7188/7186 Series µPAC

7.1. 7188/7186 Series µPAC

• Overview

ICP DAS develops a family of palm-size PAC named **µPAC** (micro Programmable Automation Controller). Featuring robust, powerful, space-saving, cost-effective and more, µPAC presents excellent performance in various Industry Automation applications in the challenging environments.

I-7188 — the 1st generation

"I-7188 Series", the first generation of µPAC, has been widely used in various Industry Automation applications. It is characterized by fast-booting operating system MiniOS7, interchangeable X-Board for function expansion, flexible COM port configuration and user-defined I/O pins.

µPAC-7186 — the 2nd generation

"µPAC-7186 Series", debuting in 2008, further improves and upgraded features, such as faster CPU, better 10/100 Base-TX Ethernet port, lower power consumption and diversified Memory combination selections. With better performance, it is suitable for more sophisticated applications: auto-reporting data acquisition, M2M automation system, wire/wireless remote control, data logger application, redundant solution, etc.

Generation	CPU	Ethernet	Memory Expansion	Power consumption
I-7188 Series	40 MHz	10 BaseT	SRAM, Flash	2W
µPAC-7186	80 MHz	10/100 BaseTX	SRAM, Flash	1.5W

• Top 12 reasons to choose µPAC by ICP DAS

1. Powerful Embedded OS — MiniOS7

MiniOS7 is the most stable OS used in the last decade. Up to now, several hundred thousand copies with our PACs have been distributed worldwide.

Features:

- DOS-like embedded OS
- Antivirus ability
- Internet connectivity
- Libraries & demo programs for various peripherals, devices and remote I/O modules
- Short boot time period (<1 Second)
- Less memory resource required
- Faster watchdog response time

2. Free IDE Software — MiniOS7 Studio Simple Programming for Your Applications!

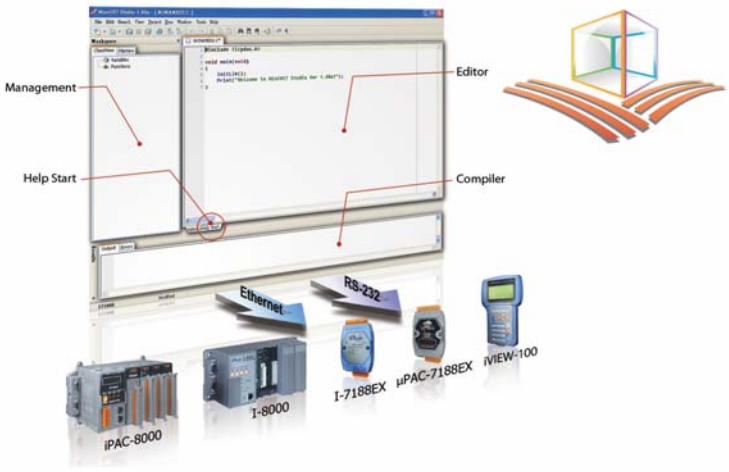
MiniOS7 Studio is a powerful, easy-to-use & free of charge Software Development Toolkit for PACs embedded with MiniOS7.

Including:

Program editor, compiler, debugger, linker, I/O setting, communication configuration, utilities, libraries and networking example code...etc.

Programming support:

• MSC • MSVC • BC++ • TC • TC++



3. Rich Development Support

We provide over 100 Libraries and Demos for users to develop applications easily and quickly to integrate with some popular software, SCADA, protocols or tools.

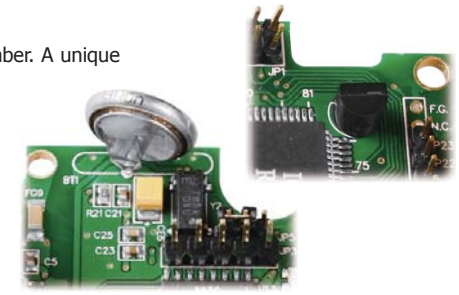
- Provide Libraries: Xserver, Modbus, MiniOS7 Framework
- Support development tool: ISaGRAF, C Language

4. Patented Technology: "Self-Tuner" Chip

Our µPAC contains a patented "Self-tuner" chip which automatically tunes Baud rate and data format in the whole RS-485 network. It also handles the direction of RS-485 communication line.

5. Unique 64-bit Hardware Serial Number Protecting Your Program

All µPAC-7186 series and most I-7188 series come with a 64-bit unique hardware serial number. A unique serial number is assigned to each hardware device to protect your software against piracy.



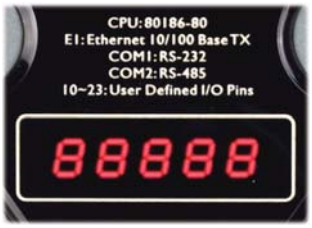
6. Built-in RTC — Real Time Clock

- Provides second, minute, hour, day of week, day of month, month & year (1980 ~ 2079)
- With on-board battery
- Data valid up to 10 years
- Keep accurate time/date while the main power is lost

7. 5-Digit 7-Segment LED Display

Optional 5-digit 7-segment LED display shows information, such as system status, user-defined message...etc.

- Display numbers, letters, symbols, units, etc.



8. Highly Reliable Under Harsh Environment

Our PAC can operate in a wide range of temperature and humidity.

- Operating Temperature: -25 ~ +75°C
- Storage Temperature: -40 ~ +80°C
- Humidity: 10 ~ 90% RH, non-condensing

9. Built-in WDT — Watchdog Timer

When I-7188 or µPAC-7186 is power-up, the watchdog timer can be enabled. The watchdog timer resets the controller after a short period (about 0.8 seconds) when the running software fails to reset the watchdog.

10. Various Memory Expansion Options

- **Memory Configuration:**

Memory	Size	Description
Flash Disk	64 MB NAND	rugged data storage that resists shock and vibration. MiniOS7 file system and APIs are provided to read/write files.
NVRAM	31 bytes	No writing limitation
EEPROM	2 KB or 16 KB	to store not frequently changed parameters.
Note: Different model has different SRAM size, NVRAM and Flash size. Please refer to the Selection Guide.		

- **Expansion Memory Board (Optional):**

Flash memory Board

Battery-backup RAM Board

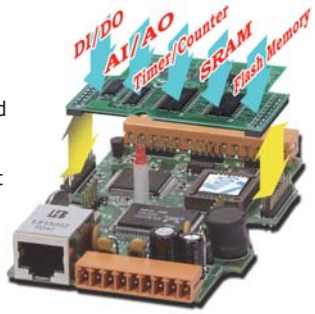
- **Expansion Memory Board (Optional):**

The writing protection and limitation of Flash and EEPROM prevent memories from being modified due to noise interference. NVRAM doesn't have writing limitation. It is the best choice for temporary data storage. Furthermore, it is non-volatile, data can be kept even when the power is lost or the system crashes.

11. Expandable Local I/Os & Hardware Functions

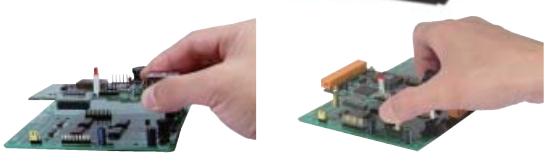
Most µPAC-7186 and I-7188 series have a built-in expansion bus. X-Board can be plugged on the Bus to expand I/O channels, COM Ports, memories or hardware functions (Listed below).

- DI, DO, AI, O, Timer/Counter, Communications, Flash memory, Battery backup SRAM, Motion control , Self-test
  We provide various standard X-Boards, and also ODM service.



The X-Board has two methods to combine with the palm-size PAC. Plug an X-Board into a palm-size PAC or mount a controller on a larger X-Board.

Plug an X-Board into a palm-size PAC



Mount a controller on a larger X-Board

• Selection Guide

I-7188 X X X

Ethernet Port
- : Without I/O Expansion Bus & Ethernet Port
E: With Ethernet Port
X: Without Ethernet Port

Software & Communication Ports
A: C language based (2-DI , 2-DO, RS-232 and RS-485)
B: C language based (1-DI , 1-DO, RS-232 and RS-485)
C: C language based (2-DI , 3-DO, RS-232 and RS-485)
X: C language based (RS-232 and RS-485)
G: ISaGRAF

LED Display
D: With 5-digit 7-segment LED Display

µPAC-7186 E X X - XX

Software
X: C language based
G: ISaGRAF

LED Display
D: With 5-digit 7-segment LED Display

Special Feature
SM: 640 KB SRAM
FD: 64 MB NAND Flash

C Language Based I-7188 and µPAC-7186

Serial Connectivity

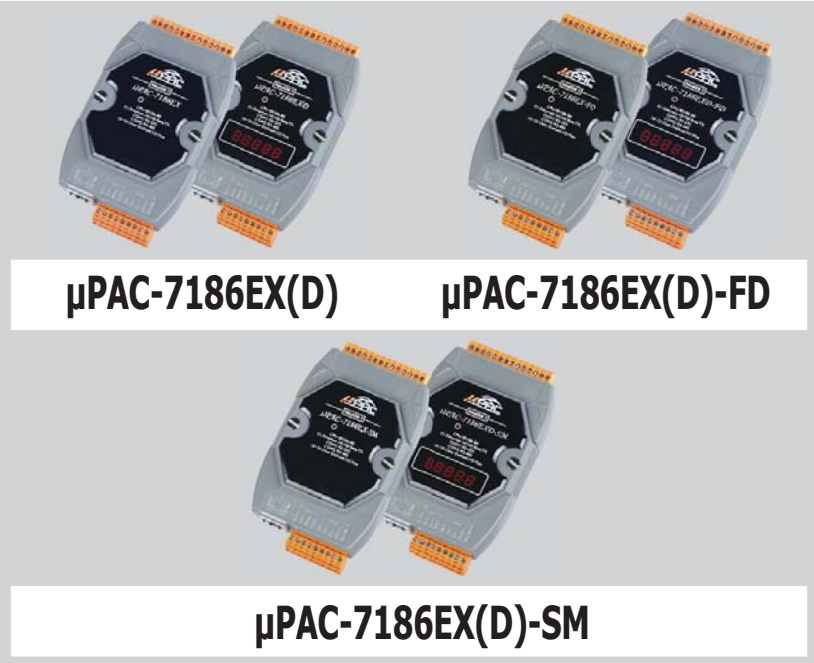
Model Name	CPU	SRAM	Flash	I/O Expansion Bus	64-bit Hardware Serial Number	RTC	DI	DO	RS-232/RS-485
I-7188 I-7188D	40 MHz	256 KB	512 KB	-	-	Yes	-	-	4 (Note)
I-7188XA I-7188XAD		512 KB		For memory board only	Yes		2	2	
I-7188XB I-7188XBD				Yes			1	1	1/1
I-7188XC I-7188XCD	20 MHz	128 KB		Yes	-	-	2	3	

Note: RS-232 × 2, RS-485 × 1, RS-232/485 × 1

Model Name	CPU	SRAM	Flash	NAND Flash	I/O Expansion Bus	RTC	DI	DO	Ethernet	RS-232/RS-485
I-7188EA I-7188EAD	40 MHz	512 KB	512 KB	-	-	Yes	6	7	10 Base-T	1/1
I-7188EX I-7188EXD					Yes		-	-		
µPAC-7186EX µPAC-7186EXD	80 MHz	512 KB	512 KB	-	Yes	Yes			10/100 Base-Tx	1/1
µPAC-7186EX-SM µPAC-7186EXD-SM		640 KB								
µPAC-7186EX-FD µPAC-7186EXD-FD		512 KB		64 MB						

ISaGRAF Based µPAC-7186 & I-7188

Model Name	CPU	SRAM	Flash	I/O Expansion Bus	RTC	DI	DO	Ethernet	RS-232/RS-485
µPAC-7186EG µPAC-7186EGD	80 MHz	768 KB	512 KB	Yes	Yes	-	-	10/100 Base-TX	1/1
I-7188XG I-7188XGD	40 MHz	512 KB				1	1	-	1/1



µPAC-7186EX(D)　　µPAC-7186EX(D)-FD

µPAC-7186EX(D)-SM

Features

- 80186, 80 MHz CPU
- MiniOS7 Inside
- C Language Programming
  - TCP/IP Library
  - Modbus Library
  - SNMP Library
- Various Storage Media
  - 512 KB Flash
  - 16 KB EEPROM
  - 64 MB NAND Flash Disk
- Various Communication Interfaces
  - 10/100 Base-TX Ethernet
  - RS-232/485
- 64-bit Hardware Serial Number
- I/O Expansion Bus
- Operating Temperature: -25 ~ +75°C

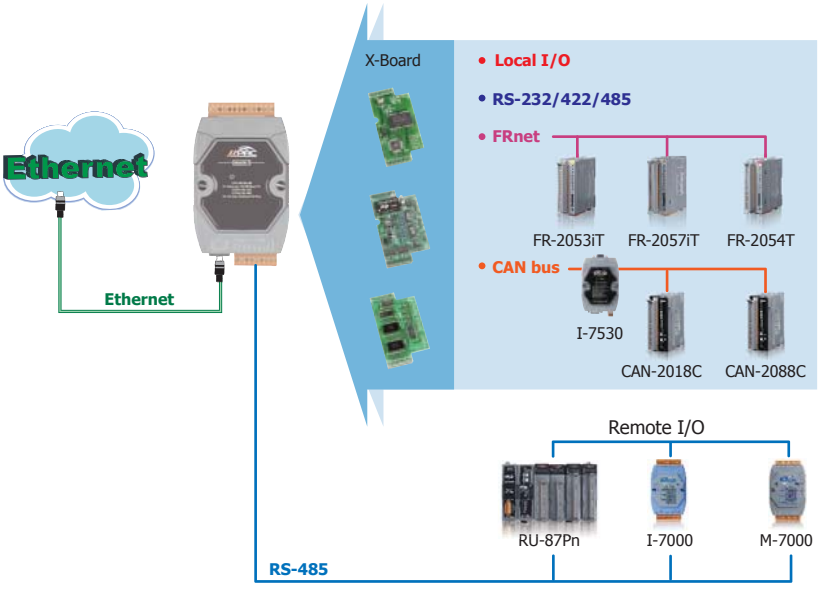
Introduction

The µPAC-7186EX series is a palm-size programmable automation controller that with Ethernet, RS-232, RS-485 communication. ICP DAS provides easy-to-use software development tool kits (Xserver, MiniOS7 framework, VxComm, Modbus libraries). Users can use them to easily integrate serial devices to have Ethernet/Internet communication ability and through the standard Modbus protocol to communicate with SCADA software (Indusoft, ISaGARF, DasyLab, Trace Mode, Citect, iFix, etc.).

For hardware expansion, it also supports an I/O expansion bus. The I/O expansion bus can be used to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory and other I/O functions. Nearly all kinds of I/O functions can be implemented by this bus. But the bus can support only one board. There are more than 50 boards available for µPAC-7186EX, you can choose one of them to expand hardware features.

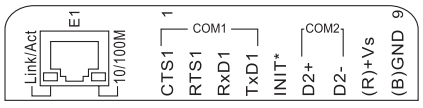
Applications

Rich I/O Expansion Ability

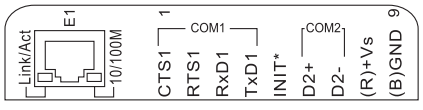


Pin Assignments

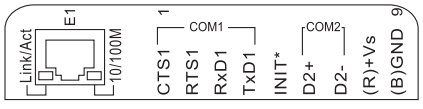
µPAC-7186EX(D)



µPAC-7186EX(D)-FD



µPAC-7186EX(D)-SM



Specifications

Models	µPAC-7186EX(D)	µPAC-7186EX(D)-SM	µPAC-7186EX(D)-FD
System Software			
OS	MiniOS7 (DOS-like embedded operating system)		
Program Download Interface	RS-232 (COM1) or Ethernet		
Programming Language	C language		
Compilers to create.exe Files	TC++ 1.01 TC 2.01 BC++3.1 ~ 5.2x MSC 6.0 MSVC++ (before version 1.5.2)		
CPU Module			
CPU	80186, 80 MHz		
SRAM	512 KB	640 KB	512 KB
Flash	512 KB		
NAND Flash Disk	-		64 MB
EEPROM	16 KB		
NVRAM	31 Bytes (battery backup, data valid up to 10 years)		
RTC (Real Time Clock)	Provides second, minute, hour, date, day of week, month, year		
64-bit Hardware Serial Number	Yes, for Software Copy Protection		
Watchdog Timers	Yes (0.8 second)		
Communication Ports			
Ethernet	RJ-45 x 1, 10/100 Base-TX		
COM 1	RS-232 (TxD, RxD, RTS, CTS, GND), non-isolated, Speed: 115200 bps Max.		
COM 2	RS-485 (Data+, Data-) with internal self-tuner ASIC; non-isolated, Speed: 115200 bps Max.		
CAN Bus	-		
LED Indicator			
System LED	Yes		
LED Display	5-digit 7-segment LED display for D versions		
Special Indicator	-	-	
Hardware Expansion			
I/O Expansion Bus	Yes, 1		
Mechanical			
Dimensions (W x L x H)	72 mm x 123 mm x 35 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 V_{DC}		
Protection	Power reverse polarity protection		
Power Consumption	1.5 W; 2.5 W for (D) version	2 W; 3 W for (D) version	

Ordering Information

µPAC-7186EX CR	µPAC with 10/100M Ethernet (RoHS)
µPAC-7186EXD CR	µPAC-7186EX with display (RoHS)
µPAC-7186EX-SM CR	µPAC with 10/100M Ethernet, 640 KB SRAM (RoHS)
µPAC-7186EXD-SM CR	µPAC-7186EX-SM with display (RoHS)
µPAC-7186EX-FD CR	µPAC with 10/100M Ethernet, 64 MB Flash Disk (RoHS)
µPAC-7186EXD-FD CR	µPAC-7186-FD with display (RoHS)

I-7188XG(D) µPAC-7186EG(D)

Features

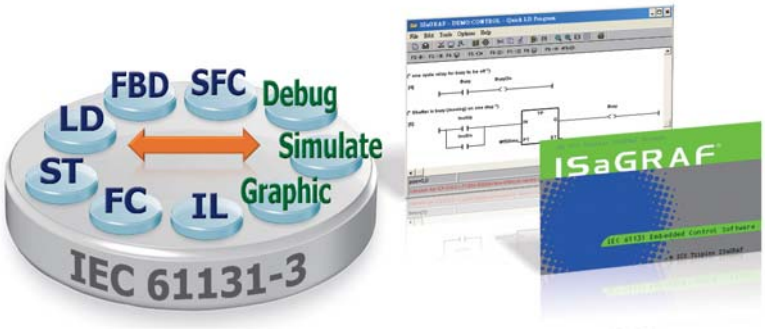
- 80186, 80 MHz CPU or 80188, 40 MHz CPU
- Development Software: ISaGRAF Ver.3
  - Provide 6 PLC Syntaxes (5 IEC 61131-3 Standard)
  - Code Size: Max. 64 KB ISaGRAF Code Size
  - Support Off-line Simulation
  - On-line Debugging, Monitoring and Controlling
  - Easy to integrating with HMI/MMI
- MiniOS7 Inside
- Ethernet
  - 10/100 Base-TX (for µPAC-7186EG)
- Support Modbus Master
  - RTU, ASCII, RS-232/485/422
- Support Modbus RTU/TCP Slave
  - Modbus RTU (RS-232/485/422) Slave
  - Modbus TCP Slave (not for I-7188XG)
- Operating Temperature: -25 ~ +75°C

Introduction

µPAC-7186EG Series is a palm-size PAC and includes ISaGRAF SoftLogic. It has one 10/100 Base-TX Ethernet port, one RS-232 port and one RS-485 port. The user can choose an I/O expansion board, X-Board, to expand the I/Os or memories of µPAC. µPAC-7186EG support Modbus Serial protocol, Modbus TCP/IP protocol, Modbus Master protocol, Remote I/O, Fbus, Ebus, SMS: Short Message Service, modem link, MMICON/LCD, ZigBee wireless communication, GPS application, FRnet, CAN remote I/O connection and user defined protocol.

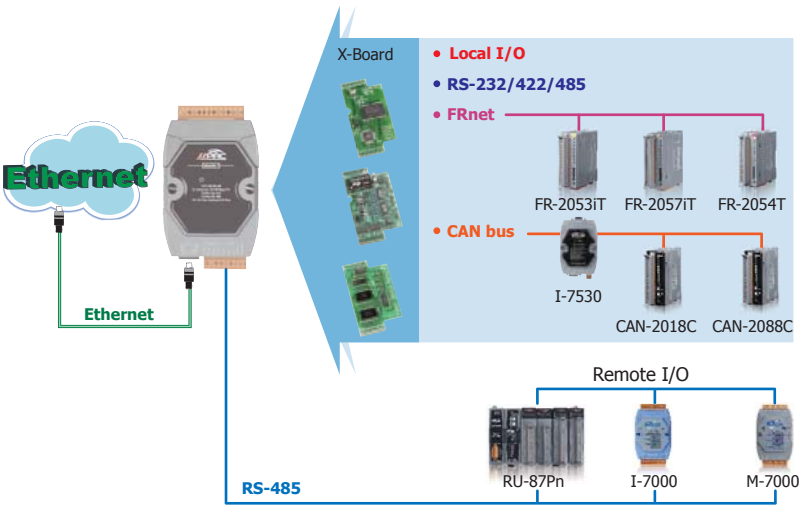
I-7188XG series is a palm-size PAC with ISaGRAF SoftLogic. It has 2 Serial ports (COM1:RS-232/RS-485 & COM2:RS-485).

The user can choose an I/O expansion board, X-Board, to expand COM Ports, I/Os or memories of I-7188XG and µPAC-7186EG.



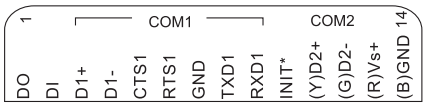
Applications

Rich I/O Expansion Ability

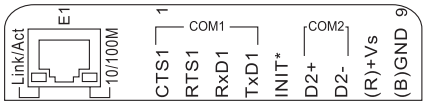


Pin Assignments

I-7188XG(D)



µPAC-7186EG(D)



µPAC Specifications

Models		I-7188XG(D)	µPAC-7186EG (D)
System Software			
OS		MiniOS7 (DOS-like embedded operating system)	
Development Software			
ISaGRAF Software	ISaGRAF Version 3	IEC 61131-3 standard	
	Languages	LD, ST, FBD, SFC, IL & FC	
	Max. Code Size	64 KB	
	Scan Time	5 ~ 100 ms for normal program 25 ~ 500 ms (or more) for complex or large program	2 ~ 5 ms for normal program 10 ~ 125 ms (or more) for complex or large program
CPU Module			
CPU		80188, 40 MHz	80186, 80 MHz
SRAM		512 KB	640 KB
Flash		512 KB	
EEPROM		2 KB	16 KB
NVRAM		31 Bytes (battery backup, data valid up to 10 years)	
RTC (Real Time Clock)		Provides second, minute, hour, date, day of week, month, year	
64-bit Hardware Serial Number		Yes, for Software Copy Protection	
Watchdog Timers		Yes (0.8 second)	
Communication Ports			
Ethernet		-	RJ-45 x 1, 10/100 Base-TX
COM 1		RS-232 or RS-485 with internal self-tuner ASIC; non-isolated	RS-232 (TxD, RxD, RTS, CTS, GND), non-isolated
COM 2		RS-485 with internal self-tuner ASIC; non-isolated	
LED Indicator			
System LED		Yes	
LED Display		5-digit 7-segment LED display for (D) version	
Special Indicator		-	
Digital Input			
Channels		1	-
Contact		Dry	-
On Voltage Level		Connect to GND	-
Off Voltage Level		Open	-
Digital Output			
Channels		1	-
Output Type		Open Collector	-
Load Current		100 mA	-
Load Voltage		30 VDC Max.	-
Hardware Expansion			
I/O Expansion Bus		Yes, 1 (14 Pins)	
Mechanical			
Dimensions (W x L x H)		72 mm x 123 mm x 33 mm	72 mm x 123 mm x 35 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	
Protection		Power reverse polarity protection	
Power Consumption		2 W; 3 W for (D) version	1.5 W; 2.5 W for (D) version

ISaGRAF Specifications

Protocols (some protocols need optional devices)		
NET ID		User-assigned by software, 1 ~ 255
Modbus RTU/ASCII Master Protocol		Up to 2 COM ports: I-7188XG COM 2 ~3, µPAC-7186EG COM 1~3 (*). (To connect to other Modbus Slave I/O devices) Max. Mbus_xxx Function Block amount for 2 ports: µPAC-7186EG: 128; I-7188XG: 64.
Modbus RTU Slave Protocol		Up to 2 COM Ports: COM1, one of COM2 or COM3 (*). (For connecting ISaGRAF, PC/HMI/OPC Server & MMI panels)
Modbus TCP/IP Slave Protocol		Ethernet port supports Modbus TCP/IP Slave protocol for connecting ISaGRAF & PC/HMI. Max. connections: µPAC-7186EG: 6 I-7188XG: 0
User-Defined Protocol		By serial communication function blocks. µPAC-7186EG: COM1 ~ COM8 (*) or I-7188XG: COM2 ~ COM8 (*).
Remote I/O		One of COM2 or COM3:RS-485 (*) supports I-7K, I-87K I/O modules as Remote I/O. I-87K series must plug on RU-87Pn (High profile) or I-87K (Low profile) I/O Unit. Max. 64 I/O modules for one PAC.
Fbus		Built-in COM2 Port to exchange data between ICP DAS's ISaGRAF controllers.
Ebus		To exchange data between ICP DAS's ISaGRAF Ethernet controllers via Ethernet port. (Not for I-7188XG)
Send E-mail		Send email to maximum 10 receivers each time via internet. If applying with an X607/608 X-Board, it could send email with one attached file and the maximum file size is about 488 KB (using X608) or about 112 KB (using X607). (Not for I-7188XG)
SMS: Short Message Service		One COM port (µPAC-7186EG: one of COM1 or COM3 or COM4; I-7188XG: one of COM3 or COM4) (*) can link to a GSM modem to support SMS. User can request data/control the controller by cellular phone. The controller can also send data & alarms to user's cellular phone. Optional GSM modems: GTM-201-RS232 (GSM/GPRS 850/900/1800/1900)
Modem Link		Support PC remotely download & monitor the controller through COM4 of X504.
MMICON/LCD		COM3: RS-232 (*) supports ICP DAS's MMICON. The MMICON is featured with a 240 x 64 dot LCD and a 4 x 4 Keyboard. User can use it to display picture, string, integer, float, and input a character, string, integer and float.
Redundant Solution		One is Master, one is Slave. Master handles all inputs & outputs at run time. If Master is damaged (or Power off), Slave takes the control of Bus7000b. If Master is alive again, it takes the control of Bus7000b again. The change over time is about 5 seconds. Control data is exchanging via Ebus (if using a cross cable, there is no need of any Ethernet switch). All I/O should be RS-485 I/O except the status I/O in the slot 0: X107. (for µPAC-7186EG only)
CAN/CANopen		Use COM1 or COM3 ~ COM8 (*) to connect one I-7530: the RS-232 to CAN converter to support CAN/CANopen devices/sensors. One PAC supports Max. 3 RS-232 ports to connect Max. 3 I-7530 modules. (FAQ-086) (for µPAC-7186EG only)
PWM Output	Pulse Width Modulation Output	All X-Board series DO boards support PWM output. 8 channels Max. for one controller. 500 Hz Max. for Off=1 & On=1 ms, Output square curve: Off: 1 ~ 32767 ms, On: 1 ~ 32767 ms
Counters	Parallel DI Counter	All X-Board series DI boards support DI counter. 8 channels. Max. for one controller. Counter value: 32 bit, 500 Hz Max. Min. ON & OFF width must > 1 ms
	Remote DI Counter	All remote I-7000 & I-87K DI modules support counters. 100 Hz Max. value: 0 ~ 65535 (16-bit)
	Remote High Speed Counter	Optional I-87082: 100 kHz Max., 32-bit
SRAM Expansion	Battery Backup SRAM	With an X607/X608 plug in the only expansion I/O slot. Data can be stored in X607/X608, and then PC can load these data via COM1 or Ethernet. PC can also download pre-defined data to the X607/X608. (for retain variables) Optional: X607: 128 KB, X608: 512 KB

*** Note: COM3 ~ COM8 are resided at the optional X-series board if it is plugged inside the µPAC-7186EG & I-7188XG.**
*** ISaGRAF FAQ: http://www.icpdas.com/faq/isagraf.htm**

Ordering Information

µPAC-7186EG CR	ISaGRAF based µPAC with 10/100M Ethernet (RoHS)
µPAC-7186EGD CR	µPAC-7186EG with display (RoHS)
I-7188XG CR	ISaGRAF based µPAC with 1 DI, 1 DO (RoHS)
I-7188XG CR	I-7188XG with display (RoHS)

Accessories

ISaGRAF Development Software	
ISaGRAF-256-E	ISaGRAF Workbench Software Ver.3 (256 I/O Tags) with One Application Book (English version) and one USB Dongle
ISaGRAF-256-C	ISaGRAF Workbench Software Ver.3 (256 I/O Tags) with One Application Book (Chinese version) and one USB Dongle
ISaGRAF-32-E	ISaGRAF Workbench Software Ver.3 (32 I/O Tags) with One Application Book (English version)
ISaGRAF-32-C	ISaGRAF Workbench Software Ver.3 (32 I/O Tags) with One Application Book (Chinese version)
Note: Do not offer upgrade service from ISaGRAF-32 to ISaGRAF-256	
Others	
MDR-20-24 CR	24 VDC/1.0 A, 24 W Power Supply with DIN-Rail Mounting (RoHS)
GPSU06U-6 CR	24 VDC/0.25 A, 6 W Power Supply (RoHS)
DIN-KA52F CR	24 VDC/1.04 A, 25 W Power Supply with DIN-Rail Mounting (RoHS)
I/O Expansion Boards	Other add-on expansion boards refer to expansion board selection guide
NS-205 CR	Unmanaged 5-port Industrial Ethernet Switch (RoHS)

Features

- 80188, 40 MHz or 20 MHz CPU
- MiniOS7 Inside
- C Language Programming
  - Modbus Library
  - CAN Bus Library
- Various Storage Media
  - 512 KB Flash
  - 2 KB EEPROM
  - 31 Bytes NVRAM
- Various Communication Interfaces
  - RS-232/485
- 64-bit Hardware Serial Number
- I/O Expansion Bus
- Operating Temperature: -25 ~ +75°C

Introduction

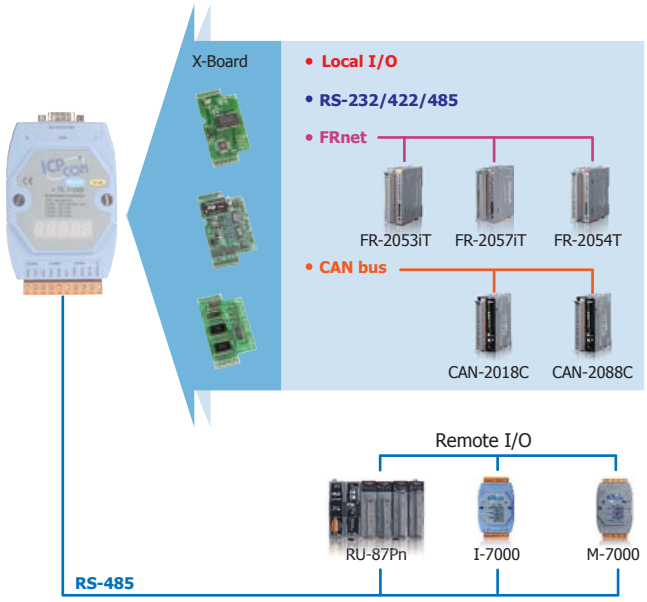
The I-7188 series is a palm-size PAC designed to work in harsh environment. It has a CPU, SRAM, Flash and several RS-232, RS-485 ports. With a DOS-like OS (MiniOS7) and a developed firmware running inside, the I-7188 can act like a small PC.

For the hardware expansion, it supports an I/O expansion bus to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory, etc. Customers can develop their own I/O expansion boards or choose one of 50 available boards that ICP DAS has developed.

For the firmware developing, a 16-bit C compiler for 80188/80186 CPU and C language programming knowledge are needed. To shorten the developing time, there are many demo programs for reference. And for industrial applications, a Modbus library and CAN bus library are provided to ease the developing.

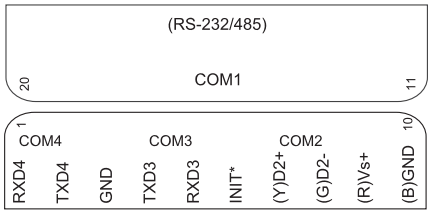
Applications

Rich I/O Expansion Ability

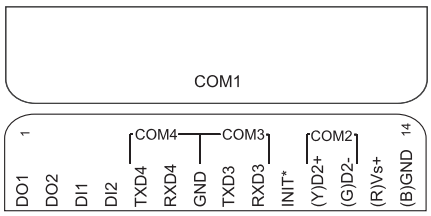


Pin Assignments

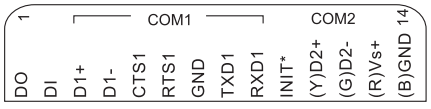
I-7188(D)



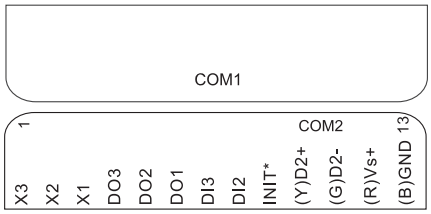
I-7188XA(D)



I-7188XB(D)



I-7188XC(D)

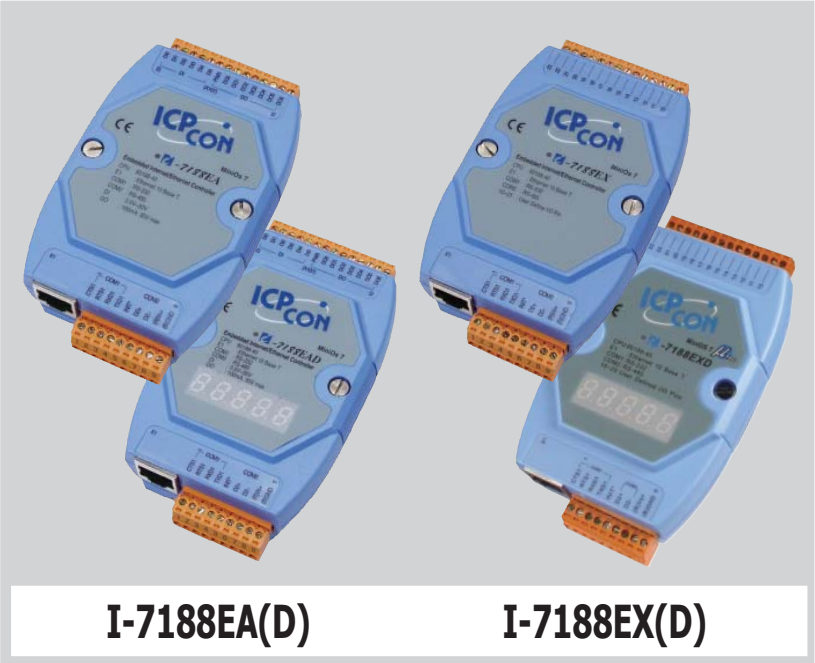


Specifications

Models	I-7188(D)	I-7188XA(D)	I-7188XB(D)	I-7188XC(D)
System Software				
OS	MiniOS7 (DOS-like embedded operating system)			
Program Download Interface	RS-232 (COM4)		RS-232 (COM1)	
Programming Language	C language			
Compilers to create.exe Files	TC++ 1.01; TC 2.01; BC++3.1 ~ 5.2x; MSC 6.0; MSVC++ (before version 1.5.2)			
CPU Module				
CPU	80188, 40 MHz			80188, 20 MHz
SRAM	256 KB	512 KB		128 KB
Flash	512 KB			
EEPROM	2 KB			
NVRAM	31 Bytes (battery backup, data valid up to 10 years)			-
RTC (Real Time Clock)	Provides second, minute, hour, date, day of week, month, year			-
64-bit Hardware Serial Number	-	Yes		-
Watchdog Timers	Yes (0.8 second)			
Communication Ports				
COM 1	RS-232 with modem control or RS-485	RS-232 with modem control or RS-485 with internal self-tuner ASIC; non-isolated	RS-232 or RS-485 with internal self-tuner ASIC; non-isolated	
COM 2	RS-485, non-isolated	RS-485 with internal self-tuner ASIC; 3000 V_{DC} isolated	RS-485 with internal self-tuner ASIC; non-isolated	
COM 3	RS-232 (TxD, RxD, GND)		-	
COM 4	RS-232 (TxD, RxD, GND)		-	
LED Indicator				
System LED	Yes			
LED Display	5-digit 7-segment LED display for (D) versions			
Digital Input				
Channels	-	2	1	2
Contact	-	Dry		
On Voltage Level	-	Connect to GND		
Off Voltage Level	-	Open		
Digital Output				
Channels	-	2	1	3
Type	-	Open Collector		
Load Current	-	100 mA/channel		
Load Voltage	-	+30 V_{DC} Max.		
Hardware Expansion				
I/O Expansion Bus	-	Yes (for memory board only)	Yes	Yes
Mechanical				
Dimensions (W x L x H)	72 mm x 119 mm x 33 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 V_{DC}			
Protection	Power reverse polarity protection			
Power Consumption	2 W; or 3 W for (D) version			

Ordering Information

I-7188/512 CR	µPAC with 4 COM ports (RoHS)
I-7188D/512 CR	I-7188/512 CR with display
I-7188XA CR	µPAC with 4 COM ports and 2 DI, 2 DO (RoHS)
I-7188XAD CR	I-7188XA CR with display
I-7188XB-512 CR	µPAC with 2 COM ports and 1 DI, 1 DO (RoHS)
I-7188XBD-512 CR	I-7188XB-512 CR with display
I-7188XC-512 CR	µPAC with 2 COM ports and 2 DI, 3 DO (RoHS)
I-7188XCD-512 CR	I-7188XC-512 CR with display



I-7188EA(D) I-7188EX(D)

Features

- 80188, 40 MHz CPU
- MiniOS7 Inside
- C Language Programming
  - TCP/IP Library
  - Modbus Library
  - SNMP Library
- Various Storage Media
  - 512 KB Flash
  - 2 KB EEPROM
  - 31 Bytes NVRAM
- Various Communication Interfaces
  - 10 Base-T Ethernet
  - RS-232/485
- 64-bit Hardware Serial Number
- I/O Expansion Bus
- Operating Temperature: -25 ~ +75°C

Introduction

The I-7188EX series is a palm-size PAC designed to survive in harsh environment and has ability to connect to the Internet word. It has a CPU, SRAM, Flash, Ethernet port and several RS-232, RS-485 ports. With a DOS-like OS (MiniOS7) and a developed firmware running inside, the I-7188EX series can act like a small PC.

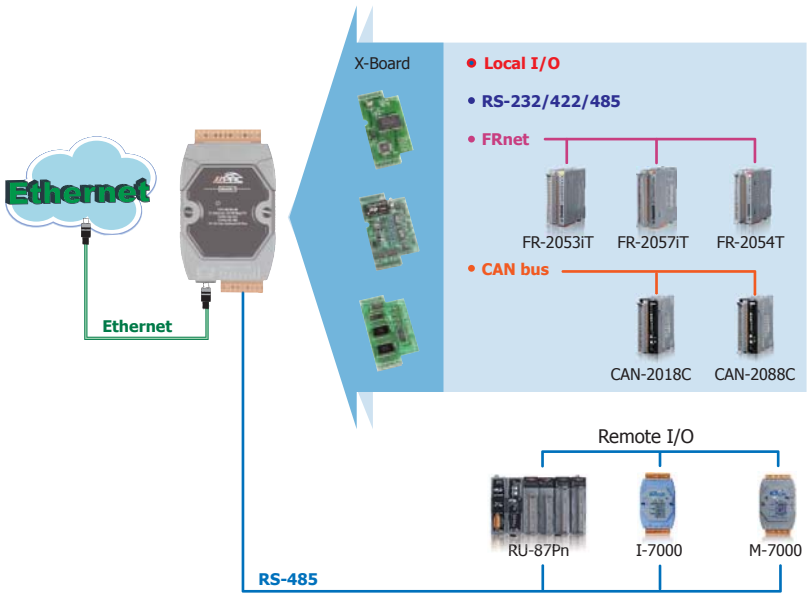
For the hardware expansion, it supports an I/O expansion bus to implement various I/O functions such as D/I, D/O, A/D, D/A, Timer/Counter, UART, flash memory, etc. Customers can develop their own I/O expansion boards or choose one of 50 available boards that ICP DAS has developed.

For the firmware developing, a 16-bit C compiler for 80188/80186 CPU and C language programming knowledge are needed. To shorten the developing time, there are many demo programs for reference. And for industrial applications, a Modbus library is provided to ease the developing.

Depending on the type of embedded firmware that is being developed, and which I/O expansion board, the I-7188EX series can be used as a single versatile controller. The application fields can be factory automation, building automation, machine automation, environment monitoring, etc.

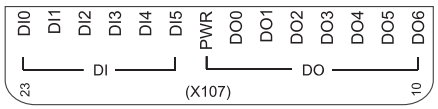
Applications

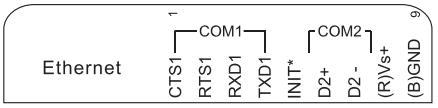
Rich I/O Expansion Ability



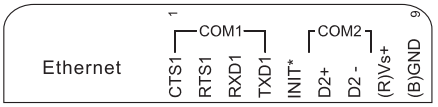
Pin Assignments

I-7188EA(D)





I-7188EX(D)



Specifications

Models	I-7188EA(D)	I-7188EX(D)
System Software		
OS	MiniOS7 (DOS-like embedded operating system)	
Program Download Interface	RS-232 (COM1) or Ethernet	
Programming Language	C language	
Compilers to create.exe Files	TC++ 1.01; TC 2.01; BC++3.1 ~ 5.2x; MSC 6.0; MSVC++ (before version 1.5.2)	
CPU Module		
CPU	80188, 40 MHz	
SRAM	512 KB	
Flash	512 KB	
EEPROM	2 KB	
NVRAM	31 Bytes (battery backup, data valid up to 10 years)	
RTC (Real Time Clock)	Provides second, minute, hour, date, day of week, month, year	
64-bit Hardware Serial Number	Yes, for Software Copy Protection	
Watchdog Timers	Yes (0.8 second)	
Communication Ports		
Ethernet	RJ-45 x 1, 10 Base-T	
COM 1	RS-232 (TxD, RxD, RTS, CTS, GND); non-isolated	
COM 2	RS-485 (Data+, Data-) with internal self-tuner ASIC; non-isolated	
LED Indicator		
System LED	Yes	
LED Display	5-digit 7-segment LED display for (D) versions	
Digital Input		
Channels	6	-
Input Type	Non-isolated	-
On Voltage Level	+3.5 ~+30 V_{DC} Max.	-
Off Voltage Level	1 V_{DC} Max. (Connect to GND)	-
Digital Output		
Channels	7	-
Output Type	Open Collector	-
Load Current	100 mA/channel	-
Load Voltage	+30 V_{DC} Max.	-
Hardware Expansion		
I/O Expansion Bus	-	Yes
Mechanical		
Dimensions (W x L x H)	72 mm x 119 mm x 33 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 V_{DC}	
Protection	Power reverse polarity protection	
Power Consumption	2 W; or 3 W for (D) version	

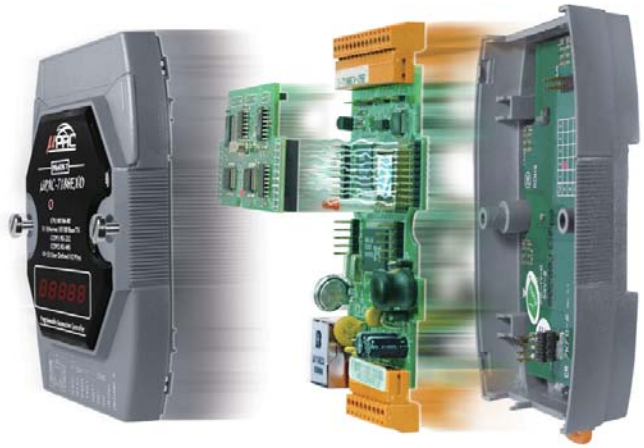
Ordering Information

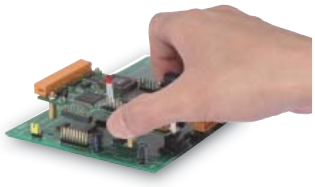
I-7188EA CR	µPAC with 10 M Ethernet and 6 DIs, 7 DOs (RoHS)
I-7188EAD CR	I-7188EA with display (RoHS)
I-7188EX CR	µPAC with 10 M Ethernet (RoHS)
I-7188EXD CR	I-7188EX with display (RoHS)

7.2. I/O Expansion Boards for 7188/7186 Series

• Overview

X-Board is a small I/O expansion board inserted in µPAC (µPAC-7186 Series & I-7188 series) for expanding I/O functions. Most µPACs (except some modules like I-7188 & I-7188D) support one I/O expansion bus. Each bus can be plugged in one X-Board. The X-Board allows users to implement various I/O functions such as DI, DO, A/D, D/A, Timer/Counter, UART, flash memory, battery backup SRAM, AsicKey & other I/O functions.





Users may choose our functioned X-Boards (model number X1xx ~ X7xx) or design their own I/O expansion boards (module number X0xx). We have designed several X-Boards for expanding the µPAC's features. If users choose a small size X-Board, then they can mount this I/O expansion board directly onto the µPAC. Customized I/O Expansion Boards can be ordered through ODM project.

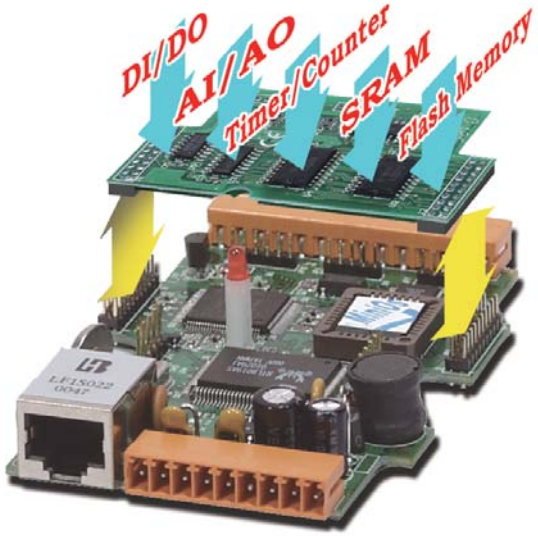
Pin Assignment of I/O Expansion Bus

J1				J2			
GND	01	02	GND	MA0	01	02	AD0
CLKOUTA	03	04	ARDY	MA1	03	04	AD1
INT0	05	06	INT1	MA2	05	06	AD2
VCC	07	08	RESET	MA3	07	08	AD3
GND	09	10	RESET\	MA4	09	10	AD4
TO0	11	12	TO1	MA5	11	12	AD5
TI0	13	14	TI1	MA6	13	14	AD6
SCLK	15	16	DIO9	MA7 (or NC)	15	16	AD7
DIO4	17	18	DIO14	INT4 (or NC)	17	18	WRITE\
VCC	19	20	VCC	CS\	19	20	READ\
CON20A JDIP20P				CON20A JDIP20P			

• Selection Guide

X XXX

1XX: For DI, DO Expansion
2XX: For A/D, D/A, DI, DO Expansion
3XX: For A/D, D/A, DI, DO Expansion
5XX: For RS-232/422/485, DI, DO Expansion
6XX: For Memory Expansion
7XX: For Motion Control Expansion



Following µPAC supports I/O Expansion Bus, can mount one X-Board

- For C language solution: I-7188XB(D), I-7188EX(D), µPAC-7186EX(D), µPAC-7186PEX(D),µPAC-7186EX(D)-FD, µPAC-7186EX(D)-SM
- For ISaGRAF solution: I-7188XG(D), µPAC-7186EG(D)

X-Board is Series has following common specifications

- DI channel: Dry contact, sink type, non-isolated
- DO channel: Open Collector, sink type, 100 mA/channel load current, non-isolated

DI, DO Expansion

Model Name	DI (Dry Contact)	DO (Open Collector)
X107	6	7
X110	14	-
X111	-	13

AI, AO, DI, DO Expansion

Model Name	AI (12-bit)		AO (12-bit)		DI (Dry Contact)	DO (Open Collector)
	Ch	Range	Ch	Range		
X202	7	0 ~ 20 mA	-	-	-	-
X203	2	0 ~ 20 mA	-	-	2	6
X303	1	+/-5 V_{DC}	1	+/-5 V_{DC}	4	6
X304	3	+/-5 V_{DC}	1	+/-5 V_{DC}	4	4
X305	7	+/-5 V_{DC}	1	+/-5 V_{DC}	2	2
X308	4	0 ~ 10 V_{DC}	-	-	-	6
X310	2	0 ~ 20 mA 0 ~ 10 V_{DC}	2	0 ~ 10 V_{DC}	3	3
X324	-	-	4	0 ~ 5 V_{DC}	-	4

RS-232/422/485, DI, DO Expansion

Model Name	Serial Port			DI (Dry Contact)	DO (Open Collector)	EEPROM
	Type	Channel	Wire			
X503	RS-232	1	5-wire	-	-	-
X504	RS-232	2	5-wire and 9-wire			
X505	RS-232	3	5-wire			
X506	RS-232	6	3-wire			
X507	RS-422/485	1	4/2-wire	4	4	
X508	RS-232	1	5-wire	4	4	
X509	RS-232	2	3-wire	4	4	
X510	RS-232	1	3-wire	5	5	256 KB
X510-128	RS-232	1	3-wire	5	5	128 KB
X511	RS-485	3	2-wire	-	-	-
X518	RS-232	1	5-wire	-	8	

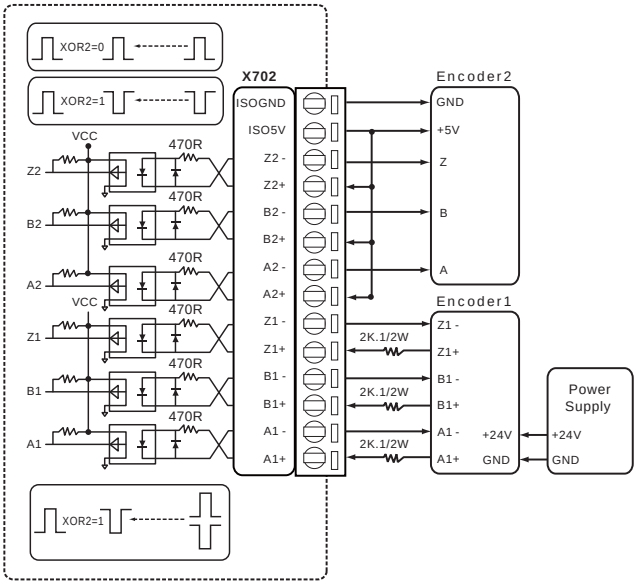
Memory Expansion

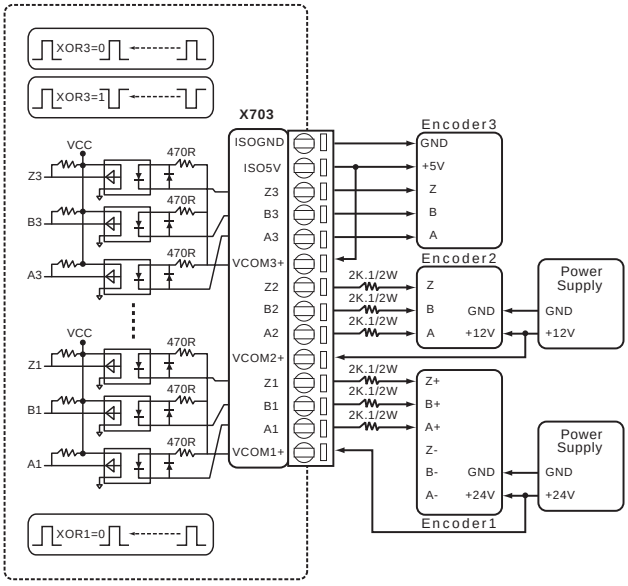
Model Name	Memory Type	Size	Data Retention	Endurance
X603	NAND Flash	256 MB	10 years	100,000 erase cycles
X607	Battery Backup SRAM	128 KB	9 years	No erase cycle limitation
X608		512 KB		

Encoder Expansion

Model Name	Axis	Counter	Mode	Max. Speed	5V Input Level	12V Input Level (with 1 KΩ external resistors)	24V Input Level (with 2 KΩ external resistors)
X702	2	32-bit	Quadrant, CW/CCW, Pulse/Direction	1 MHz	3.5 ~ 5 V 0 ~ 2 V	5 ~ 12 V 0 ~ 2 V	7 ~ 24 V 0 ~ 2 V
X703	3						
Note1: ISaGRAF doesn't support X702 and X703.							

Wiring





7188XC only						
Model Name	DI (Dry Contact)	DO (Open Collector)	AI (12-bit)		AO (12-bit)	
			Channel	Range	Channel	Range
X101	-	8	-	-	-	-
X106	DI × 3 or DO × 2		-	-	-	-
X200	-	-	1	0 ~ 2.5 VDC	-	-
X302	-	-	1	+/-5 VDC	1	+/-5 VDC