RS-485 I/O Products

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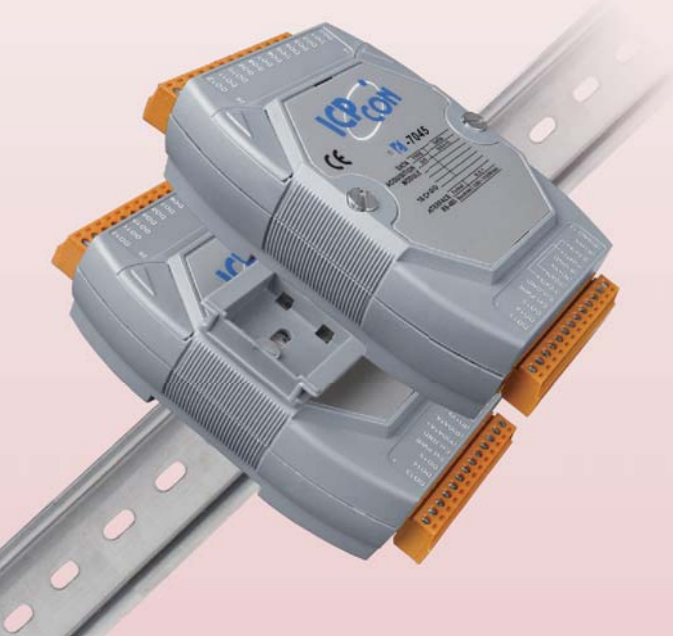


2.1. Overview

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.

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.

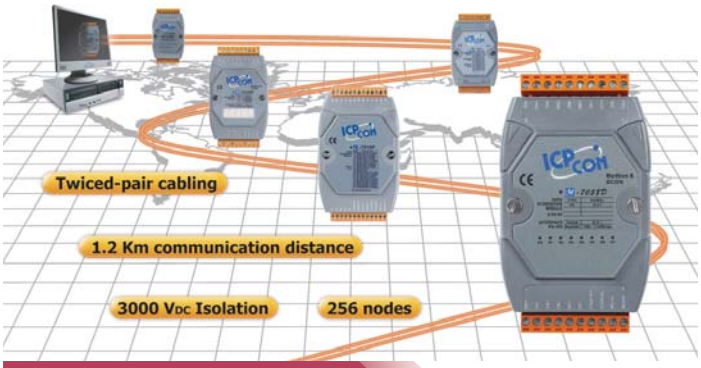
Features

- 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

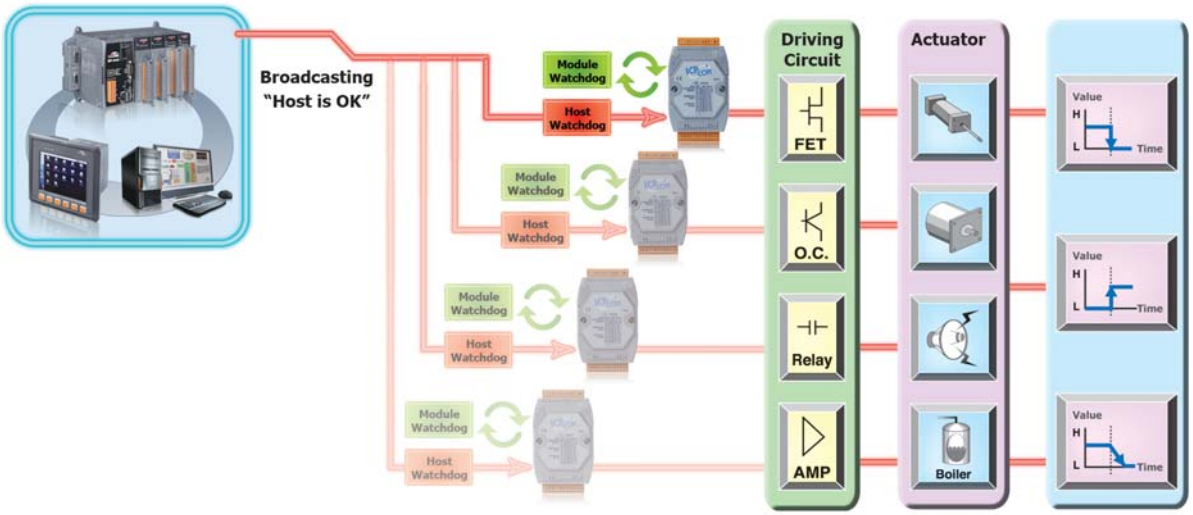
The user may mount the modules on a DIN rail or piggyback.

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.

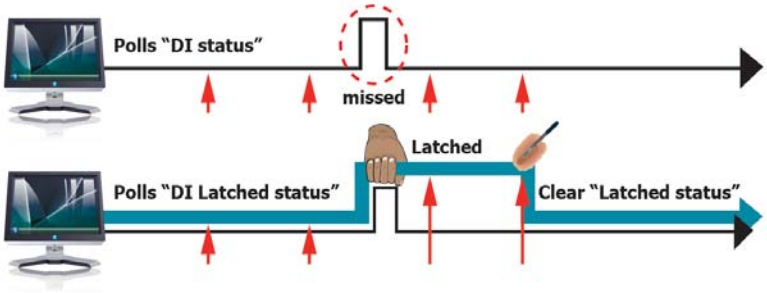


Advanced DI Functions

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.

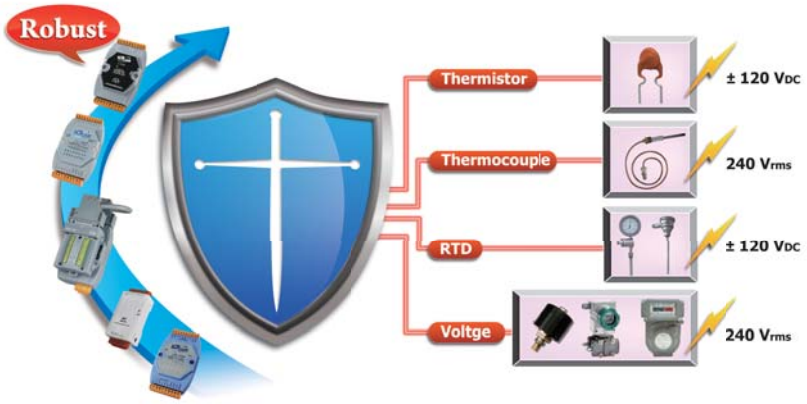


• Low Speed Counter

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

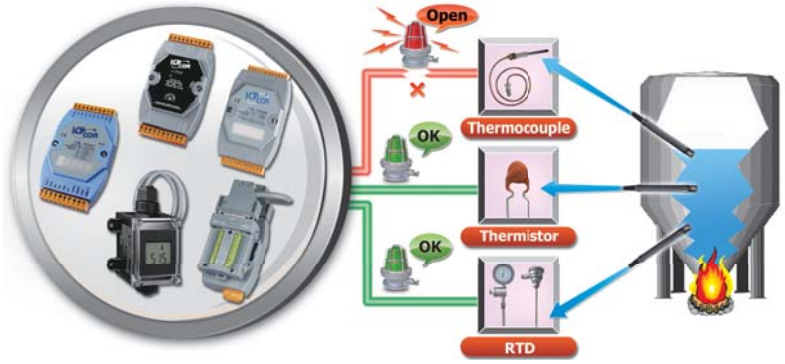
Overvoltage Protection

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.



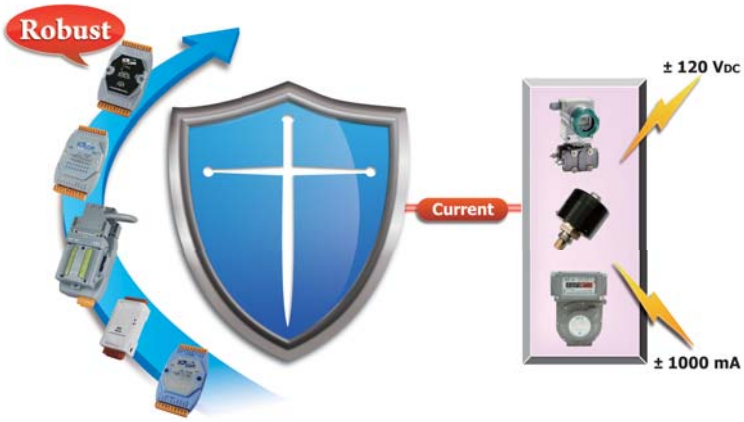
Open Wire Detection

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.



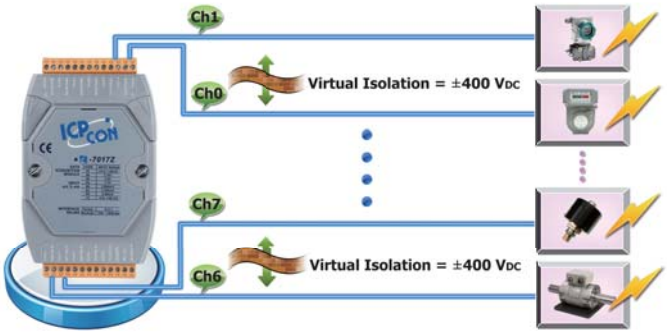
Over-current Protection

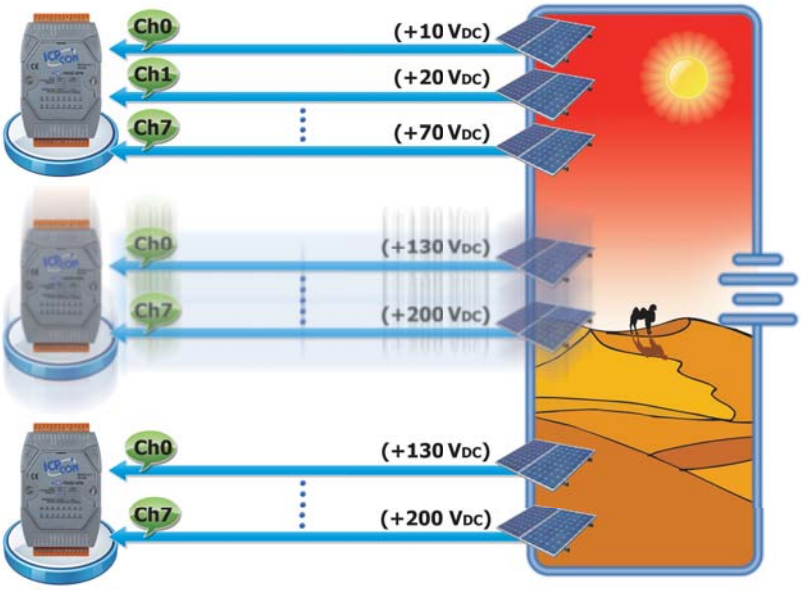
For the current measurement module, it may be damaged when there is high current or voltage introduced into the current loop. The protection for current measurement is improved to +/-120 VDC and +/-1000 mA.. A high current or voltage in the current loop will not damage the current measurement, so the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



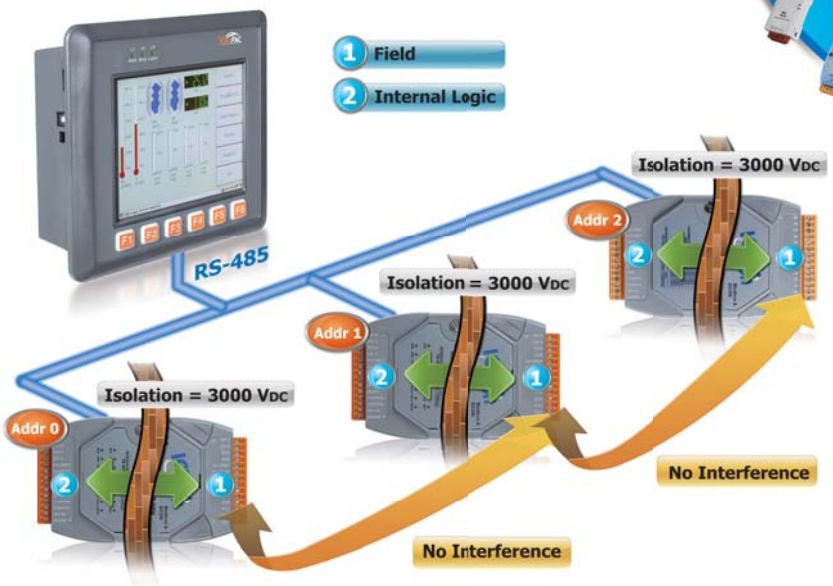


Common Voltage Protection

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

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.

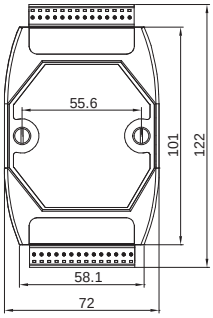
• Hardware

1. Installation

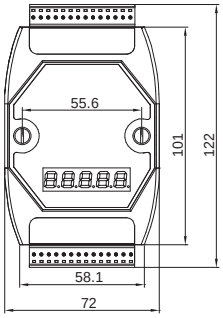
DIN-Rail Mounting

Stack Mounting

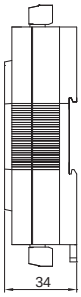
2. Dimensions (Units: mm)



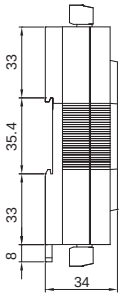
Front View



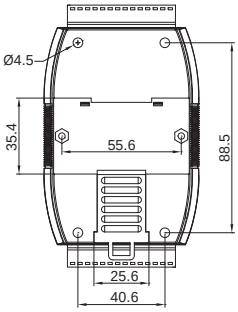
Front View



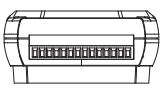
Left Side View



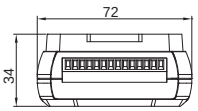
Right Side View



Rear View



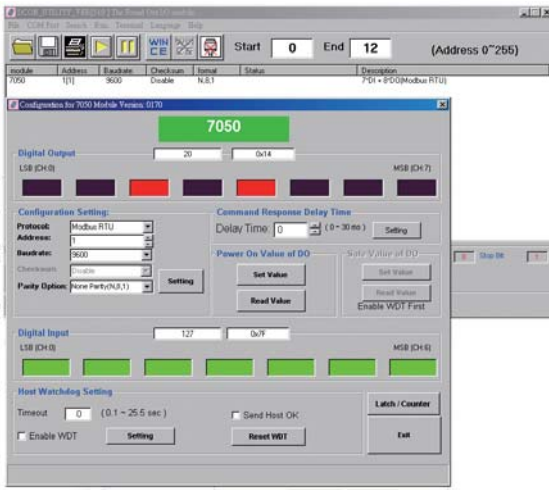
Top View



Bottom View

• Software Support

Our free charge software utility and development kit include



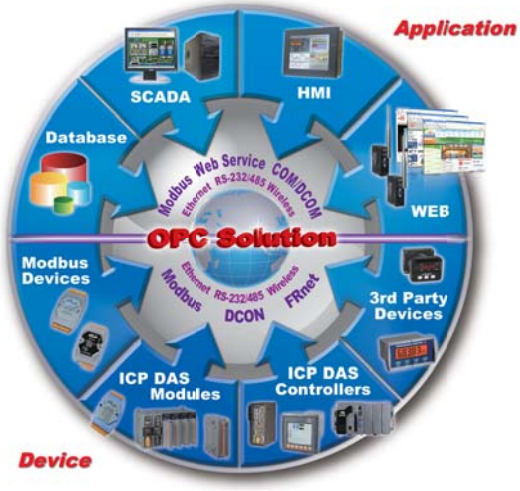
1. DCON Utility

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.

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

• I-7000 and M-7000 Selection Guide

Classified Index			Model Name	Page
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	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	
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	PhotoMos Relay Output Module		I-7066(D)	2-2-24
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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 M-7017	I-7017F	M-7017H	M-7017HL	I-7017C M-7017C	I-7017FC
Pictures						Available soon 	Available soon 		
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	±20 mA, 0~20 mA, 4~20 mA	
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

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.

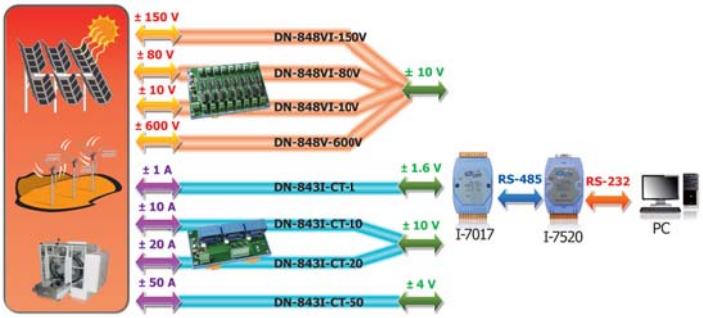
Note2: I-7012(D) and I-7012F(D) both include 1 DI and 2 DO channels. The specification is as follows

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	2
Type	Open Collector
Sink/Source (NPN/PNP)	Sink
Load Voltage	3.5 ~ 30 VDC
Max. Load Current	30 mA/Channel
Power-on Value	Yes
Safe Value	Yes

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)

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	2 MΩ
	Single-ended	-	10 MΩ	-		-	1 MΩ
★ Common Voltage Protection		±200 VDC	±15 VDC	±200 VDC			
★ Individual Channel Configuration		Yes	-	-			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

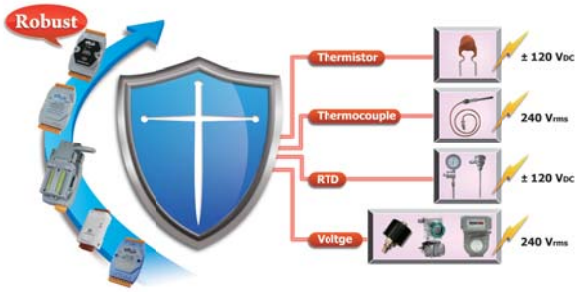
Note1: Differential wiring can be used for voltage input and current input. Single-Ended wiring can be used for voltage input only.

Digital Input for M-7002	
Channels	5
Contact	Wet
Sink/Source (NPN/PNP)	Sink/Source
On Voltage Level	3.5 ~ 30 VDC
Off Voltage Level	+1 VDC Max.
Counter (100Hz, 16-bit)	Yes
Input Impedance	10 kΩ
Overvoltage Protection	±70 VDC
Isolation Voltage	3750 Vrms

Relay Output for M-7002 and M-7003	
Channels	4
Type	Power Relay (Form A)
Contact Rating	5 A @ 250 VAC / 5 A @ 30 VDC
Surge Strength	3000 VDC
Operate Time	3 ms
Release Time	2 ms
Mechanical Endurance	2×10^7 ops.
Electrical Endurance	10^5 ops.
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, Voltge & 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

Thermocouple, Voltge & 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	
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	2
Type	Open Collector
Sink/Source (NPN/PNP)	Sink
Load Voltage	3.5 ~ 30 VDC
Max. Load Current	30 mA/Channel
Power-on Value	Yes
Safe Value	Yes

Thermocouple Type

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

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)

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	±15 mV, ±50 mV, ±100 mV, ±500 mV, ±1 V, ±2.5 V		±15 mV, ±50 mV, ±100 mV, ±150 mV, ±500 mV, ±1 V, ±2.5 V, ±5 V, ±10 V	
	Current	±20 mA (requires optional external 125 Ω resistor)		±20 mA, 0 ~ 20 mA, 4 ~ 20 mA (Jumper selectable)	
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

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

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

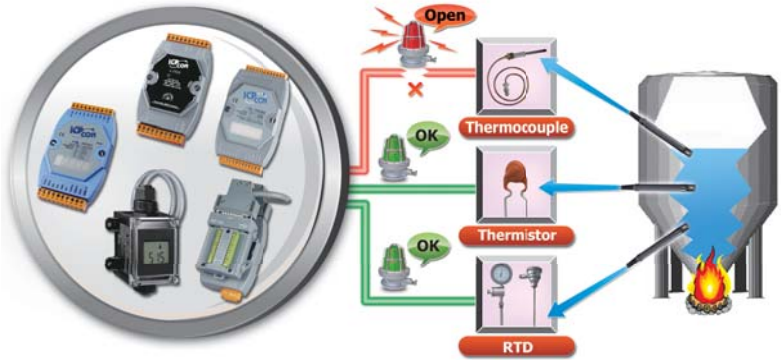
To work well in heavy industrial environment, the hardware of module need special design to against noise, surge, EFT. For this purpose, we provide several heavy industrial grade analog modules.

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

RTD Input Module (Heavy Industrial Grade)			
Model Name	**I-7015**		**I-7015P**
	M-7015	**M-7015-5**	**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

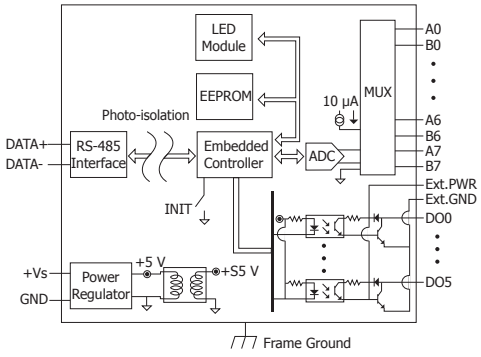
Heavy Industrial Grade

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

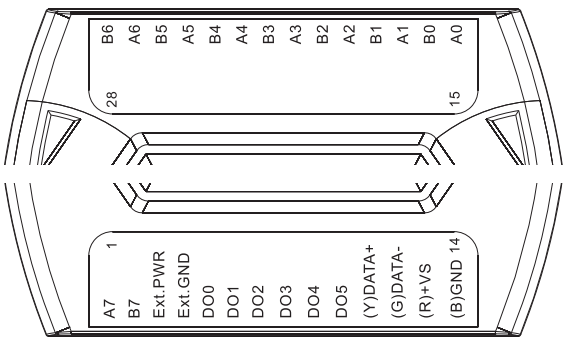
1. Common Voltage Protection
2. Overvoltage Protection
3. ESD (IEC 61000-4-2)
4. EFT (IEC 61000-4-4)

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	

Internal I/O Structure



Pin Assignments

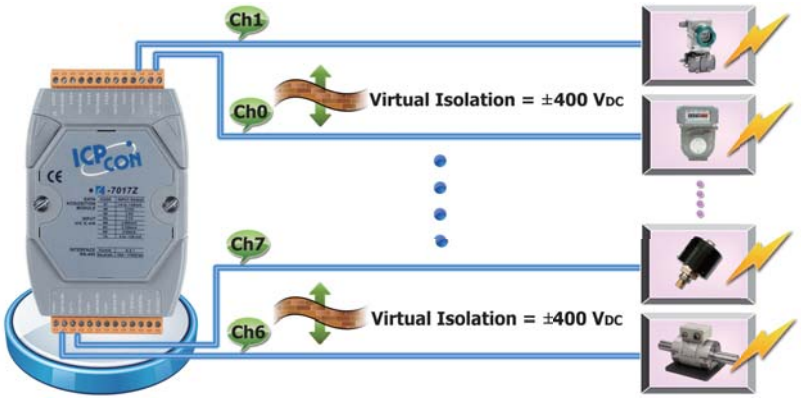


2.2.5. Transmitter Input Module

Transmitter Input Module	
Model Name	**I-7014D**
Pictures	
Transmitter Input	
Channels	1
Wiring	Differential
Sensor Type	±150 mV, ±500 mV, ±1V, ±5 V, ±10 V, ±20 mA
Resolution	16-bit
★ Accuracy	±0.05%
★ Sampling Rate	10 Hz
Input Impedance	Voltage: 30 KΩ 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 KΩ
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.

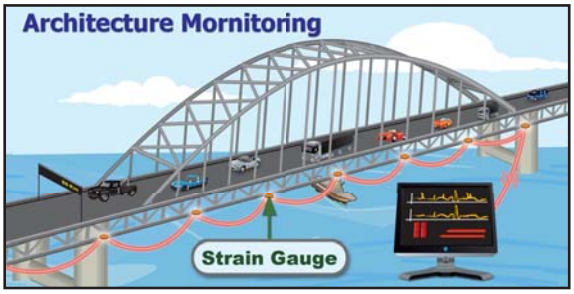


2.2.6. Strain Gauge Input Module

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



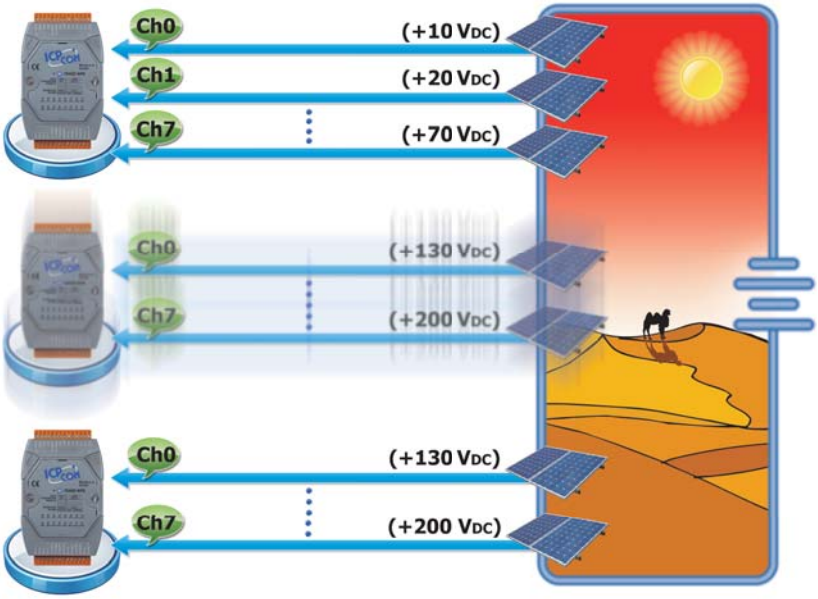
Strain Gauge Input Module			
Model Name	I-7016(D) M-7016(D)	I-7016P(D)	
Pictures			
Strain Gauge Input			
Channels	2	1	
Wiring	4 wire	6 wire	
★ Sensor Type	Full-Bridge		
Resolution	16-bit		
★ Accuracy	±0.05%		
★ Sampling Rate	2/10 Hz	10 Hz	
Input Impedance	20 MΩ		
★ Individual Channel Configuration	-		
★ 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

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		

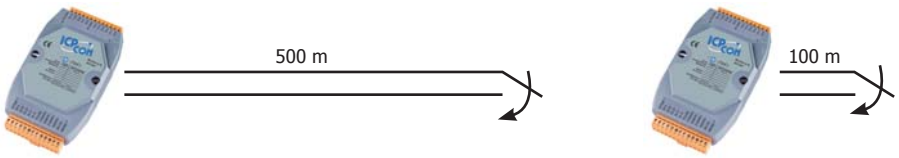
2.2.8. Digital I/O Module

DC Digital Input Module							
Model Name		I-7041(D) M-7041(D)	I-7041P(D) M-7041P(D)	 M-7041(D)-A5	I-7051(D) M-7051(D)	I-7052(D) M-7052(D)	I-7053(D)_FG M-7053(D)
Pictures				NEW 			
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 KΩ		50 KΩ	10 KΩ	3 KΩ	-
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

■ **We suggest to choose "P" version of digital input module for industrial use, example : I-7041P, M-7041P ... etc.**

■ **Effective distance for dry contact of DI/DIO module**

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.

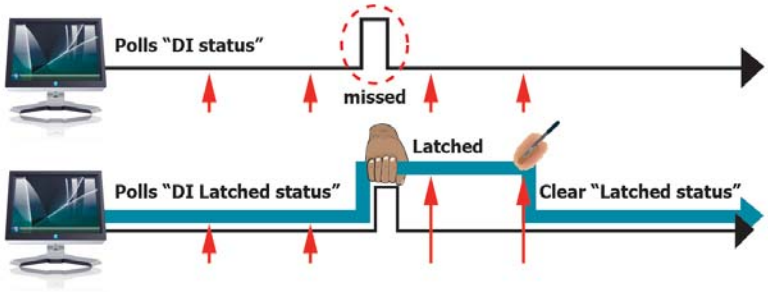


Advanced DI Functions

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

• DI Latch Function

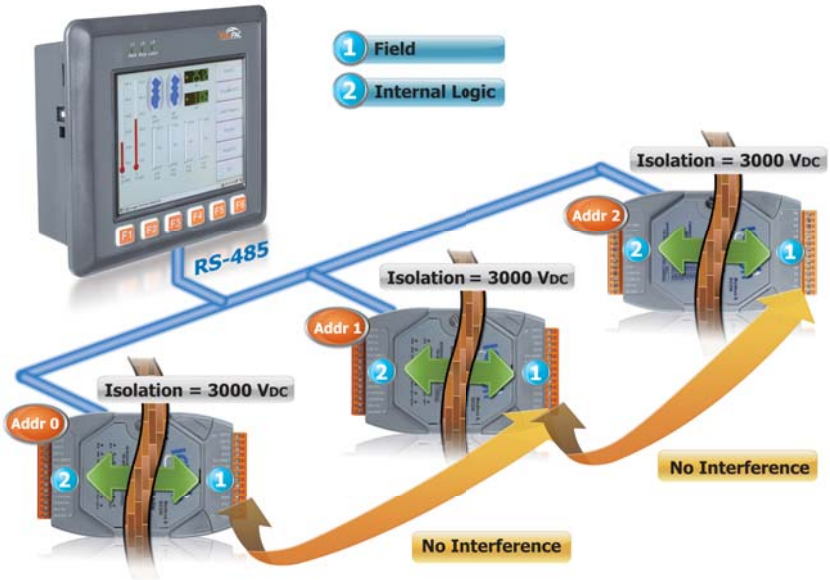
All DI channels provide Latch function to keep the high/low events in the internal registers of the module. In general, the host controller polls modules one by one to get all DI status. Because RS-485 is a low speed field bus, the polling will take time and probably miss a short duration signal. With 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.

AC Digital Input Module		
Model Name	**I-7058(D)** **M-7058(D)**	**I-7059(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.

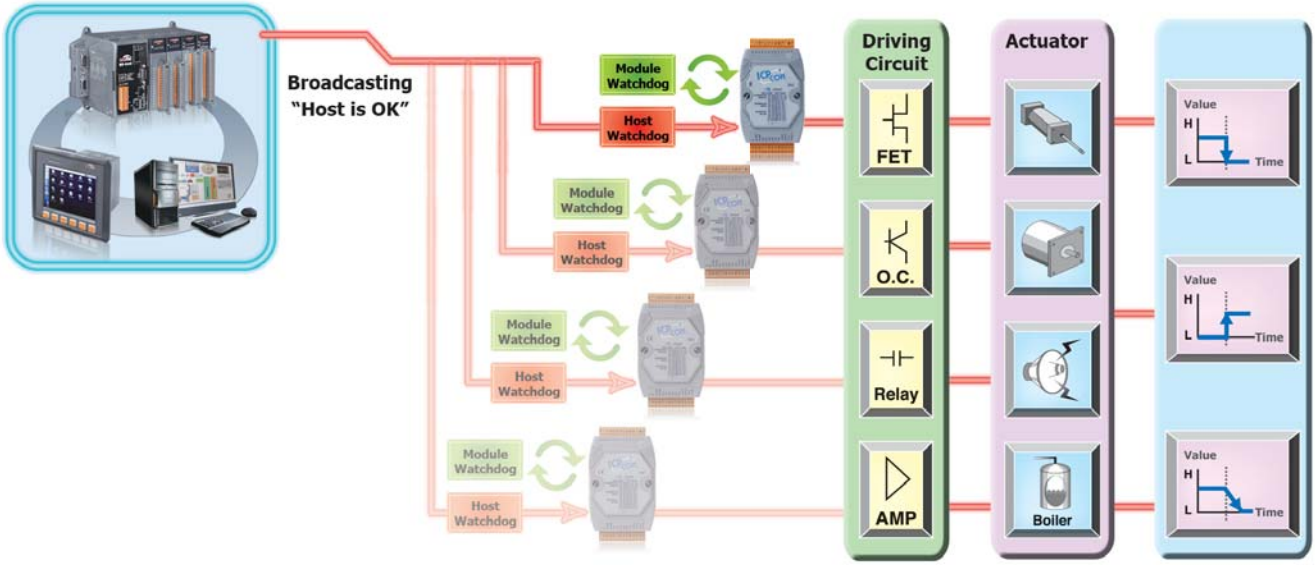
Digital Output Module				
Model Name	I-7042(D)	I-7043(D)	I-7045(D) M-7045(D)	I-7045(D)-NPN M-7045(D)-NPN
Pictures				
Digital Output				
Channels	13	16	16	
Type	Open Collector		MOSFET	
Sink/Source (NPN/PNP)	Sink		Source	Sink
Load Voltage	+3.5 ~ 30 VDC		+10 ~ 40 VDC	+3.5 ~ 50 VDC
Max. Load Current	100 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

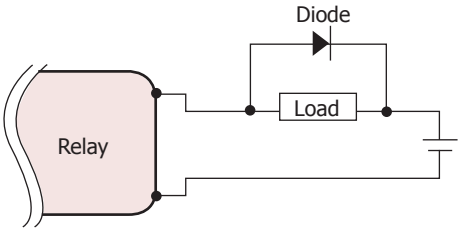
In the industrial environment there are many noise, spike, electrostatic etc. If the module is not strong enough, it is very easy to be damaged. The I-7K and M-7K modules all pass +/-4 KV ESD contact and +/-8 KV ESD air tests by static electricity gun in our laboratory. The test procedures follow the 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

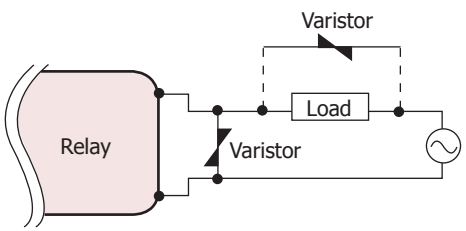
Electromagnetic Relay Output Module						
Model Name		**I-7060(D)**	**I-7063(D)**	**I-7065(D)**	**I-7061(D)**	**I-7067(D)**
	M-7060P(D)	**M-7060(D)**		**M-7065(D)**	**M-7061(D)**	**M-7067(D)**
Pictures						
Relay Output						
Channels	4		3	5	12	7
Type	Power Relay (Form A × 2, Form C × 2)		Power Relay (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.	2×10^7 ops.			5×10^6 ops.
Electrical Endurance	5×10^4 ops.	5×10^5 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 V_{rms}					
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.

for DC loads



for AC loads



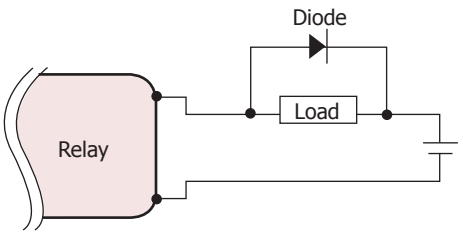
Varistor Selection

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

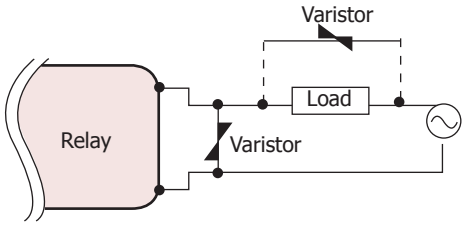
Solid-State Relay Output Module				
Model Name	I-7063A(D)	I-7065A(D) M-7065A(D)	I-7063B(D)	I-7065B(D) M-7065B(D)
Pictures				
SSR Relay Output				
Channels	3	5	3	5
Type	AC-SSR (Form A)		DC-SSR (Form A)	
Operating Voltage Range	24 ~ 265 Vrms		3 ~ 30 VDC	
★ Max. Load Current	1.0 A			
Leakage Current	1.5 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.

for DC loads



for AC loads



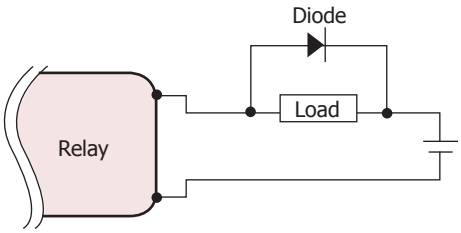
Varistor Selection

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

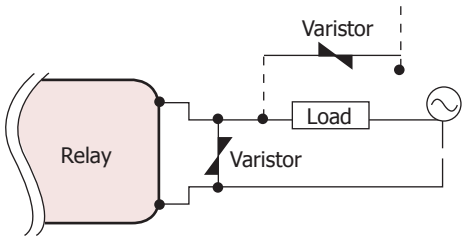
PhotoMos Relay Output Module		
Model Name	**I-7066(D)**	**M-7066P(D)**
Pictures		NEW 
Channels	7	
Type	PhotoMOS Relay (Form A)	
Operating Voltage Range	350 VAC or 350 VDC	80 VAC or 80 VDC
★ Max. Load Current	0.13 A	1 A
Operate Time	0.7 ms	5 ms
Release Time	0.05 ms	0.5 ms
Electrical Endurance	No arcing, 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 Vrms	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



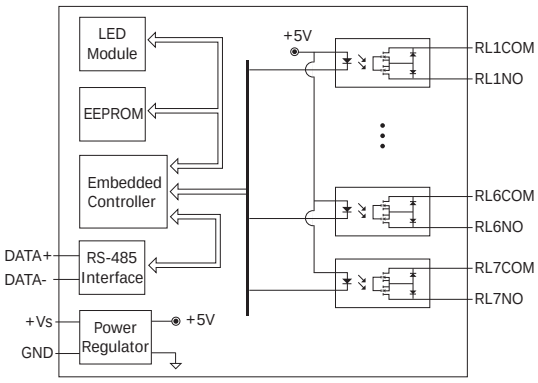
for AC loads



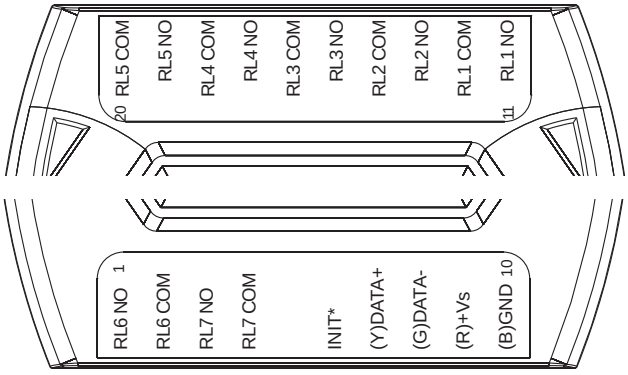
Varistor Selection

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

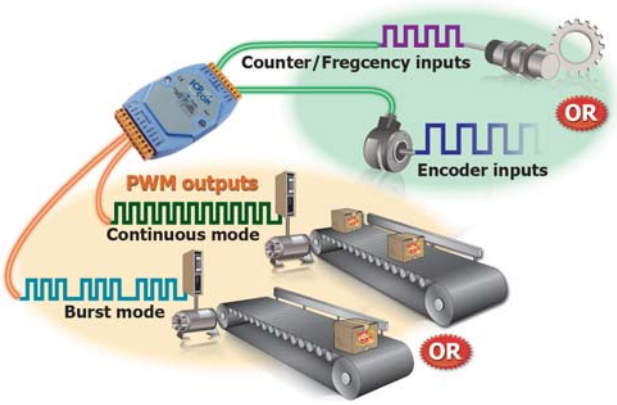
PWM Introduction

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) M-7080(D)	I-7080B(D) M-7080B(D)	I-7083(D)	I-7083B(D)	M-7084	I-7088 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

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.

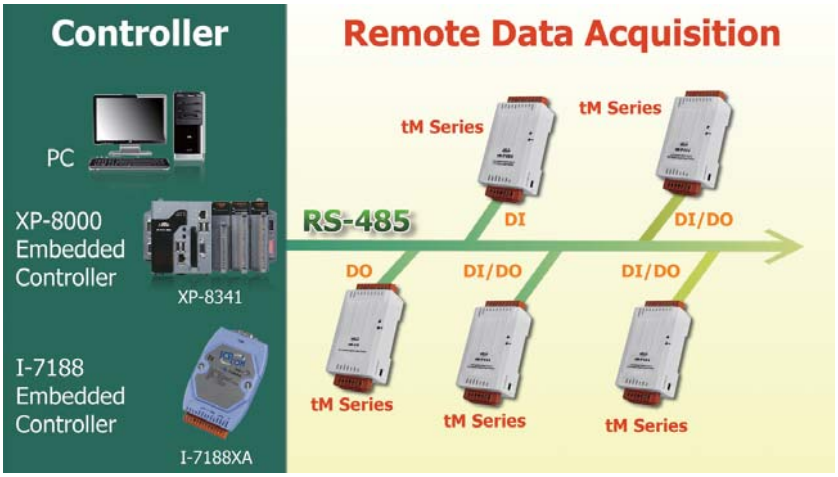
The tM series tiny RS-485 I/O modules support various I/O types, like photo-isolated digital input, power relay, photoMOS relay, open collector output, and analog input (voltage and current). Compared with the M-7000 series, the tM series is more cost-effective with low channel count design that is suitable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

X: Input Type
'P' = Photocoupler
'AD' = Analog Input
'TH' = Thermistor

Y: Number of Channels

Z: Output Type
'C' = Open Collector (NPN, Sink)
'A' = Open Emitter (PNP, Source)
'R' = Relay

W: Number of Channels

tM Series Models

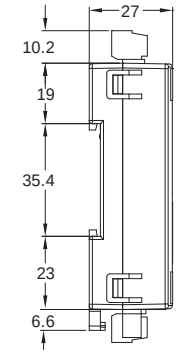
Model Name	Bus	Protocols	AI	AO	DI	DO
tM-AD5	RS-485	Modbus RTU Modbus ASCII DCON	5-ch (Differential, Voltage)	-	-	-
tM-AD5C			5-ch (Differential, Current)	-	-	-
tM-AD8			8-ch (Single-Ended, Voltage)	-	-	-
tM-AD8C			8-ch (Single-Ended, Current)	-	-	-
tM-AD4P2C2			2-ch (Single-Ended, Voltage) 2-ch (Single-Ended, 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

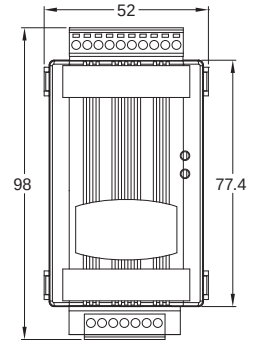
1. Installation

DIN-Rail Mounting

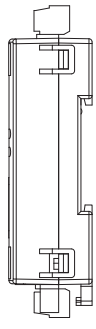
2. Dimensions (Units: mm)



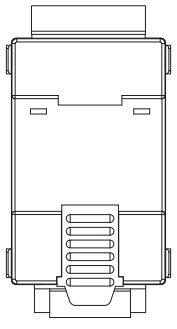
Left Side View



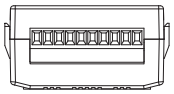
Front View



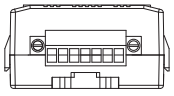
Right Side View



Rear View



Top View



Bottom View

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				
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		

Multi-function Module		
Model Name	**tM-AD4P2C2**	**tM-DA1P1R1**
Pictures		
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						
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 KΩ, 0.66 W			10 KΩ, 0.66 W
★ Counters	Channels	4			8
	Max. Count	65535 (16-bit)			65535 (16-bit)
	Max. Input Frequency	100 Hz			100 Hz
	Min. Pulse Width	5 ms			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			

Relay Output Module			
Model Name		**tM-P3R3**	**tM-R5**
Pictures			NEW 
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 KΩ, 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

Patent

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 none-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

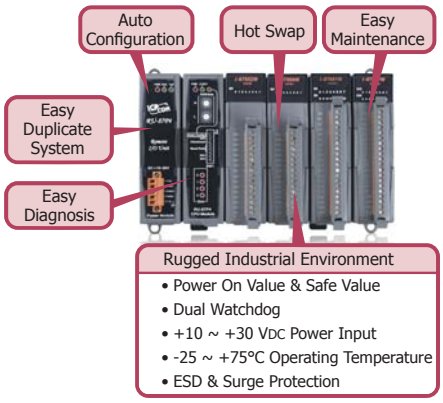
Reliable 3-piece construction enables users to hot swap modules during operation, without rewiring. All I/O module data are backed up in the non-volatile memory of the RU-87Pn. After hot-swapping a module, all settings are automatically loaded to recover.

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.

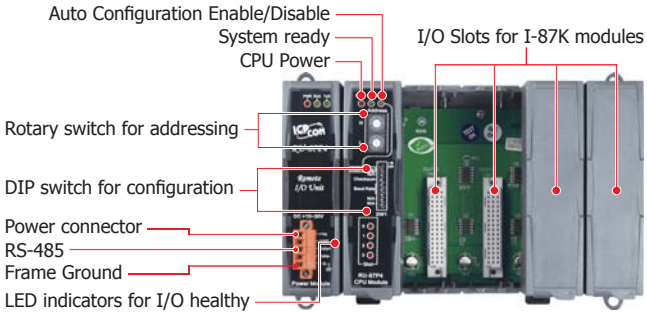
If one I-87K module fails, the operator just needs to replace it with one good I-87K module with the same item number. And then checks the LED indicators to know whether the replacement is performed correctly. The switch and LED design makes it easy for maintenance. There is no PC and Notebook needed.

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

RU-87P4



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 × 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-87P2 CR	2 slots I/O Expansion Unit (RoHS)
RU-87P4 CR	4 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

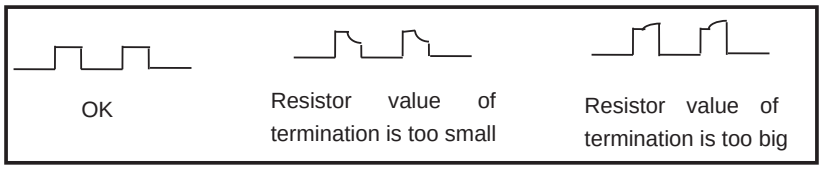
The RS-485 Bias and Termination Resistors Module

Features

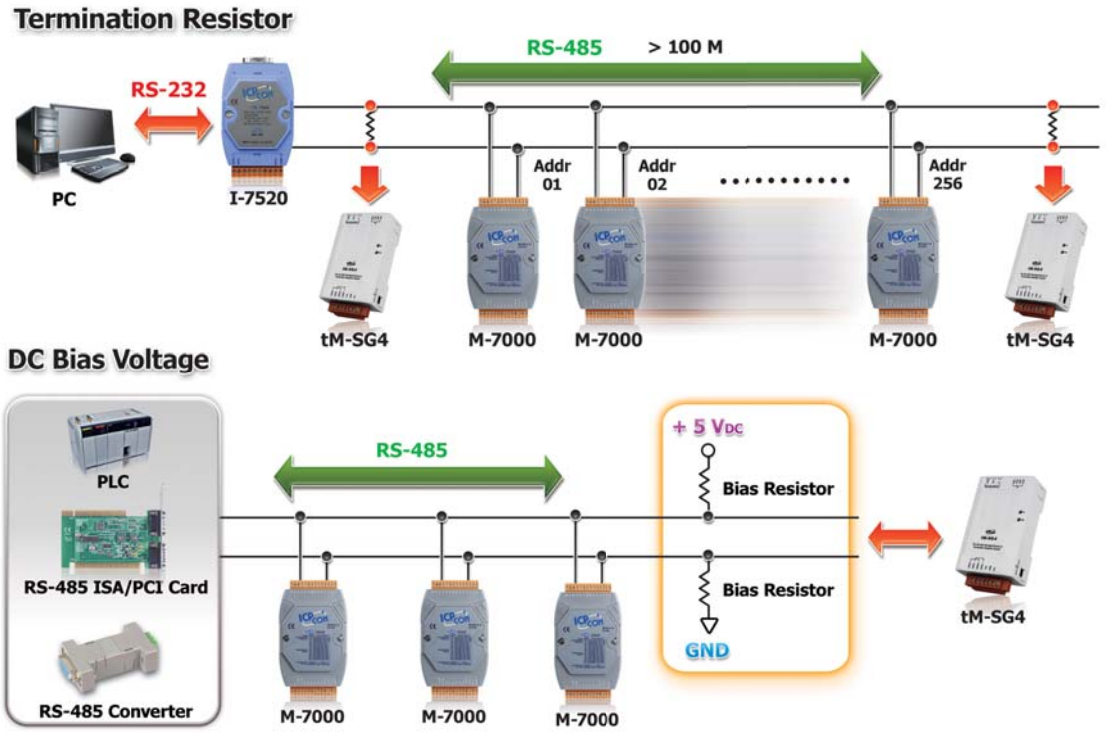
- Switch-selectable Bias Resistors
- 15-step Switch-selectable Termination Resistor
- LED Indicator for Power/Termination
- DIN-Rail Mountable
- Cost-effective
- Wide Operating Temperature Range: -25 ~ +75°C

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



System Specifications

RS-485 Interface	
Bias Resistor	1 kΩ, 10 kΩ, 100 kΩ, 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 V_{DC}
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°C
Storage Temperature	-40 ~ +85°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

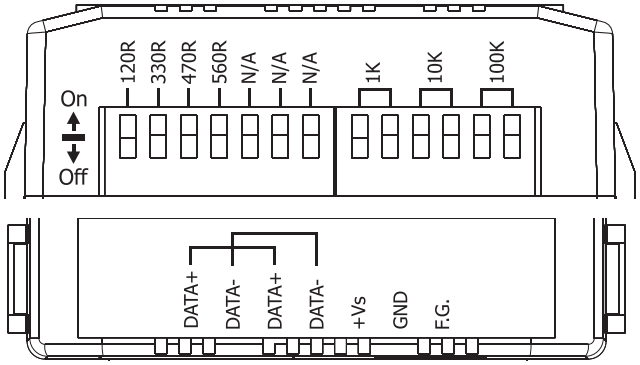
Termination Resistor On/Off Switch

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

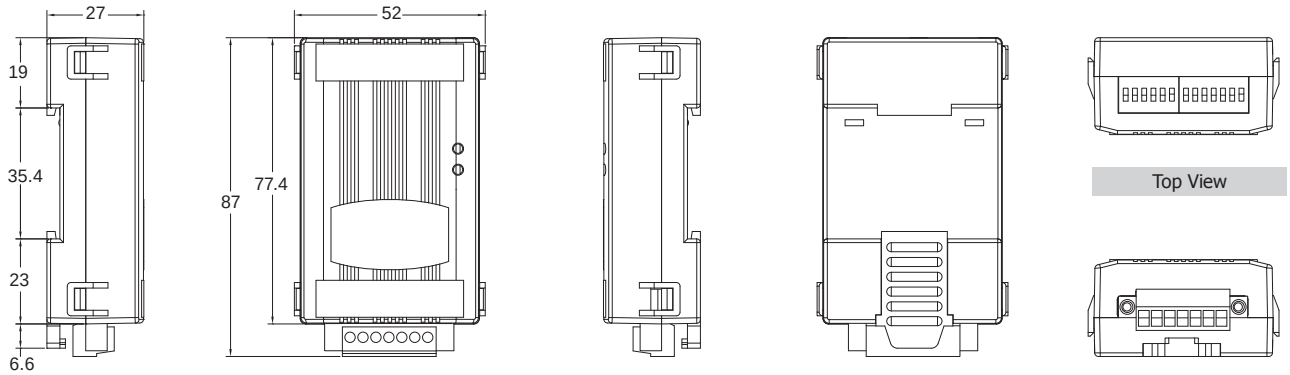
Bias Resistor Settings

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)



Left Side View | Front View | Right Side View | Rear View | Top View | Bottom View

Ordering Information

tM-SG4 CR	RS-485 Bias and Termination Resistor Module (RoHS)

2.6. Converter/Repeater/Hub/Splitter

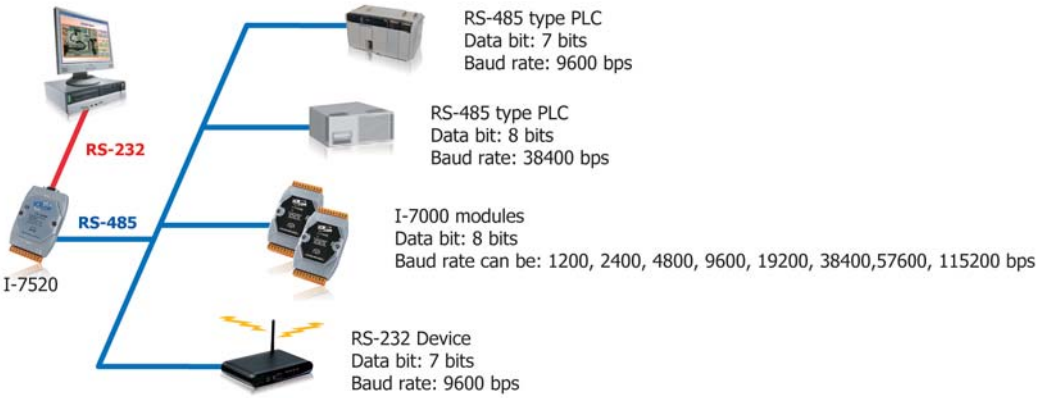
ICP DAS Self-Tuner ASIC Features:
- Multiple Baud Rate
- Multiple Data Format
- Automatic RS-485 Direction Control

▲ I-7520

"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.

Furthermore, the RS-485 is a 2-wire half-duplex network. To transmit and receive data via the twiced pair wire, a transmission direction control for the RS-485 is needed. In conventional designs, software has to switch a hardware handshaking signal such as RTS (Request To Send) to control the transmission direction. The Self-Tuner chip automatically detects and controls the direction of the transmission of the RS-485 network. So the application program does not have to care about the direction control.



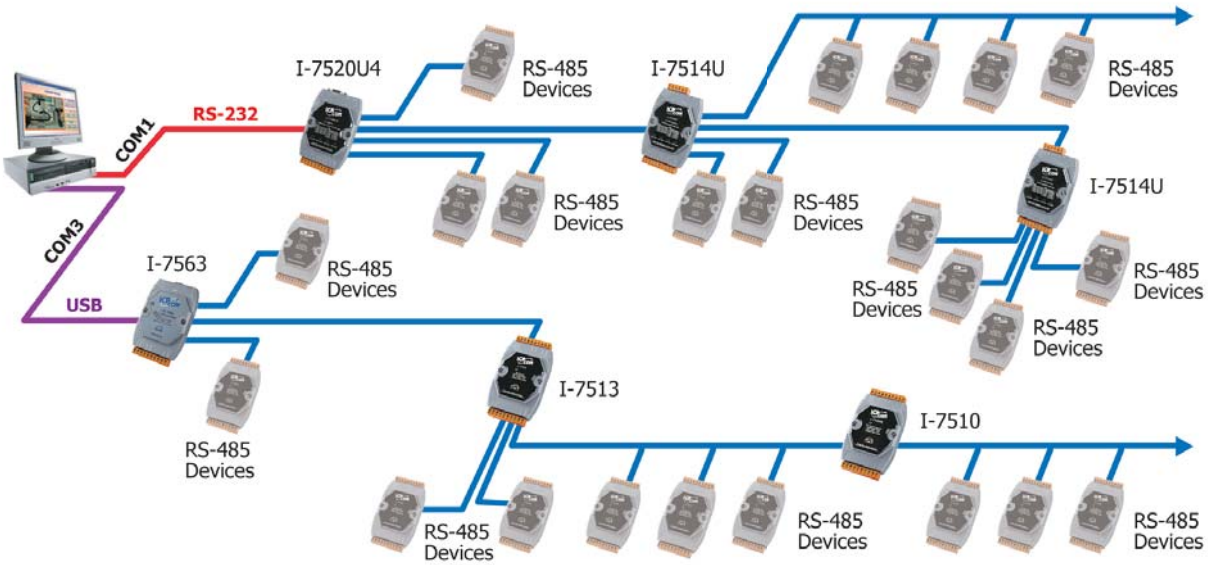
▲ I-7520U4

▲ I-7514U

High Quality Isolated RS-485 Repeater/Hub/Splitter

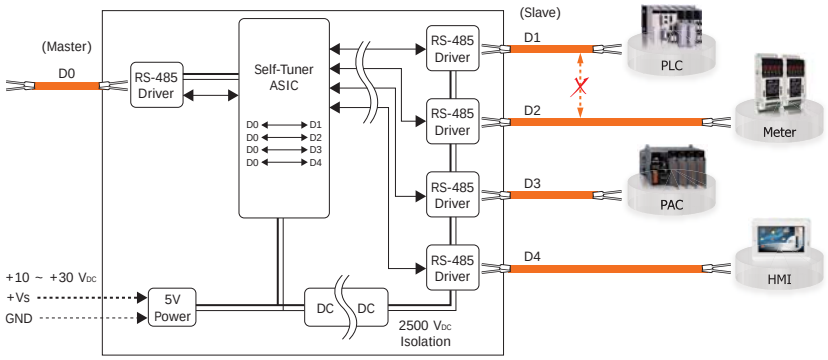
The maximum effective distance of RS-485 without repeater is 1200 meters (4000 feet) at baud rates up to 9.6 Kbps and up to 32 (256) nodes can be connected. With the professional design, the repeater I-7510 solves the problem of signal weakening and extends the maximum effective distance by 1200m and 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 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