

RS-485 I/O Products



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2.1. Overview




Although RS-485 is a very old technology, it is still a good choice to establish a cost-effective remote I/O system. Our RS-485 remote I/O module supports DCON protocol, Modbus RTU/ASCII protocol. According to different application, we have developed various RS-485 I/O modules, such as palm-size I-7000/M-7000 series (Ch 2.2) and tiny-size tM series (Ch2.3). The module has diversified I/O interface, such as overvoltage-protection analog input module, relay output, digital input/output, counter, timer...etc.

The brief comparison is as the following table. Besides those regular RS-485 I/O modules, we can also provide some ODM modules.

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RS-485 I/O Products

Model Name	tM series	I-7000	M-7000
Pictures			
Communication			
Protocol	DCON, Modbus RTU, Modbus ASCII	DCON	DCON, Modbus RTU
Data Format	(N, 8, 1), (N, 8, 2), (O, 8, 1), (E, 8, 1)	(N,8,1)	
Max. Nodes	32	256	
Bias resistor	Yes, 10 KΩ	No (Note1)	
Dual Watchdog	Yes, Module (2.3 second), Communication (Programmable)	Yes, Module (1.6 second), Communication (Programmable)	
I/O			
DIO max. channel	8	16	
AIO	Resolution	12/14 bits	12/16 bits
	Max. channel	8 (tM-AD8)	20 (I-7017Z, M-7017Z)
	Individual Channel Configuration	-	Yes
Display			
Power and Communication LED	Yes	Yes	
I/O Status LED	-	Yes (for D version only)	
7-Segment LED	-	Yes (for D version only)	
Mechanical			
Dimensions (W x L x D)	52 mm x 98 mm x 27 mm	72 mm x 123 mm x 35 mm	

Note1: The RS-485 master is required to provide the bias. Otherwise, the tM-SG4 or SG-785 should be added to provide the bias. All ICP DAS controllers and converters provide the bias.

Furthermore, we also developed RU-87Pn, a series of RS-485 remote I/O unit for compact and modular I/O expansion. It comprises a CPU, a power module and a backplane with a number of I/O slots for flexible I/O configuration. With its patented technology, namely auto configuration and hot swap, it saves lots of labor on the set up and maintenance of the automation systems. Reliable 3-piece construction enables users to hot swap modules during operation, without rewiring. All I/O module data are backed up in the non-volatile memory of the RU-87Pn. After hot-swapping a module, all settings are automatically loaded to recover.



Features

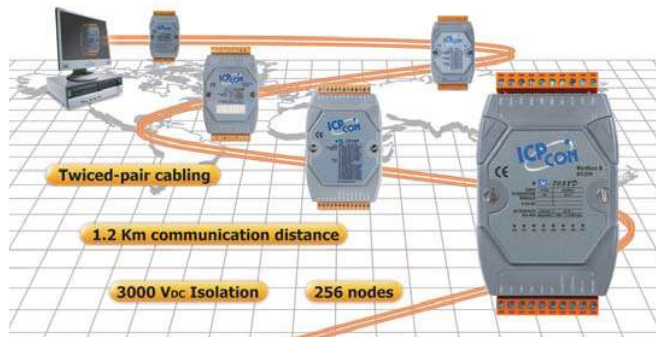
- Hot Swap
- Auto Configuration
- Easy Duplicate System
- Easy Maintenance and Diagnosis
- DCON Protocol



For more details of, refer to **PAC Product Catalog**

2.2. I-7000 and M-7000 Modules

• Introduction



I-7000 and M-7000 remote I/O modules provide cost-effective protection and conditioning for a wide range of valuable industrial control system. The product line includes sensor-to-computer, computer-to-sensor, digital I/O, timer/ counter, RS-232 to RS-485 converter, USB to RS-485 converter, RS-485 repeater, RS-485 hub and RS-232/422/485 to Fiber Optics. I-7000 supports DCON protocol, and M-7000 modules support Modbus RTU and DCON protocols. Many SCADA/HMI software and PLCs support Modbus RTU protocol. It is easy for them to integrate with M-7000 modules.

• Applications

Factory automation, machine automation, testing equipment, building automation, solar energy system, pollution monitoring system, heating chamber...etc

• Features

RS-485 Industrial Multi-Drop Network

I-7000/M-7000 series modules use the industrial EIA RS-485 communication interface to transmit and receive data at high speed over long distance. All modules are easy to integrate to the regular computer and controller. Internal surge protection circuitry is used on data lines to protect the modules from spikes.

I/O type and Range Programmable

The analog modules support several types and ranges which can be selected remotely by issuing command from the host.

Easy Mounting and Connection

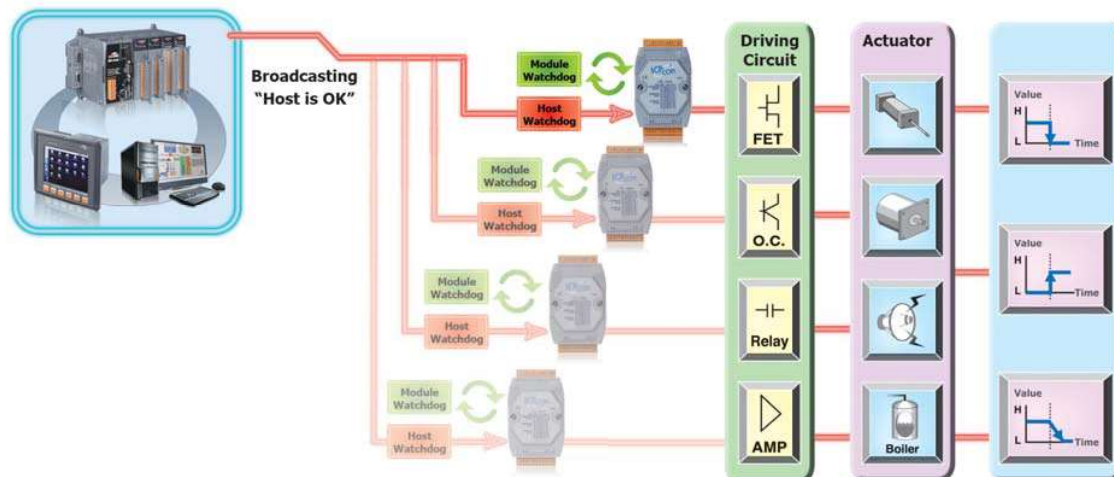
The user may mount the modules on a DIN rail or piggyback.

Rugged Industrial Environment

I-7000 and M-7000 modules provide module watchdog and host watchdog. The module watchdog is a hardware watchdog designed to automatically reset the micro-processor when the module hangs. The host watchdog is a software watchdog that monitors the communication status of the host controller, such as PC, PLC and PAC. The output of module will go to the safe value state when the host fails to prevent any erroneous operations. The Dual Watchdog design ensures higher reliability and stability.

• Programmable Power-on Value and Safe Value

The DO and AO I/O modules provide programmable power-on value and safe value. When the host watchdog is active, the DO and AO output go to the pre-configured safe value.

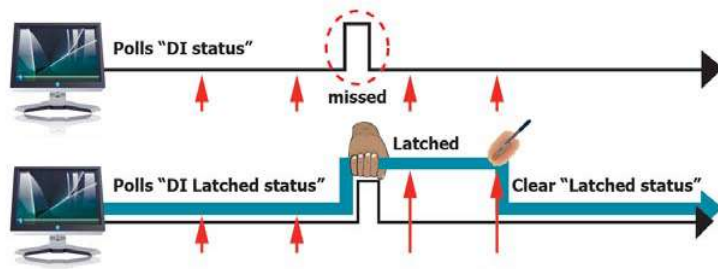


Advanced DI Functions

DI channel is not only for reading digital input status but also provides several advanced functions in the meanwhile.

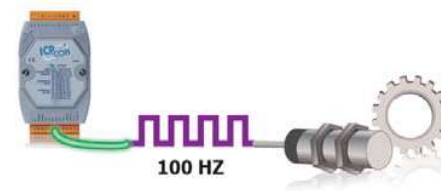
• DI Latch Function

All DI channels provide Latch function to keep the high/low events in the internal registers of the module. In general, the host controller polls modules one by one to get all DI status. Because RS-485 is a low speed field bus, the polling will take time and probably miss a short duration signal. With the DI latch function, the short duration (>=5ms) signal will not be lost any more.



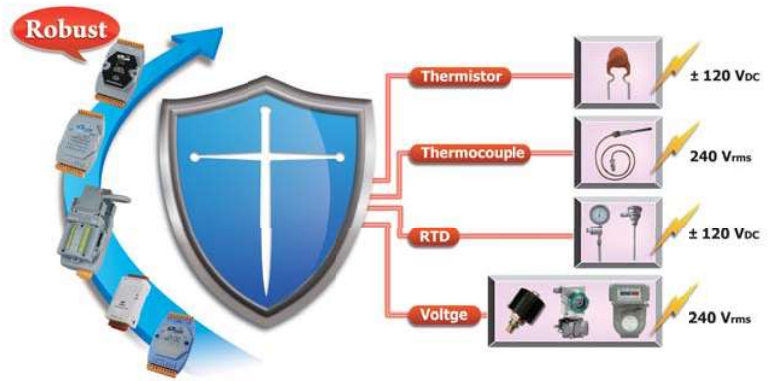
• Low Speed Counter

The DI module automatically counts the DI signal in the background. The signal under 100Hz can be detected and counted.



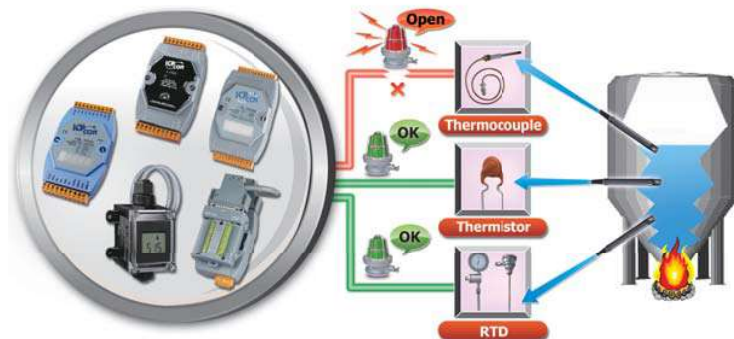
Overvoltage Protection

Many of our analog input modules provide high overvoltage protection for the analog input channels. When user picks wrong line accidentally or high voltage spike is applied to the analog input terminals, the module will not be broken and can still get the correct readings. This feature improves the reliability, reduces maintenance frequency, and makes the whole system more robust.



Open Wire Detection

The thermocouple, RTD and thermistor sensors are widely used in temperature control applications. If the system can not monitor the open wire status of the sensors, it may be very dangerous and cause large damage to life and property. When the wire of sensor is broken and the controller does not know the open wire status, the system may heat the boiler continuously and result in fire or explosion. Our thermocouple, RTD, thermistor modules provide open wire detection and make the system safer.



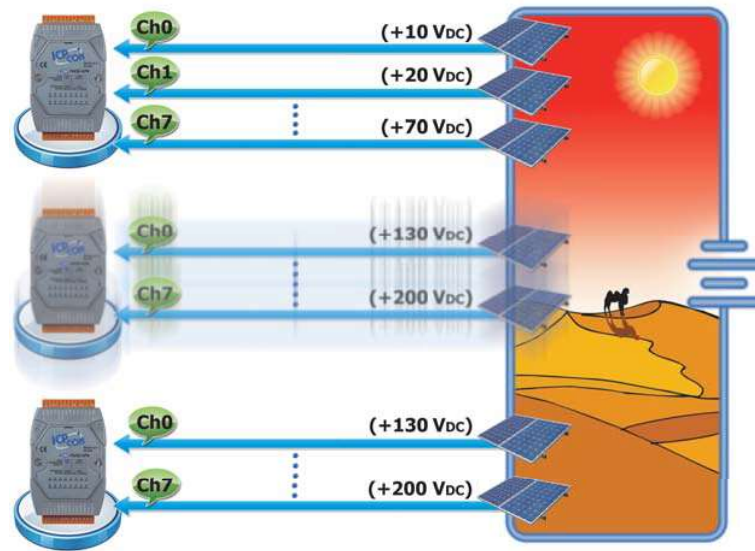
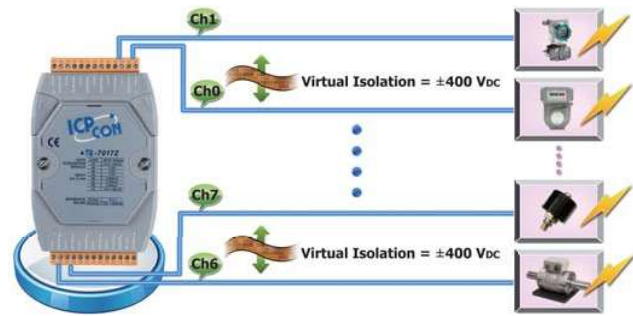
Over-current Protection

For the current measurement module, it may be damaged when there is high current or voltage introduced into the current loop. The protection for current measurement is improved to +/-120 VDC and +/-1000 mA. A high current or voltage in the current loop will not damage the current measurement, so the whole system can work normally.



Virtual Channel to Channel Isolation

The "R" and "Z" version of analog input modules provide +/-400 VDC virtual channel to channel isolation to avoid the noise interference from adjacent channel in the industrial environment. To name a few of the modules, they are I-7017R, I-7017Z, I-7018R, I-7018Z, I-7019R, and I-7019Z. Though it is not real channel to channel isolation, there is only 1uA leakage current between two adjacent channels and the interference is very small and can be negligible.

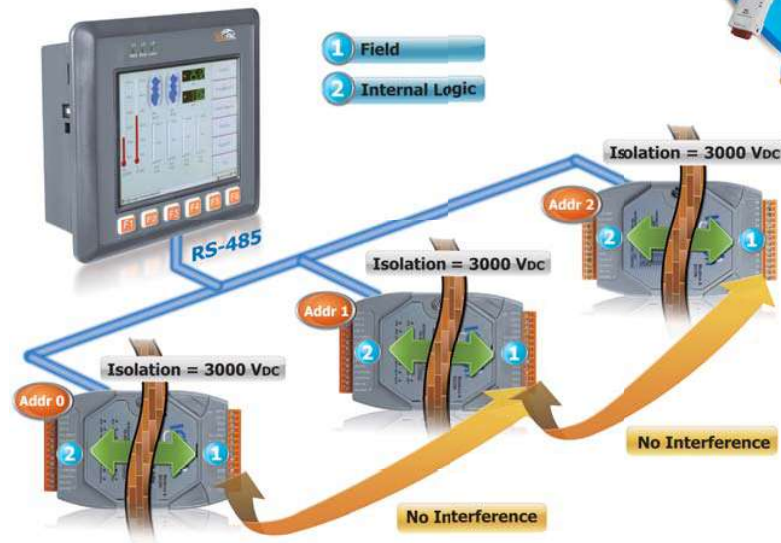


Common Voltage Protection

The typical application is to monitor the charging status of the batteries in series. The voltage of each battery is +10 VDC so the first battery is +10 VDC , the second battery is +20 VDC etc. The differential voltage of the 20th battery is only +10 VDC between vin+ and vin- terminal, while the common voltage is up to 200 VDC . If the common voltage of the analog input module is not large enough, then it can not measure the correct voltage of the battery in charging. ICP DAS analog input modules provide +/-200 VDC high common voltage for industrial applications.

ESD Protection

In the industrial environment there are many noise, spike, electrostatic etc. If the module is not strong enough, it is very easy to be damaged. The I-7K and M-7K modules all pass +/-4 KV ESD contact and +/-8 KV ESD air tests by static electricity gun in our laboratory. The test procedures follow the IEC 61000-4-2 standard. Our modules are immunity to the electrostatic discharges by using components that can clamp and resist to the high voltages defined by IEC 61000-4-2 standard.



3000 VDC Isolation

The I-7K and M-7K series have 3000 VDC isolation between the field and the internal logic. This isolation prevents the noise from the field to the internal logic that can damage the module. It is recommended to choose isolated modules that will be connected on RS-485 network. There will be no interference from the neighbor module because the noise from the neighbor module is isolated.

Dual Communication Protocols

All I-7000 and M-7000 modules use a simple command /response protocol for communication. M-7000 also supports the industrial standard Modbus RTU protocol. The user can use high-level language, such as C, VB, Delphi, and others to write their application programs. Some famous software package can control I-7000 and M-7000 directly, such as LabView, Indusoft, Tracemode, EZ data logger, EZ Prog..etc.

I-7000: supports DCON protocol

M-7000: supports Modbus RTU and DCON protocols

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RS-485 I/O Products

Self-Tuner Inside



"Self-Tuner" is a patented ASIC. It auto-tunes the baud rate and data format in whole RS-485 network, and auto-handles the direction of the RS-485 communication line. Since the unique features of this ASIC, the user can implement a very flexible remote I/O configuration via the RS-485 network.

Expandable Network

I-7510 repeater is more than a pure isolated repeater. "Self-Tuner" ASIC is built-in. It has some outstanding features, such as 3000V isolation, 115K max. speed, variable baud rate and data format. Each I-7510 repeater can let you extend the network to another 4,000 ft long. Actually the user should consider the network length and the hardware loading effect and use I-7510 to isolate different groups to avoid high voltage hitting the whole system through a single communication network.

• Hardware

1. Installation

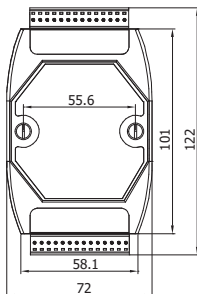


DIN-Rail Mounting

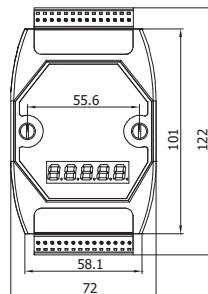


Stack Mounting

2. Dimensions (Units: mm)



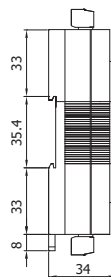
Front View



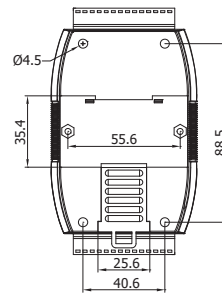
Front View



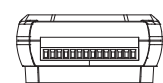
Left Side View



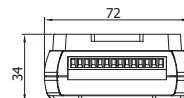
Right Side View



Rear View



Top View



Bottom View

• Software Support

Our free charge software utility and development kit include

1. DCON Utility

DCON Utility is used to search, configure and test simply the I-7000 and M-7000 modules via the serial port (RS-232/485).

2. OPC Server

NAPOPC_ST DA Server is a free OPC DA Server ("OPC" stands for "OLE for Process Control" and "DA" stands for "Data Access") for ICP DAS products. Based on Microsoft's OLE COM (component object model) and DCOM (distributed component object model) technologies, NAPOPC_ST DA Server defines a standard set of objects, interfaces and methods for use in process control and manufacturing automation applications to facilitate the interoperability.

Using NAPOPC_ST DA Server, system integrates data with SCADA/HMI/ Database software on the same computer and others. SCADA/HMI/Database sends a request and NAPOPC DA Server fulfills the request by gathering the data of ICP DAS modules (License Free) and third-party devices (License Charge) to SCADA/HMI/Database.

For different OS of PAC products, ICP DAS provides several professional DA Servers:

Version	NAPOPC_ST	NAPOPC_XPE	NAPOPC_CE5	NAPOPC_CE6
Platform	Desktop Windows	Windows XP Embedded	Windows CE5	Windows CE6
Price	Free/\$	Free	Free	Free

For more Information please visit <http://opc.icpdas.com>

3. EZ Data Logger

EZ Data Logger is the software that ICP DAS provides for users to easily build a small SCADA system on Windows 2000/XP/Vista. It comes with two versions, "Lite" & "Professional". The Lite version is not only full-functioned but free to all ICP DAS users!

EZ Data Logger is a small data logger software. It can be applied to small remote I/O system. With its user-friendly interface, users can quickly and easily build a data logger software without any programming skill.

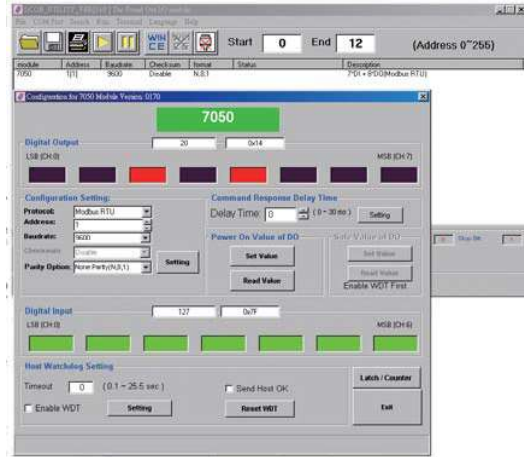
EZ Data Logger
 DCON
 Modbus TCP
 Modbus Serial

- ★ Virtual Channel Definition
- ★ Control Logic (VB Script)
- ★ Alarm Notifier
- ★ IP Camera Viewer

High/Low Alarm, Layout, Data Trend, Database and Report

4. Various Software Development Toolkits

Plenty of library functions and demo programs are provided to let user develop programs easily under Windows, Linux and DOS operating systems. We also provide LabVIEW driver, DASYLab driver and InduSoft driver for all I-7000 and M-7000 modules. The SDK includes: DLL, ActiveX, Labview driver, Indusoft driver, Dasylab driver, Linux driver



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RS-485 I/O Products

• I-7000 and M-7000 Selection Guide

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RS-485 I/O Products

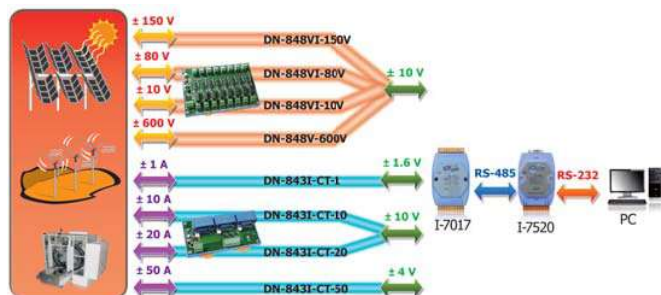
Classified Index		Model Name	Page	
Analog Input Modules	Voltage & Current Input Module	I-7012(D), I-7012F(D), I-7017, I-7017F, I-7017C, I-7017FC	2-2-7	
		M-7017, M-7017C, M-7017H, M-7017HL		
		Heavy Industrial Grade	I-7017R, I-7017R-A5, I-7017RC, I-7017Z	2-2-8
			M-7002, M-7003, M-7017R, M-7017R-A5, M-7017RC, M-7017Z	
	Thermocouple, Voltage & Current Input Module	I-7011(D), I-7018, M-7011(D)	2-2-9	
		M-7018		
		Heavy Industrial Grade	I-7018R, I-7018Z, I-7019R	2-2-10
			M-7018R, M-7018Z, M-7019R, M-7019Z	
	RTD Input Modules	I-7013(D), I-7033(D)	2-2-11	
		M-7033(D)		
		Heavy Industrial Grade	I-7015, I-7015P	2-2-12
			M-7015, M-7015-5, M-7015P	
	Thermistor Input Module (Heavy Industrial Grade)	I-7005	2-2-13	
		M-7005		
Transmitter Input Module	I-7014D	2-2-14		
Strain Gauge Input Module	I-7016(D), I-7016P(D)	2-2-15		
	M-7016(D)			
Analog Output Modules		I-7021, I-7021P, I-7022, I-7024	2-2-16	
		M-7022, M-7024		
		I-7024R	2-2-17	
		M-7024R, M-7024U		
Digital I/O Modules	DC Digital Input Module	I-7041(D), I-7041P(D), I-7051(D), I-7052(D), I-7053(D)_FG	2-2-18	
		M-7041(D), M-7041P(D), M-7041(D)-A5, M-7051(D), M-7052(D), M-7053(D)		
	AC Digital Input Module	I-7058(D), I-7059(D)	2-2-19	
		M-7058(D), M-7059(D)		
	Digital Output Module	I-7042(D), I-7043(D), I-7045(D), I-7045(D)-NPN	2-2-20	
		M-7045(D), M-7045(D)-NPN		
	Digital Input & Output Module	I-7044(D), I-7050(D), I-7050A(D), I-7055(D), I-7055(D)-NPN	2-2-21	
		M-7050(D), M-7055(D), M-7055(D)-NPN		
Relay Output Modules	Relay Output Module	I-7060(D), I-7063(D)I-7065(D), I-7061(D), I-7067(D)	2-2-22	
		M-7060P(D), M-7060(D), M-7065(D), M-7061(D), M-7067(D)		
	Solid-State Relay Output Module	I-7063A(D), I-7065A(D), I-7063B(D), I-7065B(D)	2-2-23	
		M-7065A(D), M-7065B(D)		
	PhotoMos Relay Output Module	I-7066(D)	2-2-24	
		M-7066P(D)		
Counter/Frequency/PWM Modules		I-7080(D), I-7080B(D), I-7083(D), I-7083B(D), I-7088	2-2-25	
		M-7080(D), M-7080B(D), M-7084, M-7088		

2.2.1. Voltage & Current Input Module

Voltage & Current Input Module									
Model Name		I-7012(D)	I-7012F(D)	I-7017	I-7017F	M-7017H	M-7017HL	I-7017C	I-7017FC
Pictures									
Channels		1		8		8			
Wiring		Differential		Differential (Note 1)		Differential			
Input Range		±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA (requires optional external 125 Ω resistor)		±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA (requires optional external 125 Ω resistor)		±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA (requires optional external 125 Ω resistor)		±15 mV, ±50 mV, ±100 mV, ±500 mV, ±1 V, ±2.5 V	
Resolution		16-bit	12/16-bit	16-bit	12/16-bit	16-bit		16-bit	12/16-bit
★ Accuracy	Normal mode	0.1%		0.1%		0.1%		0.1%	
	Fast mode	-	0.5%	-	0.5%	0.2%		-	0.5%
★ Sampling Rate	Normal mode	10 Hz		10 Hz (Total)		40 Hz (Total)		10 Hz (Total)	
	Fast mode	-	100 Hz	-	60 Hz (Total)	800 Hz (Total)		-	60 Hz (Total)
Input Impedance		20 MΩ		20 MΩ		10 MΩ		20 MΩ	
Common Voltage Protection		±10 Vdc		±15 Vdc		±15 Vdc	±5 Vdc	±15 Vdc	
★ Individual Channel Configuration		-		-		Yes		-	
★ Overvoltage Protection		±15 Vdc		±120 Vdc		±15 Vdc	±5 Vdc	±120 Vdc	
Overcurrent Protection				-				Yes	
Virtual Channel to Channel Isolation		±30 Vdc				±15 Vdc	±5 Vdc	±30 Vdc	
System									
★ Dual Watchdog		Yes							
ESD (IEC 61000-4-2)		±2 kV		±2 kV for I-7017 ±4 kV for M-7017	±2 kV	±4 kV		±2 kV	±4 kV
EFT (IEC 61000-4-4)		-		±4 kV for M-7017	-	±4 kV		±4 kV	
Intra-Module Isolation, Field-to-Logic		3000 Vdc				2500 Vdc		3000 Vdc	
Power Input		10 ~ 30 Vdc							
Power Consumption		1.3 W; 1.9 W for (D) version		1.3 W		1.8 W		1.7 W	1.3 W
<p>Note1: I-7017 and I-7017F are 6-channel differential and 2-channel single-ended, or 8-channel differential. M-7017 is 8-channel differential.</p> <p>Note2: I-7012(D) and I-7012F(D) both include 1 DI and 2 DO channels. The specification is as follows</p>									
Digital Input					Digital Output				
Channels	1				Channels	2			
Contact	Dry				Type	Open Collector			
Sink/Source (NPN/PNP)	Source				Sink/Source (NPN/PNP)	Sink			
On Voltage Level	Close to GND				Load Voltage	3.5 ~ 30 Vdc			
Off Voltage Level	Open				Max. Load Current	30 mA/Channel			
Counter (50 Hz, 16-bit)	Yes				Power-on Value	Yes			
Input Impedance	3 kΩ				Safe Value	Yes			
Overvoltage Protection	±30 Vdc								

Accessories

	DN-843V-600V CR	3-channel 600 V voltage attenuator (RoHS)
	DN-848VI-80V CR	8-channel 80 V voltage attenuator (RoHS)
	DN-848VI-150V CR	8-channel 150 V voltage attenuator (RoHS)
	DN-843I-CT-1 CR	3-channel 1 A Current Transformer (RoHS)
	DN-843I-CT-50 CR	3-channel 50 A Current Transformer (RoHS)



Heavy Industrial Grade

To work well in heavy industrial environment, the hardware of module need special design to against noise, surge, EFT. For this purpose, we provide several heavy industrial grade analog modules.

- 1. Common Voltage Protection
- 2. Overvoltage Protection
- 3. ESD (IEC 61000-4-2)
- 4. EFT (IEC 61000-4-4)

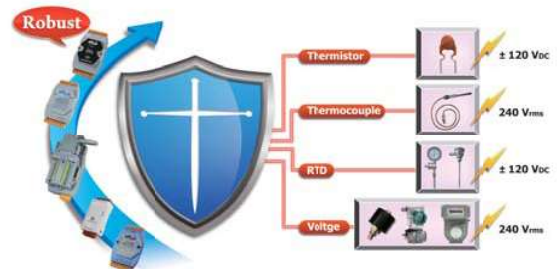
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RS-485 I/O Products

Voltage & Current Input Module (Heavy Industrial Grade)						
Model Name	M-7002	M-7003	I-7017R M-7017R	I-7017R-A5 M-7017R-A5	I-7017RC M-7017RC	I-7017Z M-7017Z
Pictures	NEW 	Available soon 				
Channels	4	8	8		8	10/20 (Note 1)
Wiring	Differential	5-channel differential and 3-channel single-ended	Differential		Differential	Diff./Single-Ended
Input Range	±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V ±20 mA, 0 ~ 20 mA, 4 ~ 20 mA (Jumper selectable)		±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA (requires optional external 125 Ω resistor)		±50 V, ±150 V ±20 mA, 0~20 mA, 4~20 mA	±150 mV, ±500 mV, ±1 V, ±5 V, ±10 V, ±20 mA, 0 ~ 20 mA, 4 ~ 20 mA (Jumper selectable)
Resolution	12/16-bit		12/16-bit		12/16-bit	
Accuracy	Normal mode	0.1%	0.1%		0.1%	
	Fast mode	0.5%	0.5%		0.5%	
Sampling Rate	Normal mode	10 Hz (Total)		10 Hz (Total)		10 Hz (Total)
	Fast mode	60 Hz (Total)		60 Hz (Total)	50 Hz (Total)	60 Hz (Total)
Input Impedance	Differential	2 MΩ	20 MΩ	2 MΩ	290 kΩ	2 MΩ
	Single-ended	-	10 MΩ	-	-	1 MΩ
Common Voltage Protection	±200 Vdc	±15 Vdc	±200 Vdc			
Individual Channel Configuration	Yes	-	-			
Overvoltage Protection	240 Vrms	120 Vdc	240 Vrms	±200 Vdc	240 Vrms	240 Vrms
Overcurrent Protection	Yes	-	-		Yes	
Virtual Channel to Channel Isolation	±400 Vdc	±30 Vdc	±400 Vdc			
System						
Dual Watchdog			Yes			
ESD (IEC 61000-4-2)			±4 kV			
EFT (IEC 61000-4-4)			±4 kV			
Surge (IEC 61000-4-5)	±3 kV		0.5 kV			
Intra-Module Isolation, Field-to-Logic	2500 Vdc		3000 Vdc			
Power Input			10 ~ 30 Vdc			
Power Consumption	1.9 W	1.8 W	1.3 W		1.3 W	2.0 W
Note1: Differential wiring can be used for voltage input and current input. Single-Ended wiring can be used for voltage input only.						
Digital Input for M-7002			Relay Output for M-7002 and M-7003			
Channels	5		Channels	4		
Contact	Wet		Type	Power Relay (Form A)		
Sink/Source (NPN/PNP)	Sink/Source		Contact Rating	5 A @ 250 Vac / 5 A @ 30 Vdc		
On Voltage Level	3.5 ~ 30 Vdc		Surge Strength	3000 Vdc		
Off Voltage Level	+1 Vdc Max.		Operate Time	3 ms		
Counter (100Hz, 16-bit)	Yes		Release Time	2 ms		
Input Impedance	10 kΩ		Mechanical Endurance	2 × 10 ⁷ ops.		
Overvoltage Protection	±70 Vdc		Electrical Endurance	10 ⁵ ops.		
Isolation Voltage	3750 Vrms		Power-on Value	Yes		
			Safe Value	Yes		

Overvoltage Protection

Many of our analog input modules provide high overvoltage protection for the analog input channels. When user picks wrong line accidentally or high voltage spike is applied to the analog input terminals, the module will not be broken and can still get the correct readings. This feature improves the reliability, reduces maintenance frequency, and makes the whole system more robust.



2.2.2. Thermocouple, Voltage & Current Input Module

■ Thermocouple Introduction

A thermocouple is a temperature sensor which consists of two wires of different conductors. Based on the Seebeck effect in thermoelectricity, the temperature difference results voltage difference on the two wires. Thermocouples are widely used in scientific and industrial applications because they're generally accurate and can operate over wide range of temperature.



■ Applications



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RS-485 I/O Products

Thermocouple, Voltage & Current Input Module							
Model Name		I-7011(D) M-7011(D)	I-7018 M-7018				
Pictures							
Channels		1	8 (I-7018 is 6-channel differential and 2-channel single-ended, or 8-channel differential. M-7018 is 8-channel differential.)				
Wiring		Differential					
★ Sensor Type	Thermocouple	J, K, T, E, R, S, B, N, C					
	Voltage	±15 mV, ±50 mV, ±100 mV, ±500 mV, ±1 V, ±2.5 V					
	Current	±20 mA (requires optional external 125 Ω resistor)	±20 mA, 0 ~ 20 mA, 4 ~ 20 mA (requires optional external 125 Ω resistor)				
Resolution		16-bit					
★ Accuracy		0.1%					
★ Sampling Rate		10 Hz	10 Hz (Total)				
Input Impedance		> 400 kΩ					
★ Common Voltage Protection		±5 Vdc	±15 Vdc				
★ Individual Channel Configuration		-					
★ Overvoltage Protection		±5 Vdc	±80 Vdc				
Overcurrent Protection		-					
Virtual Channel to Channel Isolation		-	±30 Vdc				
Open Wire Detection (for thermocouple only)		Yes	-				
Temperature Outputs Consistency		-					
Stable Temperature Output in the Field		-					
System							
★ Dual Watchdog		Yes					
ESD (IEC 61000-4-2)		-					
EFT (IEC 61000-4-4)		-					
Intra-Module Isolation, Field-to-Logic		3000 Vdc					
Power Input		10 ~ 30 Vdc					
Power Consumption		0.9 W; 1.5 W for (D) version	1.0 W				
Note1: I-7011(D) and M-7011(D) both include 1 DI and 2 DO channels. The specification is as following							
Digital Input		Digital Output		■ Thermocouple Type			
Channels	1	Channels	2	Type	Range (°C)	Type	Range (°C)
Contact	Dry	Type	Open Collector	J	-210 ~ +760	B	0 ~ +1820
Sink/Source (NPN/PNP)	Source	Sink/Source (NPN/PNP)	Sink	K	-270 ~ +1372	N	-270 ~ 1300
On Voltage Level	Close to GND	Load Voltage	3.5 ~ 30 Vdc	T	-270 ~ +400	C	0 ~ 2320
Off Voltage Level	Open	Max. Load Current	30 mA/Channel	E	-270 ~ +1000	L	-200 ~ +800
Counter (50 Hz, 16-bit)	Yes	Power-on Value	Yes	R	0 ~ +1768	M	-200 ~ +100
Input Impedance	3 kΩ	Safe Value	Yes	S	0 ~ +1768	L (DIN43710)	-200 ~ +900
Overvoltage Protection	±30 Vdc						

Heavy Industrial Grade

To work well in heavy industrial environment, the hardware of module need special design to against noise, surge, EFT. For this purpose, we provide several heavy industrial grade analog modules.

1. Common Voltage Protection
2. Overvoltage Protection
3. ESD (IEC 61000-4-2)
4. EFT (IEC 61000-4-4)

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RS-485 I/O Products

Thermocouple, Voltge & Current Input Module (Heavy Industrial Grade)																																
Model Name	I-7018R M-7018R	I-7018Z M-7018Z	I-7019R M-7019R	M-7019Z																												
Pictures																																
Thermocouple, Voltge & Current Input																																
Channels	8	10	8	10																												
Wiring	Differential																															
Sensor Type	Thermocouple J, K, T, E, R, S, B, N, C, L, M, LDIN43710																															
	Voltage		Voltage																													
	Current		Current																													
Resolution	16-bit																															
Accuracy	0.1%																															
Sampling Rate	10 Hz (Total)		8 Hz (Total)	10 Hz (Total)																												
Input Impedance	> 400 kΩ																															
Common Voltage Protection	±200 Vdc		±200 Vdc																													
Individual Channel Configuration	-	Yes	Yes																													
Overvoltage Protection	240 Vrms		240 Vrms																													
Overcurrent Protection	-																															
Virtual Channel to Channel Isolation	±400 Vdc																															
Open Wire Detection (for thermocouple only)	Yes		Yes																													
Temperature Outputs Consistency	-	Yes	-	Yes																												
Stable Temperature Output in the Field	-	Yes	-	Yes																												
System																																
Dual Watchdog	Yes																															
ESD (IEC 61000-4-2)	±4 kV																															
EFT (IEC 61000-4-4)	±4 kV																															
Intra-Module Isolation,Field-to-Logic	3000 Vdc																															
Power Input	10 ~ 30 Vdc																															
Power Consumption	1.0 W	1.1 W	1.2 W	1.8 W																												
Note1: We recommend to choose I-7018Z/M-7018Z and M-7019Z for extremely accurate thermocouple measurement.																																
Thermocouple Type																																
<table border="1"> <thead> <tr> <th>Type</th> <th>Range (°C)</th> <th>Type</th> <th>Range (°C)</th> </tr> </thead> <tbody> <tr> <td>J</td> <td>-210 ~ +760</td> <td>B</td> <td>0 ~ +1820</td> </tr> <tr> <td>K</td> <td>-270 ~ +1372</td> <td>N</td> <td>-270 ~ 1300</td> </tr> <tr> <td>T</td> <td>-270 ~ +400</td> <td>C</td> <td>0 ~ 2320</td> </tr> <tr> <td>E</td> <td>-270 ~ +1000</td> <td>L</td> <td>-200 ~ +800</td> </tr> <tr> <td>R</td> <td>0 ~ +1768</td> <td>M</td> <td>-200 ~ +100</td> </tr> <tr> <td>S</td> <td>0 ~ +1768</td> <td>L (DIN43710)</td> <td>-200 ~ +900</td> </tr> </tbody> </table>	Type	Range (°C)	Type	Range (°C)	J	-210 ~ +760	B	0 ~ +1820	K	-270 ~ +1372	N	-270 ~ 1300	T	-270 ~ +400	C	0 ~ 2320	E	-270 ~ +1000	L	-200 ~ +800	R	0 ~ +1768	M	-200 ~ +100	S	0 ~ +1768	L (DIN43710)	-200 ~ +900				
Type	Range (°C)	Type	Range (°C)																													
J	-210 ~ +760	B	0 ~ +1820																													
K	-270 ~ +1372	N	-270 ~ 1300																													
T	-270 ~ +400	C	0 ~ 2320																													
E	-270 ~ +1000	L	-200 ~ +800																													
R	0 ~ +1768	M	-200 ~ +100																													
S	0 ~ +1768	L (DIN43710)	-200 ~ +900																													
Accessories for I-7018Z, M-7018Z and M-7019Z																																
 I-7018Z-G/S = I-7018Z-G Connects DB-1820 Directly	 I-7018Z-G/2S = I-7018Z-G Connect DN-1822 Directly +1.8 m Cable	 I-7018Z-G/S + CD-2518D	 CD-2518D = 1.8 m Cable + DB-1820	 I-7018Z-G/S + CD-25015 + 4PAPP-006-G																												
			 CD-25015 = 15 cm Cable + DB-1820	 4PAPP-006-G																												

2.2.3. RTD Input Module

RTD Introduction

Resistance Temperature Detectors (RTD), as the name implies, are sensors used to measure temperature by correlating the resistance of the RTD element with temperature. Most RTD elements consist of a length of fine coiled wire wrapped around a ceramic or glass core. The element is usually quite fragile, so it is often placed inside a sheathed probe to protect it. The RTD element is made from a pure material whose resistance at various temperatures has been documented. RTDs are also relatively immune to electrical noise and therefore well suited for temperature measurement in industrial environments, especially around motors, generators and other high voltage equipment.

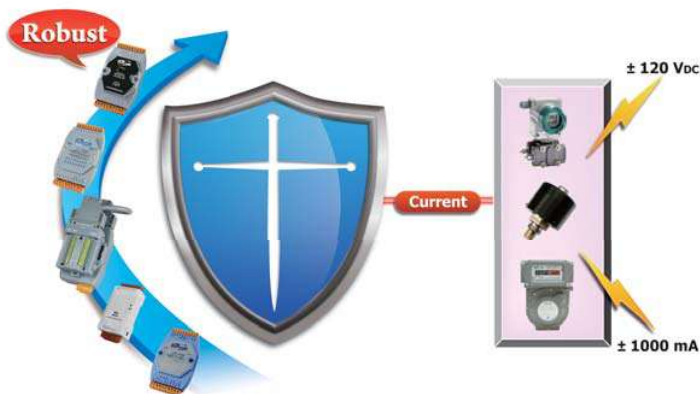
Applications



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RS-485 I/O Products

RTD Input Module		
Model Name	I-7013(D)	I-7033(D) M-7033(D)
Pictures		
RTD Input		
Channels	1	3
Wiring	2/3/4 wire	2/3/4 wire
★ Sensor Type	Pt100, Pt1000, Ni120	Pt100, Pt1000, Ni120
★ Resolution	16-bit	16-bit
★ Accuracy	±0.05%	±0.1%
★ Sampling Rate	10 Hz	15 Hz (Total)
★ Individual Channel Configuration	-	-
★ Overvoltage Protection	±5 Vdc	±25 Vdc
Open Wire Detection	Yes	Yes
3-wire RTD Lead Resistance Elimination	Yes	Yes
Resistance Measurement	3.2 KΩ Max.	
System		
★ Dual Watchdog	Yes	Yes
ESD (IEC 61000-4-2)	-	-
EFT (IEC 61000-4-4)	-	-
Intra-Module Isolation, Field-to-Logic	3000 Vdc	
Power Input	10 ~ 30 Vdc	
Power Consumption	0.7 W; 1.3 W for (D) version	1.0 W; 1.6 W for (D) version



Over-current Protection

For the current measurement module, it may be damaged when there is high current or voltage introduced into the current loop. The protection for current measurement is improved to +/-120 Vdc and +/-1000 mA.. A high current or voltage in the current loop will not damage the current measurement, so the whole system can work normally.

Heavy Industrial Grade

To work well in heavy industrial environment, the hardware of module need special design to against noise, surge, EFT. For this purpose, we provide several heavy industrial grade analog modules.

1. Common Voltage Protection
2. Overvoltage Protection
3. ESD (IEC 61000-4-2)
4. EFT (IEC 61000-4-4)

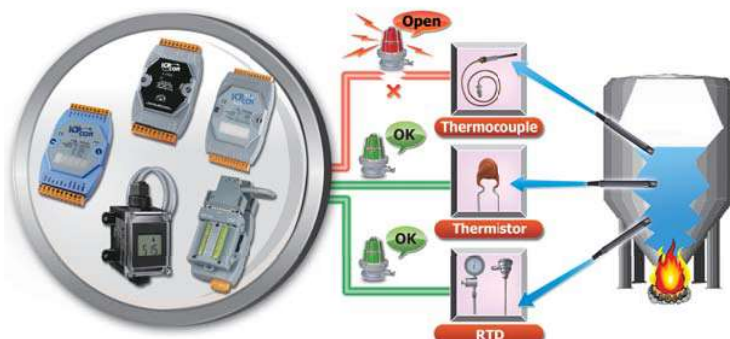
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RS-485 I/O Products

RTD Input Module (Heavy Industrial Grade)			
Model Name	I-7015	M-7015-5	I-7015P
	M-7015		M-7015P
Pictures		Available soon 	
RTD Input			
Channels	6	5	6
Wiring	2/3 wire		
★ Sensor Type	Pt100, Pt1000, Ni120, Cu100, Cu1000		
★ Resolution	16-bit		
★ Accuracy	±0.05%		
★ Sampling Rate	12 Hz (Total)		
★ Individual Channel Configuration	Yes		
★ Overvoltage Protection	120 Vdc		
Open Wire Detection	Yes		
3-wire RTD Lead Resistance Elimination	-	Yes	Yes
Resistance Measurement	3.2 KΩ Max.		
Digital Output			
Channels	8		
Type	Open Collector		
Sink/Source (NPN/PNP)	Sink		
Load Voltage	3.5 ~ 50 Vdc		
Max. Load Current	700 mA/Channel		
Short Circuit Protection	Yes		
Power-on Value	Yes		
Safe Value	Yes		
System			
Dual Watchdog	Yes		
ESD (IEC 61000-4-2)	±4 kV		
EFT (IEC 61000-4-4)	±4 kV		
Intra-Module Isolation, Field-to-Logic	3000 Vdc		
Power Input	10 ~ 30 Vdc		
Power Consumption	1.1 W	1.5 W	1.2 W

Open Wire Detection

The thermocouple, RTD and thermistor sensors are widely used in temperature control applications. If the system can not monitor the open wire status of the sensors, it may be very dangerous and cause large damage to life and property. When the wire of sensor is broken and the controller does not know the open wire status, the system may heat the boiler continuously and result in fire or explosion. Our thermocouple, RTD, thermistor modules provide open wire detection and make the system safer.



2.2.4. Thermistor Input Module

■ Thermistor Introduction

A **thermistor** is a type of resistor whose resistance varies significantly with temperature, more so than in standard resistors. The word is a portmanteau of *thermal* and *resistor*. Thermistors are widely used as inrush current limiters, temperature sensors, self-resetting overcurrent protectors, and self-regulating heating elements.

Thermistors differ from resistance temperature detectors (RTD) in that the material used in a thermistor is generally a ceramic or polymer, while RTDs use pure metals. The temperature response is also different; RTDs are useful over larger temperature ranges, while thermistors typically achieve a higher precision within a limited temperature range (usually -90 ~ 130°C).

■ Applications



Heavy Industrial Grade

To survive in heavy industrial environments, the hardware needs ultra strong design to against noise, surge, ESD, EFT, etc. For the purpose, we provide heavy industrial grade analog modules. The following specifications are outstandingly enhanced

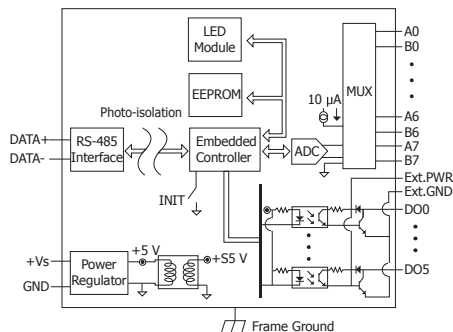
1. Common Voltage Protection
2. Overvoltage Protection
3. ESD (IEC 61000-4-2)
4. EFT (IEC 61000-4-4)

Thermistor Input Module (Heavy Industrial Grade)	
Model Name	I-7005
	M-7005
Pictures	
Thermistor Input	
Channels	8
Wiring	Differential
★ Sensor Type	Precon ST-A3, Fenwell U, YSI L100, YSI L300, YSI L1000, YSI B2252, YSI B3000, YSI B5000, YSI B6000, YSI B10000, YSI H10000, YSI H30000, User-defined
★ Resolution	16-bit
★ Accuracy	±0.1%
★ Sampling Rate	8 Hz (Total)
★ Individual Channel Configuration	Yes
★ Overvoltage Protection	120 Vdc
Open Wire Detection	Yes
Resistance Measurement	200 KΩ Max.
Digital Output	
Channels	6
Type	Open Collector
Sink/Source (NPN/PNP)	Sink
Load Voltage	+3.5 ~ 50 Vdc
Max. Load Current	650 mA/Channel
Overvoltage Protection	60 Vdc
Overload Protection	1.4 A (with short-circuit protection)
★ Power-on Value	Yes
★ Safe Value	Yes
System	
★ Dual Watchdog	Yes
ESD (IEC 61000-4-2)	±4 kV
EFT (IEC 61000-4-4)	±4 kV
Intra-Module Isolation, Field-to-Logic	3000 Vdc
Power Input	10 ~ 30 Vdc
Power Consumption	1.3 W

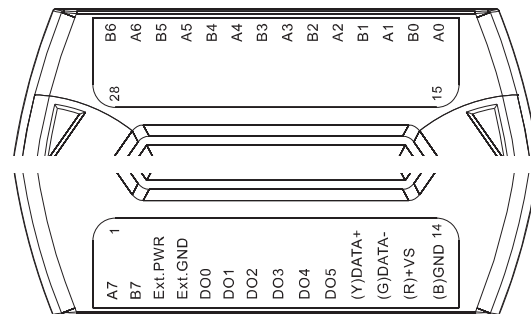
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RS-485 I/O Products

■ Internal I/O Structure




■ Pin Assignments



2.2.5. Transmitter Input Module

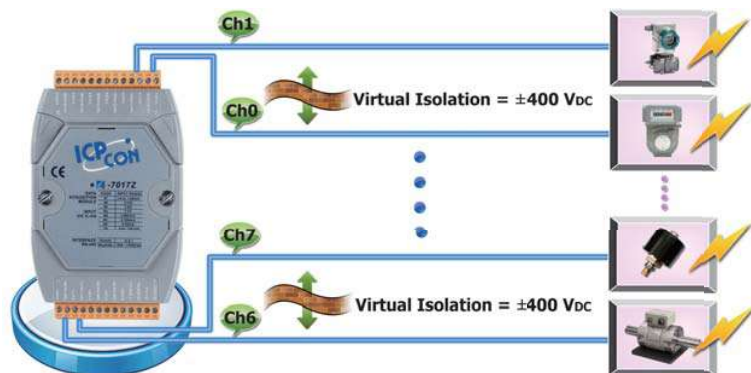
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RS-485 I/O Products

Transmitter Input Module	
Model Name	I-7014D
Pictures	
Transmitter Input	
Channels	1
Wiring	Differential
Sensor Type	± 150 mV, ± 500 mV, ± 1 V, ± 5 V, ± 10 V, ± 20 mA
Resolution	16-bit
Accuracy	$\pm 0.05\%$
Sampling Rate	10 Hz
Input Impedance	Voltage: 30 K Ω Currnet: 125 Ω
Isolated Loop Power	15 Vdc, 30 mA
Overvoltage Protection	± 15 V
Open Wire Detection	-
Digital Input	
Channels	1
Contact	Dry
Sink/Source (NPN/PNP)	Source
On Voltage Level	Close to GND
Off Voltage Level	Open
Counter (50 Hz, 16-bit)	Yes
Input Impedance	3 K Ω
Overvoltage Protection	± 30 Vdc
Digital Output	
Channels	2
Type	Open Collector
Sink/Source (NPN/PNP)	Sink
Load Voltage	+3.5 ~ 50 Vdc
Max. Load Current	30 mA/Channel
Power-on Value	Yes
Safe Value	Yes
System	
Dual Watchdog	Yes
ESD (IEC 61000-4-2)	-
EFT (IEC 61000-4-4)	-
Intra-Module Isolation, Field-to-Logic	3000 Vdc
Power Input	10 ~ 30 Vdc
Power Consumption	1.9 W

Virtual Channel to Channel Isolation

The "R" and "Z" version of analog input modules provide +/-400 VDC virtual channel to channel isolation to avoid the noise interference from adjacent channel in the industrial environment. To name a few of the modules, they are I-7017R, I-7017Z, I-7018R, I-7018Z, I-7019R, and I-7019Z. Though it is not real channel to channel isolation, there is only 1uA leakage current between two adjacent channels and the interference is very small and can be negligible.

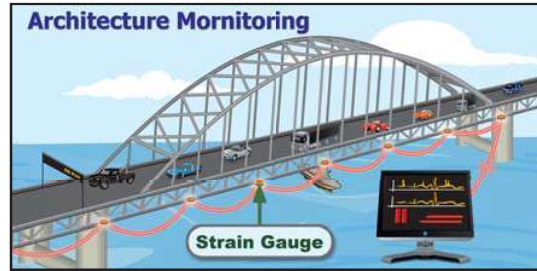


2.2.6. Strain Gauge Input Module

■ Strain Gauge Introduction

A strain gauge is a resistive sensor. The measurement of strain is usually made using a Wheatstone bridge circuit with excitation voltage. The variation in strain can be calculated based on the measured voltage. The resistance of the gauge varies when the gauge is compressed or stretched. With the characteristic, it can be applied to measure stress or the growth of the crack or movement in buildings, foundations, and other structures to ensure the safety.



■ Applications



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RS-485 I/O Products

Strain Gauge Input Module		
Model Name	I-7016(D) M-7016(D)	I-7016P(D)
Pictures		
Strain Gauge Input		
Channels	2	1
Wiring	4 wire	6 wire
★ Sensor Type	Full-Bridge	
Resolution	16-bit	
★ Accuracy	±0.05%	
★ Sampling Rate	2/10 Hz	10 Hz
Input Impedance	20 MΩ	
★ Individual Channel Configuration	-	
★ Overvoltage Protection	±5 Vdc	
Open Wire Detection	-	
Long Distance Measurement	-	Yes
Excitation Voltage Output		
Channels	1	
Range	0 ~ 10 V	
Max. Load Current	40 mA	
Resolution	16-bit	
Accuracy	±0.05%	
Power-on Value	Yes	
Digital Input		
Channels	1	
Contact	Dry	
Sink/Source (NPN/PNP)	Source	
On Voltage Level	Close to GND	
Off Voltage Level	Open	
★ Counter (50 Hz, 16-bit)	Yes	
Input Impedance	3 KΩ	
Overvoltage Protection	±30 Vdc	
Digital Output		
Channels	4	
Type	Open Collector	
Sink/Source (NPN/PNP)	Sink	
Load Voltage	+3.5 ~ 50 Vdc	
Max. Load Current	30 mA/Channel	
★ Power-on Value	Yes	
★ Safe Value	Yes	
System		
★ Dual Watchdog	Yes	
ESD (IEC 61000-4-2)	-	
EFT (IEC 61000-4-4)	-	
Intra-Module Isolation, Field-to-Logic	3000 Vdc	
Power Input	10 ~ 30 Vdc	
Power Consumption	2.4 W; 3.0 W for (D) version	2.4 W; 3.0 W for (D) version

2.2.7. Analog Output Module

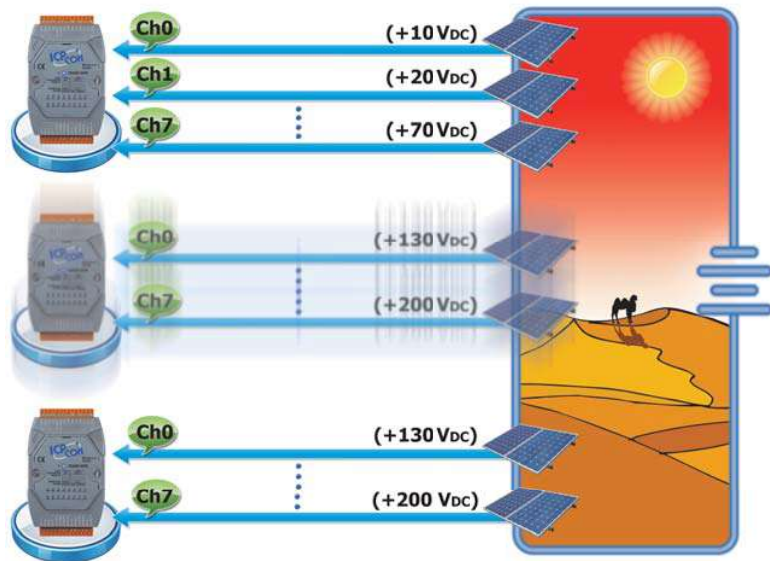
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RS-485 I/O Products

Analog Output Module				
Model Name	I-7021	I-7021P	I-7022 M-7022	I-7024 M-7024
Pictures				
Analog Output				
Channels	1		2	4
Wiring	Unipolar		Unipolar	Bipolar/Unipolar
Range	0 ~ 10 V, 0 ~ 20 mA, 4 ~ 20 mA		0 ~ 10 V, 0 ~ 20 mA, 4 ~ 20 mA	0 ~ 5 V, ±5 V, 0 ~ 10 V, ±10 V, 0 ~ 20 mA, 4 ~ 20 mA
Resolution	12-bit	16-bit	12-bit	14-bit
★ Accuracy	0.1%	0.02%	0.1%	0.1%
DA Output Response Time	10 ms		10 ms	10 ms
Open Wire Detection (for current only)	Yes		Yes	-
★ Channel to Channel Isolation	-		Yes	-
★ Power-on Value	Yes		Yes	Yes
★ Safe Value	Yes		Yes	Yes
Digital Input				
Channels				
Contact				
Sink/Source (NPN/PNP)				
On Voltage Level				
Off Voltage Level				
★ Counter (50 Hz, 16-bit)				
Input Impedance				
Overvoltage Protection				
System				
★ Dual Watchdog	Yes			Yes
ESD (IEC 61000-4-2)	±2 kV			±2 kV
EFT (IEC 61000-4-4)	-			-
RS (IEC 61000-4-3)	-			-
Intra-Module Isolation, Field-to-Logic	3000 Vdc			3000 Vdc
Power Input	10 ~ 30 Vdc			
Power Consumption	1.8 W	1.8 W	3.0 W	2.4 W

Common Voltage Protection



The typical application is to monitor the charging status of the batteries in series. The voltage of each battery is +10 VDC so the first battery is +10 VDC, the second battery is +20 VDC etc. The differential voltage of the 20th battery is only +10 VDC between vin+ and vin- terminal, while the common voltage is up to 200 VDC. If the common voltage of the analog input module is not large enough, then it can not measure the correct voltage of the battery in charging. ICP DAS analog input modules provide +/-200 VDC high common voltage for industrial applications.



Heavy Industrial Grade

To work well in heavy industrial environment, the hardware of module need special design to against noise, surge, EFT. For this purpose, we provide several heavy industrial grade analog modules.

1. Common Voltage Protection
2. Overvoltage Protection
3. ESD (IEC 61000-4-2)
4. EFT (IEC 61000-4-4)
5. RS (IEC 61000-4-3)

Analog Output Module (Heavy Industrial Grade)		
Model Name	I-7024R M-7024R	M-7024U
Pictures		
Analog Output		
Channels	4	
Range	0 ~ 5 V, ±5 V, 0 ~ 10 V, ±10 V, 0 ~ 20 mA, 4 ~ 20 mA	
Wiring of Current Output	Sink	Source
Resolution	14-bit	16-bit
★ Accuracy	0.1%	0.05%
DA Output Response Time	10 ms	
Open Wire Detection (for current only)	-	Yes
Channel to Channel Isolation	-	
★ Power-on Value	Yes	Yes
★ Safe Value	Yes	Yes
Digital Input		
Channels	5	6
Contact	Dry	
Sink/Source (NPN/PNP)	Source	
On Voltage Level	Close to GND	
Off Voltage Level	Open	
★ Counter (50 Hz, 16-bit)	Yes	
Input Impedance	100 KΩ	
Overvoltage Protection	±30 Vdc	
Digital Output		
Channels	4	
Type	Open Collector	
Sink/Source (NPN/PNP)	Sink	
Load Voltage	+3.5 ~ 30 Vdc	
Max. Load Current	700 mA/Channel	
Overvoltage Protection	Yes	
Overload Protection	Yes	
Power-on Value	Yes	
Safe Value	Yes	
System		
★ Dual Watchdog	Yes	
ESD (IEC 61000-4-2)	±4 kV	
EFT (IEC 61000-4-4)	±4 kV	
RS (IEC 61000-4-3)	5 V/m, 80 MHz ~ 1 GHz	
Intra-Module Isolation, Field-to-Logic	3000 Vdc	
Power Input	10 ~ 30 Vdc	
Power Consumption	3.2 W	

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RS-485 I/O Products

2.2.8. Digital I/O Module

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RS-485 I/O Products

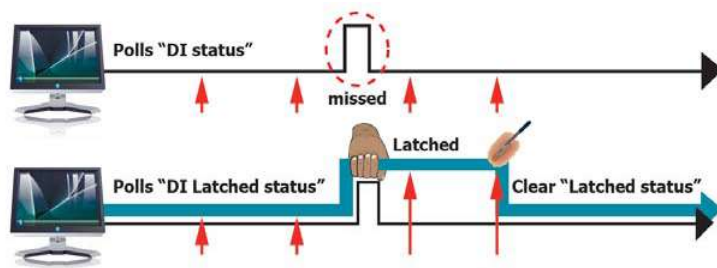
DC Digital Input Module							
Model Name	I-7041(D)	I-7041P(D)	M-7041(D)-A5	I-7051(D)	I-7052(D)	I-7053(D)_FG	
	M-7041(D)	M-7041P(D)	NEW	M-7051(D)	M-7052(D)	M-7053(D)	
Pictures							
Digital Input							
Channels	14			16	8	16	
Contact	Wet			Dry + Wet	Wet	Dry	
Sink/Source (NPN/PNP)	Sink/Source			Dry: Source Wet: Sink/Source	Sink/Source	Source	
Wet Contact	On Voltage Level	+1 Vdc Max.	+11 Vdc Max.	+48 Vdc Max.	+10 ~ 50 Vdc	+4 ~ 30 Vdc	-
	Off Voltage Level	+4 ~ 30 Vdc	+19 ~ 30 Vdc	+68 ~ 150 Vdc	+4 Vdc Max.	+1 Vdc Max.	-
Dry Contact	On Voltage Level	-		Close to GND	-	Open	
	Off Voltage Level	-		Open	-	Close to GND	
Counter (100 Hz, 16-bit)	Yes			Yes	Yes	Yes	
Input Impedance	3 K Ω		50 K Ω	10 K Ω	3 K Ω	-	
Channel to Channel Isolation	-			-	Yes, ± 2 kV for differential only.	-	
Overvoltage Protection	± 35 Vdc		± 180 Vdc	± 70 Vdc	± 35 Vdc	-	
System							
Dual Watchdog	Yes			Yes		Yes	
ESD (IEC 61000-4-2)	± 4 kV			± 4 kV		-	
EFT (IEC 61000-4-4)	± 2 kV			± 4 kV		-	
Intra-Module Isolation, Field-to-Logic	3750 Vrms			3750 Vrms		-	
Power Input	10 ~ 30 Vdc						
Power Consumption	0.2 W; 0.9 W for (D) version			0.3 W; 1.1 W for (D) version	0.2 W; 0.6 W for (D) version	0.7 W; 0.9 W for (D) version	
<p>■ We suggest to choose "P" version of digital input module for industrial use, example : I-7041P, M-7041P ... etc.</p> <p>■ Effective distance for dry contact of DI/DIO module</p> <p>In general, the effective distance for dry contact of DI module is 100 m. With the enhanced circuit design, the distance can be extended up to 500 m.</p>							

Advanced DI Functions

DI channel is not only for reading digital input status but also provides several advanced functions in the meanwhile.

• DI Latch Function



All DI channels provide Latch function to keep the high/low events in the internal registers of the module. In general, the host controller polls modules one by one to get all DI status. Because RS-485 is a low speed field bus, the polling will take time and probably miss a short duration signal. With the DI latch function, the short duration (≥ 5 ms) signal will not be lost any more.

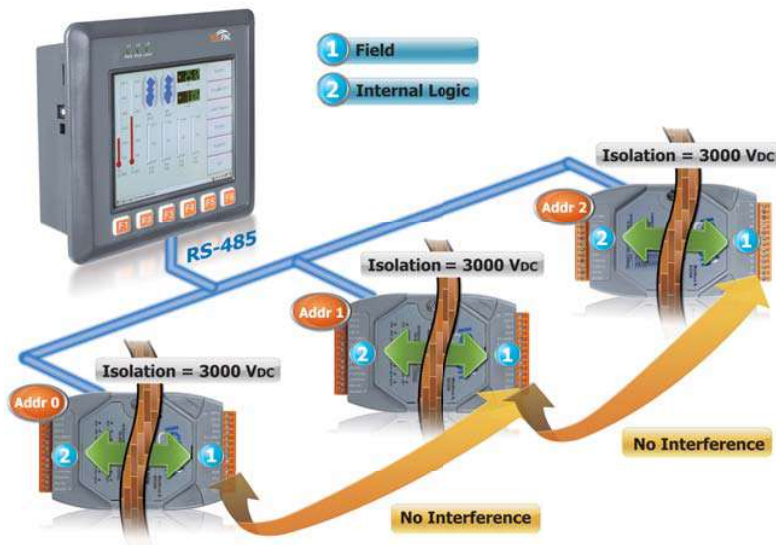


• Low Speed Counter

The DI module automatically counts the DI signal in the background. The signal under 100Hz can be detected and counted.



AC Digital Input Module		
Model Name	I-7058(D)	I-7059(D)
	M-7058(D)	M-7059(D)
Pictures		
Digital Input		
Channels	8	
Contact	Wet	
Wiring	Differential	
On Voltage Level	80 ~ 250 VAC	10 ~ 80 VAC
Off Voltage Level	30 VAC Max.	3 VAC Max.
★ Counter (100 Hz, 16-bit)	Yes	
Input Impedance	68 KΩ	10 KΩ
Channel to Channel Isolation	Yes, ±2 kV	
Overvoltage Protection	300 VAC	120 VAC
System		
★ Dual Watchdog	Yes	
ESD (IEC 61000-4-2)	±4 kV	
EFT (IEC 61000-4-4)	±4 kV	
Intra-Module Isolation, Field-to-Logic	5000 Vrms	
Power Input	10 ~ 30 Vdc	
Power Consumption	0.3 W; 0.7 W for (D) version	0.3 W; 0.7 W for (D) version



3000 VDC Isolation

The I-7K and M-7K series have 3000 VDC isolation between the field and the internal logic. This isolation prevents the noise from the field to the internal logic that can damage the module. It is recommended to choose isolated modules that will be connected on RS-485 network. There will be no interference from the neighbor module because the noise from the neighbor module is isolated.

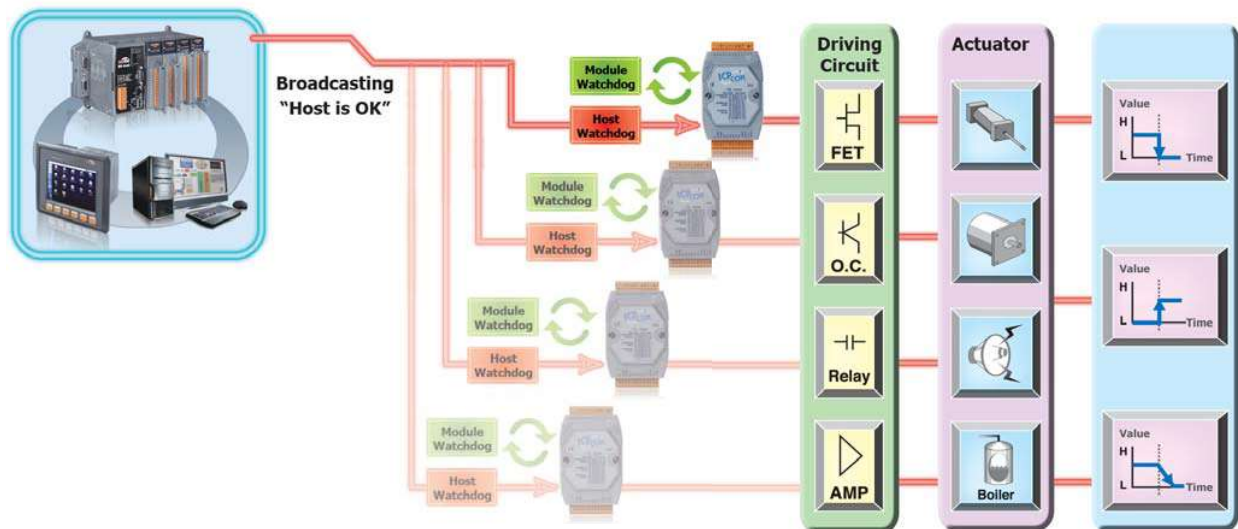
Digital Output Module				
Model Name	I-7042(D)	I-7043(D)	I-7045(D)	I-7045(D)-NPN
			M-7045(D)	M-7045(D)-NPN
Pictures				
Digital Output				
Channels	13	16	16	
Type	Open Collector		MOSFET	
Sink/Source (NPN/PNP)	Sink		Source	Sink
Load Voltage	+3.5 ~ 30 Vdc		+10 ~ 40 Vdc	+3.5 ~ 50 Vdc
Max. Load Current	100 mA/Channel		650 mA/Channel	700 mA/Channel
Overvoltage Protection	-		47 Vdc	60 Vdc
Overload Protection	-		1.4 A (with short-circuit protection)	
Power-on Value	Yes		Yes	
Safe Value	Yes		Yes	
System				
Dual Watchdog	Yes		Yes	
ESD (IEC 61000-4-2)	±2 kV	-	±4 kV	
EFT (IEC 61000-4-4)	±2 kV	-	±4 kV	
Surge (IEC 61000-4-5)	-	-	-	±3 kV
Intra-Module Isolation, Field-to-Logic	3750 Vrms	-	-	3750 Vrms
Power Input	10 ~ 30 Vdc			
Power Consumption	1.0 W; 1.7 W for (D) version	0.4 W; 1.1 W for (D) version0	0.6 W; 1.5 W for (D) version	0.4 W; 1.2 W for (D) version






Rugged Industrial Environment

I-7000 and M-7000 modules provide module watchdog and host watchdog. The module watchdog is a hardware watchdog designed to automatically reset the micro-processor when the module hangs. The host watchdog is a software watchdog that monitors the communication status of the host controller, such as PC, PLC and PAC. The output of module will go to the safe value state when the host fails to prevent any erroneous operations. The Dual Watchdog design ensures higher reliability and stability.

• **Programmable Power-on Value and Safe Value**

The DO and AO I/O modules provide programmable power-on value and safe value. When the host watchdog is active, the DO and AO output go to the pre-configured safe value.



Digital Input & Output Module					
Model Name	I-7044(D)	I-7050(D) M-7050(D)	I-7050A(D)	I-7055(D) M-7055(D)	I-7055(D)-NPN M-7055(D)-NPN
Pictures					
Digital Input					
Channels	4	7		8	
Contact	Wet	Dry	Wet	Dry + Wet	
Sink/Source (NPN/PNP)	Sink/Source	Source	Sink	Dry: Source Wet: Sink/Source	
Wet Contact	On Voltage Level	+1 Vdc Max.	-	+4 ~ 30 Vdc	+10 ~ 50 Vdc
	Off Voltage Level	+4 ~ 30 Vdc	-	+1 Vdc Max.	+4 Vdc Max.
Dry Contact	On Voltage Level	-	Open	-	Close to GND
	Off Voltage Level	-	Close to GND	-	Open
★ Counter (100 Hz, 16-bit)	Yes	Yes		Yes	
Input Impedance	3 KΩ	100 KΩ		10 KΩ	
Overvoltage Protection	±35 Vdc	-		±70 Vdc	
Digital Output					
Channels	8				
Type	Open Collector	Open Collector		MOSFET	
Sink/Source (NPN/PNP)	Sink	Sink	Source	Source	Sink
Load Voltage	+3.5 ~ 30 Vdc	+3.5 ~ 30 Vdc		+10 ~ 40 Vdc	+3.5 ~ 50 Vdc
Max. Load Current	375 mA/Channel	30 mA/Channel		650 mA/Channel	700 mA/Channel
Overvoltage Protection	-	-		47 Vdc	60 Vdc
Overload Protection	-	-		1.4 A (with short-circuit protection)	
★ Power-on Value				Yes	
★ Safe Value				Yes	
System					
★ Dual Watchdog	Yes				
ESD (IEC 61000-4-2)	±2 kV	-		±4 kV	
EFT (IEC 61000-4-4)	±2 kV	-		±4 kV	
Surge (IEC 61000-4-5)		-		-	±3 kV
Intra-Module Isolation, Field-to-Logic	3750 Vrms	-		3750 Vrms	
Power Input	10 ~ 30 Vdc				
Power Consumption	1.0 W; 1.7 W for (D) version	0.4 W; 1.1 W for (D) version	0.5 W; 1.2 W for (D) version	0.8 W; 1.6 W for (D) version	1.2 W; 2.2 W for (D) version

ESD Protection

In the industrial environment there are many noise, spike, electrostatic etc. If the module is not strong enough, it is very easy to be damaged. The I-7K and M-7K modules all pass +/-4 KV ESD contact and +/-8 KV ESD air tests by static electricity gun in our laboratory. The test procedures follow the IEC 61000-4-2 standard. Our modules are immunity to the electrostatic discharges by using components that can clamp and resist to the high voltages defined by IEC 61000-4-2 standard.



2.2.9. Relay Output Module

2
2

RS-485 I/O Products





Electromagnetic Relay Output Module						
Model Name		I-7060(D)	I-7063(D)	I-7065(D)	I-7061(D)	I-7067(D)
	M-7060P(D)	M-7060(D)		M-7065(D)	M-7061(D)	M-7067(D)
Pictures	NEW 				NEW 	
Relay Output						
Channels	4		3	5	12	7
Type	Power Relay (Form A x 2, Form C x 2)		Power Relay (Form A)			
Contact Rating	Form A: 16 A@250 VAC 10A @ 30 Vdc Form C: 10 A(NO)/ 6 A(NC) @ 250 VAC	0.6 A @ 125 VAC 2 A @ 30 Vdc	5 A @ 250 VAC 5 A @ 30 Vdc			0.5 A @ 120 VAC 1 A @ 24 VDC
Surge Strength	2500 Vdc	500 Vdc	4000 Vdc		3000 Vdc	1500 Vdc
Operate Time	15 ms	3 ms	6 ms		2 ms	5 ms
Release Time	5 ms	2 ms	3 ms		2 ms	2 ms
Mechanical Endurance	10 ⁷ ops.	10 ⁸ ops.	2 x 10 ⁷ ops.			5 x 10 ⁶ ops.
Electrical Endurance	5 x 10 ⁴ ops.	5 x 10 ⁵ ops.	10 ⁵ ops.			
Power-on Value	Yes	Yes	Yes		Yes	Yes
Safe Value	Yes	Yes	Yes		Yes	Yes
Digital Input						
Channels	4		8	4		
Contact	Wet					
Sink/Source (NPN/PNP)	Sink/Source					
On Voltage Level	+10 ~50 Vdc	+1 Vdc Max.				
Off Voltage Level	+4 Vdc Max.	+4 ~ 30 Vdc				
Counter (100 Hz, 16-bit)	Yes					
Input Impedance	10 kΩ	3 kΩ				
Overvoltage Protection	±70 Vdc	±35 Vdc				
System						
Dual Watchdog	Yes					
ESD (IEC 61000-4-2)	±4 kV					
EFT (IEC 61000-4-4)	±2 kV		±4 kV			±2 kV
Surge (IEC 61000-4-5)	±3 kV	-			±3 kV	-
Intra-Module Isolation, Field-to-Logic	3750 Vrms					
Power Input	10 ~ 30 Vdc					
Power Consumption	1.7 W (M-7060P) 2.2 W (M-7060PD)	1.3 W; 1.9 W for (D) version	1.0 W; 1.5 W for (D) version	1.3 W; 2.2 W for (D) version	1.7 W; 2.3 W for (D) version	1.5 W; 2.2 W for (D) version

Note: When inductive loads are connected to the relays, a large counter electromotive force may occur when the relay actuates because of the energy stored in the load. These flyback voltages can severely damage the relay contacts and greatly shorten the relay life. Limit these flyback voltages at your inductive load by installing a flyback diode for DC loads or a metal oxide varistor for AC loads.

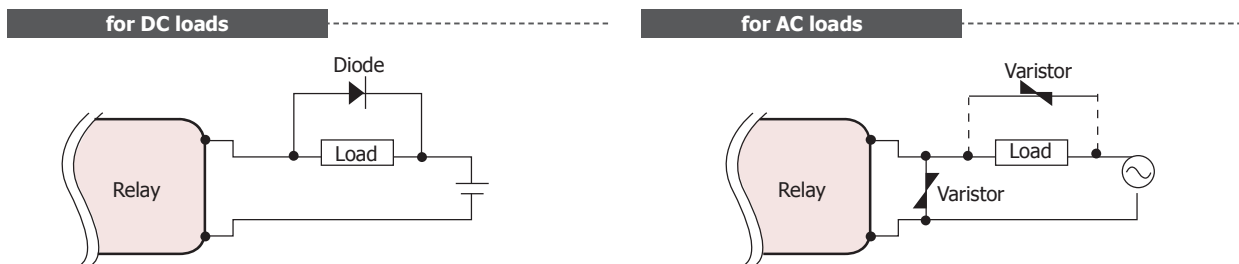


Varistor Selection

Operating Voltage	Varistor Voltage	Max. Peak Current
100 ~ 120 VAC	240 ~ 270 VAC	> 1000 A
200 ~ 240 VAC	440 ~ 470 VAC	> 1000 A

Solid-State Relay Output Module				
Model Name	I-7063A(D)	I-7065A(D) M-7065A(D)	I-7063B(D)	I-7065B(D) M-7065B(D)
Pictures				
SSR Relay Output				
Channels	3	5	3	5
Type	AC-SSR (Form A)		DC-SSR (Form A)	
Operating Voltage Range	24 ~ 265 Vrms		3 ~ 30 Vdc	
* Max. Load Current			1.0 A	
Leakage Current	1.5 mA		0.1 mA	
Min. Operate Time			1 ms	
Min. Release Time	1/2 cycle + 1 ms		1 ms	
Dielectric Strength	2500 Vrms			
Electrical Endurance	No arcing, no bounce and no switching			
* Power-on Value	Yes			
* Safe Value	Yes			
Digital Input				
Channels	8	4	8	4
Contact	Wet			
Sink/Source (NPN/PNP)	Sink/Source			
On Voltage Level	+1 Vdc Max.			
Off Voltage Level	+4 ~ 30 Vdc			
* Counter (100 Hz, 16-bit)	Yes			
Input Impedance	3 kΩ			
System				
* Dual Watchdog	Yes			
ESD (IEC 61000-4-2)	±4 kV			
EFT (IEC 61000-4-4)	±2 kV			
Intra-Module Isolation, Field-to-Logic	3750 Vrms			
Power Input	10 ~ 30 Vdc			
Power Consumption	0.7 W; 1.5 W for (D) version	0.8 W; 1.6 W for (D) version	0.6 W; 1.4 W for (D) version	0.7 W; 1.5 W for (D) version

Note: When inductive loads are connected to the relays, a large counter electromotive force may occur when the relay actuates because of the energy stored in the load. These flyback voltages can severely damage the relay contacts and greatly shorten the relay life. Limit these flyback voltages at your inductive load by installing a flyback diode for DC loads or a metal oxide varistor for AC loads.



Varistor Selection

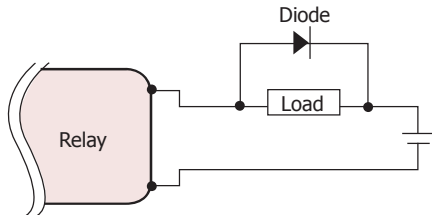
Operating Voltage	Varistor Voltage	Max. Peak Current
100 ~ 120 VAC	240 ~ 270 VAC	> 1000 A
200 ~ 240 VAC	440 ~ 470 VAC	> 1000 A

PhotoMos Relay Output Module

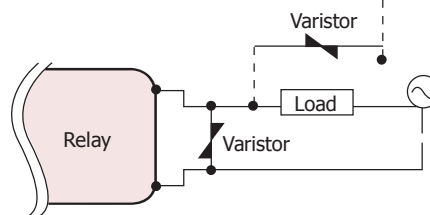
Model Name	I-7066(D)	M-7066P(D)
Pictures		
Channels	7	
Type	PhotoMOS Relay (Form A)	
Operating Voltage Range	350 Vac or 350 Vdc	80 Vac or 80 Vdc
Max. Load Current	0.13 A	1 A
Operate Time	0.7 ms	5 ms
Release Time	0.05 ms	0.5 ms
Electrical Endurance	No arcing, no bounce and no switching	
Power-on Value	Yes	
Safe Value	Yes	
System		
Dual Watchdog	Yes	
ESD (IEC 61000-4-2)	±2 kV	±4 kV
EFT (IEC 61000-4-4)	±2 kV	±4 kV
Intra-Module Isolation, Field-to-Logic	5000 V _{rms}	2000 Vdc
Power Consumption	0.5 W; 0.8 W for (D) version	0.5 W; 0.8 W for (D) version

Note: When inductive loads are connected to the relays, a large counter electromotive force may occur when the relay actuates because of the energy stored in the load. These flyback voltages can severely damage the relay contacts and greatly shorten the relay life. Limit these flyback voltages at your inductive load by installing a flyback diode for DC loads or a metal oxide varistor for AC loads.

for DC loads



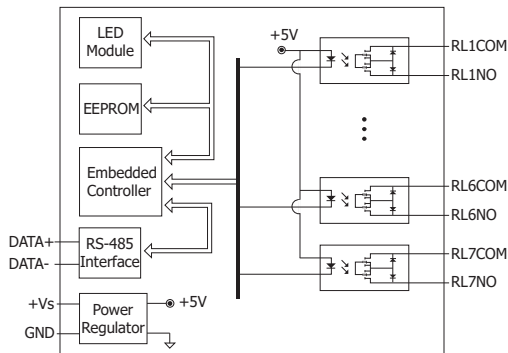
for AC loads



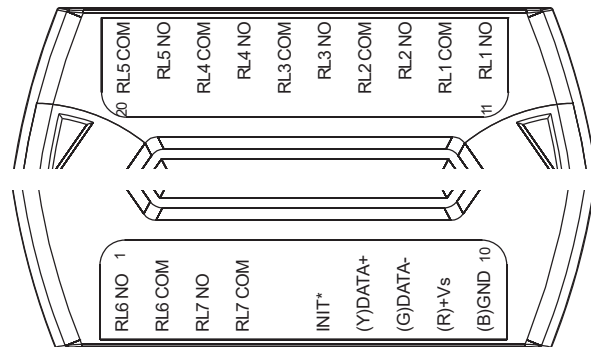
Varistor Selection

Operating Voltage	Varistor Voltage	Max. Peak Current
100 ~ 120 VAC	240 ~ 270 VAC	> 1000 A
200 ~ 240 VAC	440 ~ 470 VAC	> 1000 A

Internal I/O Structure



Pin Assignments



2.2.10. Counter/Frequency/PWM Module

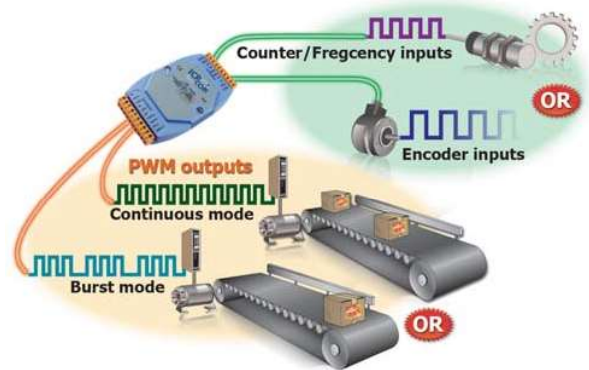
■ PWM Introduction

PWM (Pulse width modulation) is a powerful technique for controlling analog circuits. It uses digital outputs to generate a waveform with variant duty cycle and frequency to control analog circuits. I-8088W and I-87088W have 8 PWM output channels and 8 digital inputs. It can be used to implement powerful and cost effective analog control system.

■ PWM Features

- Automatic generation of PWM outputs by hardware, without software intervention.
- Software and hardware trigger mode for PWM output
- Individual and synchronous PWM output
- Burst mode PWM operation for standby
- DI channel can be configured as simple digital input channel or hardware trigger source of the PWM output.

■ Applications



Counter/Frequency/PWM Module							
Model Name	I-7080(D)	I-7080B(D)	I-7083(D)	I-7083B(D)	I-7088		
	M-7080(D)	M-7080B(D)			M-7084	M-7088	
Pictures					Available soon 		
Digital Input							
Channels	2		3		4 Up/Down Counter or 8 Up Counter	8	
Contact	Wet						
Sink/Source (NPN/PNP)	Sink						
On Voltage Level	Isolated	+3.5 ~ +30 Vdc	5 V: +3.5 ~ +5 Vdc 12 V with 1 kΩ external resistor: +5 ~ +12 Vdc 24 V with 2 kΩ external resistor: +7 ~ +24 Vdc		+3.5 ~ +30 Vdc	+3.5 ~ +5 Vdc	
	Non-isolated	+2.4 ~ +5 Vdc	-		+2.4 ~ +5 Vdc	-	
Off Voltage Level	+1 Vdc Max.		+2 Vdc Max.		+1 Vdc Max.	+1 Vdc Max.	
Programmable Filter	2 us to 65 ms		-		1 ~ 32767 us	-	
Programmable Threshold Voltage	+0.1 ~ +5 Vdc		-		-	-	
Counter/Encoder Bits	32-bit						
★ Counter Mode	Up		-		Up, Up/Down	Up	
★ Encoder Mode	-		CW/CCW, Pulse/Dir., AB Phase		-	-	
★ Frequency Mode	Yes		-		Yes	-	
★ Virtual Battery Backup	-	Yes	-	Yes	Yes	-	
Frequency Accuracy	1 Hz or 10 Hz		-		0.4% of Input Frequency	-	
Max. Speed	100 KHz		1 MHz		200 KHz	1 MHz	
Digital Output							
Channels	2				8		
Type	Open Collector				PWM, TTL		
Sink/Source (NPN/PNP)	Sink				Sink		
Load Voltage	+3.5 ~ +30 Vdc				+3.5 ~ +5 Vdc		
★ Max. Load Current	30 mA/Channel				10 mA/Channel		
★ Power-on Value	Yes				-		
★ Safe Value	Yes				-		
PWM	Frequency	-				1 Hz ~ 500 KHz	
	Duty Cycle	-				0.1 ~ 99.9%	
	Mode	-				Burst, Continuous	
	Burst Count	-				1 ~ 65535	
	Trigger Start	-				Hardware or Software	
System							
★ Dual Watchdog	-				Yes		
ESD (IEC 61000-4-2)	-				±4 kV		
EFT (IEC 61000-4-4)	-				±4 kV		
Intra-Module Isolation, Field-to-Logic	3000 Vdc		2500 Vrms				
Power Consumption	2 W; 2.2 W for (D) version		1 W; 1.5 W for (D) version		2.0 W	2.4 W	

2.3. tM Series Modules

• Introduction

2

3

RS-485 I/O Products



The tM series is a family of network data acquisition and control modules with digital or analog I/O functions. The modules can be remotely controlled through an RS-485 serial bus by using DCON and Modbus RTU/ASCII protocols. The selectable transmission speed of the RS-485 port is up to 115,200 bps. Modbus has become a de facto standard communications protocol in industry, and is now the most commonly available means of connecting industrial electronic devices. This makes the tM series perfect integration with the HMI, SCADA, PLC and other software systems.

The tM series tiny RS-485 I/O modules support various I/O types, like photo-isolated digital input, power relay, photoMOS relay, open collector output, and analog input (voltage and current). Compared with the M-7000 series, the tM series is more cost-effective with low channel count design that is suitable for distributed I/O points applications.

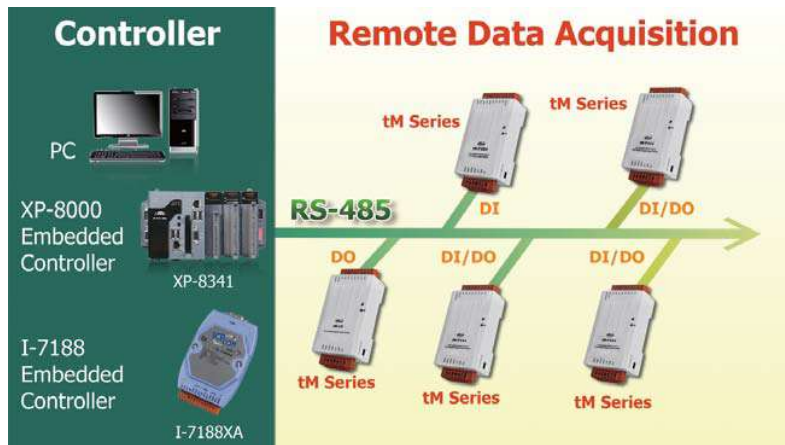
The tM series provides dual watchdog: module watchdog and host watchdog. The module watchdog is designed to automatically reset the microprocessor when the module hangs. The host watchdog monitors the host controller (PC or PLC), and the

output of the module can go to predefined safe value state when the host fails.

For maximum space savings, the tM series is offered in an amazing tiny form-factor that makes it can be easily installed in anywhere, even directly embedded into a machine. It is equipped with two removable terminal block connectors for easy wiring.

• Applications

- All Kinds of On/Off Control
- Industrial Machinery
- Food and Beverage Systems
- Control Systems
- Industrial Automation
- Building Automation
- Semiconductor Fabrication



• Features

- RS-485 Industrial Multi-Drop Network
- Programmable I/O Type and Range
- Easy Mounting and Connection
- Rugged Industrial Environment
- Dual Watchdog Design
- Programmable Power-on Value and Safe Value
- DI Latch Function
- Low Speed Counter
- Versatile Communication Protocols: DCON, Modbus RTU and Modbus ASCII
- Expandable Network
- Tiny Form Factor

• Selection Guide

tM -

X(Y)

X: Input Type

- 'P' = Photocoupler
- 'AD' = Analog Input
- 'TH' = Thermistor

Y: Number of Channels

Z(W)

Z: Output Type

- 'C' = Open Collector (NPN, Sink)
- 'A' = Open Emitter (PNP, Source)
- 'R' = Relay

W: Number of Channels

2
3

RS-485 I/O Products

tM Series Models							
Model Name	Bus	Protocols	AI	AO	DI	DO	
tM-AD5	RS-485	Modbus RTU Modbus ASCII DCON	5-ch (Differential, Voltage)	-	-	-	
tM-AD5C			5-ch (Differential, Current)	-	-	-	
tM-AD8			8-ch (Single-Ended, Voltage)	-	-	-	
tM-AD8C			8-ch (Single-Ended, Current)	-	-	-	
tM-AD4P2C2			2-ch (Single-Ended, Voltage) 2-ch (Single-Ended, Current)	-	-	2-ch (Source)	2-ch (NPN, Sink)
tM-DA1P1R1			-	1-ch (Single-Ended, Voltage)	1-ch (Sink/Source)	1-ch Form A Relay	
tM-TH8			8-ch (Thermistor)	-	-	-	
tM-P8			-	-	8-ch (Sink/Source)	-	
tM-C8			-	-	-	8-ch (NPN, Sink)	
tM-P4C4			-	-	4-ch (Source)	4-ch (NPN, Sink)	
tM-P4A4			-	-	4-ch (Sink)	4-ch (PNP, Source)	
tM-P3R3			-	-	3-ch (Sink/Source)	3-ch Form A Relay	
tM-R5			-	-	-	-	5-ch Form A Relay

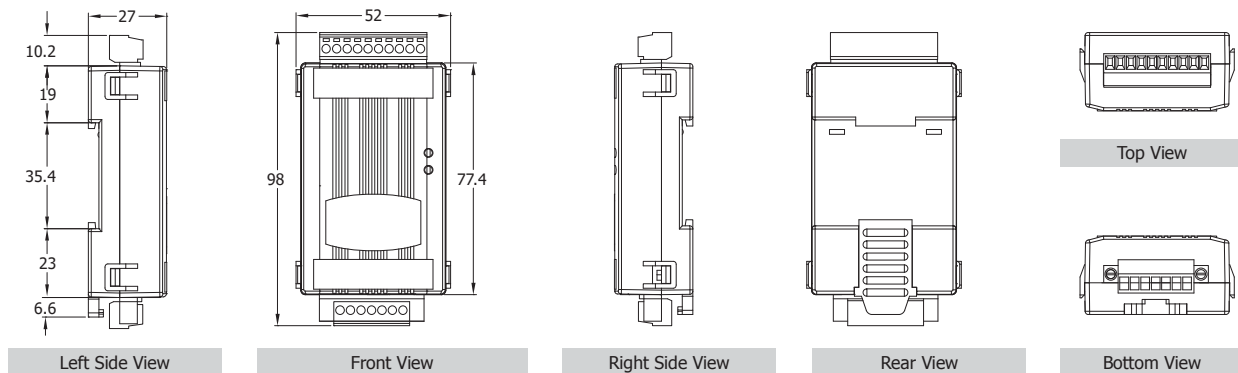
• Hardware

1. Installation



DIN-Rail Mounting

2. Dimensions (Units: mm)





tM Series

Tiny RS-485 I/O Modules

Features



- Cost-effective Remote I/O Modules
- Supports Modbus RTU and DCON Protocols
- Photocoupler Isolation
- Isolated Digital Input and Output
- RS-485 Bus Supports Baud Rate up to 115200 bps
- All DI Channels Can Be Used As 16-bit Counters
- Dual-watchdog with Power-on and Safe Value
- Terminal Block Connector for Easy Wiring
- Tiny Form-factor and Low Power Consumption
- Wide Operating Temperature Range: -25 ~ +75°C
- RoHS Compliant and Halogen Free
- Made from Fire-retardant Materials (UL94-V0 Level)
- Easy DIN-Rail Mounting



System Specifications

Model Name	tM-AD5	tM-AD5C	tM-AD8	tM-AD8C	tM-TH8	tM-P8	tM-C8	tM-P4A4	tM-P4C4	tM-P3R3	tM-R5
	tM-AD4P2C2			tM-DA1P1R1							
Communication											
Interface	RS-485										
Format	(N, 8, 1), (N, 8, 2), (O, 8, 1), (E, 8, 1)										
Baud Rate	1200 ~ 115200 bps										
Protocol	DCON, Modbus RTU, Modbus ASCII										
Dual Watchdog	Yes, Module (2.3 seconds), Communication (Programmable)										
LED Indicators											
Power	1 LED as Power Indicator										
Isolation											
Intra-module Isolation, Field-to-Logic	2500 Vdc					3750 Vdc					
EMS Protection											
ESD (IEC 61000-4-2)	±4 kV Contact for Each Terminal										
	±8 kV Air for Random Point										
EFT (IEC 61000-4-4)	±2 kV for Power										
Power Requirements											
Reverse Polarity Protection	Yes										
Powered from Terminal Block	Yes, 10 ~ 30 VDC										
Consumption	0.6 W	1.2 W			0.5 W Max.						
Mechanical											
Dimensions (W x L x H)	52 mm x 98 mm x 27 mm										
Installation	DIN-Rail Mounting										
Environment											
Operating Temperature	-25 ~ +75°C										
Storage Temperature	-30 ~ +75°C										
Humidity	10 ~ 95% RH, Non-condensing										

I/O Specifications

Multi-function Module		
Model Name	tM-AD4P2C2	tM-DA1P1R1
Pictures	Available soon 	Available soon 
Analog Input		
Channels	2	2
Wiring	Single-ended	
Input Range	±1 V, ±2.5 V, ±5 V, ±10 V	±20 mA, 0 ~ 20 mA, 4 ~ 20 mA
Resolution	14/12	
Accuracy	Normal mode	0.1%
	Fast mode	0.5%
Sampling Rate	Normal mode	10 Hz total
	Fast mode	200 Hz total
Input Impedance	10 MΩ	
Overvoltage Protection	120 Vdc	
Analog Output		
Channels	1	
Wiring of Current Output	Sink	
Range	0 ~ 10 V, 0 ~ 20 mA, 4 ~ 20 mA	
Resolution	12-bit	
Accuracy	0.1%	
DA Output Response Time	10 ms	
Open Wire Detection (for current only)	-	
Channel to Channel Isolation	-	
Power-on Value	Yes	
Safe Value	Yes	
Digital Input/Counter		
Input Channels	2	1
Contact	Wet Contact	
Sink/Source (NPN/PNP)	Source	Sink/Source
On Voltage Level	+3.5 Vdc ~ 50 Vdc	
Off Voltage Level	+1 Vdc Max.	
Input Impedance	10 KΩ, 0.66 W	
Counters	Channels	4
	Max. Count	65535 (16-bit)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Overvoltage Protection	70 Vdc	
Digital Output		
Output Channels	2	
Type	Isolated Open Emitter	
Sink/Source (NPN/PNP)	Sink	
Max. Load Current	700 mA/channel	
Load Voltage	3.5 Vdc ~ 50 Vdc	
Overvoltage Protection	60 Vdc	
Overload Protection	Yes, 1.4 A	
Short Circuit Protection	Yes	
Power-on Value	Yes, Programmable	
Safe Value	Yes, Programmable	

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RS-485 I/O Products





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RS-485 I/O Products

Multi-function Module		
Model Name	tM-AD4P2C2	tM-DA1P1R1
Pictures	Available soon 	Available soon 
Relay Output		
Output Channels		1
Type		Power Relay, Form A (SPST N.O.)
Operating Voltage Range		250 VAC or 30 Vdc
Max. Load Current		16 A
Surge Strength		2500 Vdc
Operate Time		15 ms
Release Time		5 ms
Electrical Endurance		10 ⁷ ops.
Mechanical Endurance		5 × 10 ⁴ ops.
Power-on Value		Yes, Programmable
Safe Value		Yes, Programmable

Analog Input Module					
Model Name	tM-AD5	tM-AD5C	tM-AD8	tM-AD8C	tM-TH8
Pictures	NEW 	NEW 	NEW 	NEW 	NEW 
Analog Input					
Channels	5		8		8
Wiring	Differential		Single-ended		Single-ended
Input Range	±1 V, ±2.5 V, ±5 V, ±10 V	±20 mA, 0 ~ 20 mA, 4 ~ 20 mA	0 ~ 500 mV, 0 ~ 1 V, 0 ~ 2.5 V, 0 ~ 5 V, 0 ~ 10 V	0 ~ 20 mA, 4 ~ 20 mA	-
★ Thermistor Type	-				Precon ST-A3, Fenwell U, YSI L100, YSI L300, YSI L1000, YSI B2252, YSI B3000, YSI B5000, YSI B6000, YSI B10000, YSI H10000, YSI H30000, User- defined
Resolution	14/12				16
Accuracy	Normal mode		0.1%		0.5%
	Fast mode		0.5%		-
★ Sampling Rate	Normal mode		10 Hz total		8 Hz total
	Fast mode		200 Hz total		-
Input Impedance	10 MΩ	125 Ω	20 MΩ	125 Ω	-
★ Overvoltage Protection	120 Vdc				8
★ Open Wire Detection	-	Yes	-	Yes	Yes
★ Dual Watchdog	Yes				-

Digital Input/Output Module				
Model Name	tM-P4A4	tM-P4C4	tM-C8	tM-P8
Pictures				
Digital Input/Counter				
Input Channels	4		-	8
Contact	Wet Contact	Wet Contact		Wet Contact
Sink/Source (NPN/PNP)	Sink	Source		Sink/Source
On Voltage Level	+3.5 Vdc ~ 50 Vdc			+3.5 Vdc ~ 50 Vdc
Off Voltage Level	+1 Vdc Max.			+1 Vdc Max.
Input Impedance	10 K Ω , 0.66 W			10 K Ω , 0.66 W
★ Counters	Channels	4		8
	Max. Count	65535 (16-bit)		
	Max. Input Frequency	100 Hz		
	Min. Pulse Width	5 ms		
Overvoltage Protection	70 Vdc		70 Vdc	
Digital Output				
Output Channels	4		8	
Type	Isolated Open Emitter	Isolated Open Collector		
Sink/Source (NPN/PNP)	Source	Sink		
Max. Load Current	700 mA/channel			
Load Voltage	+10 Vdc ~ +40 Vdc	3.5 Vdc ~ 50 Vdc		
Overvoltage Protection	47 Vdc	60 Vdc		
Overload Protection	Yes, 1.4 A			
Short Circuit Protection	Yes			
★ Power-on Value	Yes, Programmable			
★ Safe Value	Yes, Programmable			

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RS-485 I/O Products

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RS-485 I/O Products

Relay Output Module		
Model Name	tM-P3R3	tM-R5
Pictures		
Digital Input/Counter		
Input Channels	3	
Contact	Wet Contact	
Sink/Source (NPN/PNP)	Sink/Source	
On Voltage Level	+3.5 Vdc ~ 50 Vdc	
Off Voltage Level	+1 Vdc Max.	
Input Impedance	10 K Ω , 0.66 W	
Counters	Channels	3
	Max. Count	65535 (16-bit)
	Max. Input Frequency	100 Hz
	Min. Pulse Width	5 ms
Overvoltage Protection	70 Vdc	
Relay Output		
Output Channels	3	5
Type	Power Relay, Form A (SPST N.O.)	
Operating Voltage Range	250 VAC or 30 Vdc	
Max. Load Current	5 A	
Operate Time	6 ms	
Release Time	3 ms	
Electrical Life (Resistive load)	VDE	5 A @250 VAC 30,000 ops (10 ops/minute) at 75°C
		5 A @30 Vdc 70,000 ops (10 ops/minute) at 75°C
	UL	5 A @250 VAC/30 Vdc 6,000 ops
		3 A @250 VAC/30 Vdc 100,000 ops
Mechanical Life	20,000,000 ops at no load (300 ops/minute)	
Power-on Value	Yes, Programmable	
Safe Value	Yes, Programmable	

Ordering Information

tM-AD4P2C2 CR	4-channel Isolation Analog Input, 2-channel Isolation Digital Input and 2-channel Isolation Digital Output Module (RoHS)
tM-AD5 CR	5-channel Isolation Analog Input Module with High Voltage Protection (RoHS)
tM-AD5C CR	5-channel Isolation Current Input Module (RoHS)
tM-AD8 CR	8-channel Isolation Analog Input Module with High Voltage Protection (RoHS)
tM-AD8C CR	8-channel Isolation Current Input Module (RoHS)
tM-DA1P1R1 CR	1-channel Isolation Analog Output, 2-channel Isolation Digital Input and 2-channel Relay Output Module (RoHS)
tM-TH8 CR	8-channel Isolation Thermistor Input Module with High Voltage Protection (RoHS)
tM-P8 CR	8-channel Isolation Digital Input Module (RoHS)
tM-C8 CR	8-channel Isolation Digital Output Module (RoHS)
tM-P4C4 CR	4-channel Isolation Digital Input and 4-channel Isolation Digital Output Module (RoHS)
tM-P4A4 CR	4-channel Isolation Digital Input and 4-channel Source-type Isolated Digital Output Module (RoHS)
tM-P3R3 CR	3-channel Isolation Digital Input and 3-channel Relay Output Module (RoHS)
tM-R5 CR	5-channel Relay Output Module (RoHS)

Related Products

 tM-7561 CR	Isolated USB to RS-485 Converter (RoHS)	 tM-7510U CR	Isolated RS-485 Repeater (RoHS)
 tM-7520U CR	Isolated RS-232 to RS-485 Converter (RoHS)	 MDR-20-24 CR	24W Single Output Industrial DIN Rail Power Supply (RoHS)

2.4. RS-485 I/O Expansion Unit



Taiwan	096134568
China	200710181138.6
USA	11/979,474
Germany	102007053078.3 pending

Introduction

The RU-87Pn series, RS-485 remote I/O expansion unit, is designed to acquire and control remote I/O through RS-485 connections. It comprises

- A CPU module with non-volatile memory to backup/restore I/O module configurations; LED indicators to diagnose the I/O module; and a RS-485 port for 1.2 Km long distance communication.
- A power module
- A backplane with a number of I/O slots for flexible I/O configuration.

With its patented technologies, namely auto configuration and hot swap, it saves lots of labor on the set up and maintenance of the automation systems. Reliable 3-piece construction enables users to hot swap modules during operation, without rewiring. All I/O module data are backed up in the non-volatile memory of the RU-87Pn. After hot-swapping a module, all settings are automatically loaded to recover.

Furthermore, with the RS-485 network communication interface and more than 30 I/O modules for choice, users can apply the unit to nearly any automation system.



Features

1. Hot Swap

Reliable 3-piece construction enables users to hot swap modules during operation, without rewiring. All I/O module data are backed up in the non-volatile memory of the RU-87Pn. After hot-swapping a module, all settings are automatically loaded to recover.

2. Auto Configuration

The I-87K I/O modules can be pre-configured and backed up in the non-volatile memory of the RU-87Pn. When the RU-87Pn is power on or plugged in, the RU-87Pn will automatically checks and restores these configurations to each I-87K I/O modules on it.

3. Easy Duplicate System

Using the DCON Utility, you can easily make a backup of the I-87K module configurations and write to another RU-87Pn. This design can easily and quickly duplicate many RU-87Pn.

4. Easy Maintenance and Diagnosis

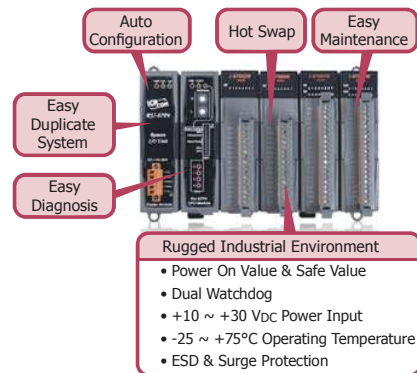
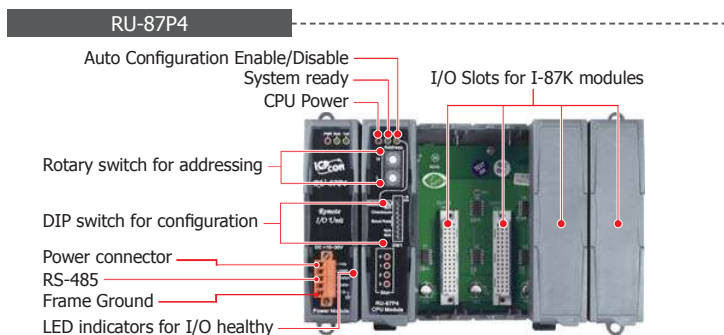
The basic configurations (includes station number, baudrate) are set by the rotary and DIP switches. The operator can use only one screwdriver to set the RU-87Pn. And there are several LED status indicators to show whether I-87K modules are configured and work properly.

If one I-87K module fails, the operator just needs to replace it with one good I-87K module with the same item number. And then checks the LED indicators to know whether the replacement is performed correctly. The switch and LED design makes it easy for maintenance. There is no PC and Notebook needed.

5. Communication

- RS-485 industrial multi-drop network
The RU-87Pn uses the industrial EIA RS-485 communication to transmit and receive data over long distance (1.2 Km).
- DCON protocol
I-87K series I/O modules plugged in a RU-87Pn provides a simple command/response protocol (named DCON protocol) for communication. All command/response are in easy use ASCII format.

Appearance



For more details, refer to **PAC Product Catalog**


RU-87P1

RU-87P4

RU-87P2

RU-87P8

Features

- One RS-485 Port for Multi-Drop Topology
- Hot Swap Allowed
- Auto Configuration
- LED Indicators for Fault Detection
- Switches to Configure Communication
- DCON Protocol
- 1/2/4/8 I/O Slots for I-87K Modules
- Operating Temperature: -25 ~ +75°C



Specifications

Models	RU-87P1	RU-87P2	RU-87P4	RU-87P8
Interface Type (RS-485)				
Baud Rate	115200 bps maximum			
Distance	1.2 km (4000 ft) maximum			
Isolation	3000 Vdc			
ESD Protection	+/-4 K Contact Discharge and +/-8 K Air Discharge			
Communication Protocol	DCON Protocol (ASCII Format)			
Switch				
Rotary Switch	x2, For RS-485 address			
DIP Switch	8-bit x 1, For auto configuration, check sum and baud rate			
LED Indicators				
Power	Yes			
System Ready	Yes			
Auto Configuration	Yes			
Slot Status	Yes			
I/O Expansion Slots				
Hot Swap	Yes			
Auto Configuration	Yes			
Support Module Type	High profile I-87K module only			
Slots Numbers	1	2	4	8
Mechanical				
Dimensions (W x L x H)	64 mm x 120 mm x 110 mm	95 mm x 132 mm x 111 mm	188 mm x 132 mm x 111 mm	312 mm x 132 mm x 111 mm
Installation	DIN-Rail or Wall Mounting			
Environmental				
Operating Temperature	-25 ~ +75°C			
Storage Temperature	-30 ~ +80°C			
Ambient Relative Humidity	10 ~ 90% RH (non-condensing)			
Power				
Input Range	+10 ~ +30 Vdc			
Reverse Polarity Protection	Yes			
Isolation	1000 Vdc			
Frame Ground	Yes			
Consumption	1 W	1 W	2 W	2.4 W
Power Board Driving	5 W	8 W	30 W	30 W

Ordering Information

RU-87P1 CR	1 slot I/O Expansion Unit (RoHS)	RU-87P4 CR	4 slots I/O Expansion Unit (RoHS)
RU-87P2 CR	2 slots I/O Expansion Unit (RoHS)	RU-87P8 CR	8 slots I/O Expansion Unit (RoHS)

2.5. Termination Resistor/DC Bias Voltage



tM-SG4

The RS-485 Bias and Termination Resistors Module

Features

- Switch-selectable Bias Resistors
- 15-step Switch-selectable Termination Resistor
- LED Indicator for Power/Termination
- DIN-Rail Mountable
- Cost-effective
- Wide Operating Temperature Range: -25 ~ +75°C

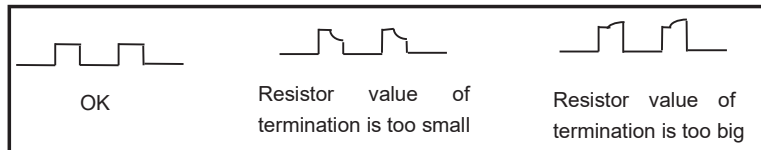


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RS-485 I/O Products

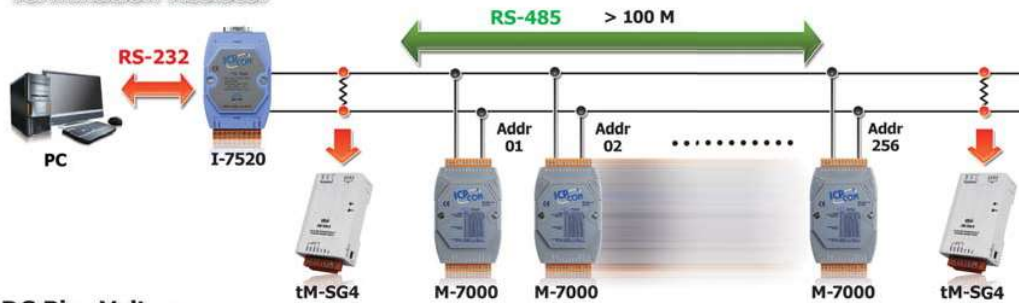
Introduction

The tM-SG4 is an optional module that is used to improve the communication of RS-485 network. It provides switch selectable bias resistors on RS-485 network. It also has 15-step switch selectable termination resistor such that the user can select a proper termination resistor to be connected to the RS-485 network easily. If the RS-485 network is not over 100 meters, the termination resistors are not needed. Otherwise, it may be necessary to insert two termination resistors at both end of the RS-485 network. It is not easy to calculate the value of a termination resistor on the RS-485 network. The best way to do this is to use an oscilloscope to check the RS-485 signal directly. If the impedance match of RS-485 network is OK, the oscilloscope will show a very nice square wave. If these square wave signals are distorted, the user will need to insert two termination resistors at both end of the RS-485 network.

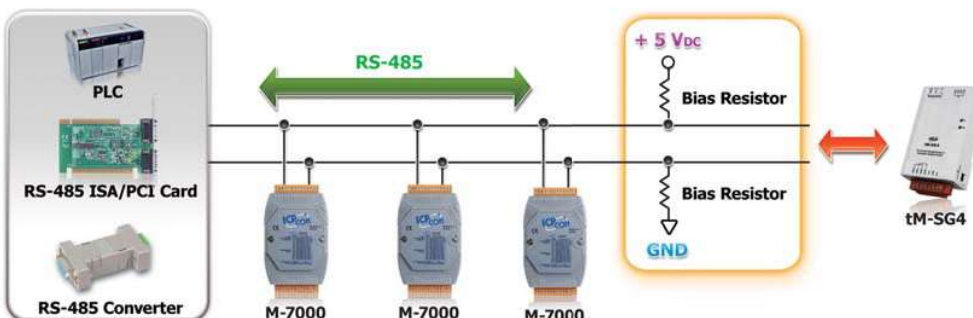


Applications

Termination Resistor



DC Bias Voltage



System Specifications

RS-485 Interface	
Bias Resistor	1 k Ω , 10 k Ω , 100 k Ω , Switch-selectable
Termination Resistor	15 Steps, 65 ~ 560 Ω
LED Indicators	
Power	1 Red LED as Power Indicator
Termination Resistor	1 Green LED as Termination Indicator
EMS Protection	
ESD (IEC 61000-4-2)	± 4 kV Contact for Each Terminal
Power Requirements	
Reverse Polarity Protection	Yes
Powered from Terminal Block	Yes, 10 ~ 30 Vdc
Consumption	0.5 W Max.
Mechanical	
Dimensions (W x L x H)	52 mm x 87 mm x 27 mm
Installation	DIN-Rail Mounting
Environment	
Operating Temperature	-25 ~ +75 $^{\circ}$ C
Storage Temperature	-40 ~ +85 $^{\circ}$ C
Humidity	10 ~ 90% RH, Non-condensing

Termination Resistor Settings

120R	330R	470R	560R	Termination Resistance (Ω)
ON	ON	ON	ON	65
ON	ON	ON	OFF	74
ON	ON	OFF	ON	76
ON	OFF	ON	ON	81
ON	OFF	OFF	ON	99
ON	OFF	ON	OFF	96
ON	ON	OFF	OFF	88
ON	OFF	OFF	OFF	120
OFF	OFF	ON	ON	144
OFF	ON	ON	OFF	193
OFF	ON	OFF	ON	207
OFF	ON	OFF	OFF	330
OFF	OFF	ON	ON	256
OFF	OFF	ON	OFF	470
OFF	OFF	OFF	ON	560

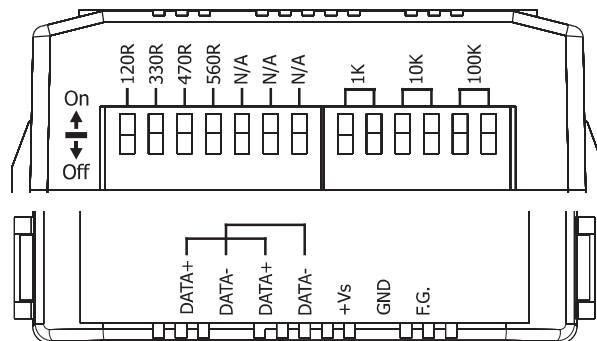
Termination Resistor On/Off Switch

OFF	Termination Resistor do NOT work.
ON	Termination Resistor is worked, and TR LED is light.

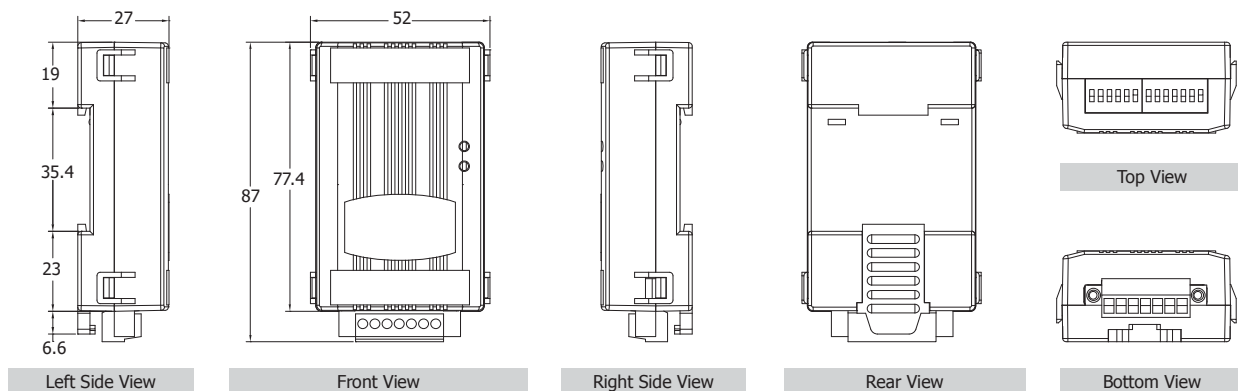
Bias Resistor Settings

1k	10k	100k	RS-485 Data Line Status
OFF	OFF	OFF	No bias resistor on RS-485 data line
ON	OFF	OFF	1k Ω bias resistor
OFF	ON	OFF	10k Ω bias resistor
OFF	OFF	ON	100k Ω bias resistor

Pin Assignments



Dimensions (Units: mm)



Ordering Information

tM-SG4 CR	RS-485 Bias and Termination Resistor Module (RoHS)
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2.6. Converter/Repeater/Hub/Splitter



ICP DAS Self-Tuner ASIC Features:

- Multiple Baud Rate
- Multiple Data Format
- Automatic RS-485 Direction Control

"Self-Tuner"

A conventional RS-232 to RS-485 converter uses the DIP switch to select the baud rate and data format for the whole RS-485 network. All modules, devices and equipments in the network should be configured to the same baud rate and data format. Unfortunately most real world applications can't be implemented in such a simple way. The Self-Tuner is an innovative chip designed to solve this problem. Every converter contains a Self-Tuner chip. The chip automatically tunes the baud rate and data format to the whole network. Therefore the I-7520 can connect to modules, devices and equipments with different baud rates and data formats in a network.

Self-Tuner Chip



▲ I-7520



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RS-485 I/O Products

High Quality Isolated RS-485 Repeater/Hub/Splitter

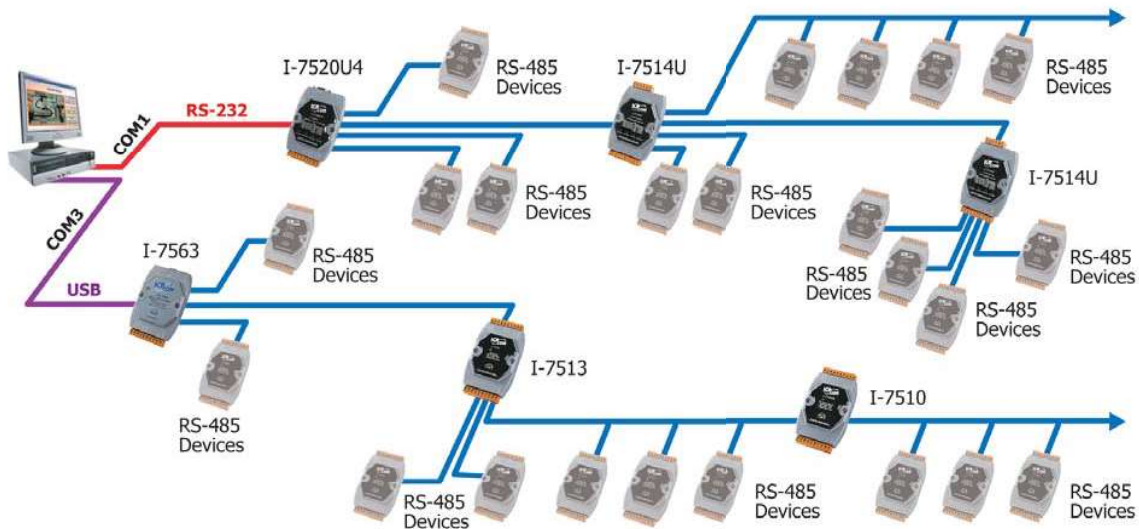
The maximum effective distance of RS-485 without repeater is 1200 meters (4000 feet) at baud rates up to 9.6 Kbps and up to 32 (256) nodes can be connected. With the professional design, the repeater I-7510 solves the problem of signal weakening and extends the maximum effective distance by 1200m and connects 32 (256) nodes more. And it has optical isolation design for lightning and surge protection. If the RS-485 topology is too complex to make the communicating well, a RS-485 hub or splitter is recommended.



▲ I-7520U4

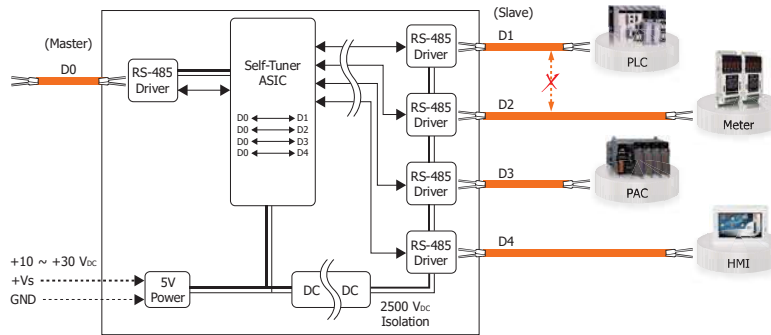
▲ I-7514U

I-7520U4 and I-7514U are multichannel RS-485 repeater/hub/splitter. Each channel is independent and has optical isolation, short circuit and open circuit protection. Thus when one channel fails, it will not affect another channel of the hub. The features make it perfect to star type or mixed type topology in complex and large scale RS-485 network.



The following block diagram shows how I-7514U was designed as independent channel. Data coming from the master input will be transmitted to all four RS-485 slave channels. But data coming from the slave channels will be returned to the master input only. Thus reduces the possibility of interference between each RS-485 slave loop and makes the RS-485 networks more robust and reliable.

► I-7514U Block Diagram



RS-232/422/485 Converter/Repeater

Model Name	tM-7520U	I-7520	I-7520R	I-7520A	I-7520AR	I-7551	tM-7510U	I-7510	I-7510A	I-7510AR
Pictures	NEW						NEW			
Function	Converter					Repeater				
Interface	RS-232 to RS-485			RS-232 to RS-422/485		RS-232 to RS-232	RS-485	RS-485	RS-422/485	
Isolation	2500 Vdc RS-232 side	3000 Vdc RS-232 side	3000 Vdc RS-485 side	3000 Vdc RS-232 side	3000 Vdc RS-422/485 side	3000 Vdc 3 ways	2500 Vdc	3000 Vdc		3000 Vdc 3 ways
Operating Temperature	-25 ~ +75°C									

USB to RS-232/422/485 Converter

Model Name	I-7560	I-7561	tM-7561
Pictures			NEW
Function	Converter	Converter	Converter
Interface	USB to RS-232	USB to RS-232/422/485	USB to RS-485
Isolation	-	3000 Vdc	2500 Vdc
Operating Temperature	-25 ~ +75°C		

USB RS-232/485 to RS-485 Hub

Model Name	I-7563	I-7513	I-7520U4	I-7514U
Pictures			NEW	NEW
Function	3-CH Hub/Splitter	3-CH Hub/Splitter/Repeater	4-CH Hub/Splitter	4-CH Hub/Splitter/Repeater
Interface	USB to 3-CH RS-485	RS-485 to 3-CH RS-485	RS-232 to 4-CH RS-485	RS-485 to 4-CH RS-485
Isolation	3000 Vdc	3000 Vdc 3 ways	2500 Vdc RS-232 side	2500 Vdc CH1-CH4 side
Operating Temperature	-25 ~ +75°C			

More products refer to Industrial Communication & Networking Products Catalog

- Multi-port Serial Cards
- Programmable Device Servers (Serial-to-Ethernet)
- Converters, Repeaters and Hubs
- Fieldbus Solutions
- Ethernet Switches

