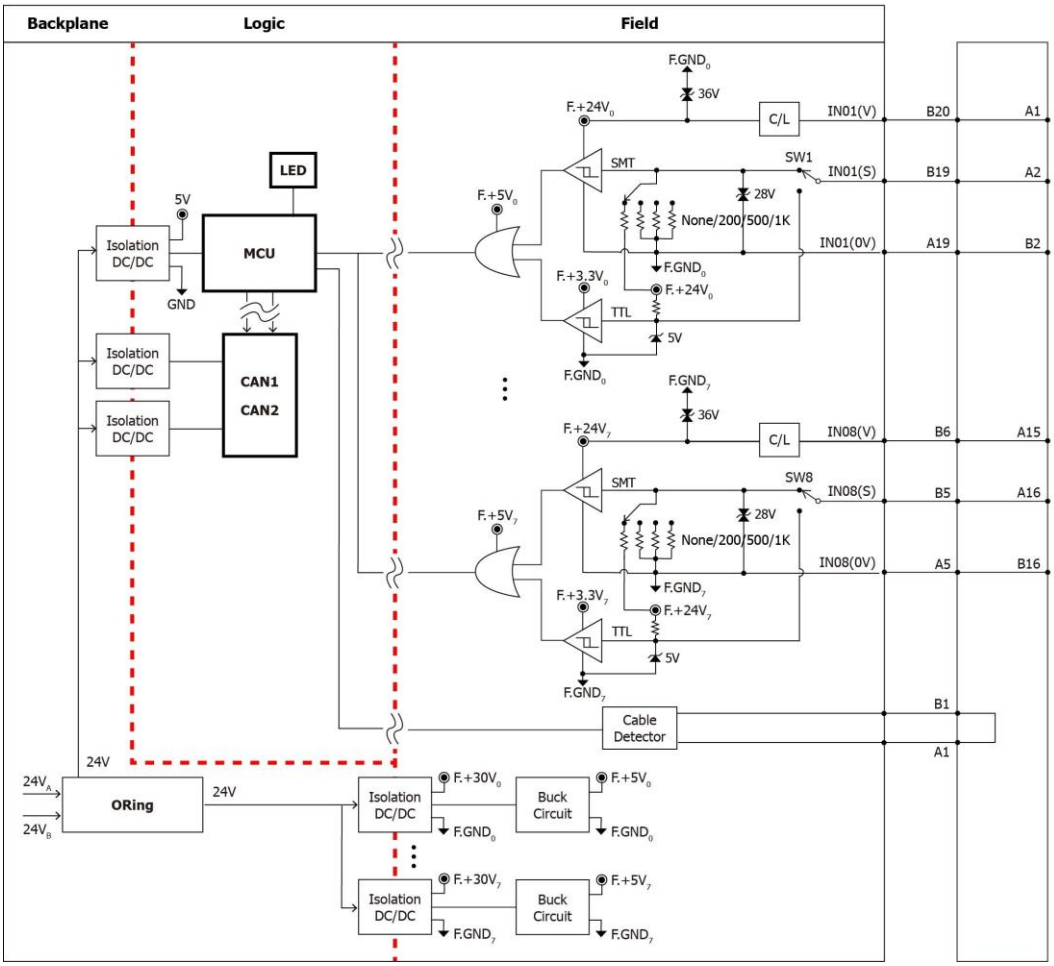
- **Input Signal Type:** Support **$3V_{DC}$/$8V_{DC}$ Schmitt** or **TTL (0.8V/2.0V)** voltage level trig and the dip switch of the "**PIN SETTING**" is used for the configuration.
- **Low-pass Filter:** Solves the problem of bouncing of the pulse input signal and ensures the stability of the input signal.
- **Measurement Frequency Range:** 1Hz ~ 10 KHz
- **Channel Isolation:** Complete isolation of electrical signals between channels ensures that channels do not interfere with each other.
- **LED Indicator:** Displays channel abnormal status and module operation status.

The R-9084 module must be used with a terminal board to connect external signals and supports a terminal board disconnection detection mechanism to ensure wiring stability. It features a 3000 VDC isolation design, providing robust noise immunity between the backplane and external signals, making it highly suitable for industrial environments. Additionally, the module supports a redundancy design, allowing the system to continue stable operation even if a single I/O module fails, further enhancing system reliability.

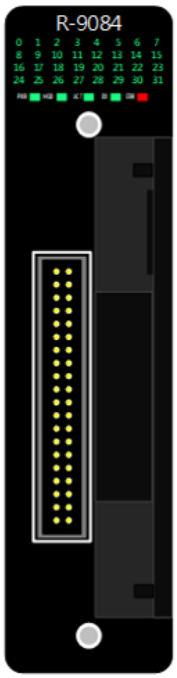
4.6.1.2 Specification

Parameter	Value
Feature	
Redundant	Yes (Switching time < 1 ms) (The counting error less than 1 counter)
Termination board disconnection detection	Yes
Digital filter	Yes (1~32767us) (default: off)
LED indicator	1 PWR, 1 MOD, 1 ACT, 1 DX, 1 ERR
	8 channel status
Pulse Input	
Number of channels	8 (isolation)
Type	CH+/CH-: $3V_{DC}/8V_{DC}$ Level with Schmitt trigger TTL/CH-: TTL Level trigger
Digital filter	Yes (1~32767us, default is off)
Input signal level (Schmitt) between CH+ and CH-	V_H (high level): from $8V_{DC}$ to $30V_{DC}$ V_L (low level): less than $3V_{DC}$
Input signal level (TTL) between TTL+ and CH-	V_H (high level): larger than $2V_{DC}$ V_L (low level): less than $0.8V_{DC}$
Input impedance	200/500/1KΩ or None
Maximum input current	24mA @ $24V_{DC}$、30mA @ $30V_{DC}$ (Input impedance: 1K)
Pulse edge	Up / Down edge trigger
Loop power	LP / CH- voltage: 27~$28V_{DC}$ (<27mA/CH.)
Input frequency range	1 Hz ~ 10 KHz
Input reaction time	<3 ms
Field-to-Logic Isolation	$3000V_{DC}$
Certification	
EMC	EN 61000-6-2 (EMS) / EN 61000-6-4 (EMI) IEC/EN 61000-4-2 (ESD) IEC/EN 61000-4-4 (EFT)
General	
Termination board	RDB-S09 / RDB-D09
Maximum power consumption	6.8W (0.28A@$24V_{DC}$)
Operating temperature	-25℃ ~ +70℃
Humidity	5 ~ 95 % RH, Non-condensing
Weight	360 g
Dimensions (W x L x H)	33 x 129 x 130 mm

4.6.1.3 Hardware Structure



4.6.1.4 Pin assignments

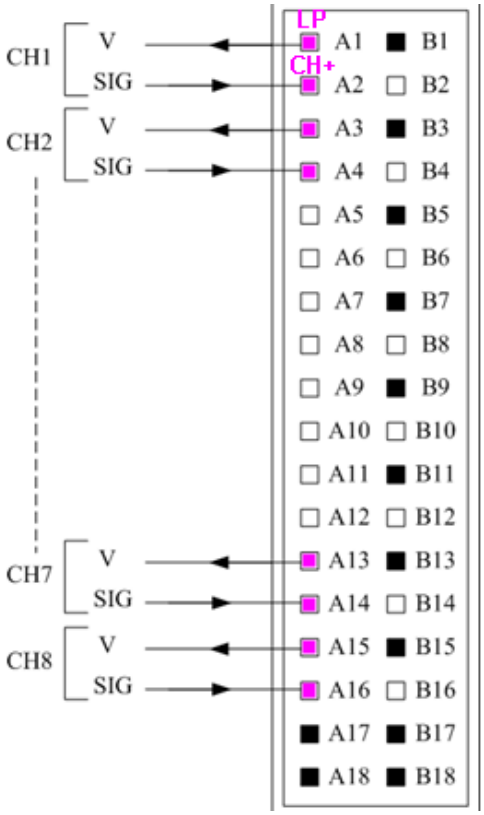


Pin Assigment Name	Terminal No.		Pin Assigment Name
IN01(V)	A1	B1	X
IN01(S)	A2	B2	IN01(0V)
IN02(V)	A3	B3	X
IN02(S)	A4	B4	IN02(0V)
IN03(V)	A5	B5	X
IN03(S)	A6	B6	IN03(0V)
IN04V)	A7	B7	X
IN04(S)	A8	B8	IN04(0V)
IN05(V)	A9	B9	X
IN05(S)	A10	B10	IN05(0V)
IN06(V)	A11	B11	X
IN06(S)	A12	B12	IN06(0V)
IN07(V)	A13	B13	X
IN07(S)	A14	B14	IN07(0V)
IN08(V)	A15	B15	X
IN08(S)	A16	B16	IN08(0V)
X	A17	B17	X
X	A18	B18	X
X	A19	B19	X
BK	A20	B20	BK

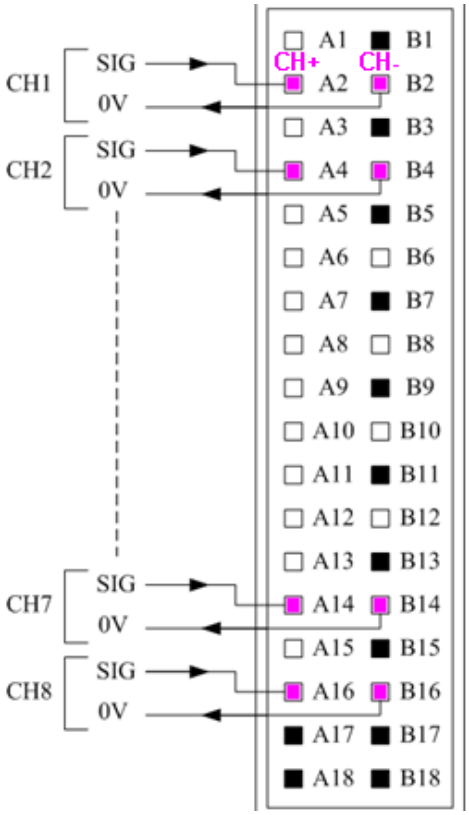
4.6.1.5 Termination Board Wiring

(1) Terminal Board of R-9084 refers to RDB-S09 / RDB-D09.

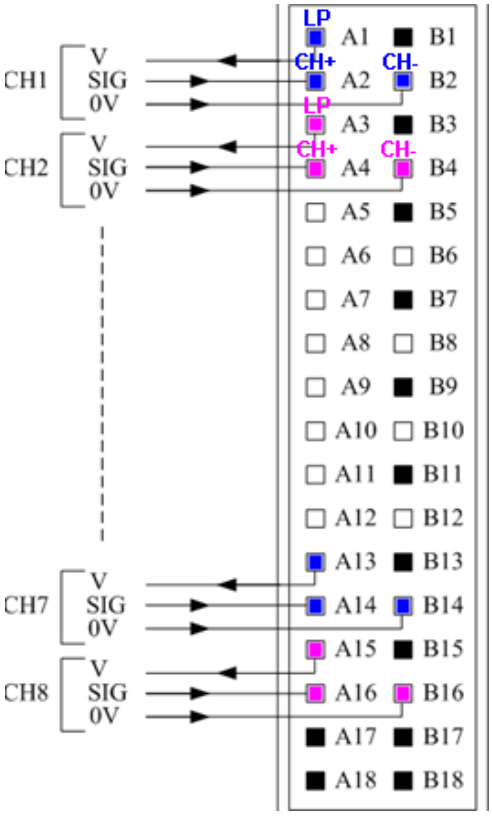
(2) **2-wire & 3-wire device :** The loop power of R-9084 is supplied to the device.



Voltage Pulse Signal (2-wire system)



Current Pulse Signal



Voltage Pulse Signal (3-wire system)

Section 5 Termination Board

5.1 Digital Input

5.1.1 RDB-S08 / RDB-D08

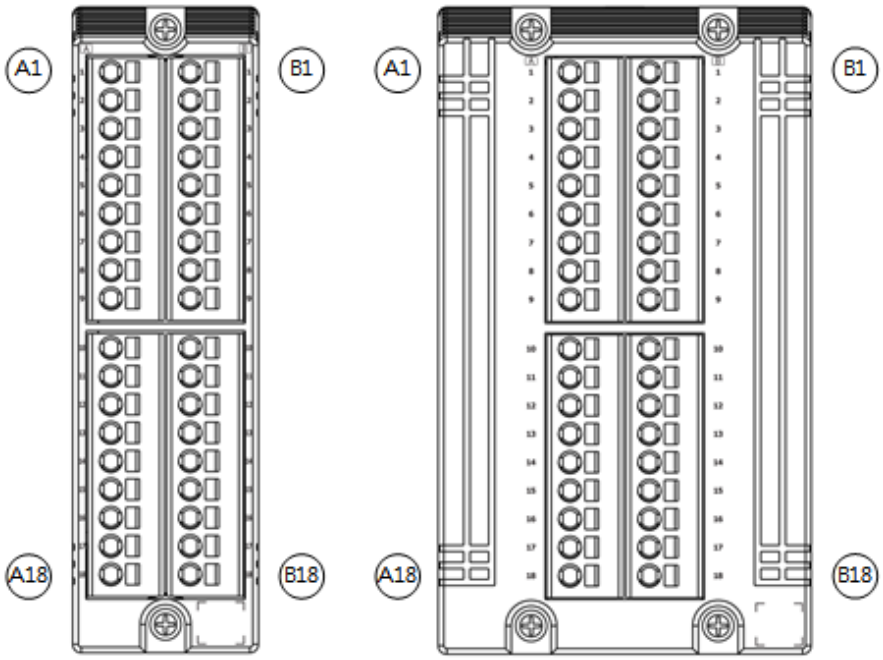
5.1.1.1 Overview

RDB-S08 is a terminal board for single digital input module (DI) and **RDB-D08** is a terminal board for duplex digital input module (DI). They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S08 or RDB-D08 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.1.1.2 Specification

Digital Input		
Model	RDB-S08	RDB-D08
Mode	Single	Duplex
Type	P-COM(Source) or N-COM(Sink), Single-Ended	
Channel	32	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

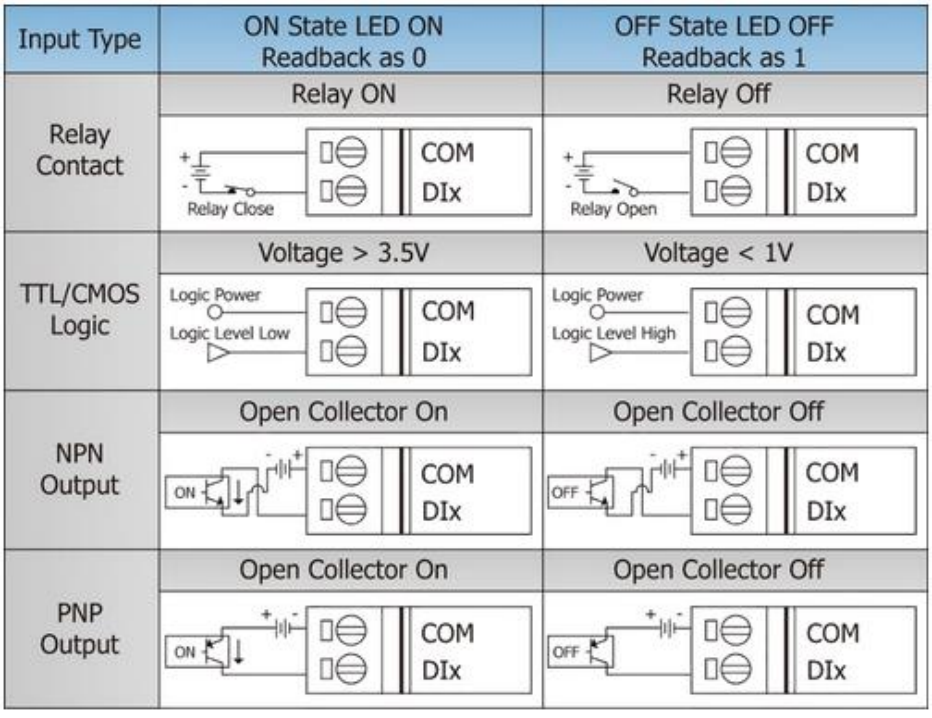
5.1.1.3 Pin assignment



A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
DI0	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	DI9	DI10	DI11	DI12	DI13	DI14	DI15	COMA	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
DI16	DI17	DI18	DI19	DI20	DI21	DI22	DI23	DI24	DI25	DI26	DI27	DI28	DI29	DI30	DI31	COMB	N/A

5.1.1.4 Wiring

- Wet contact (Current sinking / sourcing)



5.2 Digital Output

5.2.1 RDB-S05 / RDB-D05

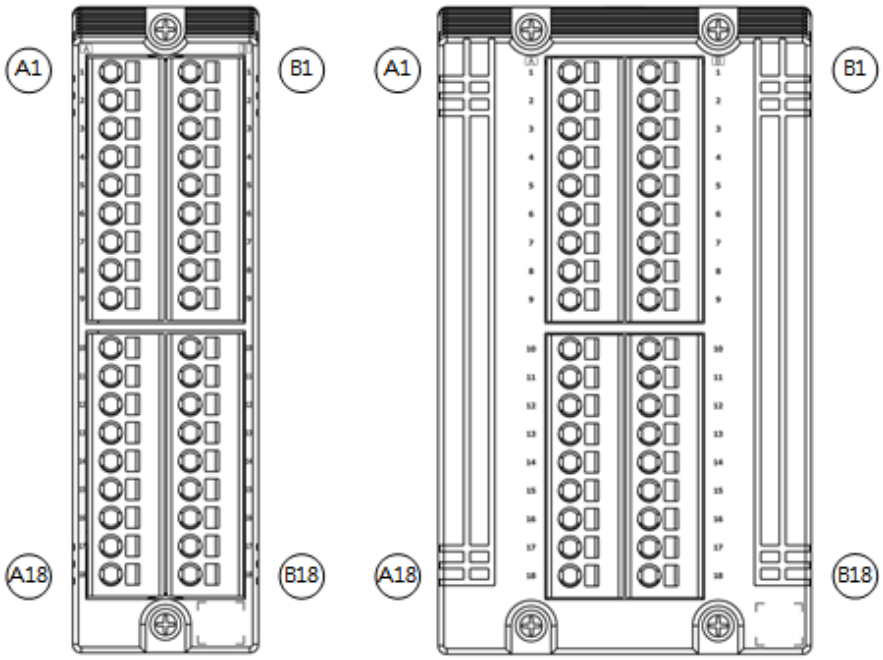
5.2.1.1 Overview

RDB-S05 is a termination board for single digital output module (DO) and **RDB-D05** is a terminal board for duplex digital output module (DO). They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S05 or RDB-D05 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.2.1.2 Specification

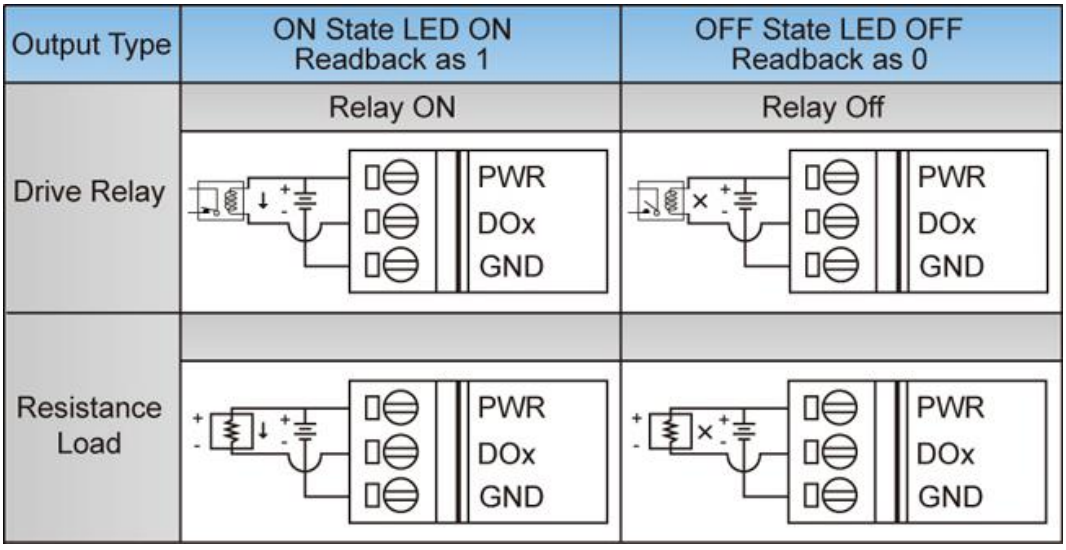
Digital Output		
Model	RDB-S05	RDB-D05
Mode	Single	Duplex
Type	Current sinking, Open-collector	
Channel	32	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.2.1.3 Pin assignment



A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
DO0	DO1	DO2	DO3	DO4	DO5	DO6	DO7	DO8	DO9	DO10	DO11	DO12	DO13	DO14	DO15	COMA	PWRA
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
DO16	DO17	DO18	DO19	DO20	DO21	DO22	DO23	DO24	DO25	DO26	DO27	DO28	DO29	DO30	DO31	COMB	PWRB

5.2.1.4 Wiring



5.3 Analog Input

5.3.1 RDB-S01 / RDB-D01 (Analog Input)

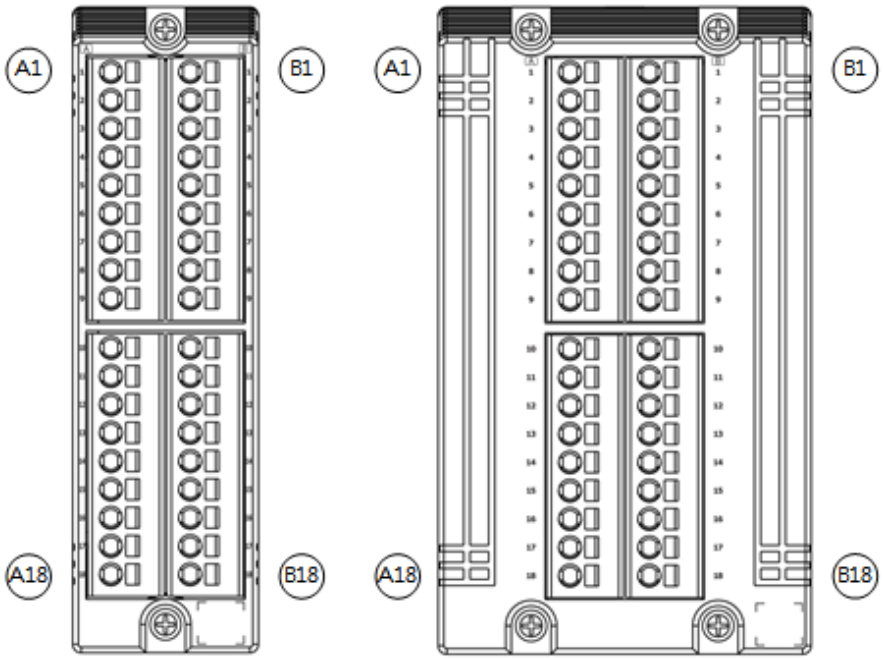
5.3.1.1 Overview

RDB-S01 is a terminal board for single non-isolated analog current/voltage module and **RDB-D01** is a terminal board for duplex non-isolated analog current/voltage module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S01 or RDB-D01 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.3.1.2 Specification

Analog Input		
Model	RDB-S01	RDB-D01
Mode	Single	Duplex
Channel	16	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.3.1.3 Pin assignment



R-9017C2H

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
CH0-	CH1-	CH2-	CH3-	CH4-	CH5-	CH6-	CH7-	CH8-	CH9-	CH10-	CH11-	CH12-	CH13-	CH14-	CH15-	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
CH0+	CH1+	CH2+	CH3+	CH4+	CH5+	CH6+	CH7+	CH8+	CH9+	CH10+	CH11+	CH12+	CH13+	CH14+	CH15+	N/A	N/A

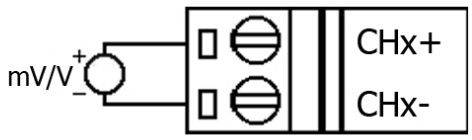
R-9017V2

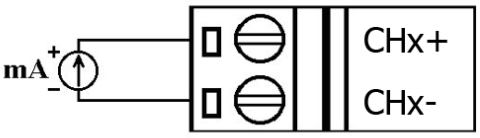
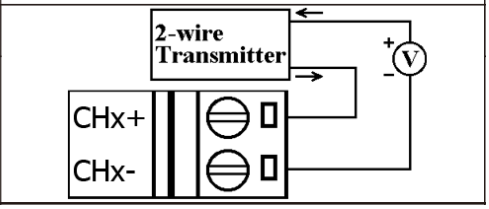
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
CH0+	CH1+	CH2+	CH3+	CH4+	CH5+	CH6+	CH7+	CH8+	CH9+	CH10+	CH11+	CH12+	CH13+	CH14+	CH15+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
CH0-	CH1-	CH2-	CH3-	CH4-	CH5-	CH6-	CH7-	CH8-	CH9-	CH10-	CH11-	CH12-	CH13-	CH14-	CH15-	N/A	N/A

R-9026C2H

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
AI0-	AI1-	AI2-	AI3-	AI4-	AI5-	AI6-	AI7-	AO0+	AO1+	AO2+	AO3+	AO4+	AO5+	AO6+	AO7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
AI0+	AI1+	AI2+	AI3+	AI4+	AI5+	AI6+	AI7+	AO0-	AO1-	AO2-	AO3-	AO4-	AO5-	AO6-	AO7-	N/A	N/A

5.3.1.4 Wiring

Input Type	Voltage Input
Wiring	

Input Type	Current Input
Current Source	
2-Wire Transmitter (Passive)	

5.3.2 RDB-S09 / RDB-D09 (Analog Input)

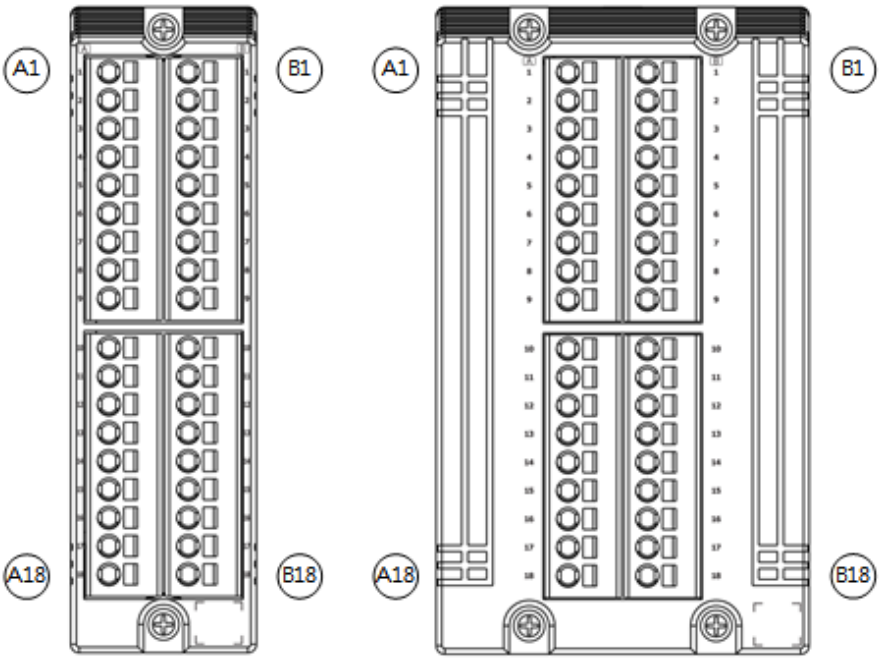
5.3.2.1 Overview

RDB-S09 is a terminal board for single **isolated** analog current/voltage or pulse module and **RDB-D09** is a terminal board for duplex **isolated** analog current/voltage or pulse module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S09 or RDB-D09 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.3.2.2 Specification

Analog Input		
Model	RDB-S09	RDB-D09
Mode	Single	Duplex
Channel	16	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

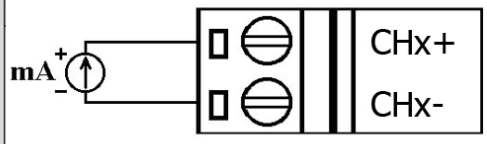
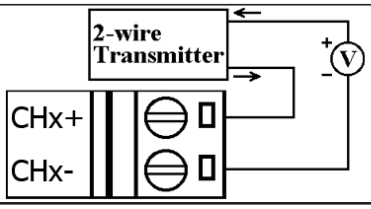
5.3.2.3 Pin assignment



R-9017C1H

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
LP0	AI0+	LP1	AI1+	LP2	AI2+	LP3	AI3+	LP4	AI4+	LP5	AI5+	LP6	AI6+	LP7	AI7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
N/A	AI0-	N/A	AI1-	N/A	AI2-	N/A	AI3-	N/A	AI4-	N/A	AI5-	N/A	AI6-	N/A	AI7-	N/A	N/A

5.3.2.4 Wiring

Input Type	Current Input
Current Source	
2-Wire Transmitter (Passive)	

5.4 Analog Output

5.4.1 RDB-S01 / RDB-D01 (Analog Output)

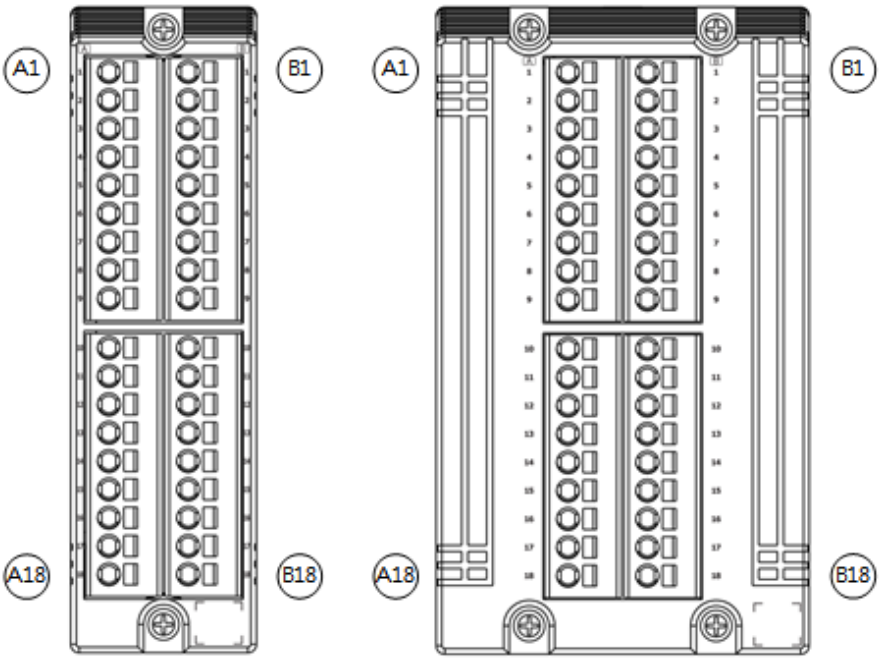
5.4.1.1 Overview

RDB-S01 is a terminal board for single non-isolated analog current/voltage module and RDB-D01 is a terminal board for duplex non-isolated analog current/voltage module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S01 or RDB-D01 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.4.1.2 Specification

Analog Input		
Model	RDB-S01	RDB-D01
Mode	Single	Duplex
Channel	16	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.4.1.3 Pin assignment



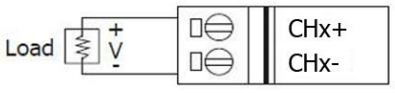
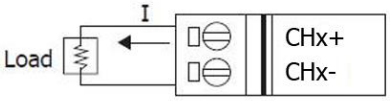
R-9028V2

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
CH0+	CH1+	CH2+	CH3+	CH4+	CH5+	CH6+	CH7+	CH8+	CH9+	CH10+	CH11+	CH12+	CH13+	CH14+	CH15+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
CH0-	CH1-	CH2-	CH3-	CH4-	CH5-	CH6-	CH7-	CH8-	CH9-	CH10-	CH11-	CH12-	CH13-	CH14-	CH15-	N/A	N/A

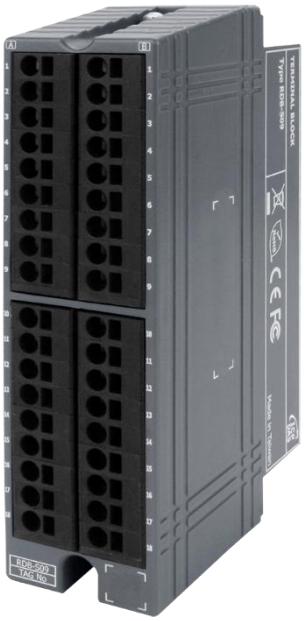
R-9026C2H

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
AI0-	AI1-	AI2-	AI3-	AI4-	AI5-	AI6-	AI7-	AO0+	AO1+	AO2+	AO3+	AO4+	AO5+	AO6+	AO7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
AI0+	AI1+	AI2+	AI3+	AI4+	AI5+	AI6+	AI7+	AO0-	AO1-	AO2-	AO3-	AO4-	AO5-	AO6-	AO7-	N/A	N/A

5.4.1.4 Wiring

Output Type	Analog Output
Voltage Output	
Current Output (HART)	

5.4.2 RDB-S09 / RDB-D09 (Analog Output)



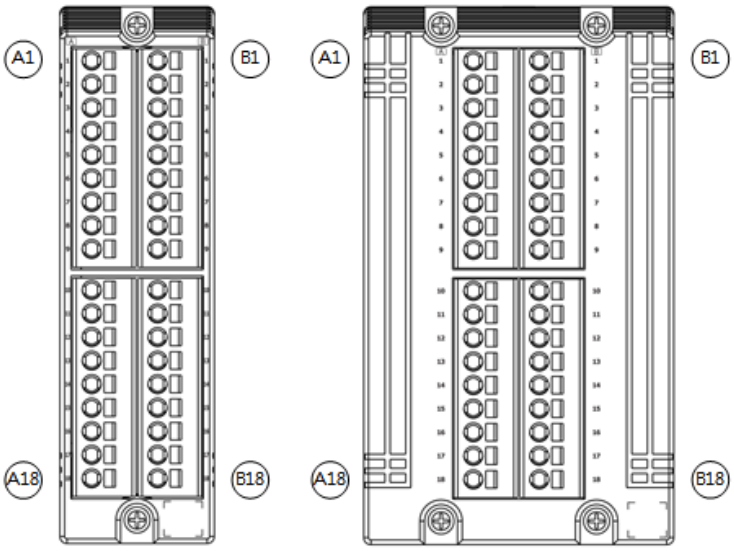
5.4.2.1 Overview

RDB-S09 is a terminal board for single **isolated** analog current/voltage or pulse module and **RDB-D09** is a terminal board for duplex **isolated** analog current/voltage or pulse module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S09 or RDB-D09 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.4.2.2 Specification

Analog Input		
Model	RDB-S09	RDB-D09
Mode	Single	Duplex
Channel	16	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.4.2.3 Pin assignment



R-9028V1

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
N/A	CH0+	N/A	CH1+	N/A	CH2+	N/A	CH3+	N/A	CH4+	N/A	CH5+	N/A	CH6+	N/A	CH7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
N/A	CH0-	N/A	CH1-	N/A	CH2-	N/A	CH3-	N/A	CH4-	N/A	CH5-	N/A	CH6-	N/A	CH7-	N/A	N/A

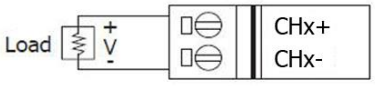
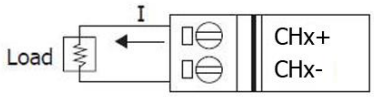
R-9028CH

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
N/A	CH0+	N/A	CH1+	N/A	CH2+	N/A	CH3+	N/A	CH4+	N/A	CH5+	N/A	CH6+	N/A	CH7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
N/A	CH0-	N/A	CH1-	N/A	CH2-	N/A	CH3-	N/A	CH4-	N/A	CH5-	N/A	CH6-	N/A	CH7-	N/A	N/A

R-9026C1H

A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
LPI0	AI0+	LPI1	AI1+	LPI2	AI2+	LPI3	AI3+	LPO0	AO0+	LPO1	AO1+	LPO2	AO2+	LPO3	AO3+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
N/A	AI0-	N/A	AI1-	N/A	AI2-	N/A	AI3-	N/A	AO0-	N/A	AO1-	N/A	AO2-	N/A	AO3-	N/A	N/A

5.4.2.4 Wiring

Output Type	Analog Output
Voltage Output	
Current Output (HART)	

5.5 Thermocouple

5.5.1 RDB-S02 / RDB-D02

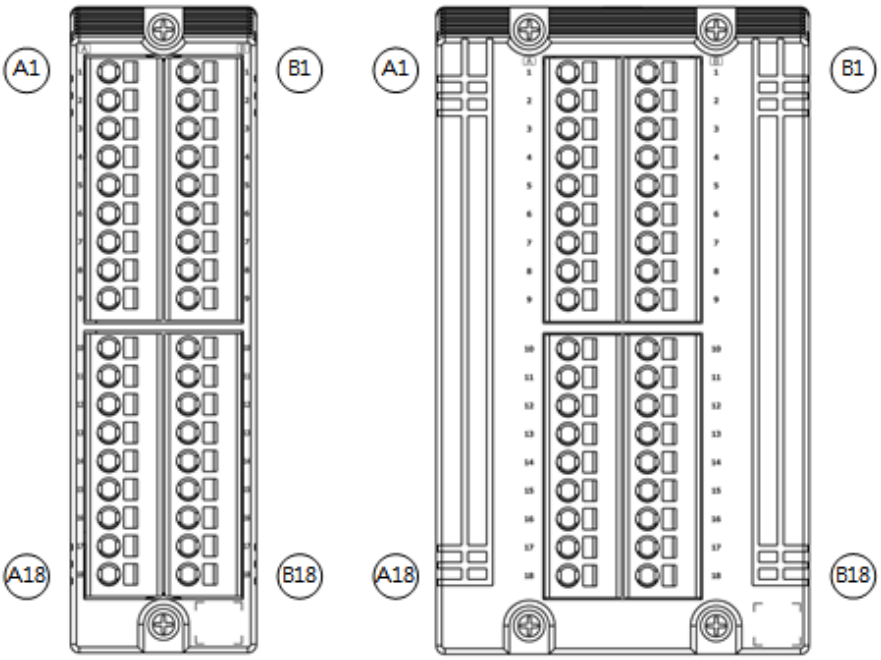
5.5.1.1 Overview

RDB-S02 is a terminal board for single thermocouple input module and RDB-D09 is a terminal board for duplex thermocouple input module. The CJC is built in and provides the accurate temperature measurement. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S02 or RDB-D02 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.5.1.2 Specification

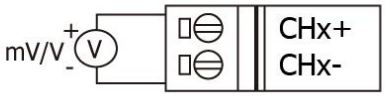
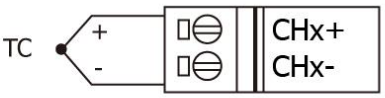
Analog Input		
Model	RDB-S02	RDB-D02
Mode	Single	Duplex
Channel	16	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.5.1.3 Pin assignment



A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
CH0+	CH1+	CH2+	CH3+	CH4+	CH5+	CH6+	CH7+	CH8+	CH9+	CH10+	CH11+	CH12+	CH13+	CH14+	CH15+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
CH0-	CH1-	CH2-	CH3-	CH4-	CH5-	CH6-	CH7-	CH8-	CH9-	CH10-	CH11-	CH12-	CH13-	CH14-	CH15-	N/A	N/A

5.5.1.4 Wiring

Input Type	Thermocouple Input
Voltage Input	
TC Input	

5.6 RTD

5.6.1 RDB-S03 / RDB-S03

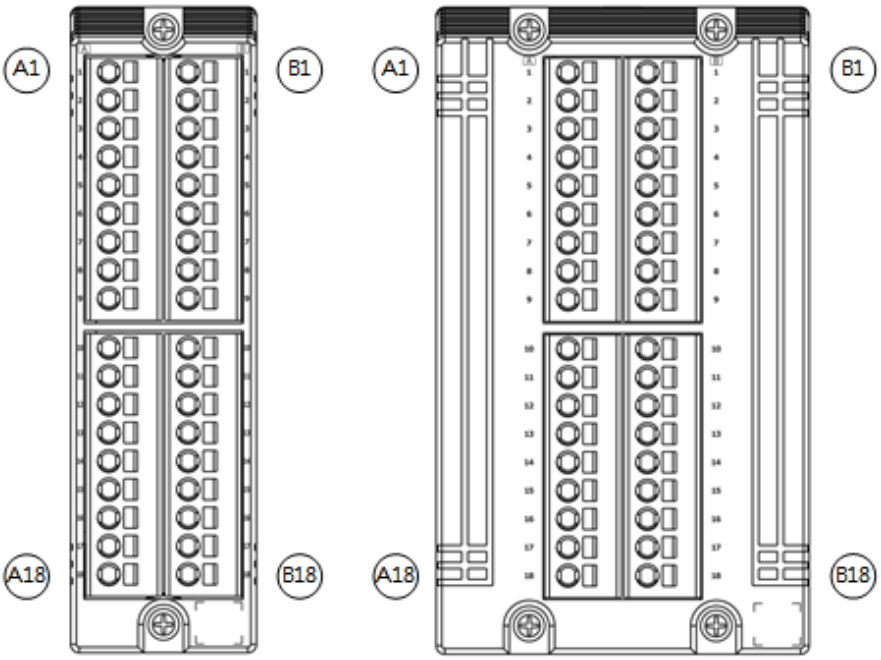
5.6.1.1 Overview

RDB-S03 is a terminal board for single RTD input module and RDB-D03 is a terminal board for duplex RTD input module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S03 or RDB-D03 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.6.1.2 Specification

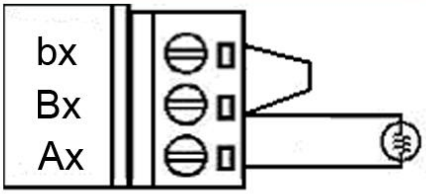
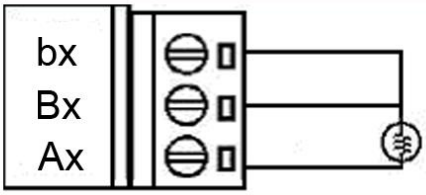
RTD Input		
Model	RDB-S03	RDB-D03
Mode	Single	Duplex
Channel	12	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.6.1.3 Pin assignment



A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
A0	B0	A1	A2	B2	A3	A4	B4	A5	A6	B6	A7	A8	B8	A9	A10	B10	A11
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
b0	B1	b1	b2	B3	b3	b4	B5	b5	b6	B7	b7	b8	B9	b9	b10	B11	b11

5.6.1.4 Wiring

Input Type	RTD Input
2-Wire	
3-Wire	

5.7 Pulse Input

5.7.1 RDB-S09 / RDB-D09 (Pulse Input)

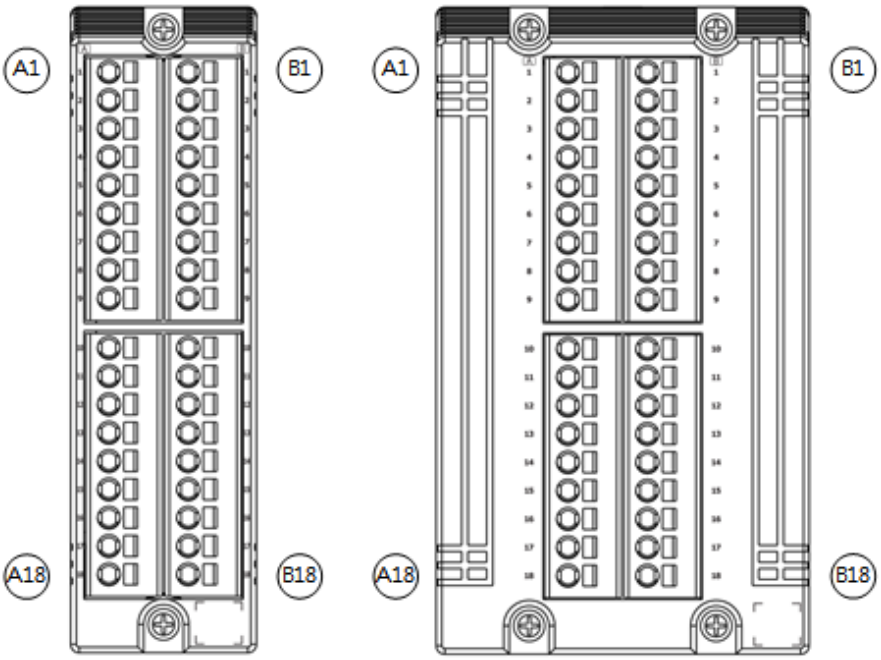
5.7.1.1 Overview

RDB-S09 is a terminal board for single **isolated** analog current/voltage or pulse module and RDB-D09 is a terminal board for duplex **isolated** analog current/voltage or pulse module. They support spring clamp terminal wiring, which can effectively simplify the wiring process and shorten the system installation time. Disconnection detection function to ensure that the alarm will be trigged in time when RDB-S09 or RDB-D09 disconnect from the I/O module and further improve the safety and stability of wiring signals to reduce the risk of system failure. These features are especially important for industrial environments that require high reliability and stability.

5.7.1.2 Specification

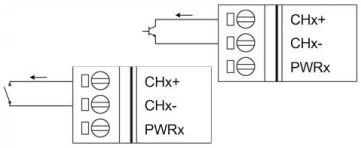
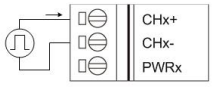
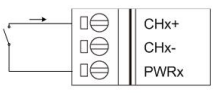
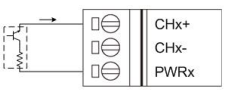
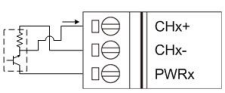
Pulse Input		
Model	RDB-S09	RDB-D09
Mode	Single	Duplex
Channel	8	
General		
Dimension (W x L x H)	32 x 115 x 60 mm	65 x 115 x 60 mm
Operating temperature	-25 ~ 70℃	
Humidity	5 ~ 95 % RH, Non-condensing	

5.7.1.3 Pin assignment



A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18
LP0	CH0+	LP1	CH1+	LP2	CH2+	LP3	CH3+	LP4	CH4+	LP5	CH5+	LP6	CH6+	LP7	CH7+	N/A	N/A
B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	B16	B17	B18
N/A	CH0-	N/A	CH1-	N/A	CH2-	N/A	CH3-	N/A	CH4-	N/A	CH5-	N/A	CH6-	N/A	CH7-	N/A	N/A

5.7.1.4 Wiring

Input Type	Pulse Input	Appropriate Impedance			
		None	200Ω	500Ω	1000Ω
Source NPN & Switch		✓	✗	✗	✗
Sink 24V		✓	✗	✗	✗
Sink Switch		✗	✓	✓	✓
Sink 2-wire transmitter		✗	✓	✓	✓
Sink 3-wire transmitter		✓	✗	✗	✗

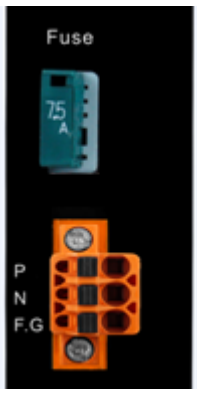
Section 6 Trouble Shooting

6.1 RPM-D24

6.1.1 RUN LED is OFF

Please follow the below steps to solve the problem.

[1] Check the power connector and fuse of RPM-D24.



[2] If the step [1] is OK, check the voltage ($24V_{DC}$ ±10%) of the external power supply.

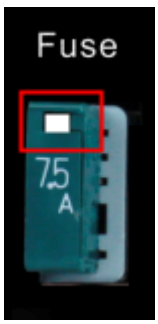
[3] If the step [2] is OK, re-insert RPM-D24.

[4] If the step [3] is NG, replace with the new RPM-D24.

[5] If the step [4] is still NG, please contact the vendor for technical support.

[Note]

[1] The below figure means that the fuse is broken of RPM-D24.



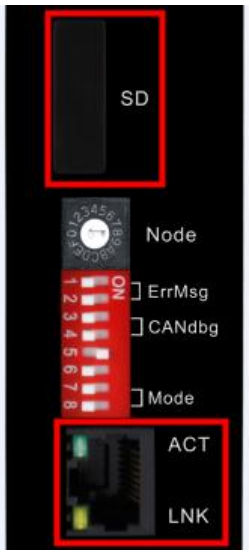
6.2 RCM-MTCP

6.2.1 ALM LED is ON

If the ALM led is ON, it means that the light fault happened in RCM-MTCP. Refer to the section 6.4 to get the light fault code of RCM-MTCP and follow the below steps to solve the problem.

[1] Check the Ethernet cable connection between RCM-MTCP and controller.

[2] If the step [1] is OK, check the SD card plugged in RCM-MTCP.



[3] If the step [2] is OK, re-insert RCM-MTCP.

[4] If the step [3] is NG, replace with the new RCM-MTCP.

[5] If the step [4] is still NG, contact the vendor for technical support.

6.2.2 ERR LED is ON

If the ERR led is ON, it means that the heavy fault happened in RCM-MTCP. Refer to the section 6.4 to get the heavy fault code of RCM-MTCP and follow the below steps to solve the problem.

[1] Re-insert RCM-MTCP.

[2] If the step [1] is NG, replace with the new RCM-MTCP.

[3] If the step [2] is still NG, contact the vendor for technical support.

6.3 I/O module

When the I/O module boots up, the 32 LEDs and 5 state LEDs will turn on and turn off once. Then the PWR LED will keep on.

6.3.1 The LED fault indication of Operation mode

When the I/O module runs in the operation mode, if the ERR led flashes or on, it means that the light fault or heavy fault happened.

[1] If the **ERR led flashes**, it means that the **light fault** happened in the I/O module. Refer to the section 6.4 to get the light fault code of I/O module.

[2] If the **ERR led is on**, it means that the **heavy fault** happened in the I/O module. Refer to the section 6.4 to get the heavy fault code of I/O module.

[3] Follow the below steps to solve the problem.

<1> Re-insert the I/O module.

<2> If the step [1] is NG, replace with the new I/O module.

<3> If the step [2] is still NG, contact the vendor for technical support.

When the light fault or heavy fault happened in the I/O module, the below table is the detailed fault description by using the 32 LEDs.

	LED0~LED7	LED8~LED15	LED16~LED23	LED24~LED31
R-9017C2H	Hi/Lo Alarm (CH0~7)	Hi/Lo Alarm (CH8~15)	Channel Break (CH0~7) ADC Break (2CH/LED): (LED-16*2, LED-16*2+1)	Channel Break (CH8~15)
R-9017C1H	Hi/Lo Alarm (CH0~7)		Channel Break (CH0~7) ADC Break (CH0~7) Field Power Break (CH0~7)	
R-9028CH	Hi/Lo Alarm (CH0~7)		Channel Break (CH0~7) ADC Break (CH0~7) DAC Break (CH0~7) AO Readback Fail (CH0~7) Field Power Break (CH0~7)	
R-9028V1	Hi/Lo Alarm (CH0~7)		Channel Break (CH0~7) ADC Break (CH0~7) Field Power Break (CH0~7)	DAC Break (CH0~7) AO Readback Fail (CH0~7)
R-9019	Hi/Lo Alarm (CH0~7)	Hi/Lo Alarm (CH8~15)	Channel Break (CH0~7)	Channel Break (CH8~15)
R-9015	Hi/Lo Alarm (CH0~7)	Hi/Lo Alarm (CH8~15)	Channel Break (CH0~7)	Channel Break (CH8~15)
R-9084			Field Power Break (CH0~7)	

Figure 6.3.1

[Example 1]

The below figure happened in R-9028CH and it means that the **light fault** happened in the channel-3.

(The fault description of the LED 19 refers to the Figure 6.3.1)

(The I/O module in the **operation** mode)

6.3.2 The LED fault indication of Reboot mode

If all the 32 LEDs and 5 state LEDs turn ON every 6 seconds period, it means that the I/O module keeps rebooting. In the condition, the ERR led will ON for 3 seconds to indicate the first fault state and then the ERR led will flash for 3 seconds to indicate the second fault state by using the 32 LEDs. If the corresponding led is on of the 32 LEDs, it means that the corresponding fault happened.

[1] The below table is the LED fault indication for the first fault state.

LED 00~07	Plug	Slot	EEPROM	CAN1_5V	CAN2_5V	CPU_3.3V	$24V_A$	$24V_B$
LED 08~15	Field Power 0	Field Power 1	Field Power 2	Field Power 3	Field Power 4	Field Power 5	Field Power 6	Field Power 7
LED 16~23	ADC0 CPLD0	ADC1 CPLD1	ADC2	ADC3	ADC4	ADC5	ADC6	ADC7
LED 24~31	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
	(ON) PWR LED	(OFF) MOD LED		(OFF) ACT LED		(OFF) DX LED		(ON) ERR LED

[Example]

The below figure means that the **ADC or CPLD** chip failed in the channel-1 of the I/O module.

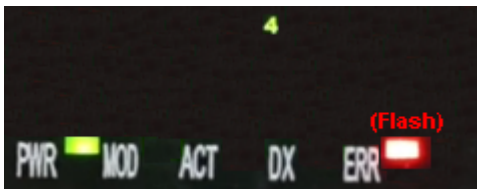
(The I/O module in the reboot mode)

[2] The below table is the LED fault indication for the second fault state.

LED 00~07	DAC0	DAC1	DAC2	DAC3	DAC4	DAC5	DAC6	DAC7
LED 08~15	DAC8	DAC9	DAC10	DAC11	DAC12	DAC13	DAC14	DAC15
LED 16~23	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
LED 24~31	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved	Reserved
	(ON) PWR LED	(OFF) MOD LED		(OFF) ACT LED		(OFF) DX LED		(Flash) ERR

[Example]

The below figure means that the **DAC** chip failed in the channel-4 of the I/O module.



(The I/O module in the **reboot** mode)

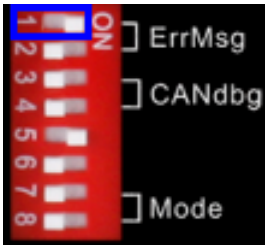
6.4 The Seven-Segment Analysis

When the pin1 of the dip switch in RCM-MTCP module is ON (right side), the 7-segment LED of RCM-MTCP will display the below information in turns.

[1] The firmware version of RCM-MTCP.

[2] The light fault and heavy fault state of RCM-MTCP. If no fault in RCM-MTCP, it will pass the fault code.

[3] The light fault and heavy fault state of all I/O modules from slot-0 to slot-7. If no fault in the slot I/O module, it will pass the fault code.



[Example 1 : The firmware version of RCM-MTCP]

[1] The below figure displays the firmware version (v1.00) of RCM-MTCP.

[Example 2 : The light fault (0x00010000) happened in I/O module]

[1] The below figure displays the error happened in the **slot-1 (S1)** I/O module.

I/O Module ERR LED	ON	Heavy fault (Example: Hard damage)
	Blink	Light fault (1 flash every 500ms) (Software setting error or disconnection)
	OFF	Normal system

[2] The below figure displays the error is light fault and the error code (4 bytes) is 0x00010000. It means that B3(byte3)=0x01 and the **"24V_A or 24V_B failed"** of the I/O module error happened. (Refer to section 6.4.1)

[Example 3 : The light fault (0x00000001) happened in I/O module]

[1] The below figure displays the error happened in the **slot-5 (S5)** I/O module.

[2] The below figure displays the error is **light** fault and the error code (4 bytes) is 0x00000001. It means that B1(byte1)=0x01 and the **"Terminal board disconnection"** of the I/O module error happened. (Section 6.4.1)

6.4.1 The Light Fault Table of I/O module

B4 Fault Description	Fault code	B3 Fault Description	Fault code
LED access failed	0x01 (b0)	$24V_A$ or $24V_B$ failed	0x01 (b0)
Lo / LoLo Alarm	0x02 (b1)	Reserved	0x02 (b1)
Hi / HiHi Alarm	0x04 (b2)	CAN1 5V failed	0x04 (b2)
CH disconnection	0x08 (b3)	CAN2 5V failed	0x08 (b3)
CH feedback failed	0x10 (b4)	CPU 3.3V failed	0x10 (b4)
DAC or ADC chip failed	0x20 (b5)	field power failed of UP board	0x20 (b5)
Reserved	0x40 (b6)	field power failed of DW board	0x40 (b6)
Reserved	0x80 (b7)	ADC chip in AO failed	0x80 (b7)
B2 Fault Description	**Fault code**	**B1 Fault Description**	**Fault code**
Reserved	0x01 (b0)	Terminal board disconnection	0x01 (b0)
Reserved	0x02 (b1)	CJC in TC terminal board failed	0x02 (b1)
Reserved	0x04 (b2)	CH disconnection + SWAP	0x04 (b2)
Reserved	0x08 (b3)	Reserved	0x08 (b3)
Reserved	0x10 (b4)	Light fault go to STOP mode	0x10 (b4)
Reserved	0x20 (b5)	Reserved	0x20 (b5)
Reserved	0x40 (b6)	Reserved	0x40 (b6)
Reserved	0x80 (b7)	Reserved	0x80 (b7)

6.4.2 The Heavy Fault Table of I/O module

Any fault code of the heavy fault in the I/O module means the hardware error happened.

6.4.3 The Light Fault Table of RCM-MTCP

Fault Description	Fault code
Micro-SD failed	b0~b3
RTC failed	b4
Ethernet Link failed	b12
Reserved	other bits

[Example 1 : The Micro-SD failed in RCM-MTCP]

[1] The below figure displays the light fault happened in RCM-MTCP and the error code (4 bytes) is 0x00000009. It means that B1(byte1)=0x09 (bit0 and bit3 = 1) and the "Micro-SD failed" happened. (Refer to section 6.4.3)

6.4.4 The Heavy Fault Table of RCM-MTCP

Fault Description	Fault code
CAN HW failed	b4
CPU HW failed	b5
Plug failed	b12
Memory failed	b20
CAN Bus Off	b24
Reserved	other bits

6.5 The Micro-SD Data Analysis

The Micro-SD card in RCM-MTCP is used to record the operation status and fault information with timestamp of all modules and useful for the abnormal system fault analysis.

[Example 1 : The boot-up information of RIO-9830 system]

[1] MCU A boot up. (FW: v01.00) => The firmware version of RCM-MTCP is v1.00.
[2] IOM[1] NMT state change. (0x01 -> 0x04) => The slot-0 I/O module is in the “Boot-up“ mode.
[3] IOM[1] NMT state change. (0x04 -> 0x10) => The slot-0 I/O module is in the “Pre-OP“mode.
[4] IOM[1] Initialize OK. (FW: v02.00) => The firmware version of the slot-0 I/O module is v2.00.
[5] IOM[1] NMT state change. (0x10 -> 0x20) => The slot-0 I/O module is in the “OP“mode.
=> The NMT state table refers to the section 6.5.1.

```
hh:mm:ss   ms   module   state    information
17:14:41 772921,[MCU],(Bootup),NODE[3] MCU_A boot up. (FW: v01.00)
17:14:41 773410,[MCU],(State),MCU state change. (MCU: 0x00 -> 0x20. AnoMCU: 0x00 -> 0x00)
17:14:41 783397,[MCU],(State),MCU state change. (MCU: 0x20 -> 0x20. AnoMCU: 0x00 -> 0x10)
17:14:41 783522,[IOM],(State),IOM[1] NMT state change. (0x01 -> 0x04)
17:14:41 793501,[IOM],(State),IOM[2] NMT state change. (0x01 -> 0x04)
17:14:41 803454,[IOM],(State),IOM[3] NMT state change. (0x01 -> 0x04)
17:14:41 813429,[IOM],(State),IOM[4] NMT state change. (0x01 -> 0x10)
17:14:41 823446,[IOM],(State),IOM[5] NMT state change. (0x01 -> 0x10)
17:14:41 834443,[IOM],(State),IOM[6] NMT state change. (0x01 -> 0x10)
17:14:41 844475,[IOM],(State),IOM[7] NMT state change. (0x01 -> 0x10)
17:14:41 864471,[IOM],(State),IOM[1] NMT state change. (0x04 -> 0x10)
17:14:41 874458,[IOM],(State),IOM[2] NMT state change. (0x04 -> 0x10)
17:14:41 884400,[IOM],(State),IOM[3] NMT state change. (0x04 -> 0x10)
17:14:43 811254,[IOM],(Init),IOM[1] Initialize OK. (FW: v02.00)
17:14:43 811610,[IOM],(Init),IOM[2] Initialize OK. (FW: v02.00)
17:14:43 813815,[IOM],(Init),IOM[3] Initialize OK. (FW: v02.00)
17:14:43 814169,[IOM],(Init),IOM[4] Initialize OK. (FW: v02.00)
17:14:43 814528,[IOM],(Init),IOM[5] Initialize OK. (FW: v02.00)
17:14:43 815659,[IOM],(State),IOM[4] NMT state change. (0x10 -> 0x20)
17:14:43 818720,[IOM],(Init),IOM[6] Initialize OK. (FW: v02.00)
17:14:43 819087,[IOM],(Init),IOM[7] Initialize OK. (FW: v02.00)
17:14:43 825530,[IOM],(State),IOM[5] NMT state change. (0x10 -> 0x20)
17:14:43 835630,[IOM],(State),IOM[6] NMT state change. (0x10 -> 0x20)
17:14:43 845500,[IOM],(State),IOM[7] NMT state change. (0x10 -> 0x20)
17:14:43 865596,[IOM],(State),IOM[1] NMT state change. (0x10 -> 0x20)
17:14:43 875519,[IOM],(State),IOM[2] NMT state change. (0x10 -> 0x20)
17:14:43 885610,[IOM],(State),IOM[3] NMT state change. (0x10 -> 0x20)
```

[Example 2 : The light fault of I/O module]

The below information of Micro-SD means that the light fault of the slot-0 I/O module happened at 16:00:38 and the fault code is from 0x00000000 to 0x08000000. The light fault code 0x08000000 means that the "**CH disconnection**" happened.
(0x08000000 : the bit3 of the B4 (byte 4) is 1 and refer to section 6.4.1.)

```
16:00:38 311755,[IOM],(State),IOM[0] light fault state change. (0x00000000 -> 0x08000000)
```

The below information of Micro-SD means that the light fault of the slot-0 I/O module is recovered at 16:03:30 and the fault code is from 0x08000000 to 0x00000000. It means that the "**CH disconnection**" is recovered.

```
16:03:30 311755,[IOM],(State),IOM[0] light fault state change. (0x08000000 -> 0x00000000)
```

[Example 3 : The HW error of I/O module]

The below information of Micro-SD means that the HW error of the slot-2 I/O module (R-9028CH) happened at 19:14:06 and the fault code is from 0x00000000-00000000 to 0x00000000-009F0000. The HW error code 0x009F0000 means that the "**ADC Failed**" happened in channel 0, 1, 2, 3, 4 and 7.
(0x009F0000 : the bit0,1,2,3,4,7 of the B2 (byte 2) are all 1 and refer to section 6.5.2.)

```
19:14:06 201008,[IOM],(State),IOM[2] HW err state change. (0x00000000-00000000 -> 0x00000000-009F0000)
```

[Example 4 : The heavy fault of RCM-MTCP]

The below information of Micro-SD means that the heavy fault of RCM-MTCP happened at 17:04:27 and the fault code is from 0x00000000 to 0x00100000. The light fault code 0x00100000 means that the "**Memory failed**" happened.
(0x00100000 : the bit20 is 1 and refer to section 6.4.4)

```
17:04:27 675723,[MCU],(State),MCU heavy fault state change. (0x00000000 -> 0x00100000)
```

[The detailed analysis of Micro-SD]

Please mail to ICP DAS service mail – service@icpdas.com with the Micro-SD file.

6.5.1 NMT state of modules

NMT Code	NMT State	Note
0x01	No IOM	module not exist
0x02	Halt mode	Comm. fault between RCM-MTCP and I/O module (I/O channel input/output will keep)
0x04	Boot-up mode	module in the initial mode.
0x10	Pre-OP mode	module parameter configuration
0x20	OP mode	I/O module channel input/output
0x40	Stop mode	hardware fault in the module (I/O channel input/output will keep)

6.5.2 The HW error Table of I/O modules

B0 Fault Description	Fault code	B1 Fault Description	Fault code
Plug failed	0x01 (b0)	Field Power 0 failed	0x01 (b0)
Slot failed	0x02 (b1)	Field Power 1 failed	0x02 (b1)
EEPROM failed	0x04 (b2)	Field Power 2 failed	0x04 (b2)
CAN1_5V failed	0x08 (b3)	Field Power 3 failed	0x08 (b3)
CAN2_5V failed	0x10 (b4)	Field Power 4 failed	0x10 (b4)
CPU_3.3V failed	0x20 (b5)	Field Power 5 failed	0x20 (b5)
Reserved	0x40 (b6)	Field Power 6 failed	0x40 (b6)
Reserved	0x80 (b7)	Field Power 7 failed	0x80 (b7)
B2 Fault Description	**Fault code**	**B3 Fault Description**	**Fault code**
ADC0 / CPLD 0 failed	0x01 (b0)	Reserved	0x01 (b0)
ADC1 / CPLD 1 failed	0x02 (b1)	Reserved	0x02 (b1)
ADC2 failed	0x04 (b2)	Reserved	0x04 (b2)
ADC3 failed	0x08 (b3)	Reserved	0x08 (b3)
ADC4 failed	0x10 (b4)	Reserved	0x10 (b4)

ADC5 failed		0x20 (b5)	Reserved		0x20 (b5)
ADC6 failed		0x40 (b6)	Reserved		0x40 (b6)
ADC7 failed		0x80 (b7)	Reserved		0x80 (b7)
B4 Fault Description		**Fault code**	**B5 Fault Description**		**Fault code**
DI/DO (Feedback)	**AO (DAC)**	X	**DI/DO (Feedback)**	**AO (DAC)**	X
CH0 failed	DAC0 failed	0x01 (b0)	CH8 failed	DAC8 failed	0x01 (b0)
CH1 failed	DAC1 failed	0x02 (b1)	CH9 failed	DAC9 failed	0x02 (b1)
CH2 failed	DAC2 failed	0x04 (b2)	CH10 failed	DAC10 failed	0x04 (b2)
CH3 failed	DAC3 failed	0x08 (b3)	CH11 failed	DAC11 failed	0x08 (b3)
CH4 failed	DAC4 failed	0x10 (b4)	CH12 failed	DAC12 failed	0x10 (b4)
CH5 failed	DAC5 failed	0x20 (b5)	CH13 failed	DAC13 failed	0x20 (b5)
CH6 failed	DAC6 failed	0x40 (b6)	CH14 failed	DAC14 failed	0x40 (b6)
CH7 failed	DAC7 failed	0x80 (b7)	CH15 failed	DAC15 failed	0x80 (b7)

B6 Fault Description			**Fault code**	**B7 Fault Description**	**Fault code**
DI/DO (Feedback)	**AO (Feedback)**	**PI**	X	**DI/DO (Feedback)**	X
CH16 failed	CH0 failed	Reserved	0x01 (b0)	CH24 failed	0x01 (b0)
CH17 failed	CH1 failed	CH0, 1 Resistor	0x02 (b1)	CH25 failed	0x02 (b1)
CH18 failed	CH2 failed	CH2, 3 Resistor	0x04 (b2)	CH26 failed	0x04 (b2)
CH19 failed	CH3 failed	CH4, 5 Resistor	0x08 (b3)	CH27 failed	0x08 (b3)
CH20 failed	CH4 failed	CH6, 7 Resistor	0x10 (b4)	CH28 failed	0x10 (b4)
CH21 failed	CH5 failed	Reserved	0x20 (b5)	CH29 failed	0x20 (b5)
CH22 failed	CH6 failed	Reserved	0x40 (b6)	CH30 failed	0x40 (b6)
CH23 failed	CH7 failed	Reserved	0x80 (b7)	CH31 failed	0x80 (b7)