

**APL SmartEIO
UIO831-S01
User Manual**

Notices
● The reproduction, transmission or use of this document or its contents is not permitted without express written authority. ● Information and specifications in this document are subject to change without notice. ● While information in this document is well edited and checked, mistake or omission may exist. Please don't hesitate to contact SUPCON if you have any question about this document. ● Please contact SUPCON via email "SMS@supcon.com" if you have any question.

Trademarks
Trademarks SUPCON, PLANTMATE, AI-POET, InPlant, dOps, ESP-iSYS, Webfield, ics, MultiF, SupField, and APC are all registered by SUPCON Technology Co., Ltd., which owns the properties of all above trademarks. It is strictly prohibited to use any of the above trademarks or marks without a written permission from SUPCON Company. We reserve the right to take legal action against any individuals or companies using trademarks or marks above illegally.

Symbol Definition	
	WARNING: Indicates information that a potentially hazardous situation which, if not avoided, could result in serious injury or death.
	RISK OF ELECTRICAL SHOCK: Indicates information that Potential shock hazard where HAZARDOUS LIVE voltages greater than 30V RMS, 42.4V peak, or 60V DC may be accessible.
	ESD HAZARD: Indicates information that Danger of an electro-static discharge to which equipment may be sensitive. Observe precautions for handling electrostatic sensitive devices
	ATTENTION: Identifies information that requires special consideration.
	TIP: Identifies advice or hints for the user.

Safety& Caution Symbols

The following table lists Safety& Caution symbols used on equipment.

No.	Symbol	Description
1		Direct current (DC)
2		Alternating current (AC)
3		Ground (Earth) terminal
4		Protective earth (ground) terminal
5		Reference ground (Earth) terminal
6		Frame or chassis
7		Equipotentiality
8		On (power)
9		Off (power)
10		Caution, risk of electric shock
11		Caution, hot surface
12		Caution, risk of danger
13		Electrostatic sensitive devices (ESD)

Table of Contents

APL SmartEIO UIO831-S01	1
Section 1 Product Overview	1
Section 2 Technical Specifications	2
Section 3 Structure	5
Section 4 Dimensions and Installation	6
4.1 Dimensions	7
4.2 Module Installation and Removal	7
4.2.1 Installation	7
4.2.2 Removal	8
Section 5 Signal Adaptor Selection	10
Section 6 Base Selection	12
6.1 Technical Specifications	12
6.2 Base Structure	12
6.3 Base Dimensions	13
6.4 Installing the Base	14
Section 7 Wiring	16
7.1 Wiring for APL Trunk Terminals	16
7.2 Power Wiring	18
7.3 Grounding	18
7.4 Cable Requirements	19
Section 8 Diagnosis and Display	20
8.1 Indicators	20
8.2 Detailed Diagnosis	20
Section 9 Notes for Application	21
Section 10 Revision History	22

APL SmartEIO UIO831-S01

Section 1 Product Overview

APL SmartEIO UIO831-S01 offers 16 isolated channels. Each channel can collect and output different signals with the aid of its dedicated signal adaptor. The supported signals are AI, AO, DI, DI (SOE), DO, PI, TC, RTD, NAMUR, HART, and more. It complies with Ethernet-APL standards.

UIO831-S01 communicates with the controller through connecting with the APL power switch with APL Trunk. It acquires configuration data and output defined value from the controller, and sends back the current module status. Downwards, it controls field equipment (such as valves, locators) via the transmission of current or digital signals.

In a redundant configuration, the working UIO831-S01 module can transmit real-time data, while the standby module ensures data synchronization through monitoring.

UIO831-S01 provides self-diagnosis functions to allow you grasp its working status either from its panel indicators or monitoring software.

UIO831-S01 can detect whether the module is properly inserted. A working UIO831-S01 module can also detect whether the corresponding signal adapter is properly inserted.

Section 2 Technical Specifications

When the UIO831 works with a pass-through I/O signal adaptor, its technical specifications are shown in the table below. If it works with other adaptors, refer to *Signal Adaptor User Manual*.

Table 2-1 Technical specifications

Parameter		Description
System power		
Rated Voltage of Auxiliary Power		24 VDC, $\pm 10\%$
Power consumption	Consumption of supplying power	<7.5 W
	Consumption of channels	< 1.4 W/channel
Trunk	Port class	TL3X (2-wire power load, 50 V/57.5 W)
	Power input redundancy	Yes
	Transfer rate	10 Mbps
	Communication distance	$\leq 1,000$ m (3280.84 ft)
I/O type		AI, AI+HART, AO, AO+HART, DI, DO, NAMUR, PI
I/O type selection		Configured through software
Channels		16
Redundancy		1:1 redundancy
Isolation type		Unified isolation
Isolation voltage		1500 V (channel and system side)
24 V anti-reverse connection for each channel		Yes
Operating Environment		
Ambient temperature		-40 to +70 °C
Storage temperature		-40 to +85 °C
Relative humidity		10%–90%, non-condensing
Storage humidity		5%–95% (RH), non-condensing
Mounting		
Mounting method		Base slot
AO/(AO+HART) Mode		
Signal type		(0–20) mA, (4–20) mA, (0–10) mA, (4–20) mA + HART
Precision		± 16 μ A
Maximum signal output range	(0–10) mA	(0–12.5) mA
	(0–20) mA	(0–24) mA
	(4–20) mA	(2–24) mA
	(4–20) mA + HART	(2.4–21.6) mA
Response time		10%–90% step: < 10 ms
Max. load capacity		(4–20) mA, (0–20) mA: 750 Ω (0–10) mA: 1.4 k Ω
Data update interval		10 ms
Temperature drift (FS)		100 PPM/°C
Self-check method		Output self-check, short-circuit detection, disconnection detection, load impedance detection
Single-point power consumption (system power)		< 0.7 W/channel

Parameter			Description
Response time of communication between device management software and HART communication module			Response time of single instrument configuration, adjustment, rectification: < 2 s
			Response time of reading real time data from HART equipment (16 pcs): < 0.4 s
AI/(AI+HART) Mode			
Signal type			(0–20) mA, (4–20) mA, (0–10) mA, (4–20) mA + HART
Precision			±16 μA
Max. signal input range	(0–10) mA		(0–12.5) mA
	(4–20) mA		(2–24) mA
	(0–20) mA		(0–24) mA
	(4–20) mA + HART		(2.4–21.6) mA
Data update interval			10 ms
Short-circuit protection current			≤40 mA
Output voltage for power distribution			26 VDC
Temperature drift (FS)			100 PPM/°C
Self-check method			Disconnection detection, short-circuit detection (over-range)
Single-channel power consumption (system power)			< 0.7 W/channel
Response time of communication between device management software and HART communication module			Response time of single instrument configuration, adjustment, rectification: < 2 s
			Response time of reading real time data from HART equipment (16 pcs): < 0.4 s
Common mode rejection ratio			≥ 120 dB@50 Hz & (4-20) mA
Serial mode rejection ratio			≥ 60 dB@50 Hz & (4-20) mA
DI/DI (SOE) Mode			
Single-channel power consumption (system power)			< 0.3 W/channel
Signal type			Dry contact input, wet contact input
ON and OFF conditions			Dry contact: ON: < 1 kΩ, OFF: > 100 kΩ Wet contact: ON: (15–30) V, OFF: < 5 V
Output voltage for power distribution			26 VDC
Self-check method			Line fault detection
Response time	ON→OFF		DI: 4.5 ms
	OFF→ON		DI (SOE): 8.5 ms
SOE	Scan period		0.5 ms
	Time resolution		0.5 ms
	Spatial resolution		1 ms
	Record cache		Up to 1,000 cached records in module
	Communication period		50 ms
	Pulse accumulation	Channel	Equipped with pulse accumulation function (does not support redundancy).
		Pulse width requirement	> 20 ms
PI Mode			
Single-channel power consumption (system power)			< 0.3 W/channel
Input frequency			0–1 kHz, 0–10 kHz
Min. pulse width			In one cycle: low level: >30 μs high level: >20 μs

Parameter		Description
Resolution		(0-1) kHz: ± 0.1 Hz (0-10) kHz: ± 0.5 Hz
Precision		(0-1) kHz: ± 0.2 Hz (0-10) kHz: ± 1 Hz
Requirements for input voltage		Low level <3 V; 12 V< high level <30 V
Pulse accumulation function		Yes (works with PIACCUM function block), not supported when module is redundantly configured
Namur Mode		
Single-channel power consumption (system power)		< 0.3 W/channel
Signal type		Dry contact input
ON and OFF conditions		ON: > 2.1 mA, OFF: < 1.2 mA
Max. open circuit voltage		9.6 VDC
Self-check method		Disconnection detection, short-circuit detection
DO Mode		
Single-channel power consumption (system power)		< 1.4 W/channel
Signal type		Source
Min. output voltage		18 V (when it provides 50 mA power for the external)
Max. output voltage		24.4 V (passes through a resistor of 72 Ω and 3 diodes)
Output current limit		50 mA (typical)
Leakage current in OFF status		<0.1 mA
Scanning period		10 ms
Self-check method		Disconnection detection, short-circuit detection
Response time	ON→OFF	< 2 ms
	OFF→ON	< 2 ms

Section 3 Structure

The structure of APL SmartEIO is shown in the figure below.

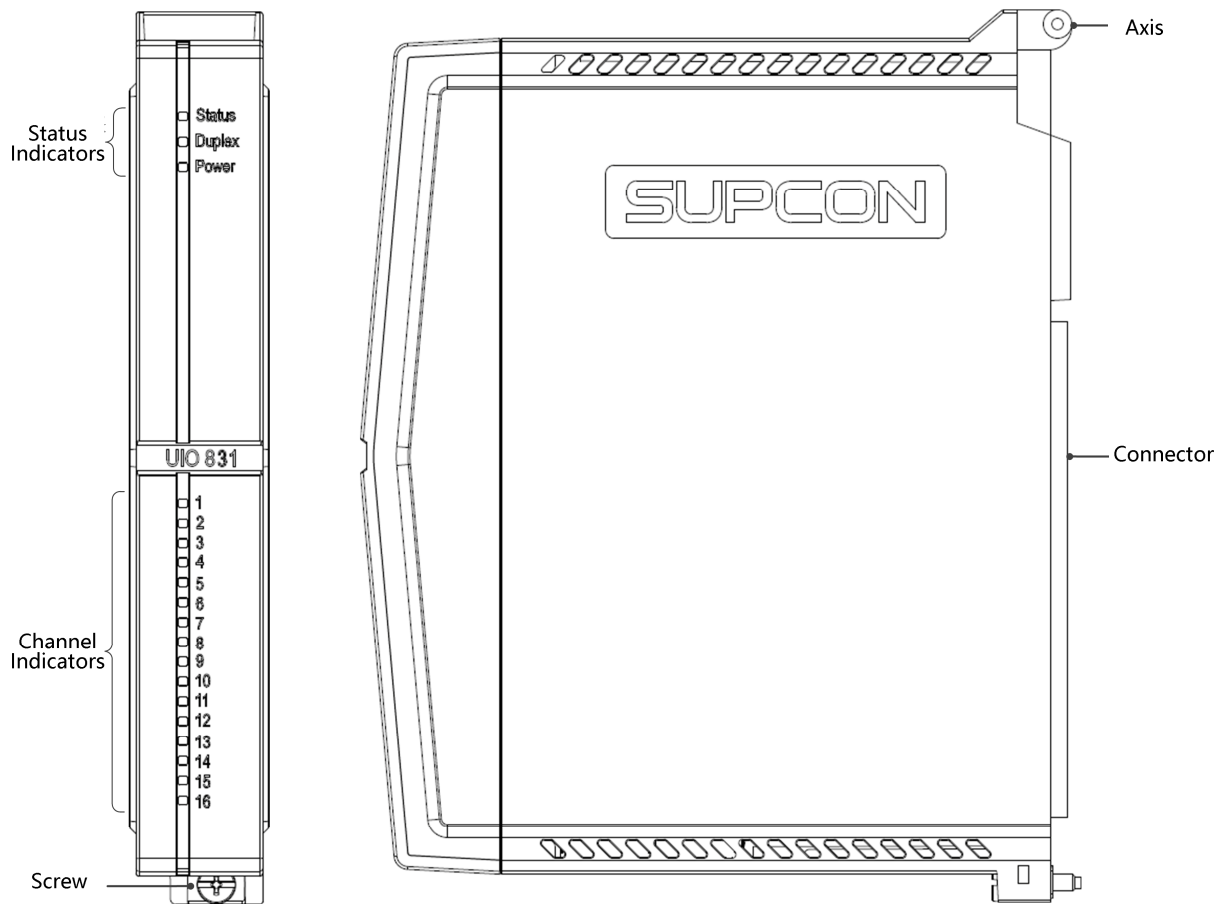


Figure 3-1 Structure of the module

Section 4 Dimensions and Installation

This section describes the dimensions and installation methods of the universal I/O module.

Attentions:



- Do not insert or remove the module with power on in explosive atmosphere.
 - Do not scratch the surface of non-metal casings in explosive atmosphere in case of flames induced by static electricity.
-

4.1 Dimensions

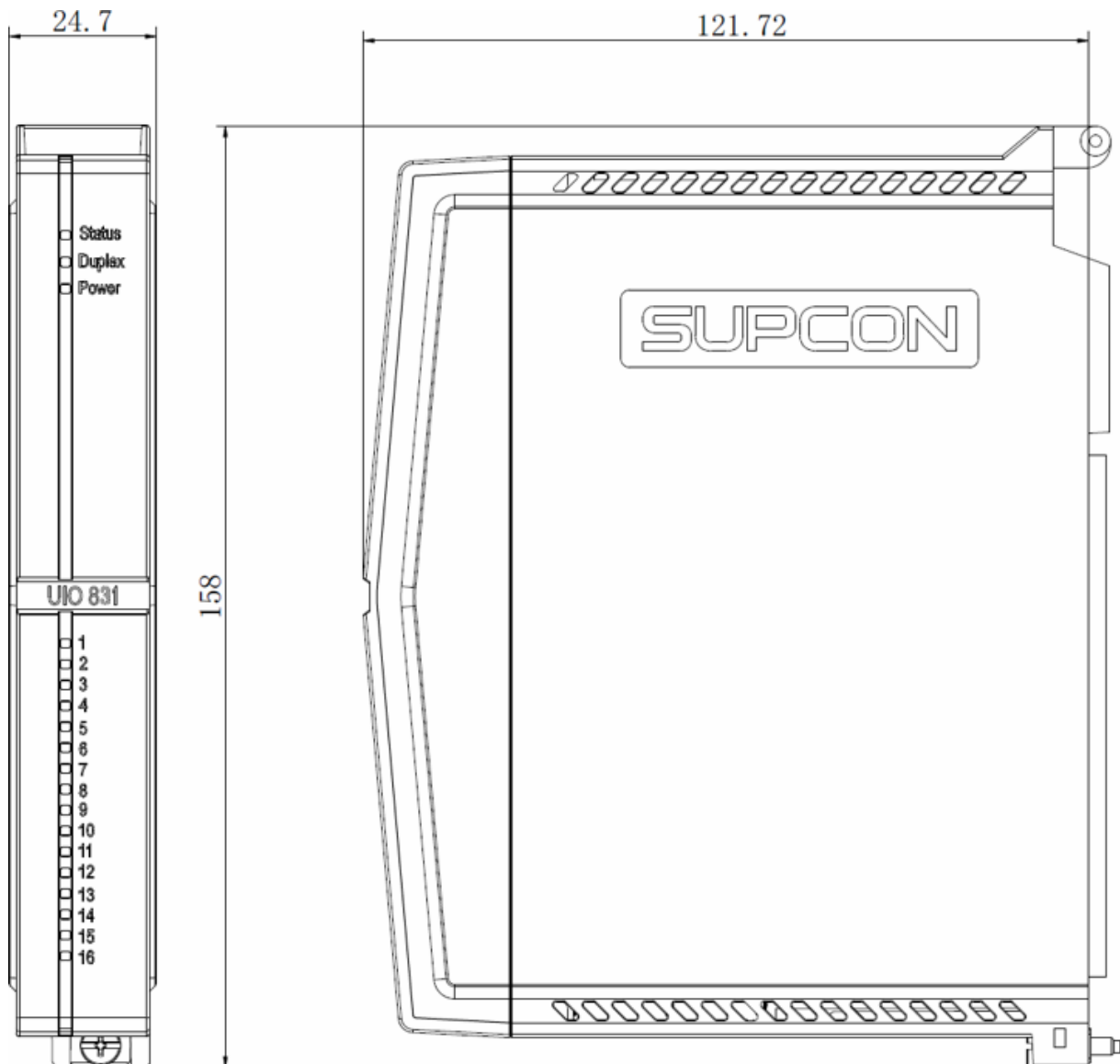


Figure 4-1 Module dimensions (unit: mm)

4.2 Module Installation and Removal

The UIO831-S01 can be installed on the APL universal I/O module slot of the SmartEIO-16 smart junction box or on the universal I/O module base, which share the same installation/removal methods.

This section takes the example of installing the module on the universal I/O module base to explain its installation/removal methods.

4.2.1 Installation

The module is always installed into MB831-S/E. When the module is working independently, only

one UIO831-S01 can be installed in slot 01. Confirm the installation position and install it by following the steps below.

- 1) Hook the module to the rail. See ① in the figure.
- 2) Hold the module and align the connector to the rack. Press the module with the hooked part as the axis. See ② in the figure.
- 3) Screw the module. See ③ and ④.

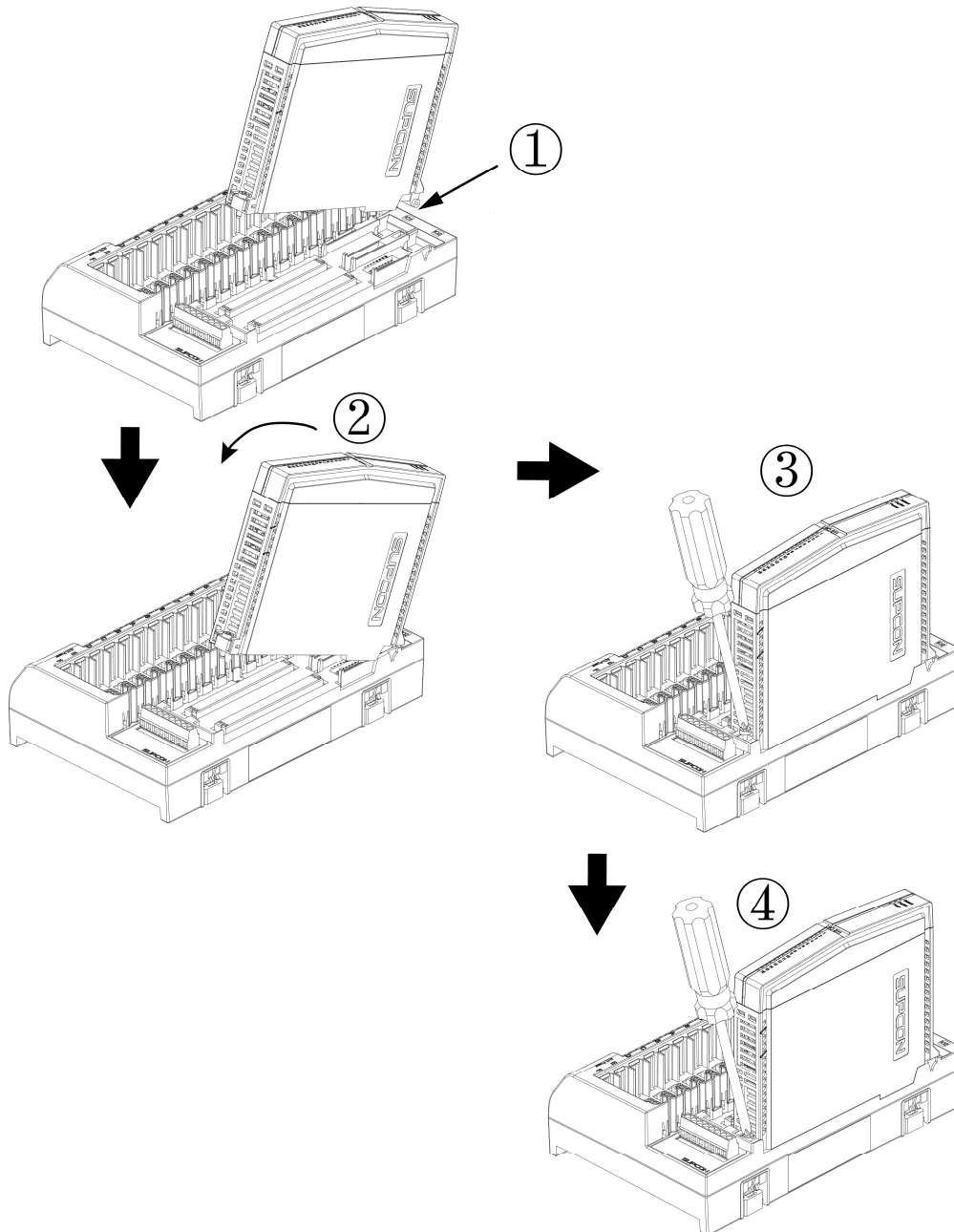


Figure 4-2 Installing the module

4.2.2 Removal

To remove the module:

- 1) Unscrew the module. See ① and ②.
- 2) Unhook the module from the slot. See ③ in the figure.
- 3) Remove the module. See ④.

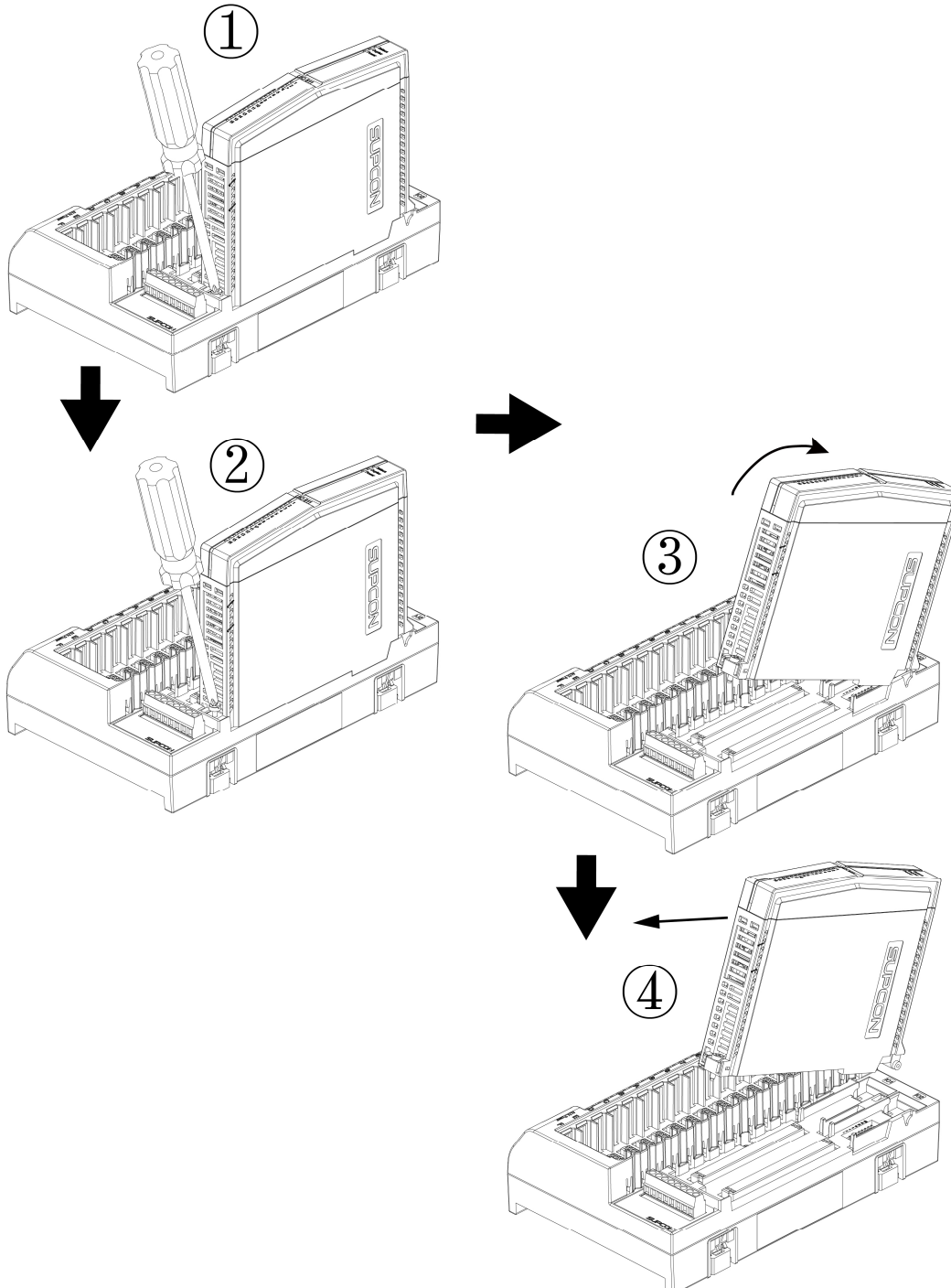


Figure 4-3 Removing the module

Section 5 Signal Adaptor Selection

When the module works with a pass-through I/O signal adaptor, all signal types, except for thermocouple and thermal resistance, are supported. TI signal adaptor is required for connecting TC and RTD resistance signals.

Table 5-1 Signal adaptor selection

Signal Type	Field Signal and Requirements	Signal Adaptor Name and Model	
DI	Inputs dry and wet contact signals. Channel current limiting <100 mA. System power supply*	Pass-through I/O Signal Adaptor	xPT811-S01
	Inputs dry and wet contact signals. Channel current limiting <1 A. Auxiliary power supply*	Pass-through I/O Signal Adaptor	xPT812-S01
	Inputs dry and wet contact signals. Channel current limiting <100 mA.	Digital Input Adaptor	xDI811-S01
	Inputs dry and wet contact signals. Only wet contact signals support channel-to-channel isolation. Channel current limiting <100 mA.	Relay Input Adaptor	xDIR811-I01
	Inputs dry contact signals. Channel-to-channel isolation. Intrinsic safety.	IS Digital Input Adaptor	xDI811-E01
DI (SOE)	Inputs dry and wet contact signals. Channel current limiting <100 mA. System power supply*	Pass-through I/O Signal Adaptor	xPT811-S01
	Inputs dry and wet contact signals. Channel current limiting <1 A. Auxiliary power supply*	Pass-through I/O Signal Adaptor	xPT812-S01
DO	Outputs wet signals (18 VDC–24.4 VDC)	Pass-through I/O Signal Adaptor	xPT811-S01
	Outputs wet signals (18 VDC–24.4 VDC)	Pass-through I/O Signal Adaptor	xPT812-S01
	Outputs dry contact signals. The maximum contact capacity is 1 A. Channel-to-channel isolation.	Relay Output Adaptor	xDOR811-I01
	Outputs wet contact signals. The maximum contact capacity is 0.25 A.	Relay Output Adaptor	xDOR812-S01
	Outputs wet contact signals (12.5 VDC–24 VDC). Channel-to-channel isolation. Intrinsic safety.	IS Digital Output Adaptor	xDO811-E01
AI	Inputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel current limiting ≤40 mA. Two-wire/Four-wire (non-auxiliary power supply*)	Pass-through I/O Signal Adaptor	xPT811-S01
	Inputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel current limiting ≤40 mA. Two-wire/Three-wire/Four-wire (non-auxiliary power supply*, ≤500 mA)	Pass-through I/O Signal Adaptor	xPT812-S01
	Inputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel current limiting ≤40 mA. Channel-to-channel isolation.	Current Input Adaptor	xAI811-I01
	Inputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel current limiting ≤40 mA. Channel-to-channel isolation. Intrinsic safety.	IS Current Input Adaptor	xAI811-E01
AO	Outputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA).	Pass-through I/O Signal Adaptor	xPT811-S01
	Outputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA).	Pass-through I/O Signal Adaptor	xPT812-S01

Signal Type	Field Signal and Requirements	Signal Adaptor Name and Model	
	Outputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel-to-channel isolation.	Current Output Adaptor	xAO811-I01
	Outputs current signals (0–20 mA, 4–20 mA, 4–20 mA+HART, or 0–10 mA). Channel-to-channel isolation. Intrinsic safety.	IS Current Output Adaptor	xAO811-E01
PI	Inputs pulse signals. Frequency: (0–1) kHz, (0–10) kHz System power supply	Pass-through I/O Signal Adaptor	xPT811-S01
	Inputs pulse signals. Frequency: (0–1) kHz, (0–10) kHz Auxiliary power supply	Pass-through I/O Signal Adaptor	xPT812-S01
	Inputs pulse signals. Frequency: (0–1) kHz, (0–10) kHz Channel-to-channel isolation (external power supply)	Digital Input Adaptor	xDI811-S01
RTD, TC	Inputs RTD, TC signals. Channel-to-channel isolation.	TC/RTD Input Adaptor	xTI811-I01
	Inputs RTD and TC signals. Channel-to-channel isolation. Intrinsic safety.	IS TC/RTD Input Adaptor	xTI811-E01
NAMUR	Inputs NAMUR signals.	Pass-through I/O Signal Adaptor	xPT811-S01
	Inputs NAMUR signals.	Pass-through I/O Signal Adaptor	xPT812-S01
	Inputs NAMUR signals. Channel-to-channel isolation. Intrinsic safety.	IS Digital Input Adaptor	xDI811-E01

* System power supply means power comes from system power; while auxiliary power supply means power comes from the auxiliary power introduced through the base.

Section 6 Base Selection

Table 6-1 Base selection

Name	Model	Description
APL Universal I/O Module Base	MB831-S01	Install two redundant UIO831-S01 or one universal I/O module.
APL Universal I/O Module Base (IS)	MB831-E01	Install two redundant UIO831-S01 or one universal I/O module.

This version (V11.12.00) of UIO831-S01 is not compatible with previous versions of the base.

6.1 Technical Specifications

Technical specifications of the bases are shown in Table 6-2.

Table 6-2 Technical specifications

Parameter		Description
Model		MB831-S01/MB831-E01
Name		APL Universal I/O Module Base
Power supply		28.8 to 50 VDC
Power supply mode		Supplied by APL Trunk terminals
Installation method		Wall-mounted
Dimensions (L × W × D)		257 mm × 135 mm × 45.5 mm (10.12" × 5.31" × 1.79")
Temperature	Ambient temperature	Hazardous zone: -20 to +60 °C Safe zone: -40 to +70 °C
	Storage temperature	-40 to +85 °C
Humidity	Operating humidity	10%–90% (RH), non-condensing
	Storage humidity	5%–95% (RH), non-condensing
Ex marking		Ex ec IIC T4 Gc

6.2 Base Structure

MB831-S01/E01 supports installing up to 2 redundant APL SmartEIO modules (UIO831-S01). When universal I/O module is not redundantly configured, 1 base supports installing 1 module at slot 01. The structure diagram of the base is shown in the following figure.

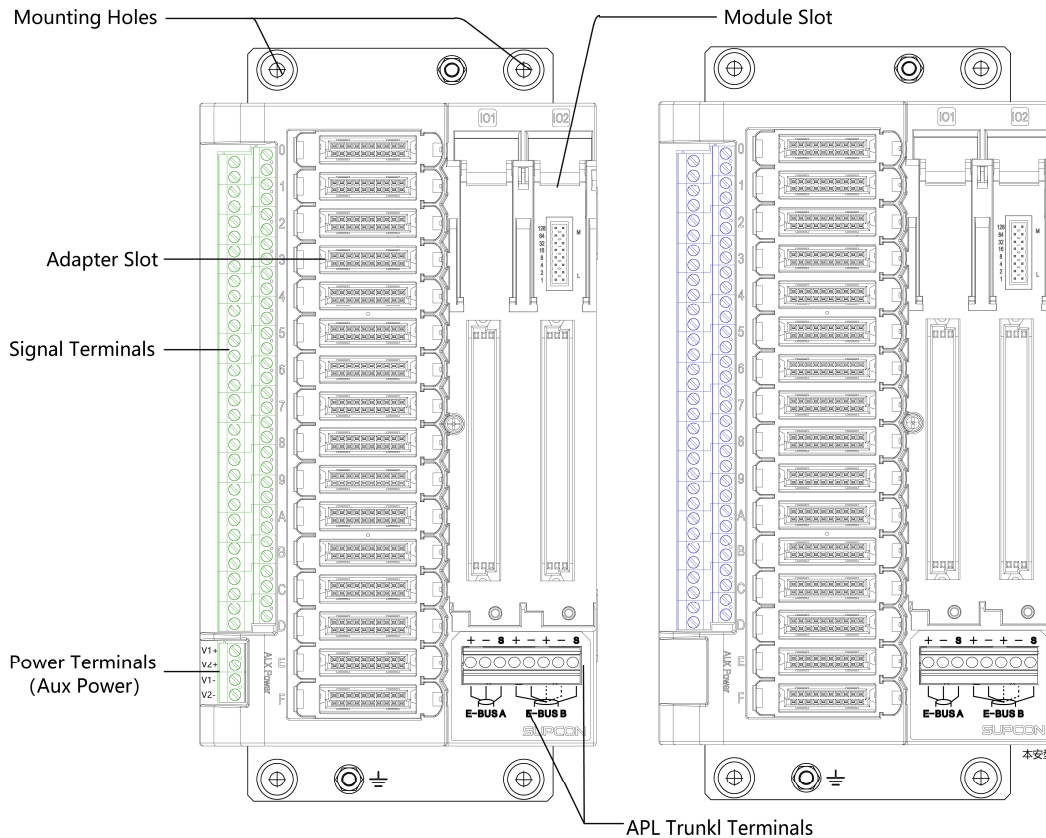


Figure 6-1 Structural diagram of MB831-S01 (left) and MB831-E01 (right)

- I/O module slots: support installing two redundant UIO831-S01. In a non-redundant configuration, only one UIO831-S01 can be installed in slot 01.
- Signal adaptor slots: 16 slots correspond with 16 channels. From top to bottom, channel numbers are from 1 to 16.
- Field signal terminals: the terminals for signal inputs. Terminals in blue are IS terminals, while the ones in green are non-IS. For details on wiring, refer to *Remote I/O Enclosure SmartEIO-16 User Manual*.
- Power terminals: connect to the power if the field signals requires power from the system. IS module base does not provide this type of terminal.
- APL Trunk terminals: connect with APL power switch for power supply and communication of UIO831-S01.

6.3 Base Dimensions

Interfaces of different APL SmartEIO module bases are slightly different but share the same dimensions. The figure below takes MB831-S as an example.

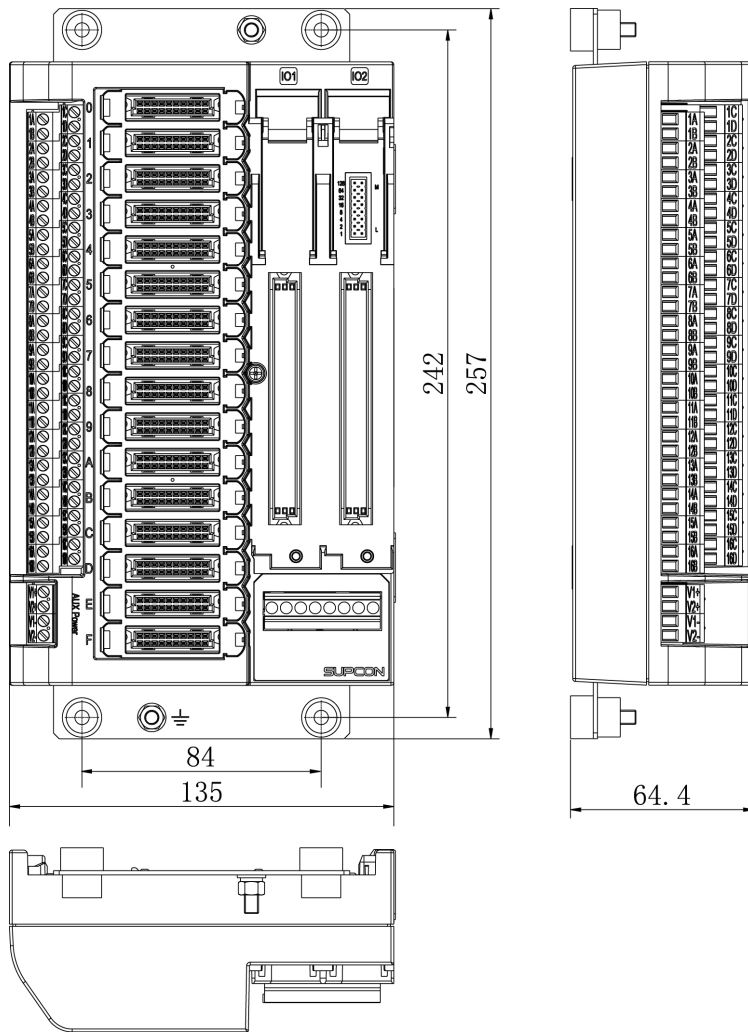


Figure 6-2 Dimensions of APL SmartEIO module base (unit: mm)

6.4 Installing the Base

MB831-S and MB831-E adopts wall mounting. To install it:

- 1) Drill holes with a height of 242 mm and a width of 84 mm on the wall or a surface.
- 2) Fix the base onto the surface with M4 screws.

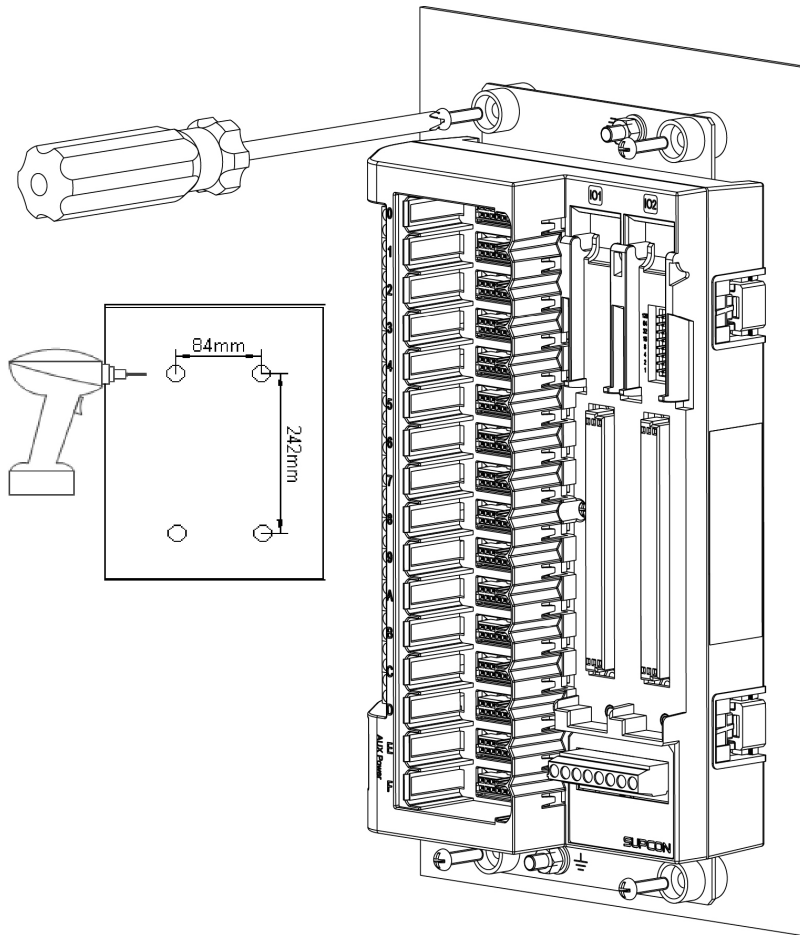


Figure 6-3 Install the base on a surface

Section 7 Wiring

7.1 Wiring for APL Trunk Terminals

APL Trunk power terminals connects with APL power switch for power and communication. APL Trunk terminals support redundant configuration.

Table 7-1 APL Trunk terminals

Terminals	Marks	Description
E-BUS A/E-BUS B	+	APL signal (+)
	-	APL signal (-)
	S	Shield

Wiring Diagrams for Various Scenarios

For easy understanding, the terminal definitions for base APL Trunk terminals are shown in the following figure.

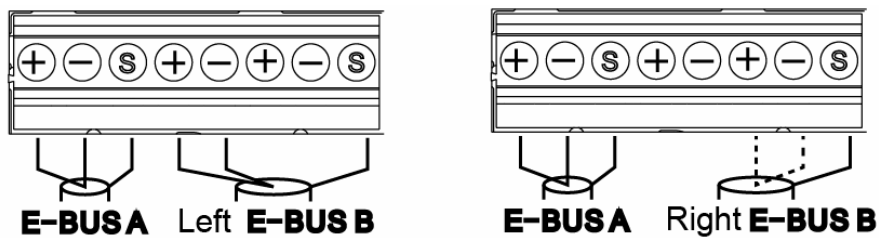


Figure 7-1 Terminal definitions

- 1) When APL power switches connect to E-BUS A and E-BUS B respectively with redundancy, and UIO831-S01 is in single module configuration, the wiring diagram is as follows.

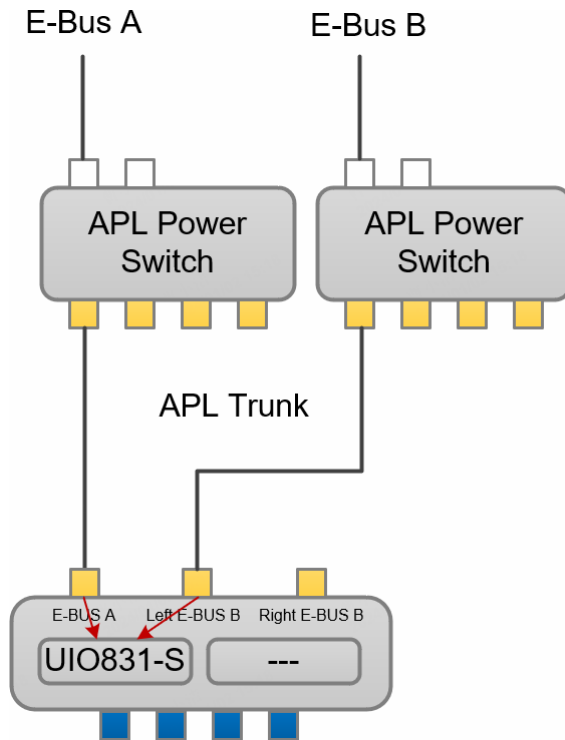


Figure 7-2 Wiring Diagram (1)

- 2) When APL power switches connect to E-BUS A and E-BUS B respectively with redundancy, and UIO831-S01 is in redundant configuration, the wiring diagram is as follows.

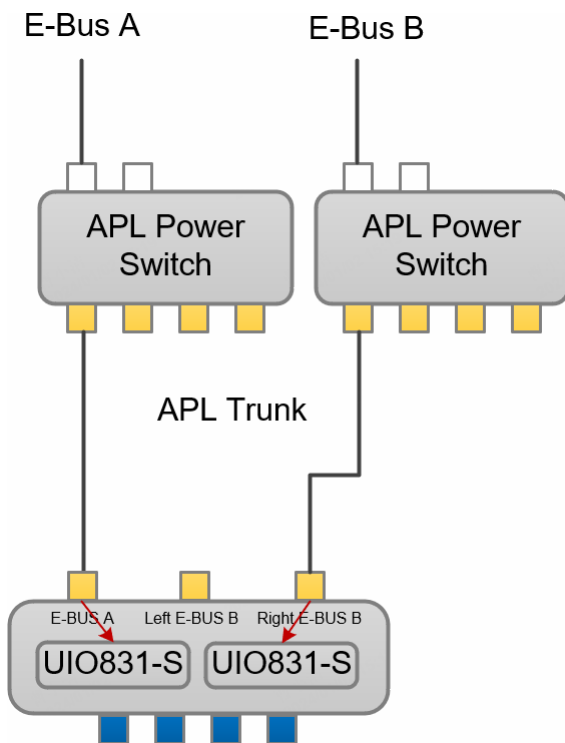


Figure 7-3 Wiring Diagram (2)

IP Address

When the trunk of UO831-S01 connects with an APL power switch, its IP is assigned by the APL power switch automatically.

Table 7-2 Module IP descriptions

Left Module IP	Right Module IP
IP address: $172.27.(X+4).(Y*4)$ Subnet mask: 255.255.0.0 Where: X = E-Bus node address (1 to 31) of the connected APL power switch Y = Trunk port number (0 to 7) of the connected APL power switch	IP address: $172.27.(X+4).(Y*4+1)$ Subnet mask: 255.255.0.0 Where: X = E-Bus node address (1 to 31) of the connected APL power switch Y = Trunk port number (0 to 7) of the connected APL power switch

7.2 Power Wiring

The power terminals (auxiliary power) on MB831-S01 in Figure 6-1 are shown in the following table. The maximum power capacity of the auxiliary power supply is 40W, and it is evaluated based on the length of the trunk and signal type.



TIP:

The evaluation tool is the "APL Network Design Tool", and you can contact SUPCON® engineering technicians to obtain it.

Table 7-3 Power terminals

Marks	Description
V1+	Auxiliary power input +
V2+	Auxiliary power output +
V1-	Auxiliary power input -
V2-	Auxiliary power output -

7.3 Grounding

The figure below shows a grounding example of the module.

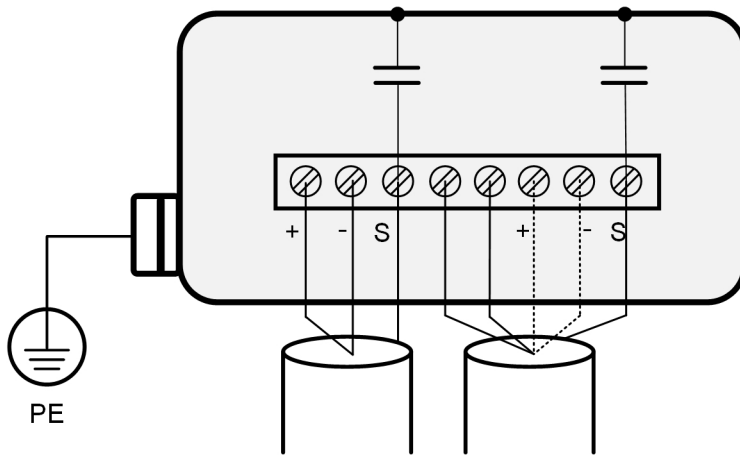


Figure 7-1 Example of grounding

7.4 Cable Requirements

The terminal blocks allow for wires with the maximum section of 2.5 mm^2 . We recommend using wires with 1 or 1.5 mm^2 section, 8 mm stripping length and $(0.5-0.6) \text{ N}\cdot\text{m}$ torque.

Section 8 Diagnosis and Display

I/O module periodically performs self-check and displays its status through its indicators and diagnosis software.

8.1 Indicators

Table 8-1 Indicator description

Indicator	Status	Meaning	Troubleshooting
Operating status indicators: Status (red, yellow, green)	Solid green	Normal	—
	Flashing green	No configurations	Downloading configuration
	Solid red	Module fault	Re-insert the module. If the fault still exists, replace the module.
	Solid yellow	Bus communication fault	Trouble shoot by the following steps: If all modules are in the same status, the controller, I/O link module, or rack might be faulty. If single module is in this status, check and replace this module.
	Off	Not working, AO/DO entering fail-safe status, or address conflict	Trouble shoot by the following steps: If all indicators are off after power on, check the power supply or rack. If status indicator of a single module is off, check if the rack address is conflicted. If not, the module may be faulty and needs replacement.
Working/Standby indicator: Duplex (green)	On	Working	—
	Off	Standby	—
Channel power supply status indicator: Power (Green)	On	Normal	—
	Off	Power fault	Check the power module and wiring. If the fault still exists, replace the module.
Channel indicators: 1–16 (green)	On	Signal is ON	An exclusive status of DI/DO signal, which means the signal is ON.
	Off	Signal is OFF or normal.	For DI/DO signals, it means the signal is OFF. For other signals, it means the signal is normal.
	Flashing (2.5 Hz)	Channel fault Or, DI, DO status changes	Check the wiring. If the fault still exists, please replace the signal adaptor or UIO module.

8.2 Detailed Diagnosis

Item	Troubleshooting
Signal sampling fault: such as the DI channel is always ON and does not change based on the actual signals.	Check if the used adaptor is consistent with the configuration.

Section 9 Notes for Application

- When the module is redundantly configured, if one of the module is not available, the two modules will switch over to ensure availability of the system. An unavailable module triggers an alarm. Please timely change it.
- In a non-redundant configuration, the module can only be inserted into Slot 01. If it is unavailable, it will impact the system. An unavailable module triggers an alarm. Please timely change it.
- Signal type of the module is configured in the software. Please make sure the configured type is consistent with the actual wiring.
- Do not connect together wet signals and the channels with power supply to avoid equipment failure.
- Channels of this module are independent from each other. Do not tie them together, meaning they are not common.

Section 10 Revision History

Table 10-1 Revision history

Version	Applicable product model	Remarks
V1.0 (20230704)	UIO831-S01 V10.11.00	First release.
V1.1 (20240102)	UIO831-S01 V11.12.00 MB831-S01 V11.00.00 MB831-E01 V10.10.00	● Added supporting redundancy descriptions for APL Trunk terminals on MB831 base. ● Updated auxiliary power capability description for "Power Wiring". ● Updated grounding diagram.