I/O Expansion Bus for 7188X/7188E User's Manual

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1. Introduction

1.1 What is the I/O Expansion Bus?

The I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG & 7521 all support I/O expansion buses. 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, battery backup SRAM & other I/O functions. Nearly all kinds of I/O functions can be implemented on this bus.

1.2 Using I-7188 I/O Expansion Boards:

The I-7188X series can plug an I/O Expansion board inside the main body. To install it, users have to loosen the screw and remove the shell of I-7188XA / I-7188XC / I-7188XB / I-7188EX / I7188XG / I7188EG. The supported I/O expansion boards are as below. It will be more.

1.3 Overview:

Even though the 7000 family is so powerful, there are some applications chart cannot be solved, such as:

- High speed applications
- Special hardware requirement applications
- Special software requirement applications
- Combine special hardware & software applications

So we developed an I/O expansion bus in the 7188X / 752N / 7188E family to solve all these applications above. 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,

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flash memory, battery backup SRAM & other I/O functions. **Nearly all kinds of I/O functions can be implemented in this bus.**

The I/O expansion bus includes serial & parallel interface. The parallel interface is very similar to an ISA bus, so the user can move the old ISA bus design to the I/O expansion bus with very little modification. The power consumption table is given as follows:

	7188XC	**7188XB / XG**	**7188EX / EG**	**Note:**
CPU Module	140mA@5V	260mA@5V	290mA@5V	Power consumption of 7-SEG LED is 140 mA For example: 7188XCD=140+140=280 So I/O=550-280=270 mA max.
I/O Expansion Board	410mA@5V	290mA@5V	260mA@5V	
Total Max.	550 mA@5V	550 mA@5V	550 mA@5V	

Note:The **7188XA(D)** supports I/O expansion bus but does not support user defined pins, so the 7188XA only supports X002, X003, X560, X600, X601, X607, X608.

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The I/O pins of serial bus are programmable. They can be programmed as D/I, or D/O. Some pins can be configured to D/I or D/O or timer input or timer output. There are many serial interface devices today. The features of these serial devices are given as follows:

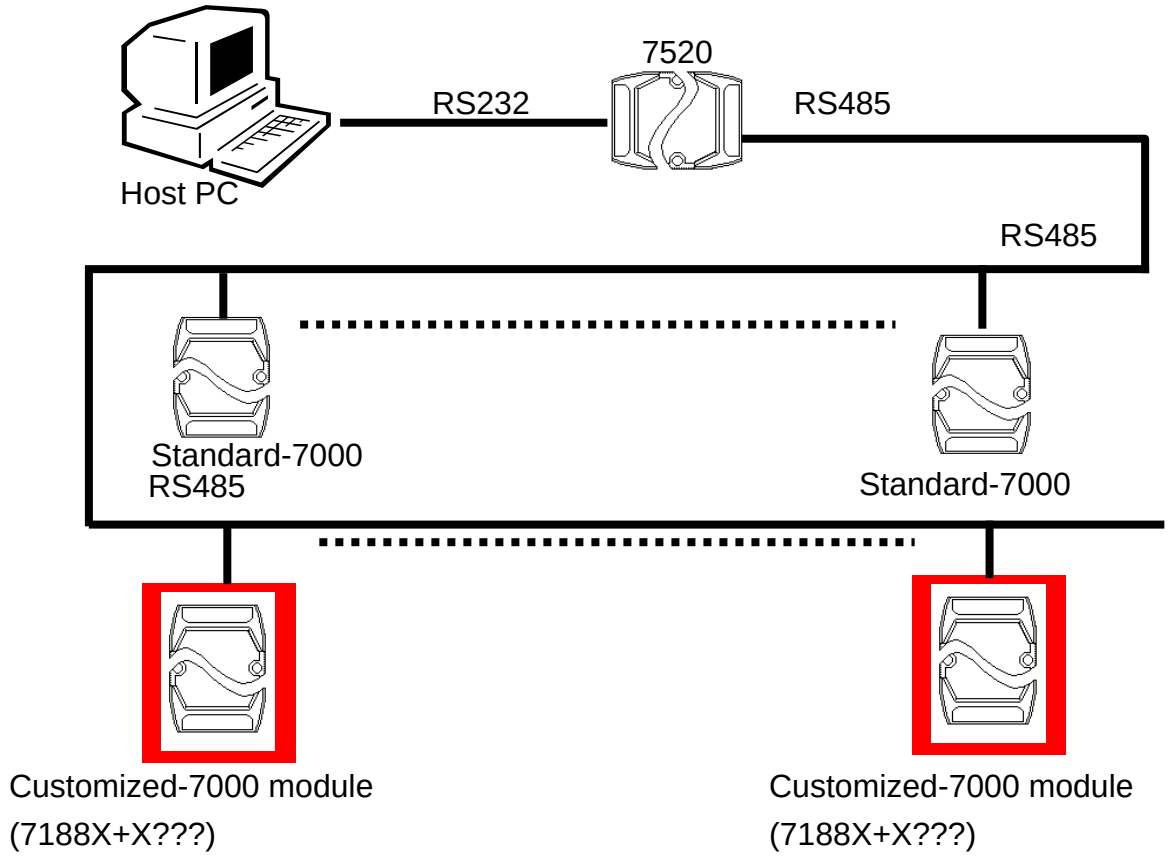
- Smaller size compared to parallel devices.
- Lower cost compared to parallel devices.
- Easier to design for isolation application.

The serial interface of an I/O expansion bus can link to these serial devices very easily. The combination of serial & parallel interface makes the I/O expansion bus very easy & powerful for various industry applications. These are many design examples given in this manual and all hardware circuit & software driver sources are OPENING for all user. From these examples, the users can buy these examples or modify them for their special requirements. The system design steps are given as follows:

Step 1: List all functions required.
Step 2: For all functions, go to step 3. If all functions are solved → STOP.
Step 3: If this function can be solved by the 7000 module → Go to step 2 for next function.
Step 4: If this function can be solved by 7188X+X??? → Go to step 2 for next function.
Step 5: Now user must design special hardware on the I/O expansion bus.
Step 6: User writes their special software driver based on this new hardware.
Step 7: Refer to **"7521/7522/7523/24/27 Software User's manual"** for firmware. Modify & download this firmware into the CPU module, this module now will work as a customized 7000 module.
Step 8: Go to step 2 for next function.

After the above steps, user can combine the **standard-7000 modules** & **customized-7000 modules** to solve all applications in the same RS-485 network. This customized solution diagram is given as follows:

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The design of a I/O Expansion Bus make the idea of a“Customized-7000 Module” come true. The features of a“Customized-7000 Module” are given as follows:

- 7188X+X??? → Single module solution → “Customized-7000 Module”
- 7000 compatible command sets & RS-485 networking
- Easy hardware/software interface for users to design & manufacture their special hardware & software
- Time-to-market ODM solution for user’s special requirements (any high speed, complex or combined functions of D/I/O, A/D, D/A, ….., etc.)
- Robust, stable, flexible, time-to-market & cost-effective total solution.

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1.4 Reconfiguring the 7188XC(D)/7521(D)

From pin-4 to pin-8 of the 7188XC(D)/7521(D) there are three D/O & two D/I pins. For the application of “Customized 7000 Modules”, these 5 D/I/O pins can be hardware reconfigured to other functions as follows:

Step 1: Remove the reconfiguration-resistor as follows:

If DO3 is reconfigured, remove R19
If DO2 is reconfigured, remove R20
If DO1 is reconfigured, remove R21
If DI3 is reconfigured, remove R22
If DI2 is reconfigured, remove R23
Then, the onboard D/I/O functions can be disabled.

Step 2: Install a 5-pin male reconfiguration-jumper into the TP0 of the 7188XC(D)/7521(D)

Step 3: Design a 5-pin female reconfiguration-jumper in X??? for Connection to TP1. Then the external signals from pin-4 to pin-8 can be connected to X???. The user can refigure these 5 D/I/O pins to their special requirements now.

Note: If the DO2 is reconfigured to D/I, its initial state must be High. If its initial state is LOW, system clock will be reduced to 10M. So all clock-related libraries will only be at half-speed.

Refer to next page for more information.

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Example:
The X100 is an 8-channel D/I board designed for the 7188X(D) / 7521(D). It removes all 5 resistors, R19 ~ R23, and reconfigures all these pins as D/I pins. It installs another 5-pin female reconfiguration-jumper into TP1 of the 7188XC(D)/7521(D). Therefore, user can select the original 3_DO_2_DI functions or new 5_DI functions by setting the jumper in different positions.

The I-7188XB(D), I-7188XG(D), I-7188EX(D), I-7188EG(D) has 14 user-defined pins. But the I-7188XB(D), I-7188XG(D), I-7188EX(D),I-7188EG(D) & I-7188XA(D) don't support the reconfiguration-resistor. So the user-defined pins of the 7188X / 7521 family are given as follows:

Module	User defined pins	Reconfiguration pins	Customized I/O pins
7188XA (D)	0	0	**0+0=0**
7188XB (D)	14	0	**14+0=14**
7188XC (D)	3	5	**3+5=8**
7188XG (D)	14	0	**14+0=14**
7188EX (D)	14	0	**14+0=14**
7188EG (D)	14	0	**14+0=14**
7521 (D)	3	5	**3+5=8**
7522 / 23 / 24 / 27 (D)	0	0	**0+0=0**

Note:The **7188XA(D)** supports I/O expansion bus but does not support user defined pins, so the 7188XA only supports X002, X003, X560, X600, X601, X607, X608.

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1.5 How to download program under the MiniOS7 ?

1. Create a file folder named "7188X" in your hard drive.
For example, "c:\7188X".

For Dos, Windows 95 & Windows 98 Users:
2. Copy \Napdos\MiniOS7\utility\7188xw.exe.
from the CD_ROM into your "7188X" folder.

3. Run "\7188X\7188xw.exe" in your hard drive. A "7188xw" screen will appear.

For Windows NT, Windows 2000 & Windows XP Users:
2. Copy \Napdos\MiniOS7\utility\7188xw.exe.
from the CD_ROM into your "7188X" folder.

3. Run "\7188X\7188xw.exe" in your hard drive. A "7188xw" screen will appear.

4. Link COM1 or COM2 of your PC to COM1 of the I-7188XC controller through a RS232 cable.

5. Power off the I-7188XC controller, connect pin "INIT" to "INIT COM" and then power it up.

6. If the connection is Ok, messages will appear on the 7188xw screen.

```
************************************************
****   7188x Ver. 1.01.0 02/23/2000   ******
***             Press F1 for help.             ****
************************************************
ICP_DAS MiniOS7 for 7188x Ver. 1.03 build 014,May 09 2001 14:30:36
SRAM:512K, FLASH MEMORY:512K
Serial number= 5A 5A 5A 5A 5A 5A 5A 5A
7188x>
```

To burn an ISaGRAF embedded driver, follow the following steps.
8. Copy the program of the correct version into your "7188X" folder.
For example, version 1.25,
copy \Napdos\Appication\application 11\english\7188xc\PWM.exe to C:\7188X\PWM.exe

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9. Power off the I-7188XC controller, connect pin "INIT" to "INIT COM" and then power it up.

10. Type "del" and reply "y" to delete the current driver.

```
7188x> del
Total File number is 2, do you really want to delete(y/n)?
```

11. Type "load", then press ALT_E and then type "pwm.exe".
It will take about 15 seconds to finish.

```
7188x> load
File will save to 8000:0000
StartAddr-->7000:FFFF
Press ALT_E to download file!
Input filename:PWM.exe
Send file info. total 260 blocks
Block 260
Transfer time is: 15.122000 seconds
Back to Terminal mode
```

12. Type "load" again, then press ALT_E and then type "autoexec.bat" .

```
7188x> load
File will save to 9037:000C
StartAddr-->9000: 037B
Press ALT_E to download file!
Input filename:autoexec.bat
Send file info. total 1 blocks
Block 1
Transfer time is: 0.060000 seconds
Back to Terminal mode
```

13. Type "dir" to make sure "autoexec.bat" and "PWM.exe" are well burned.

```
7188X> dir
0) PWM.exe 09/01/2002 22:21:23 66396[1035C]8002:0000-9037:000C
1) autoexec.bat 04/13/2001 16:50:27 20[00014]9039:000C-903B:0000
Total File number is 2 Free space=392240 bytes
```

14. Press ALT_X to exit "7188x".

15. Remove the connection between "INIT" - "INIT COM", reset the I-7188XC controller.

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2. Reference Guide

2.1 This manual can also be found at :

CD\NAPDOS\7188X\manual\hardware\iobus_e.pdf
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual/hardware/iobus_e.pdf

2.2 Software Installation & Demo Programs:

2.2.1 Software Installation:

Refer to “7521/7522/7523/7524/7527 Software User’s Manual” for software installation. The software driver will be updated frequently. Software driver and User’s manual download at: CD\NAPDOS\7188X\manual and
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual

2.2.2 Demo program:

X series for I-7188XA
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xa/demo/bc/ioexpbus/
X series for I-7188XB
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xb/demo/bc/ioexpbus/
X series for I-7188XC
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/minios7/7188xc/demo/bc/ioexpbus/
X series for I-7188EX
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188e/minios7/demo/bc/ioexpbus/
X series for I-7188XG (English_manu, Driver, Demo)
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/isagraf/7188xg/
X series for I-7188EG (English_manu, Driver, Demo)
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/isagraf/7188eg/

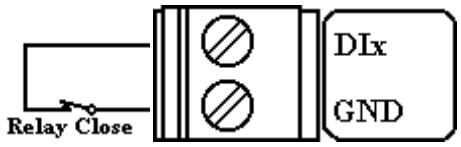
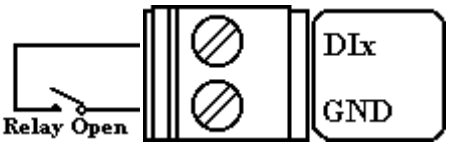
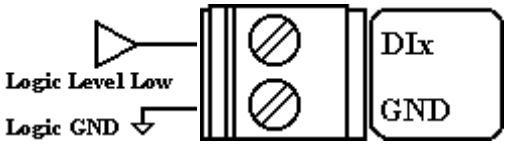
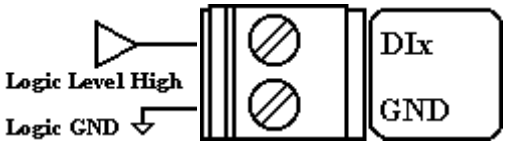
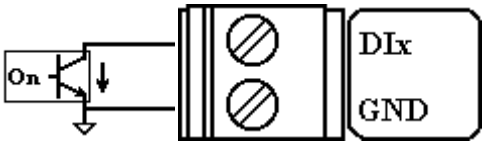
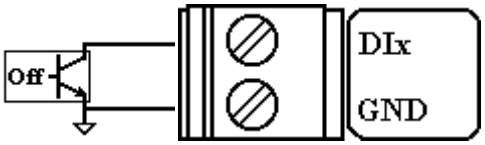
2.2.3 Performance:

CD \Napdos\7188x\manual\hardware\x-Performance
ftp://ftp.icpdas.com/pub/cd/8000cd/napdos/7188x/manual/hardware/x-performance/

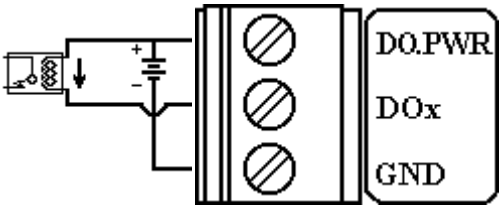
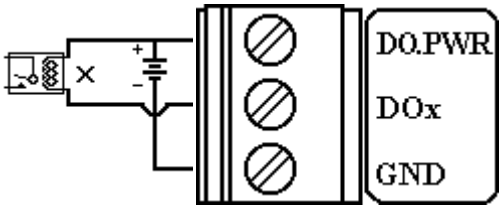
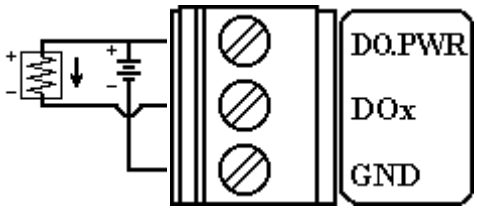
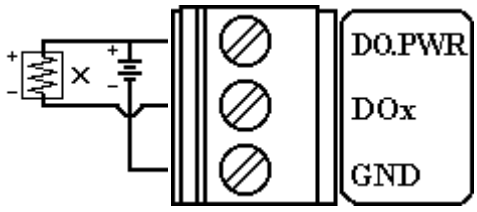
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3. Wire Connection :

3.1 Digital Input Wire Connection :

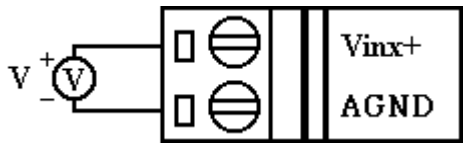
Input Type	ON State DI value as 0	OFF State DI value as 1
Relay Contact		
TTL/CMOS Logic		
Open Collector		

3.2 Digital Output Wire Connection :

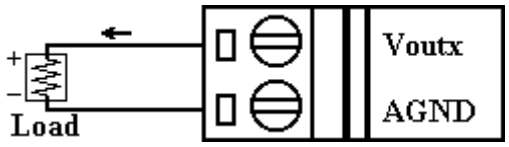
Output Type	ON State DO value as 0	OFF State DO value as 1
Drive Relay		
Resistance Load		

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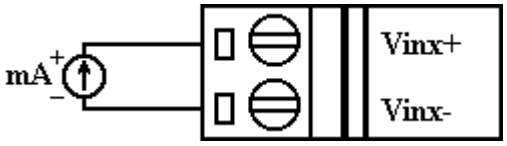
3.3 Voltage Input Wire Connection:

Input Type	

3.4 Voltage Output Wire Connection:

Output Type	

3.5 Current Input Wire Connection:

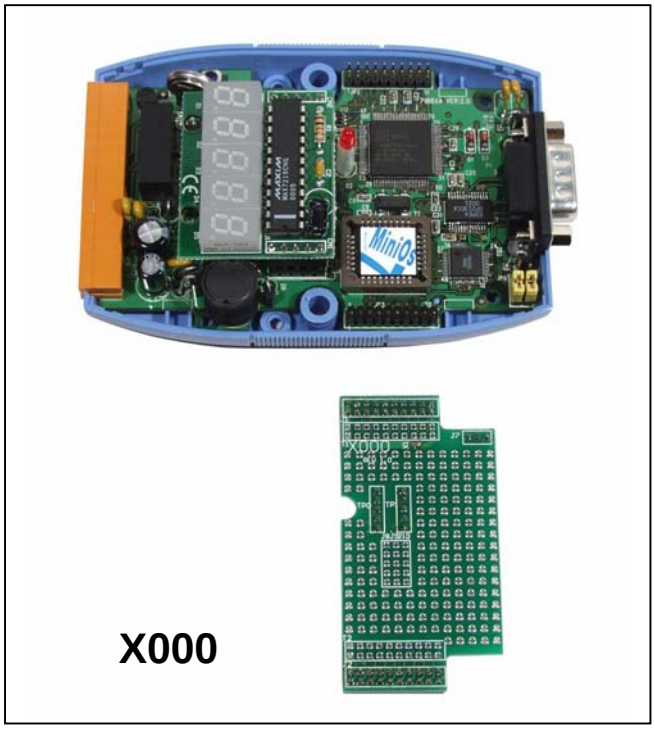
Input Type	

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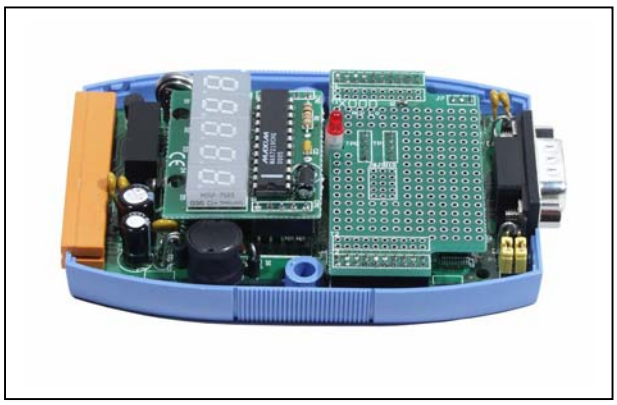
4. Mounting of I/O Expansion Bus

4.1 Minimal mounting with 7-segmemt display

Before mounting:



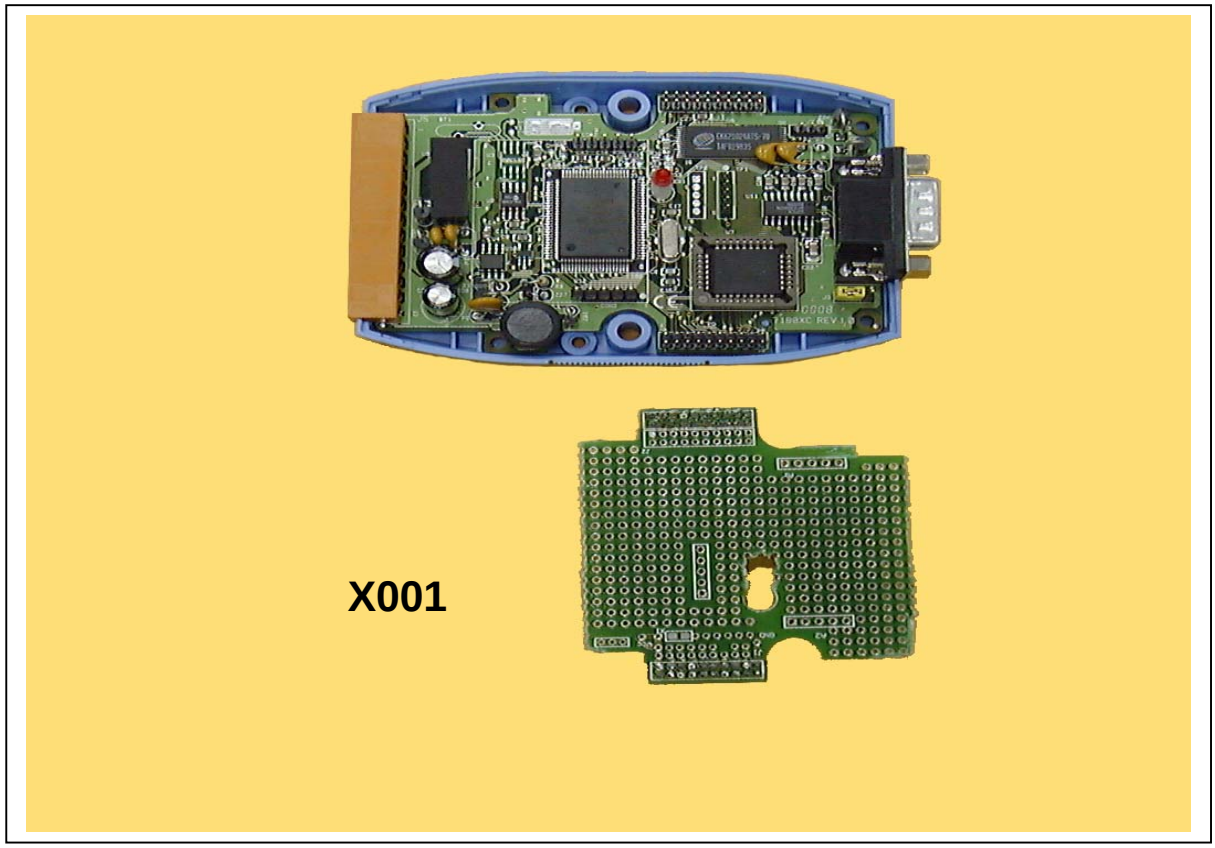
After mounting:



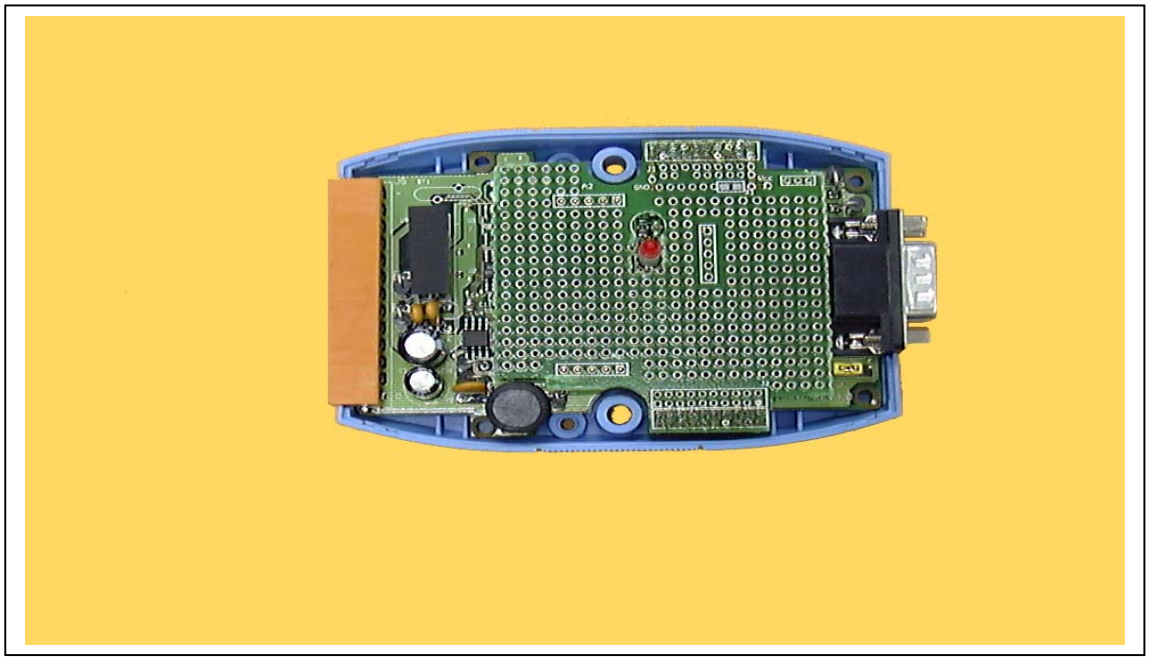
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4.2 Medium mounting without 7-SEG display

Before mounting:



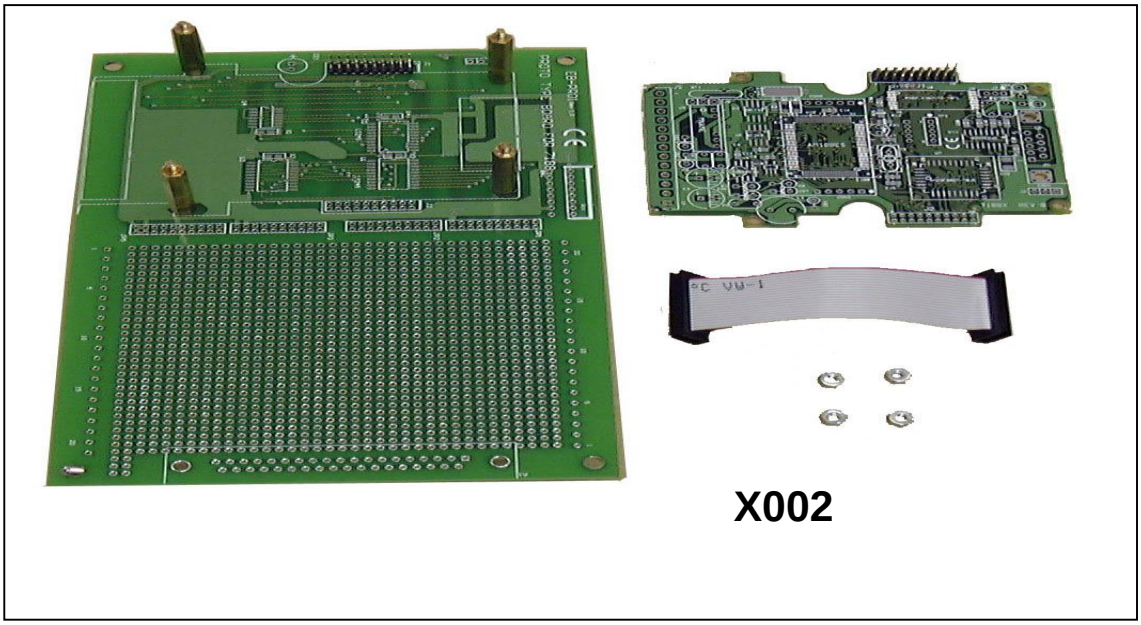
After mounting:



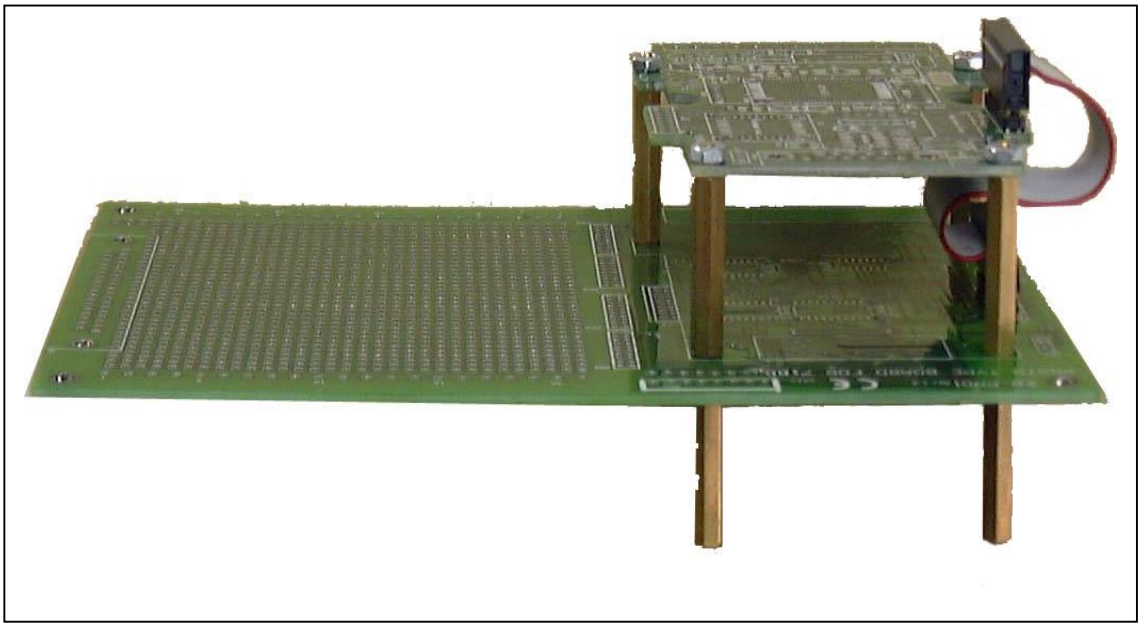
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4.3 Mounting without CASE

Before mounting:



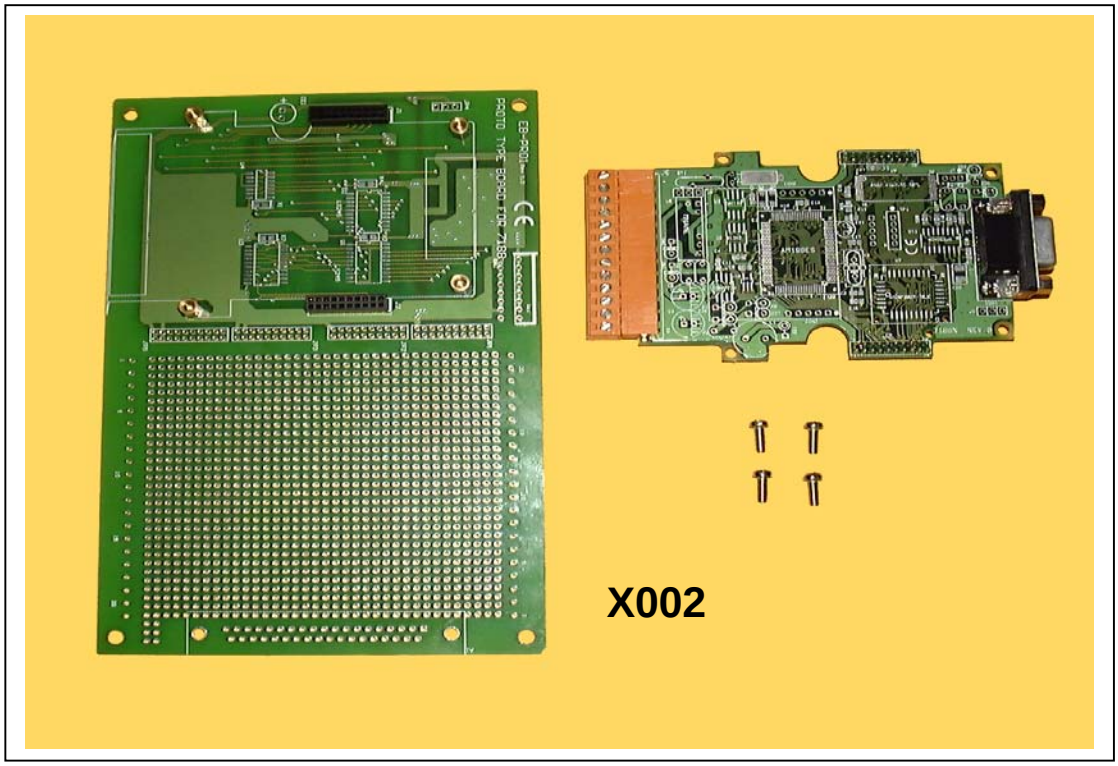
After mounting:



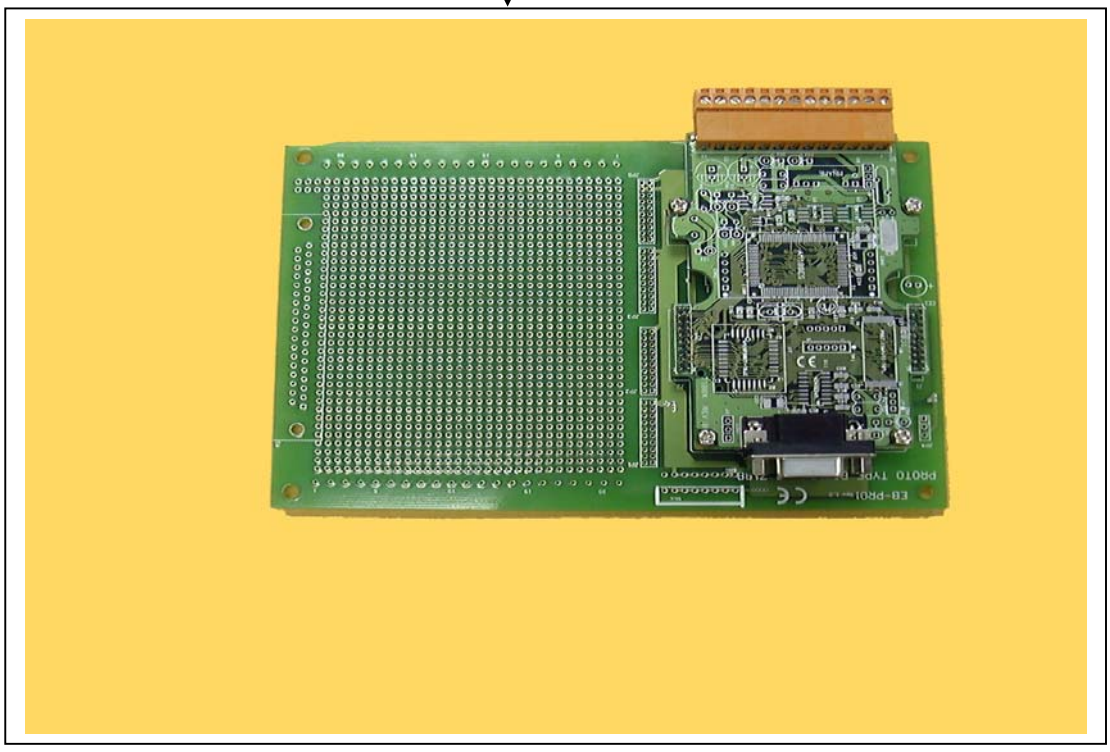
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4.4 ODM mounting without CASE

Before mounting:



After mounting:



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5. I/O Expansion Bus

The I/O expansion bus of 7188X/7188E series can be divided into 3 groups as follows:

1. Power supply & reset signals: VCC, GND, RESET, /RESET
2. Parallel Bus:

- System clock: CLOCKA
- Asynchronous ready control: ARDY
- Address bus: A0 ~ A6, A7 (7188XC & 7521 series without A7)
- Data bus: D0 ~ D7
- Interrupt control: INT0, INT1, INT4 (7188XC & 7521 series without INT4)
- Chip select & read/write strobe: /CS, /WR, /RD

3. Serial Bus: TO_0, TO_1, TI_0, TI_1, SCLK, DIO9, DIO4, DI

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5.1 Definition

The definition of I/O expansion bus is given as follows:

5.1.1 J1 Pin definition:

No	Name	Description
1	GND	Ground of PCB
2	GND	Ground of PCB
3	CLOCKA	Synchronous clock output of CPU
4	ARDY	Asynchronous ready input (level sensitive, OPEN=ready)
5	INT0	Interrupt request input of channel 0 (asynchronous, active high)
6	INT1	Interrupt request input of channel 1 (asynchronous, active high)
7	VCC	Power supply of PCB
8	RESET	Power up reset pulse (active high)
9	GND	Ground of PCB
10	/RESET	Power up reset pulse (active low)
11	TO_0	Timer output 0 of CPU (can be used as programmable D/I/O)
12	TO_1	Timer output 1 of CPU (can be used as programmable D/I/O)
13	TI_0	Timer input 0 of CPU (can be used as programmable D/I/O)
14	TI_1	Timer input 1 of CPU (can be used as programmable D/I/O)
15	SCLK	Common serial clock output of 7188 series
16	DIO9	Programmable D/I/O bit
17	DIO4	Programmable D/I/O bit
18	DIO14	Programmable D/I/O bit
19	VCC	Power supply of PCB
20	VCC	Power supply of PCB

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5.1.2 J1 Description:

- CLOCKA: 20.2752M Hz for I-7188XC
- CLOCKA: 40M Hz for I-7188XA, I-7188XB, I-7188XG, I-7188EX, I-7188EG
- ARDY: let this pin OPEN for no wait states applications
- INT0, INT1: let these two pins OPEN for no interrupt applications
- TO_0, TO_1: can be used as CPU's timer output or programmable D/I/O
- TI_0, TI_1: can be used as CPU's timer input or programmable D/I/O
- DIO4, DIO9, DIO14: programmable D/I/O bit
- SCLK: the 7188X/7188E series use this signal as a CLOCK source to drive all on-board serial devices, so it is always be programmed as D/O. Change this signal to other configuration will cause serious errors. User can use this signal to drive external serial devices without any side effects.

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5.1.3 J2 Pin definition:

No	Name	Description
1	A0	Address bus
2	D0	Data bus
3	A1	Address bus
4	D1	Data bus
5	A2	Address bus
6	D2	Data bus
7	A3	Address bus
8	D3	Data bus
9	A4	Address bus
10	D4	Data bus
11	A5	Address bus
12	D5	Data bus
13	A6	Address bus
14	D6	Data bus
15	A7 or N/C	**This pin is reserved & must be N/C for 7188XC & 7521 series**
16	D7	Data bus
17	INT4 or N/C	Interrupt request input of channel 4(asynchronous, active high), **this pin is reserved & must be N/C for 7188XC & 752N series**
18	/WR	Write strobe output (synchronous, active low)
19	/CS	Chip select output (synchronous, active low)
20	/RD	Read strobe output (synchronous, active low)

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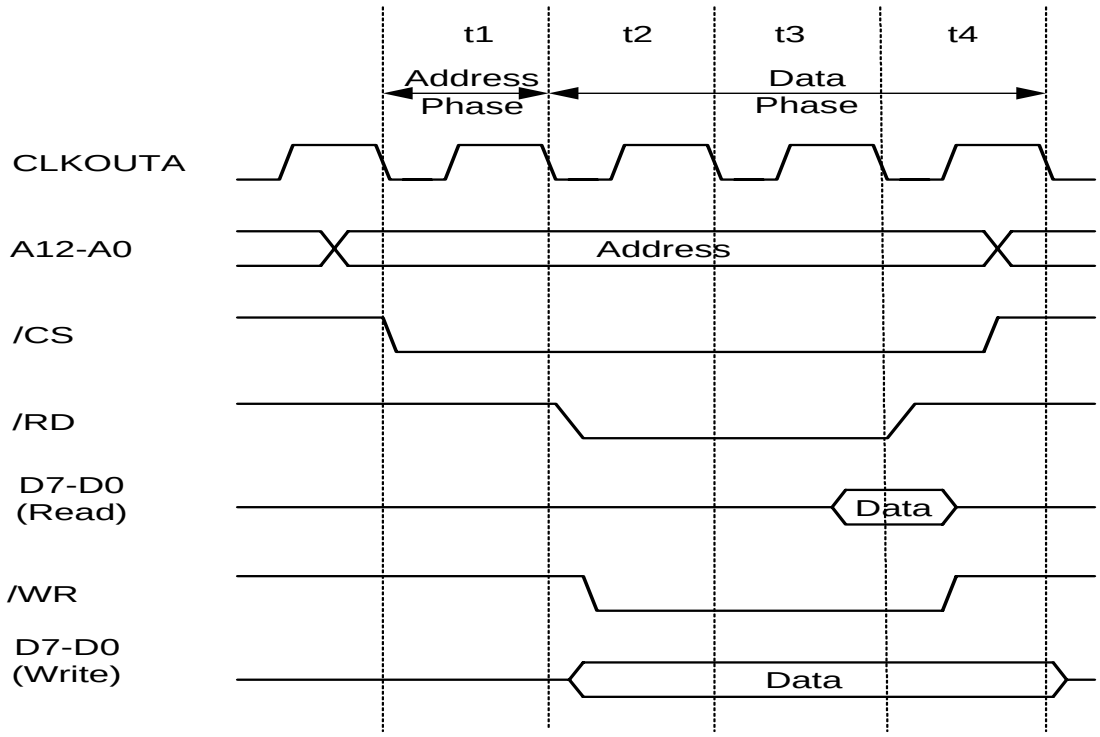
5.1.4 J2 Description:

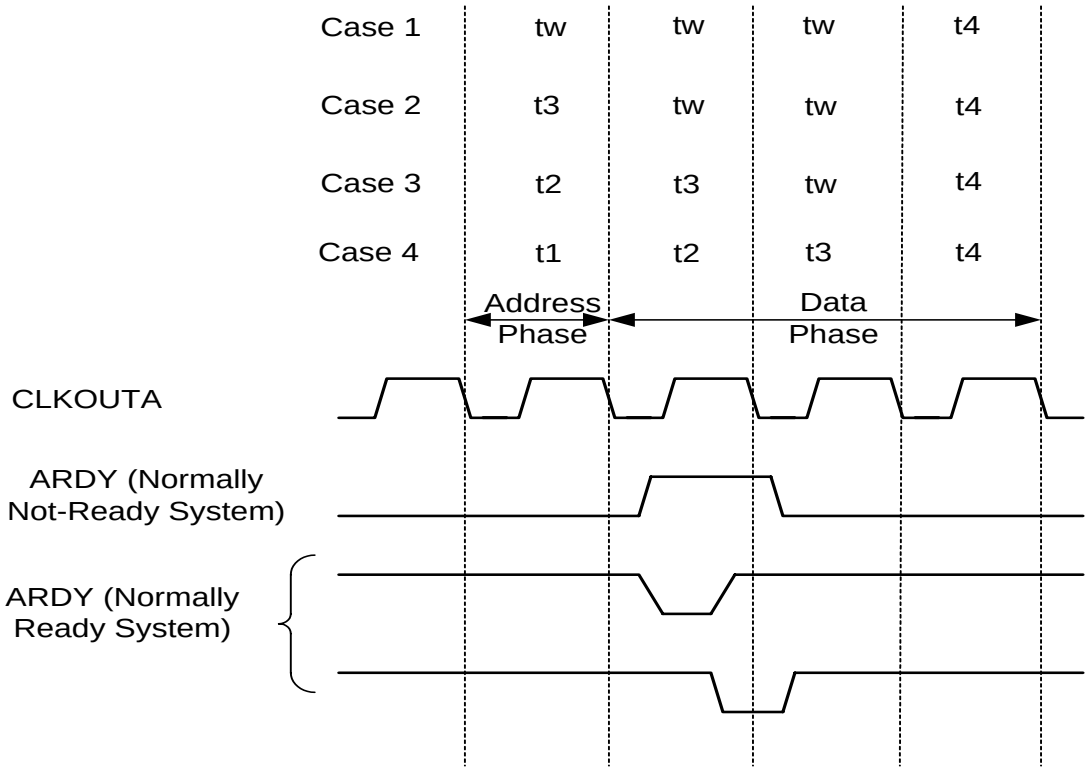
- Address bus (output): A0 ~ A6, A7
- Data Bus (tri-state, bi-direction): D0 to D7
- INT4: let this pin OPEN for no interrupt applications
- /CS, /RD, /WR: These 3 signals will synchronous to CLOCKA (in J1.3) & asynchronous to ARDY (J1.4)
- The CS\ will be active if program input/output from I/O address 0 to 0xff.
- **The pin_15 & pin_17 are reserved by 7188XC & 7521 series; user must left these two pins N/C for 7188XC & 7521 series.**

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5.2 Parallel Bus

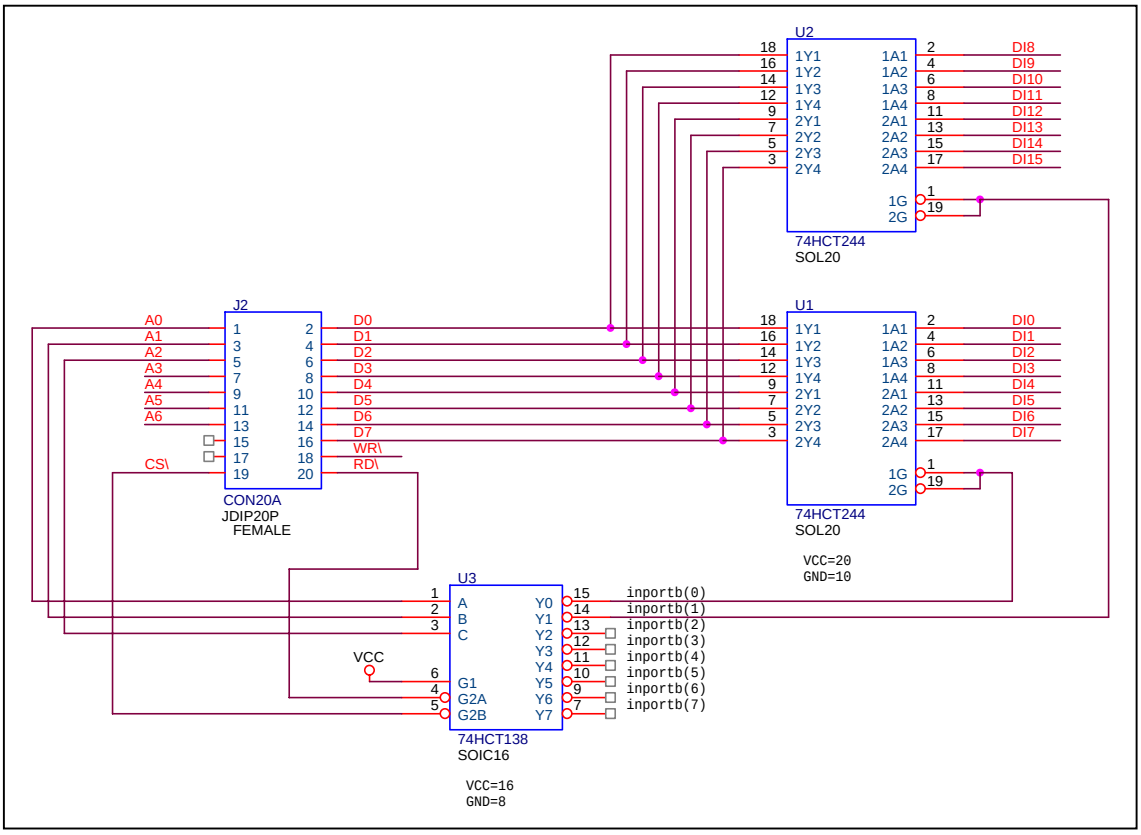
5.2.1 Timing Diagram





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5.2.2 Address decode & D/I CKT



The CS\ will be active if program input/output from I/O address BASE+0 to BASE+0xff.

Read DI 0 to 7 → DI_0_7=inportb (BASE+0);

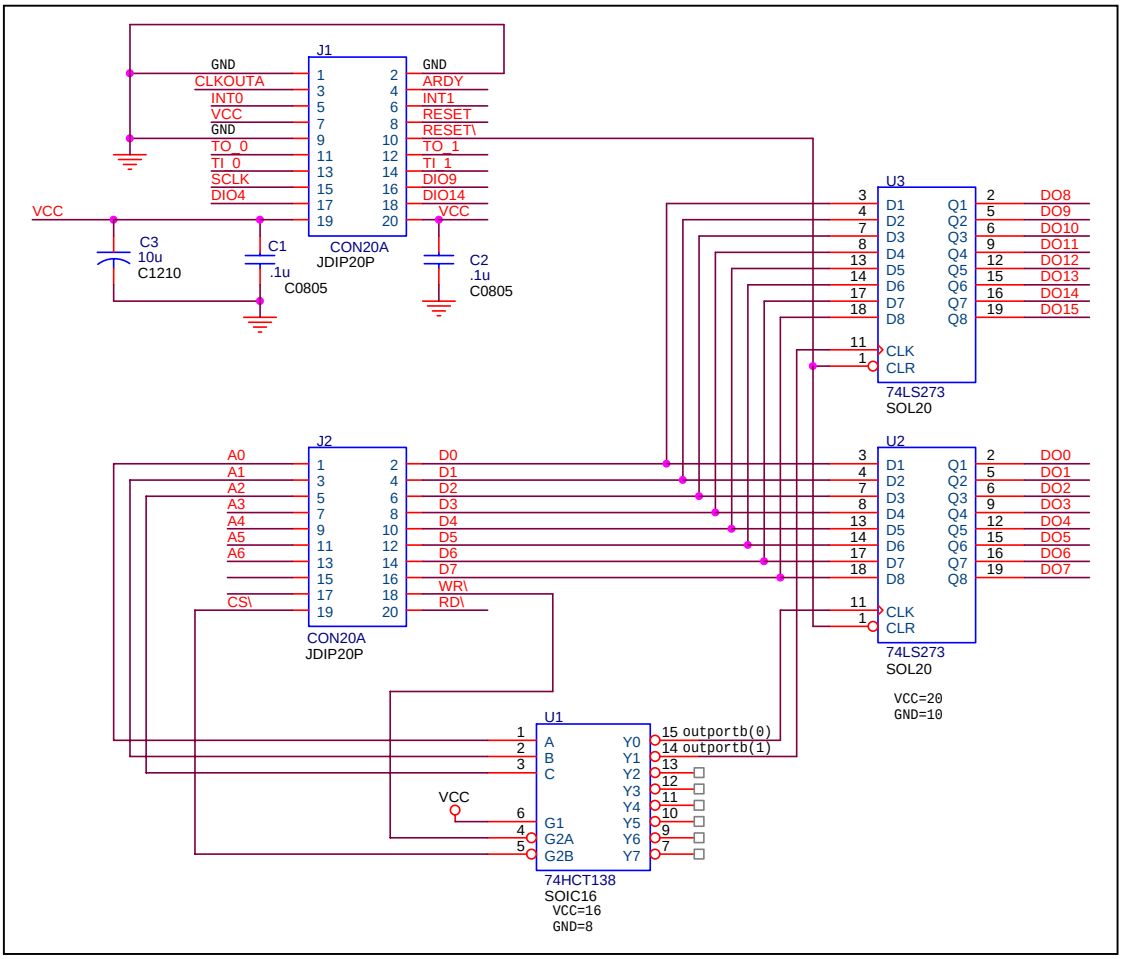
Read DI 8 to 15 → DI_8_15=inportb (BASE+1);

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

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5.2.3 Address decode & D/O CKT



The CS\ will be active if program input/output from I/O address BASE+0 to BASE+0xff.

Write value_1 to DO 0 to 7 → outportb (BASE+0, value_1);

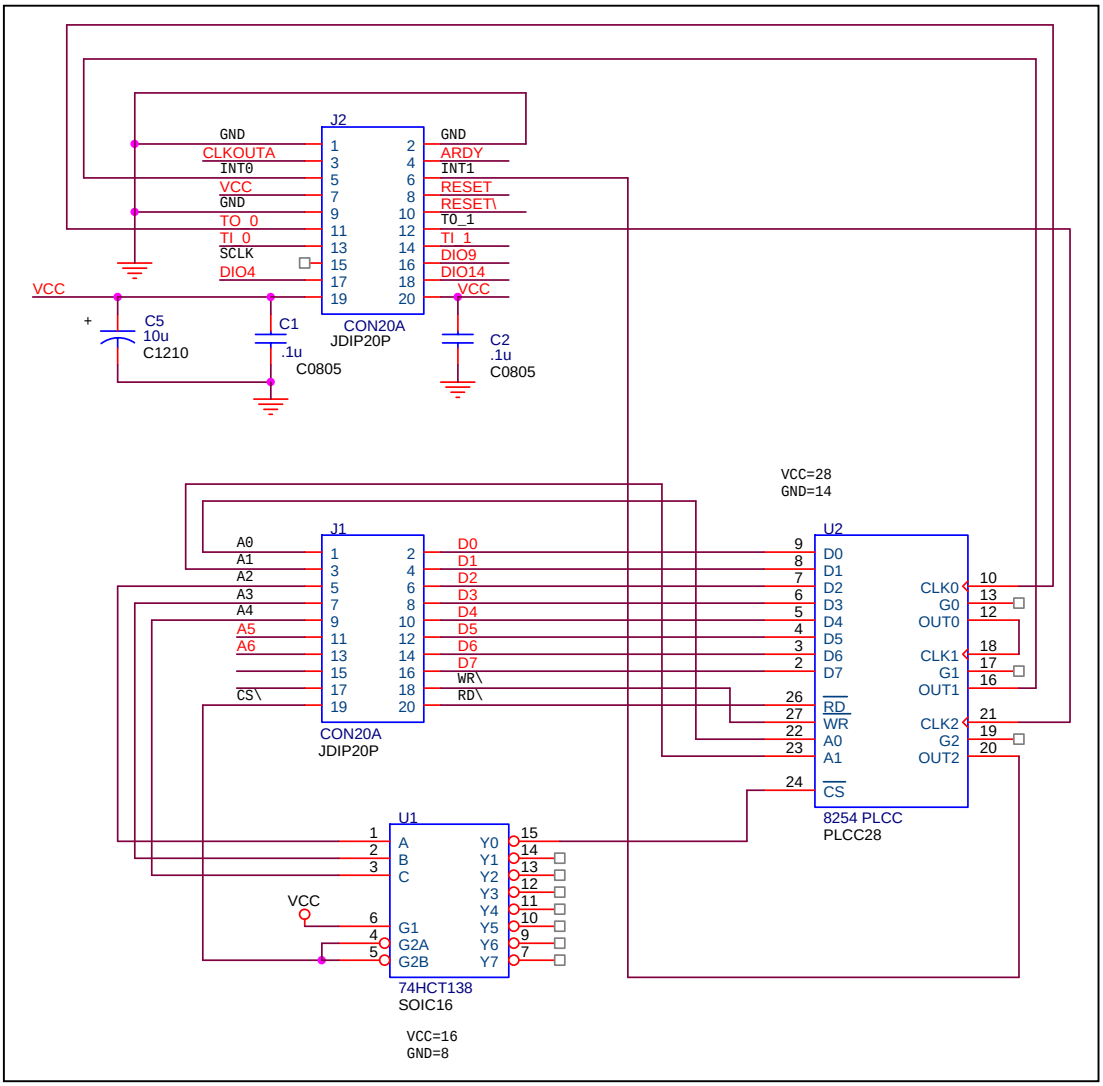
Write value_2 to DO 8 to 15 → outportb (BASE+1, value_2);

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

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5.2.4 8254 & interrupt



The addressing space of 8254 is from BASE+0 to BASE+3 as follows:

Timer/Counter_0 → BASE+0

Timer/Counter_1 → BASE+1

Timer/Counter_2 → BASE+2

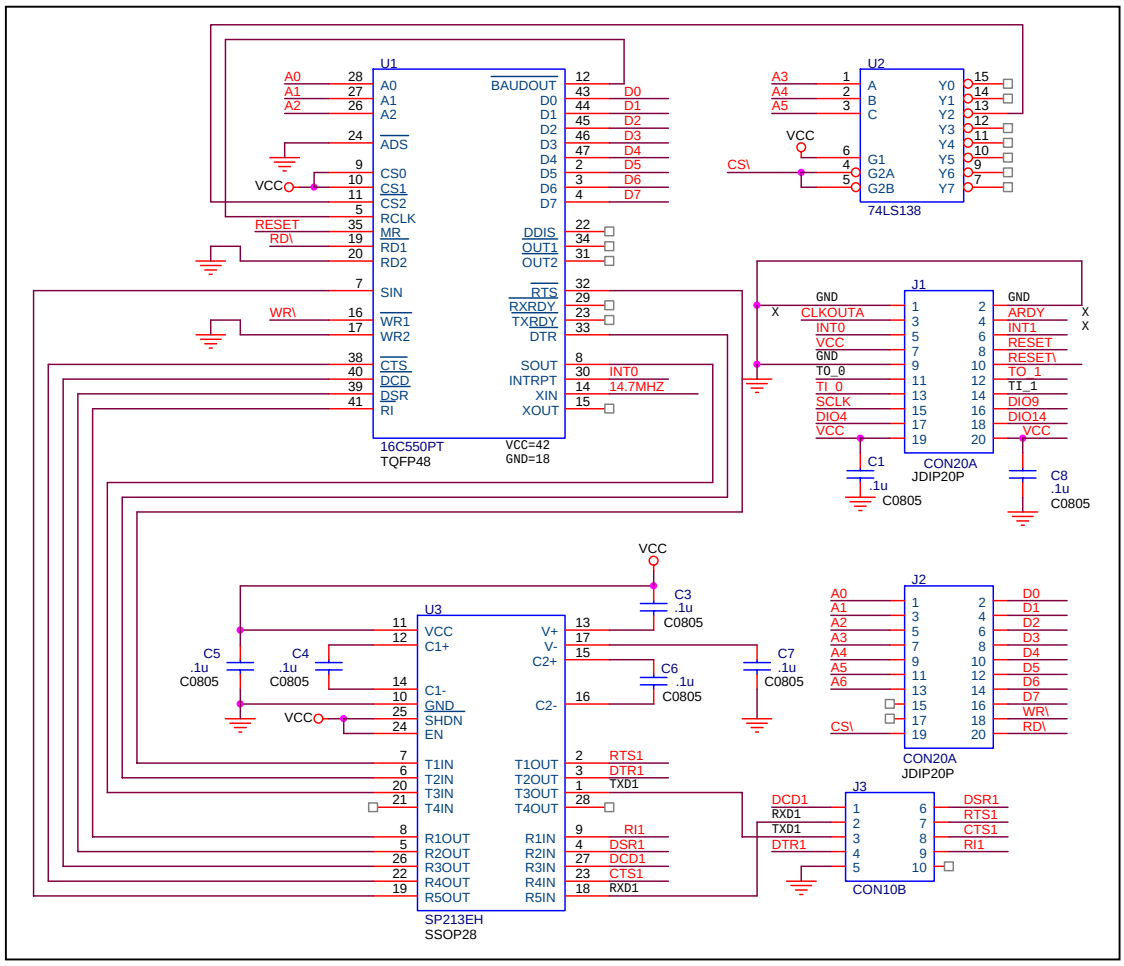
Control word → BASE+3

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

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5.2.5 16550 & interrupt



The addressing space of 16550 is from BASE+0x10 to BASE+0x17 as follows:

```
Txbuf=BASE+0x10          /* tx buffer                          */
Rxbuf=BASE+0x10          /* rx buffer                          */
Dll=BASE+0x10            /* baud lsb                           */
Dlh=BASE+0x11            /* baud msb                           */
Ier=BASE+0x11            /* int enable register                */
Fcr=BASE+0x12            /* FIFO control register                 */
Iir=BASE+0x12            /* Interrupt Identification Register     */
Lcr=BASE+0x13            /* line control register              */
Dfr=BASE+0x13            /* Data format register                  */
Mcr=BASE+0x14            /* modem control register             */
Lsr=BASE+0x15            /* line status register               */
Msr=BASE+0x16            /* modem status register              */
Scr=BASE+0x17            /* Scratch register                      */
```

The power-up default value of BASE is 0.

It is **not** recommended to change the value of BASE from 0 to another value.

Note: it is compatible to **COM3** of 7188XC/7188XB/7188E library.

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5.3 Serial Bus

Pin	Name	Default	D/I/O mode	Normal mode
J1.11	TO_0	D/I	I/O_10	Timer output channel_0
J1.12	TO_1	D/I	I/O_1	Timer output channel_1
J1.13	TI_0	D/I	I/O_11	Timer input channel_0
J1.14	TI_1	D/I	I/O_0	Timer input channel_1
J1.15	SCLK	D/O	I/O_26	UZI, don't change to this mode
J1.16	DIO9	D/I	I/O_9	A19, don't change to this mode
J1.17	DIO4	D/I	I/O_4	DT/R, don't change to this mode
J1.18	DIO14	D/I	I/O_14	MCS0, don't change to this mode

Every pin can be configured by mode control register & direction control register as follows:

Mode control register=0xff70	Direction control register=0xff72	Programmable Function
0	0	Normal mode
0	1	D/I with pull-up/pull-down resistor (10K)
1	0	D/O
1	1	D/I without pull-up/pull-down register (10K)

After the I/O pins are configured, user can read /write to **data register, 0xff74**, to access these I/O pins. Refer to Sec. 2.3.1 or Sec. 2.3.2 for demo program.

5.3.1 Using the D/I/O 4

```
SetDio4Dir(int dir)     /* select D/I or D/O first */
{
  if(dir){ /* set to input */
      outport(0xff70,  mport(0xff70)&(~(1<<4)));   /* set MODE to 0 */
      outport(0xff72,  mport(0xff72)|(1<<4));      /* set DIR   to 1 */
  }
  else {    /* set to output */
      outport(0xff70,  mport(0xff70)|(1<<4));      /* set MODE to 1 */
      outport(0xff72,  mport(0xff72)&(~(1<<4)));   /* set DIR   to 0 */
  }
}
OutDio4(int data)                                  /* set the D/O_4 ON or
OFF */
{
  if(data)  /* set D/O_4 ON */
      outport(0Xff74,  mport(0Xff74)|(1<<4));
  else             /* set D/O_4 OFF */
      outport(0Xff74,  mport(0Xff74)&~(1<<4));
}
GetDio4(void)                                      /* read the status of D/I_4 */
{
   return   mport(0Xff74)&0x0010;}
```


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5.3.2 Using the D/I/O 14

```
SetDio14Dir(int dir)   /* select D/I or D/O first              */
{
  if(dir){ /* set to input */
      outport(0xff70,  mport(0xff70)&(~(1<<14))); /* set MODE to 0 */
      outport(0xff72,  mport(0xff72)|(1<<14));    /* set DIR   to 1 */
  }
  else {   /* set to output */
      outport(0xff70,  mport(0xff70)|(1<<14));                  /* set MODE to 1 */
      outport(0xff72,  mport(0xff72)&(~(1<<14))); /* set DIR   to 0 */
  }
}
```

```
OutDio14(int data)    /* set the D/O_14 ON or OFF */
{
  if(data)  /* set D/O_14 ON */
      outport(0Xff74,  mport(0Xff74)|(1<<14));
  else            /* set D/O_14 OFF */
      outport(0Xff74,  mport(0Xff74)&~(1<<14));
}
```

```
GetDio4(void)          /* read the status of D/I_14 */
{
   return   mport(0Xff74)&0x4000;
}
```

5.3.3 Using the SCLK

The 7188 series use this signal as a CLOCK source to drive all on-board serial devices, so it is always be programmed as D/O. Change this signal to other configuration will cause serious errors. User can use this signal to drive external serial devices without any side effects. The software driver provides two subroutine to set SCLK high or low as follows:

```
ClockLow();       /* SCLK=0=Low  */
ClockHigh();      /* SCLK=1=High */
```


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6. Selection Guide

6.1 Expansion Board for Prototype, Testing

Model	Description	Size	Used with I-7188XA/ XB / XC / XG / EX / EG
X000	Photo type (Small size)	64mm x 32mm	XA / XC
X001	Photo type (Large size)	64mm x 70mm	XA / XC
X002	Photo type	114mm x 170mm	XA / XC / XB / XG / EX / EG
X003	Self-test	64mm x 32mm	XA / XC
X004	Self-test	64mm x 36mm	XB / XG / EX / EG
X005	Photo type (Small size)	64mm x 36mm	XB / XG / EX / EG
X006	Photo type (Large size)	72mm x 65mm	XB / XG / EX / EG

6.2 I/O Expansion Board for D/I/O, Timer/Counter

Model	Description	D/I	D/O	Relay Output	Counter/ Timer	Used with I-7188XA/ XB / XC / XG / EX / EG
X100	DI	8	--	--	--	XC
X101	DO	--	8	--	--	XC
X102	Relay Output	--	--	2	--	XC
X103	DI	7	--	--	--	XC
X104	DI, DO	8 (each channel can be programmed to DI/DO)		--	--	XC
X105	DI, DO	8 (each channel can be programmed to DI/DO)		--	--	XC
X106	DI, DO	Can be used as 2 channels DO or 3 channels DI		--	--	XC
X107	DI, DO	6	7	--	--	XB / XG / EX / EG
X108	PWM	2 Channels PWM		--	--	XC
X109	Photo MOS	--	--	7	--	XB / XG / EX / EG
X110	DI	14	--	--	--	XB / XG / EX / EG
X111	DO	--	13	--	--	XB / XG / EX / EG
X400	Timer/Counter	--	--	--	3 channels 16-bit timer/ counter	XC

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6.3 I/O Expansion Board for A/D, D/A, DI, DO

Model	Description	D/I	D/O	A/D	Input Range	D/A	Output Range	Used with I-7188XA/ XB / XC / XG / EX / EG
X200	A/D	--	--	1	0~2.5V	--	--	XC
X201	A/D	--	--	4	0~20Ma	--	--	XC
X202	A/D	--	--	7	0~20Ma	--	--	XB / XG / EX / EG
X203	A/D, DI, DO	2	6	2	0~20mA	--	--	XB / XG / EX / EG
X300	D/A	--	--	--	--	2	0~4.095V	XC
X301	A/D, D/A	--	--	1	0~2.5V	1	0~4.095V	XC
X302	A/D, D/A	--	--	1	+/- 5V	1	+/- 5V	XC
X303	A/D, D/A, DI, DO	4	6	1	+/- 5V	1	+/- 5V	XB / XG / EX / EG
X304	A/D, D/A, DI, DO	4	4	3	+/- 5V	1	+/- 5V	XB / XG / EX / EG
X305	A/D, D/A, DI, DO	2	2	7	+/- 5V	1	+/- 5V	XB / XG / EX / EG
X306	A/D, D/A	--	--	2	+/- 10V	--	--	XC
X307	A/D, D/A	2	2	8	+/- 10V	--	--	XB / XG / EX / EG
X308	A/D, DO	--	6	4	0~10V	--	--	XB / XG / EX / EG
X310	A/D, D/A, DI, DO	3	3	2	0~20mA / 0~10V	2	0~10V	XB / XG / EX / EG

6.4 I/O Expansion Board for RS-232/422/485, DI, DO

Model	Description	D/I	D/O	Channels	Speed	Used with I-7188XA/ XB / XC / XG / EX / EG
X500	RS-232	--	--	One channel (9-wire) ** Without Case **	115.2K	XC
X501	RS-232	--	--	One channel (5-wire)	115.2K	XC
X502	RS-232	--	--	One channel (3-wire), and one channel (5-wire)	115.2K	XC
X503	RS-232	--	--	One channel (5-wire)	115.2K	XB / XG / EX / EG
X504	RS-232	--	--	One channel (5-wire), and one channel (9-wire)	115.2K	XB / XG / EX / EG
X505	RS-232	--	--	Three channels (5-wire)	115.2K	XB / XG / EX / EG
X506	RS-232	--	--	Six channels (3-wire)	115.2K	XB / XG / EX / EG

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Model	Description	D/I	D/O	Channels	Speed	Used with I-7188XA/ XB / XC / XG / EX / EG
X507	RS-422	4	4	One channel TxD+, TxD-, RxD+, RxD-	115.2K	XB / XG / EX / EG
X508	RS-232	4	4	One channel (5-wire)	115.2K	XB / XG / EX / EG
X509	RS-232	4	4	Two channels (3-wire)	115.2K	XB / XG / EX / EG
X510	RS-232	5	5	One channels (3-wire), and EEPROM: 128K * 2 bytes	115.2K	XB / XG / EX / EG
X511	RS-485	--	--	Three channels (Data+, Data-)	115.2K	XB / XG / EX / EG
X512	RS-232 RS-485	--	--	one channel RS-485 Three channels RS-232 (3-wire)	115.2K	XB / XG / EX / EG
X560	RS-232	--	--	Three channels (3-wire), and 8M bytes NAND Flash ** Without Case **	115.2K	XA / XC / XB / XG / EX / EG

6.5 I/O Expansion Board for SRAM, Flash

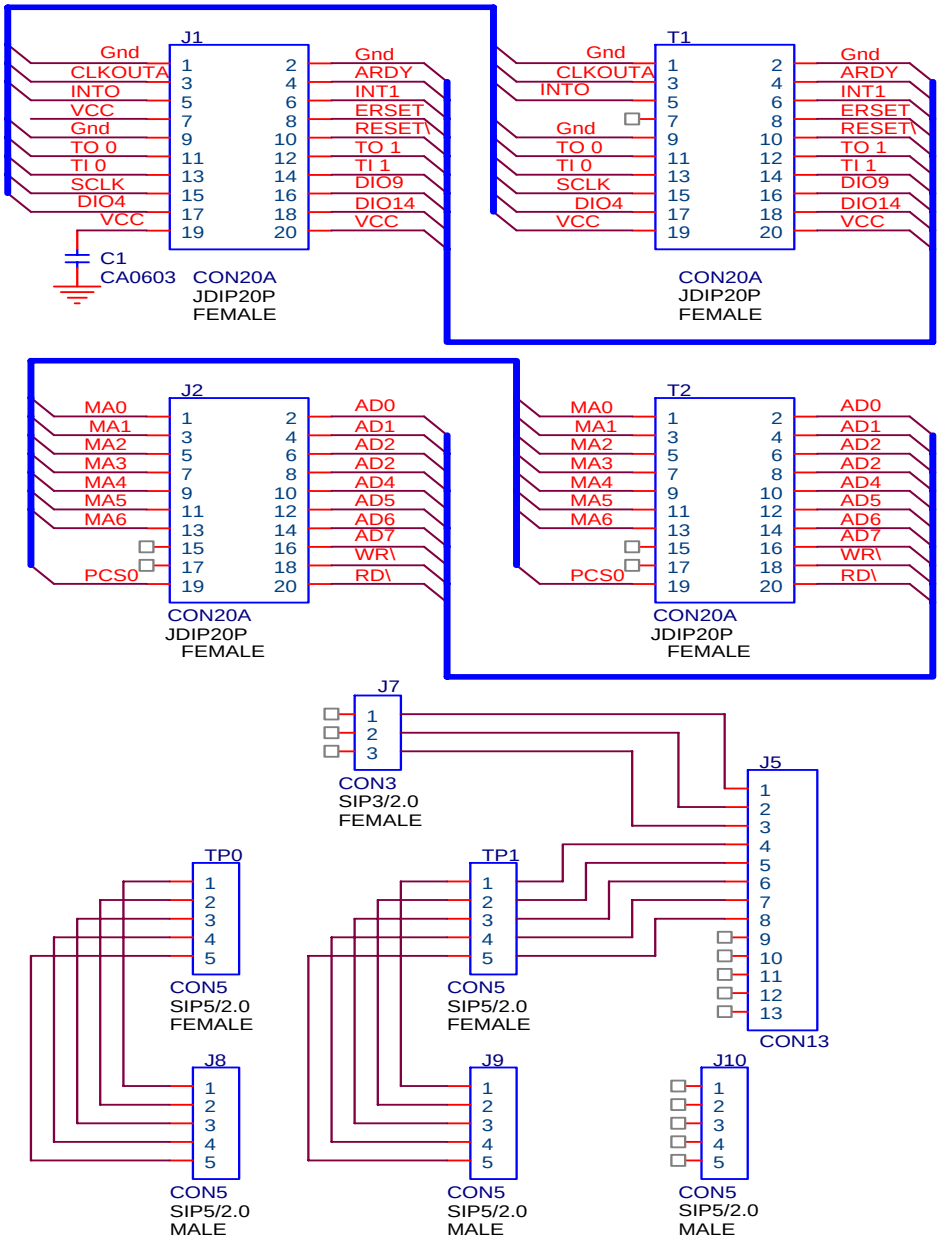
Model	Description	Flash Disk	Battery Backup SRAM Disk	Used with I-7188XA/ XB / XC / XG / EX / EG
X600	Flash Rom	4M bytes NAND Flash	--	XA / XC / XB / XG / EX / EG
X601	Flash Rom	8M bytes NAND Flash	--	XA / XC / XB / XG / EX / EG
X607	Battery backup SRAM board	--	128 K bytes	XA / XC / XB / XG / EX / EG
X608	Battery backup SRAM board	--	512 K bytes	XA / XC / XB / XG / EX / EG

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7. X0xx I/O Expansion Boards

7.1 X000 :Prototype Board

- Size : 65mm * 35mm



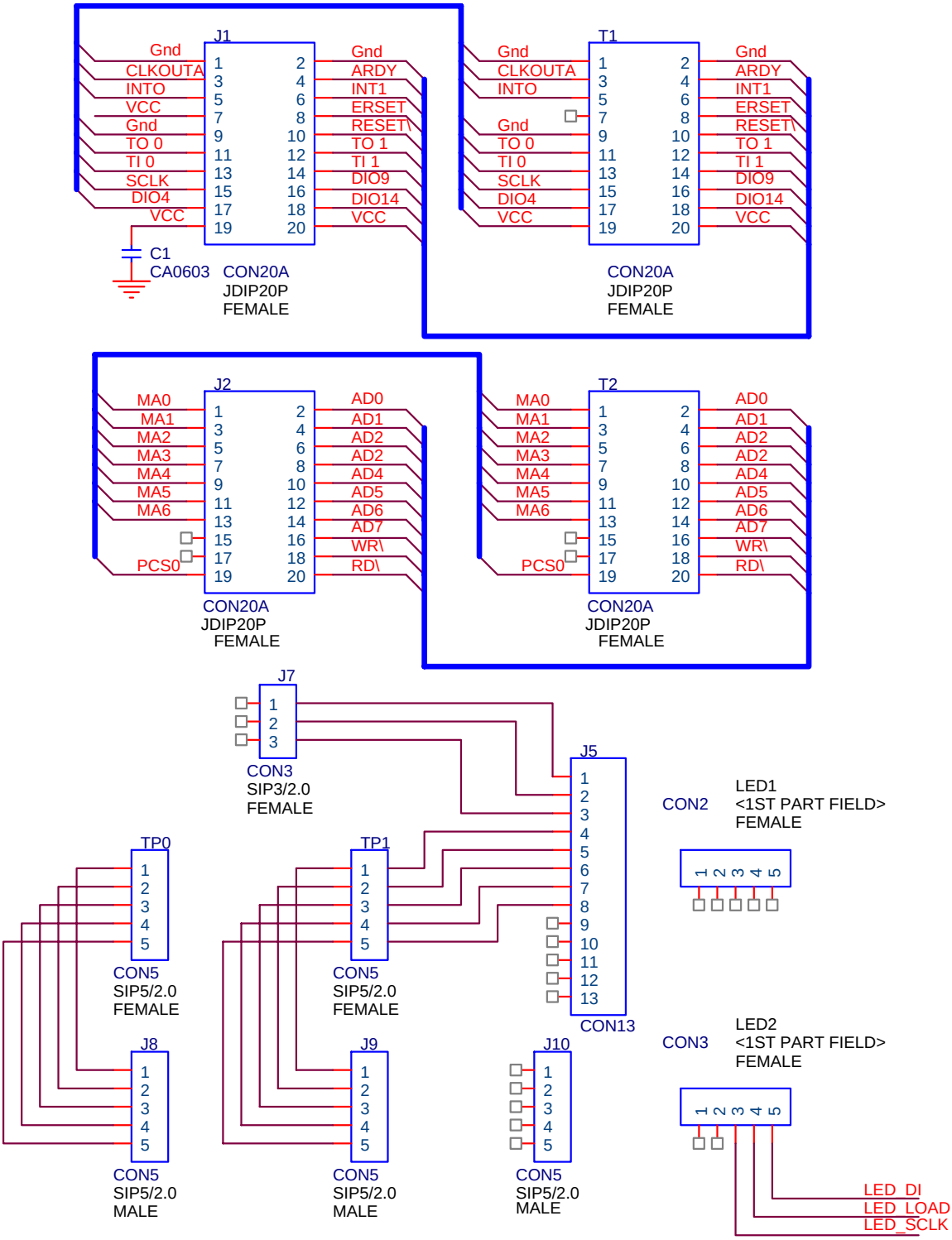

```
On Board :  JP8 , JP9  (close)

Daughter Board :  JP9 , JP10  (close)
```


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7.2 X001: Prototype Board

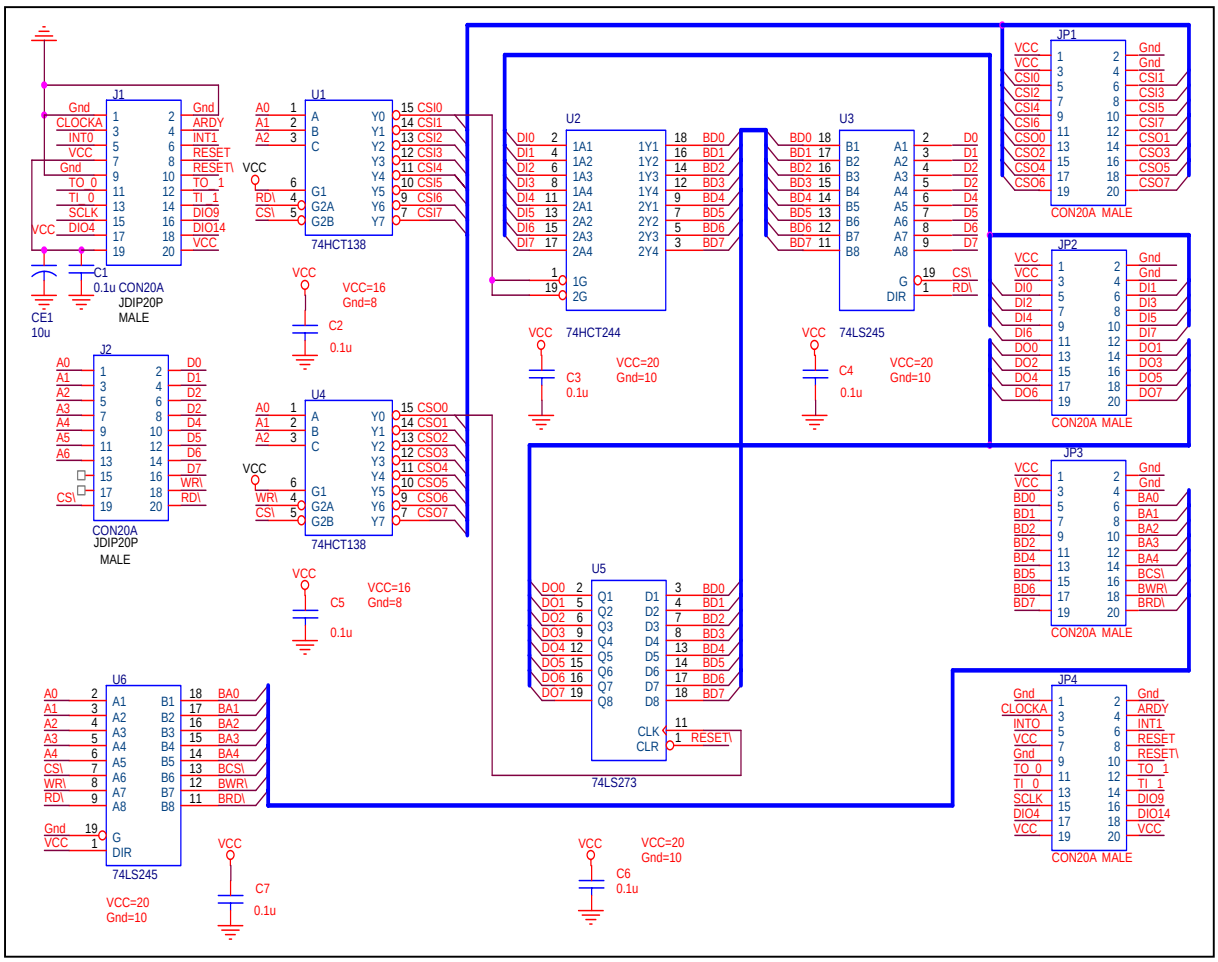
- Size : 65mm * 35mm



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7.3 X002 : Prototype Board

- Size : 115mm * 170mm



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7.4 X003: Test Board 1

- For I-7188XA (D), I-7188XC (D) & 7521
- Power consumption : 0.2W
- The X003 is self board. It can test DI, DO, System clock, Data Bus, Serial Bus.
- When you want to test DI and DO of I-7188XC (D) or I-7521, Please connect DI1 to DO1, DI2 to DO2, DI3 to DO3.

When you want to test DI and DO of I-7188XA (D) or I-7521, Please connect DI1 to DO1, DI2 to DO2.

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7.5 X004: Test Board 2

- For I-7188XB (D), I-7188XG (D), I-7188EX (D), I-7188EG (D)
- Power consumption : 0.2W
- The X004 is self board. It can test DI, DO, System clock, Data Bus, Serial Bus.
- When you want to test DI and DO of I-7188XB (D) or I-7188XG (D), Please connect DI1 to DO1. and connect for define pins: 1 to 8, 2 to 9, 3 to 10, 4 to 11, 5 to 12, 6 to 13, 7 to 14.

.

When you want to test DI and DO of I-7188EX (D) or I-7188EG (D), Please define pins: 1 to 8, 2 to 9, 3 to 10, 4 to 11, 5 to 12, 6 to 13, 7 to 14.

Run dido.exe for I-7188XB(D) / I-7188XG(D).

```
7188XB>dido
Test DI/DO 1(Please connect DI1 to DO1)
Set Do 1 to Low
Now DI1 is low -->[ DI ---->    OK ].
Set Do1 to High
Now DI1 is high -->[ DI ---->    OK ].
Set Do1 to Low
Now DI1 is low -->[ DI ---->    OK ].

S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!

 Test Timer 0
 10 Timer0/INT0 Test OK
 Test Timer 1

 10(00000) Timer1/INT1 Test OK
```


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Run dido.exe for I-7188EX(D) / I-7188EG(D).

```
i7188e>dido
S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!
Test Timer 0
10 Timer0/INT0 Test OK
Test Timer 1
10(00000) Timer1/INT1 Test OK
```


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Run dido.exe for I-7188XB(D) / I-7188XG(D).

```
7188XB>dido
Test DI/DO 1(Please connect DI1 to DO1)
Set Do 1 to Low
Now DI1 is low -->[ DI ---->    OK ].
Set Do1 to High
Now DI1 is high -->[ DI ---->    OK ].
Set Do1 to Low
Now DI1 is low -->[ DI ---->    OK ].

S_CLK --> DIO9 OK!!!
DIO4 --> DIO14 OK!!!
DIO4 <-- DIO14 OK!!!

Data Bus Test OK!

 Test Timer 0
 10 Timer0/INT0 Test OK
 Test Timer 1

 10(00000) Timer1/INT1 Test OK
```


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8. X1xx I/O Expansion Boards

8.1 X100: DI * 8

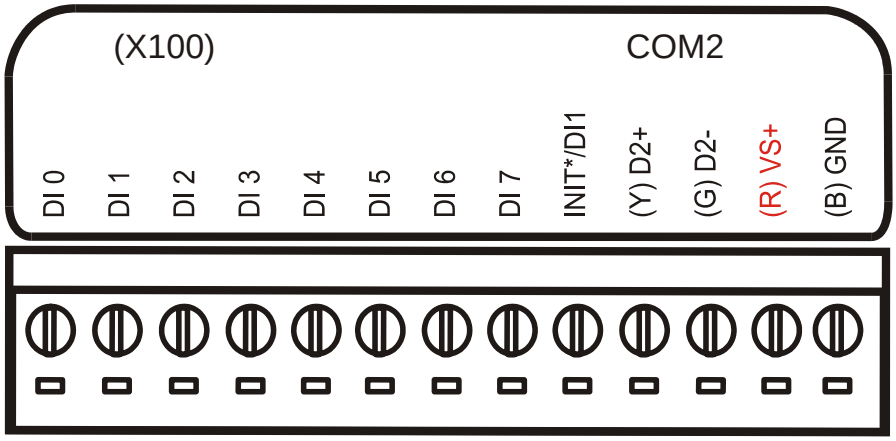
8.1.1 Specifications:

For I-7188XC (D)

Digital Input :

- Channels : **8**
  Input Range / Type : Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated : none.

8.1.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.1.3 Jumper Setting:

Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.

- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of 8 DI
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of 8 DI
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** J9 and J8 closed
  - **TP1:** J9 and J10 closed

8.1.4 Programming:

DiVal = **inportb(BASE); /* for all 8-channels */**

Note: 1. The default value of BASE is 0.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DiVal=0 → all 8-channel are Low
   DiVal=1 → Chennel_0 is High, the other channels are Low
   DiVal=0xff → all 8-channel are High

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8.2 X101: DO * 8

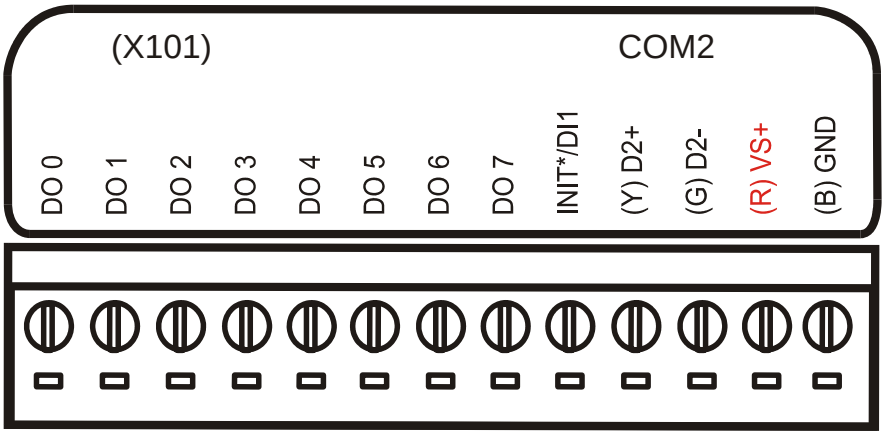
8.2.1 Specifications:

For I-7188XC (D)
Power consumption: 0.4 W

Digital Output:

- Channels: **8**
- Output: TTL level
  High Voltage : 2.4V (Min)
  Low Voltage : 0.8 (Max)
- Sink current: 64mA (Max)
- Isolated: none.

8.2.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.2.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.**
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channel of 8 D/O
- **TP0:** Original function on 7188XC
- **TP1:** Five channel of 8 D/O
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** JP9 and JP8 closed
  - **TP1:** JP9 and JP10 closed

8.2.4 Programming:

outportb(BASE, DoVal); /* for all 8-channels */

Note: 1. The default value of BASE is 0.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DoVal=0 → turn all 8-channel OFF
   DoVal=1 → turn chennel_0 ON, the other channels OFF
   DoVal=0xff → turn all 8-channel ON

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8.3 X102: Relay * 2

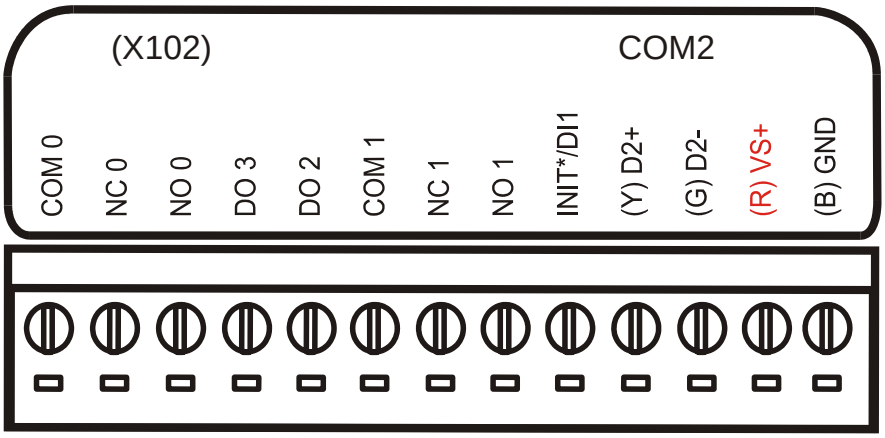
8.3.1 Specifications :

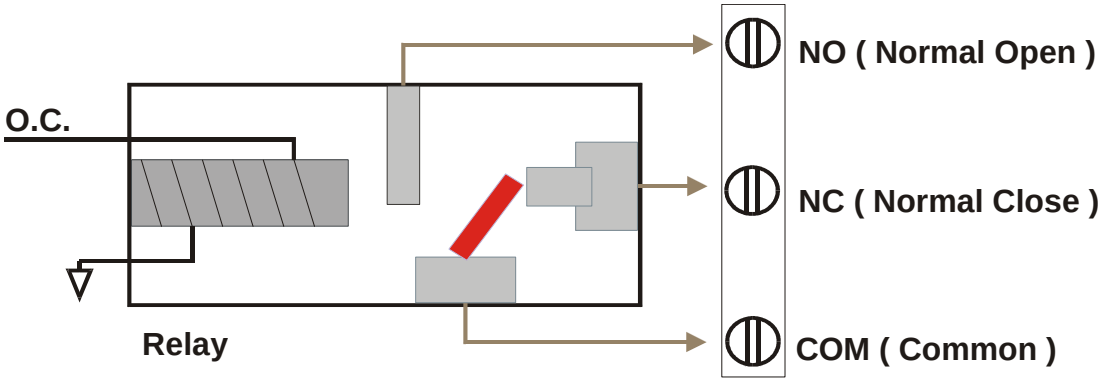
For I-7188XC (D)

Relay Output :

- Channels : 2 (Form "C")
- Max. Switching voltage : 220Vdc, 250Vac
- Max. Switching current : 2A
- Max. Carrying current : 2A
- Surge Strength : 1,500V
- Electrical endurance :
  Typical 500,000 operation at 30Vdc / 1A
  Typical 100,000 operation at 125Vac / 0.5A
- Relay on time (typical) : 6ms
- Relay off time (typical) : 6ms

8.3.2 Pin Assignment:





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8.3.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.**
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** One channel of relay output
- **TP0:** Original function on 7188XC
- **TP1:** One channel of relay output
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** JP9 and JP8 closed
  - **TP1:** JP9 and JP10 closed

8.3.4 Programming:

```
SetDio4Dir( 0 );      // Set channel-0 to DO
SetDio14Dir( 0 );     // Set channel-1 to DO

SetDio4Low();         // Turn channel_0 relay OFF
SetDio14Low();        // Turn channel_1 relay OFF

SetDio4High();        // Turn channel_0 relay ON
SetDio14High();       // Turn channel_1 relay ON
```


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8.4 X103: Isolated DI * 7

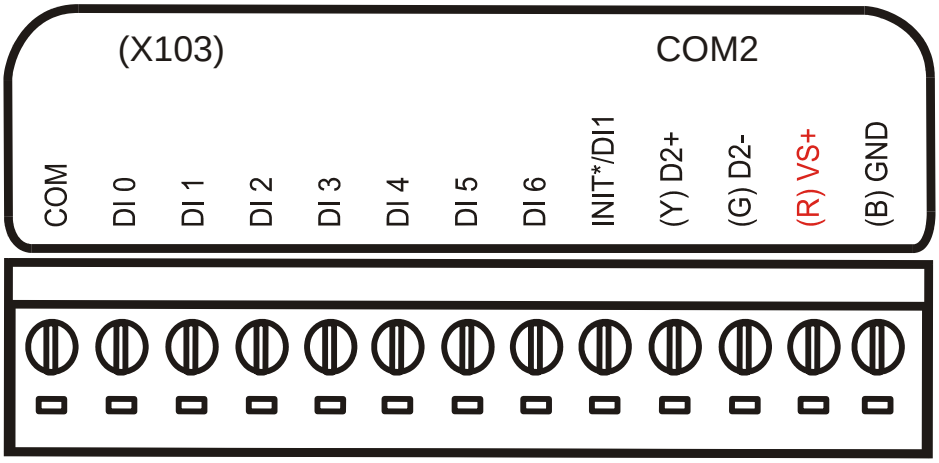
8.4.1 Specifications:

For I-7188XC (D)
Power consumption: 0.3 W

Digital Input :

- Channels : **7**
  Input Range / Type : Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated digital input.

8.4.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.4.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22, R23 in the 7188XC first.**
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Two channels of isolated DI
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of isolated DI
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** JP9 and JP8 closed
  - **TP1:** JP9 and JP10 closed

8.4.4 Programming:

```
SetTo10Dir(1);   XDI1=GetTo1();     // set to D/I & read D/I, channel_1
SetTi1Dir(1);    XDI2=GetTi1();       // set to D/I & read D/I, channel_2
SetDio9Dir(1);   XDI3=GetDio9();    // set to D/I & read D/I, channel_3
SetDio14Dir(1);  XDI4=GetDio14();   // set to D/I & read D/I, channel_4
SetDio4Dir(1);   XDI5=GetDio4();    // set to D/I & read D/I, channel_5
SetTi0Dir(1);    XDI6=GetTi0();       // set to D/I & read D/I, channel_6
SetTo0Dir(1);    XDI7=GetTo0();     // set to D/I & read D/I, channel_7
```


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8.5 X104: D/I/O * 8, single-bit

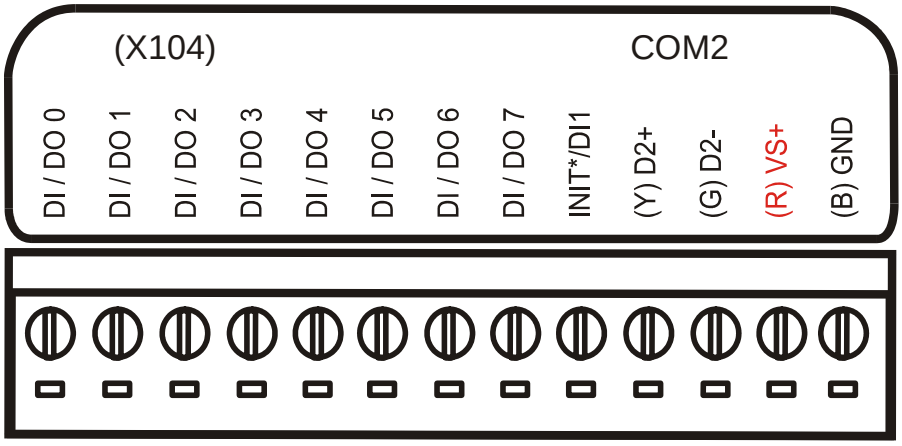
8.5.1 Specifications:

For I-7188XC (D)
Power consumption: 0.3 W

Digital Input / Output:

- Channels: **8**
  Input / Output: each channel can be programmed to D/I or D/O.
- Input Range: 0~5V(Max)
- Isolated: none.

8.5.2 Pin Assignment:



Note: Provide functions of DI and DO from CPU.

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8.5.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.**
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of 8 D/I/O
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of 8 D/I/O
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** JP9 and JP8 closed
  - **TP1:** JP9 and JP10 closed

8.5.4 Programming:

Software library

void SetDio4Dir(int dir);
void SetDio4High(void);
void SetDio4Low(void);
int GetDio4(void);

void SetDio9Dir(int dir);
void SetDio9High(void);
void SetDio9Low(void);
int GetDio9(void);

void SetDio14Dir(int dir);
void SetDio14High(void);
void SetDio14Low(void);
int GetDio14(void);

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```
void SetTi1Dir(int dir);
void SetTi1High(void);
void SetTi1Low(void);
int GetTi1(void);

void SetTo1Dir(int dir);
void SetTo1High(void);
void SetTo1Low(void);
int GetTo1(void);

void SetTi0Dir(int dir);
void SetTi0High(void);
void SetTi0Low(void);
int GetTi0(void);

void SetTo0Dir(int dir);
void SetTo0High(void);
void SetTo0Low(void);
int GetTo0(void);

void SetDo1High(void);
void SetDo1Low(void);
int GetDo1(void);

void SetDo2High(void);
void SetDo2Low(void);
int GetDo2(void);

void SetDo3High(void);
void SetDo3Low(void);
int GetDo3(void);

int GetDi2(void);
int GetDi3(void);

void ClockHighLow(void);
void ClockHigh(void);
void ClockLow(void);
```


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8.6 X105: D/I/O * 8, 8-bit

8.6.1 Specifications:

For I-7188XC
Power consumption: 0.3 W

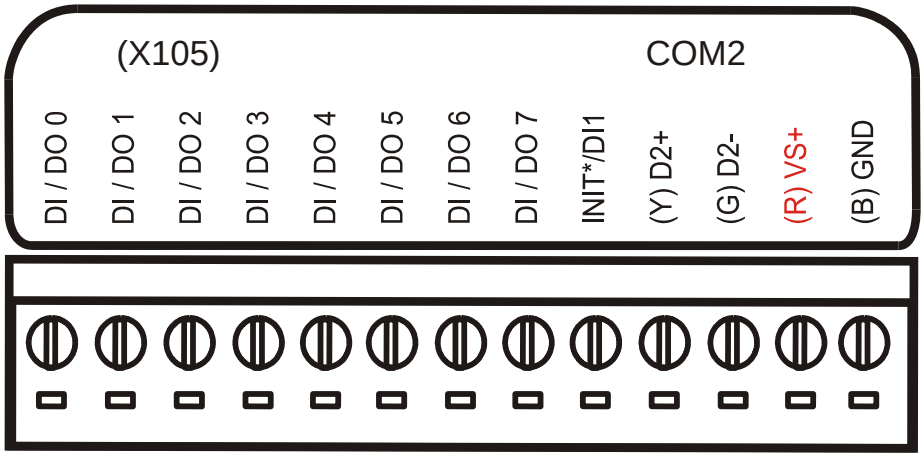
Digital Input:

- Channels: **8**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **8**
- Output: TTL level
- Isolated: none

8.6.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.6.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22 and R23 in the 7188XC first.**
- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of 8 D/I/O
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of 8 D/I/O
- **Jumper:** Select **TP0** or **TP1** function
  - **TP0:** JP9 and JP8 closed
  - **TP1:** JP9 and JP10 closed

8.6.4 Programming

DiVal = **inportb(BASE); /* for all 8-channels */**

Note: 1. The default value of BASE is 0.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DiVal=0x00 → all 8-channel are Low
   DiVal=0x01 → Chennel_0 is High, the other channels are Low
   DiVal=0xFF → all 8-channel are High

outportb(BASE, DoVal); /* for all 8-channels */

Note: 1. The default value of BASE is 0.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DoVal=0x00 → turn all 8-channel OFF
   DoVal=0x01 → turn chennel_0 ON, the other channels OFF
   DoVal=0xFF → turn all 8-channel ON
   DIO14 is used to select D/I or D/O
   If DIO14 is **LOW → select D/O*8** → D/I is read-back value of D/O

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If DIO14 is **HIGH → select D/I*8** → D/I signals are come from J5

Select D/I*8 as following:

```
SetDio14Dir(0);          /* select DIO14 as D/O          */
SetDio14High();          /* select D/I*8                 */
DiVal=inportb(BASE);     /* read D/I*8 (from J5)             */
```

Select D/I*8 as following:

```
SetDio14Dir(0);          /* select DIO14 as D/O          */
SetDio14Low();           /* select D/O*8                     */
outportb(BASE,DoVal);    /* set value of D/O*8 (to J5)   */
DiVal=inportb(BASE);     /* D/O*8   read back                */
```


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8.7 X106: DO *2 or DI *3

8.7.1 Specifications:

For I-7188XC

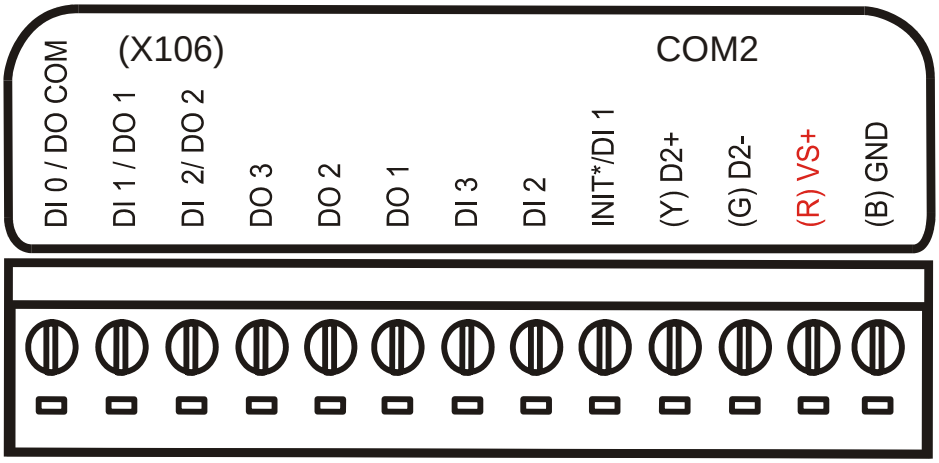
Digital Input:

- Channels: **3**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels:**3**
- Open-collector Output: 250 mA / 30V max
- Isolated: none

8.7.2 Pin Assignment:



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.7.3 Jumper Setting:

- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three channels of D/I or two channels of D/O
- **Jumper:** Select **D/I** or **D/O** function
  D/I: j4, j5,j6 select 2-3 **(default setting)**
  D/O: j4, j5, j6 select 1-2

8.7.4 Programming

- ***DO***

```
SetDio4Dir( 0 );          // Set D/O channel_1
SetDio14Dir( 0 );         // Set D/O channel_2
SetDio4Low();             // Turn D/O channel_1 OFF
SetDio14Low();            // Turn D/O channel_2 OFF
SetDio4High();            // Turn D/O channel_1 ON
SetDio14High();           // Turn D/O channel_2 ON
```

- ***DI***

```
Data = SetTo1Dir( 1 );    // Set D/I channel_1
Data = SetTo0Dir( 1 );    // Set D/I channel_2
Data = SetDio9Dir( 1 );   // Set D/I channel_3
Data = GetTo1Dir(  );     // Read D/I channel_1
Data = GetTo0Dir(  );     // Read D/I channel_2
Data = GetDio9Dir(  );    // Read D/I channel_3
```


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8.8 X107: DI * 6 and DO * 7

8.8.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

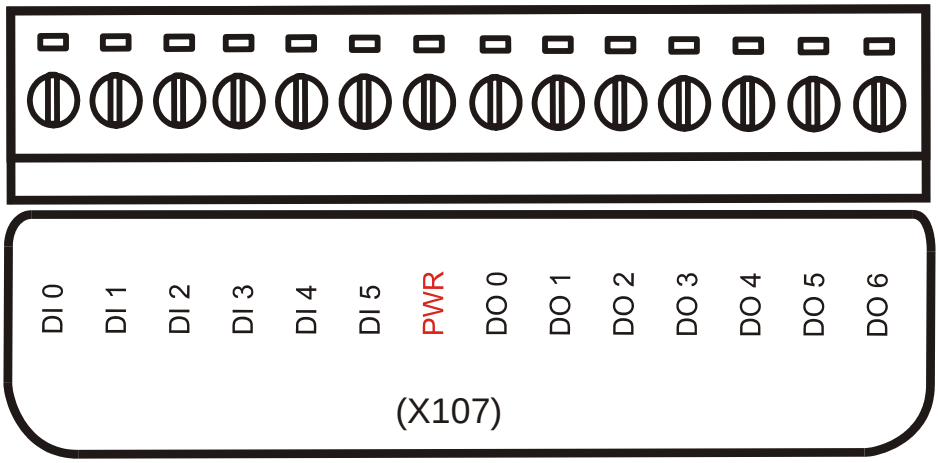
Digital Input :

- Channels: **6**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **7**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

8.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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8.8.3 Programming :

DiVal = **inportb(BASE);** **/* for all 6 channels */**

Note: 1. The default value of BASE is **1**.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DiVal=0x00 → all 6-channel are Low

   DiVal=0x01 → Chennel_0 is High, the other channels are Low

   DiVal=0x3F → all 6-channel are High

outportb(BASE, DoVal); **/* for all 7 channels */**

Note: 1. The default value of BASE is **0**.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DoVal=0x00 → turn all 7-channel OFF

   DoVal=0x01 → turn chennel_0 ON, the other channels OFF

   DoVal=0x7F → turn all 7-channel ON

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8.9 X108: PWM * 2

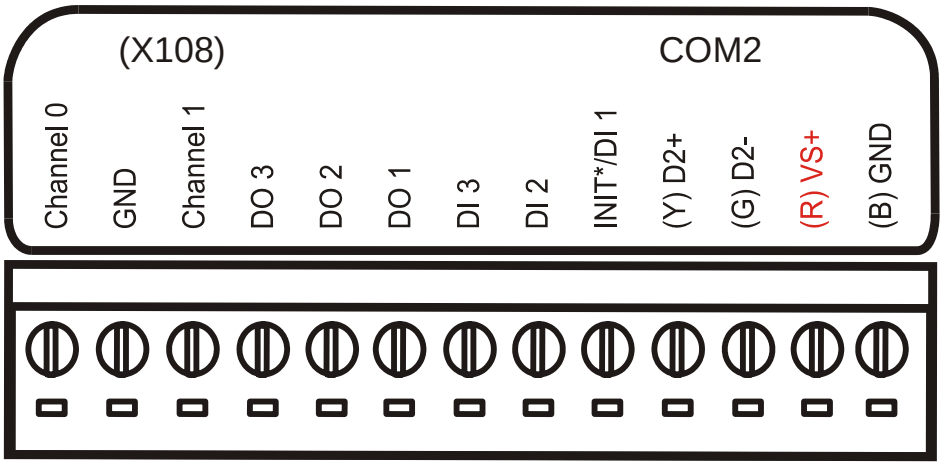
8.9.1 Specifications:

For I-7188XC
Power consumption: 0.5 W

Frequency :

- Low frequency : 40Hz
- High frequency : 100KHz
- Open-collector output: 250mA/30V, Max (Per channel)

8.9.2 Pin Assignment:



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8.9.3 Programming :

Note: How to download PWM.exe, Refer to Section 1.5

1. Download :

COM1 will download PWM.exe & AUTOEXEC.bat

So $aaB0115200 --> change COM1 to 115200

So $aaB09600 --> change COM1 to 9600

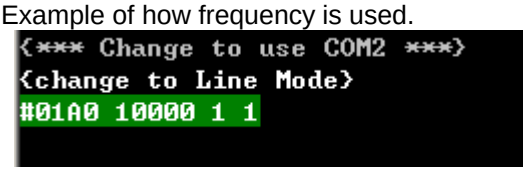
2. default setting:

address=01, baud rate=9600

3. Command Sets :

Press Alt + L [Enter] under MinOS7.

Example of how frequency is used.



#aaA0 (freq) (high) (low)	--> !aa chan_0 (freq) (high) (low)	--> set pwm-0
#aaB00	--> !aa chan_0 OFF	--> turn pwm-0 off
#aaB01	--> !aa chan_0 On	--> turn pwm-0 on
#aaC0	--> !aa (freq) (high) (low) (OnOff)	--> read pwm-0 status
#aaA1 (freq) (high) (low)	--> !aa chan_1 (freq) (high) (low)	--> set pwm-1
#aaB10	--> !aa chan_1 OFF	--> turn pwm-1 off
#aaB11	--> !aa chan_1 On	--> turn pwm-1 on
#aaC1	--> !aa (freq) (high) (low) (OnOff)	--> read pwm-1 status

4. testing procedure :

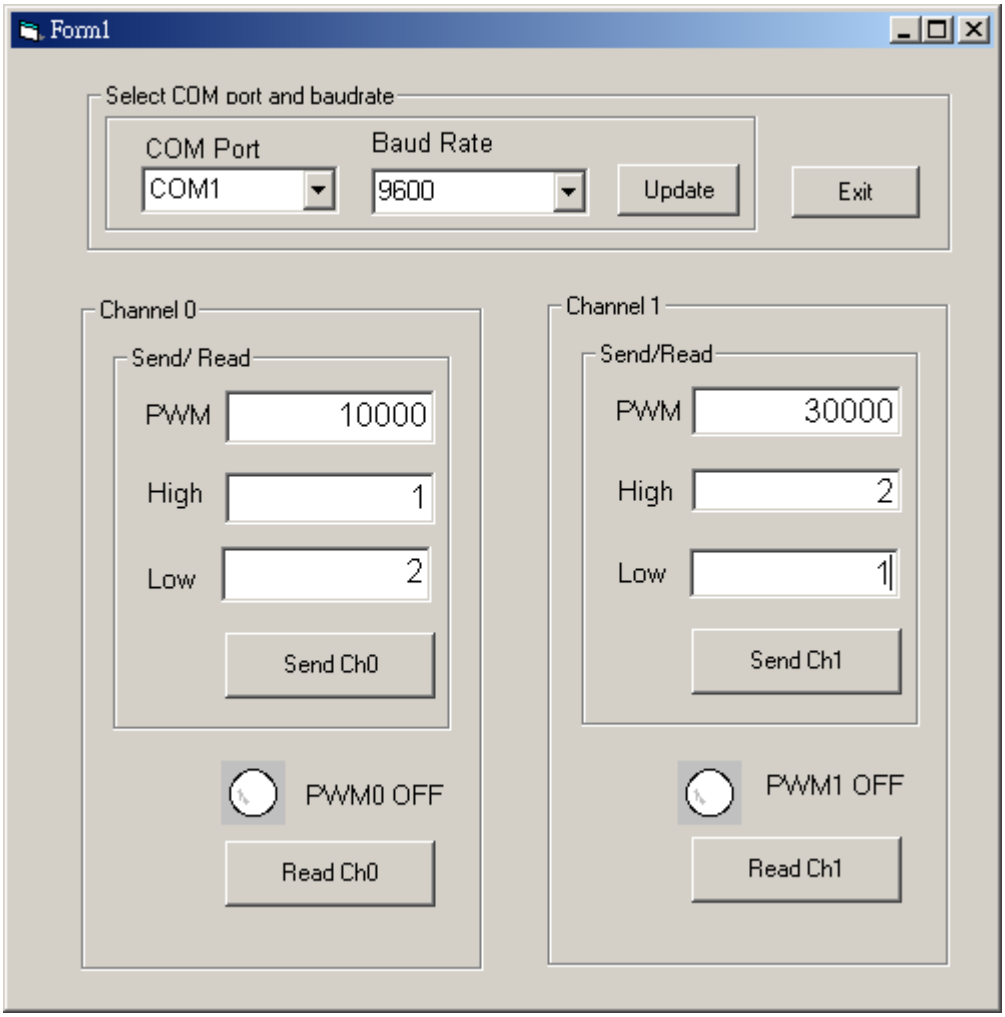
$01M	--> !01PWM
#01A0 100 1 1	--> !01 chan_0 100 1 1
#01C0	--> !01 100 1 1 1
#01A1 200 2 1	--> !01 chan_1 200 2 1
#01C1	--> !01 200 2 1 1
#01B10	--> !01 chan_1 Off
#01C1	--> !01 200 2 1 0

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#01B00 --> !01 CHAN_0 Off

#01C0 --> !01 100 1 1 0

5. Run Visual Basic:



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8.10 X109: PhotoMOS Relay * 7

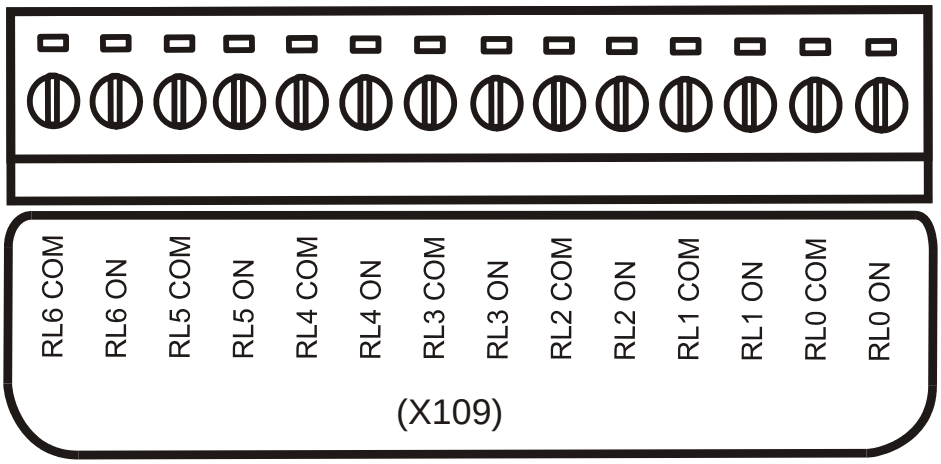
8.10.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

- Channels: **7** (**Form A**)
- Continuous load current:120mA (peak AC)
- Peak load current: 0.3A
- Output Off state leakage current : 1Ua
- Output On resistance : 25Ohm
- Load voltage : 350V(peak AC)
- Turn On time : 0.23ms (Typical)
- Turn Off time : 0.04ms (Typical)
- Input / Output Isolation : 1,500V AC



8.10.2 Pin Assignment :



8.10.3 Programming :

outportb(BASE, DoVal); /* for all 7-channels */

Note: 1. The default value of BASE is 0.

2. It is **not** recommended to change the value of BASE from 0 to another value.

3. DoVal=0x00 → turn all 7-channel OFF

   DoVal=0x01 → turn chennel_0 ON, the other channels OFF

   DoVal=0x7F → turn all 7-channel ON

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8.11 X110: 14 Channels D/I

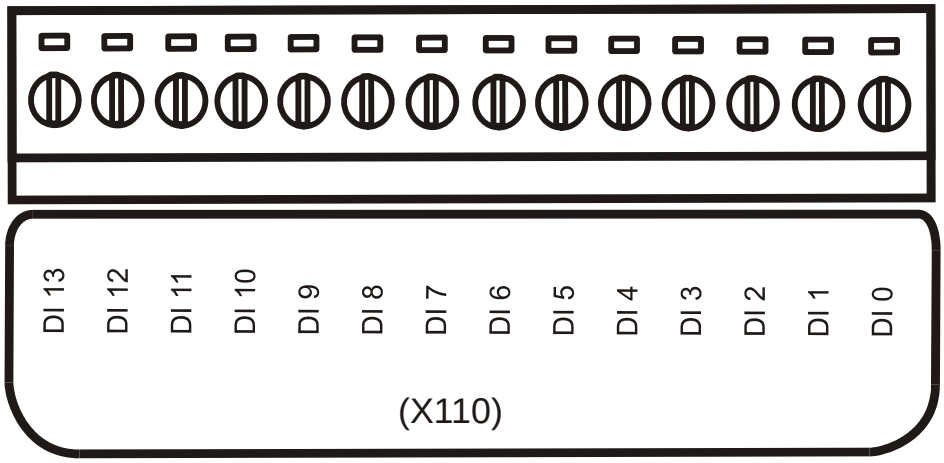
8.11.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Digital Input :

- Channels: **14**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

8.11.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.11.3 Programming :

iValue = inpw(port); **/* for all 14-channel */**

DiVal=0x0000 → all 14-channel are Low
DiVal=0x0001 → Chennel_0 is High, the other channels are Low
DiVal=0x3FFF → all 14-channel are High

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8.12 X111: 13 Channels D/O

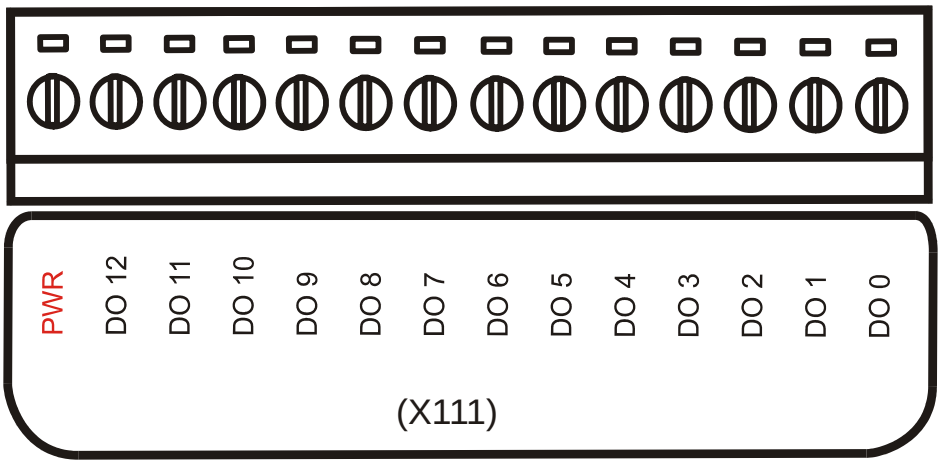
8.12.1 Specifications:

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Digital Output:

- Channels: **13**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

8.12.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

8.12.3 Programming :

outpw(port, DoVal); **/* for all 13-channels */**

Please notice that Base address "0x0080" **not used.**

DoVal=0x0000 → turn all 13-channel OFF

DoVal=0x0001 → turn chennel_0 ON, the other channels OFF

DoVal=0x2000 → turn all 13-channel ON

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9. X2xx I/O Expansion Boards

9.1 X200: AD*1

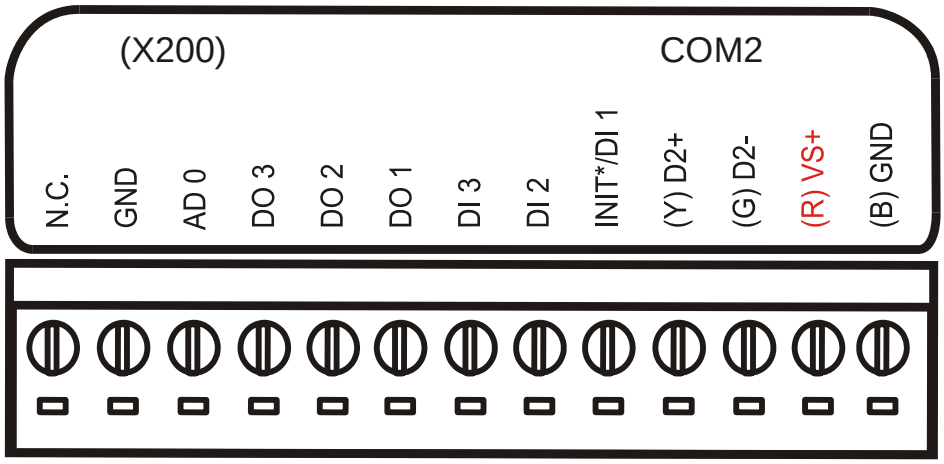
9.1.1 Specifications :

For I-7188XC

Analog Input:

- Channel : **1** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 2.5 V
- Sampling rate : 900 Hz
- Isolated : none

9.1.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

9.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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9.2 X201: AD*1

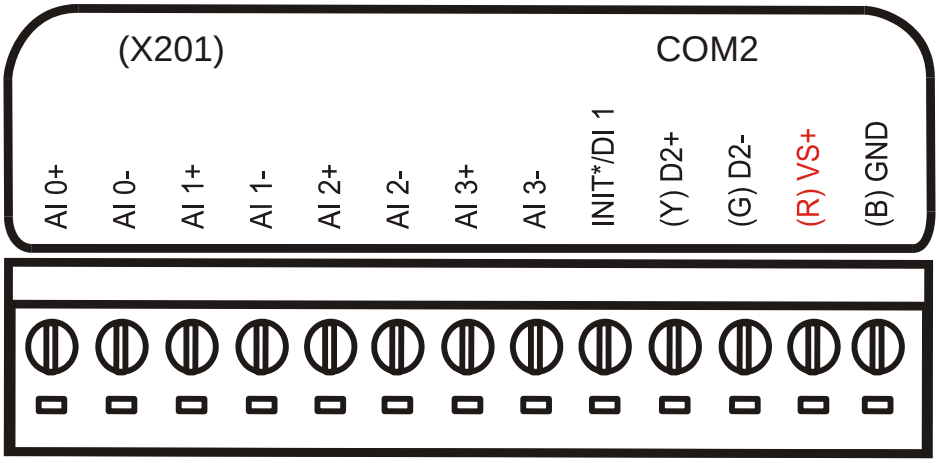
9.2.1 Specifications :

For I-7188XC
Power consumption: 0.4W

Analog Input:

- Channel : **1** (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 900 Hz
- Isolated : none

9.2.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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9.2.3 Jumper Setting:

- **Note: user should remove R19, R20, R21, R22, R23 in the 7188XC first.**
- **J7:** I1+, I1-, I2+
- **TP0, TP1:** I2-, I3+, I3- ,I4+, I4-
- **TP0:** Original function on 7188XC
- **TP1:** Five channels of isolated DI
- **Jumper:** Select **TP0** or **TP1** function

  TP0: JP9 and JP8 closed

  TP1: JP9 and JP10 closed

9.2.4 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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9.3 X202: AD*7

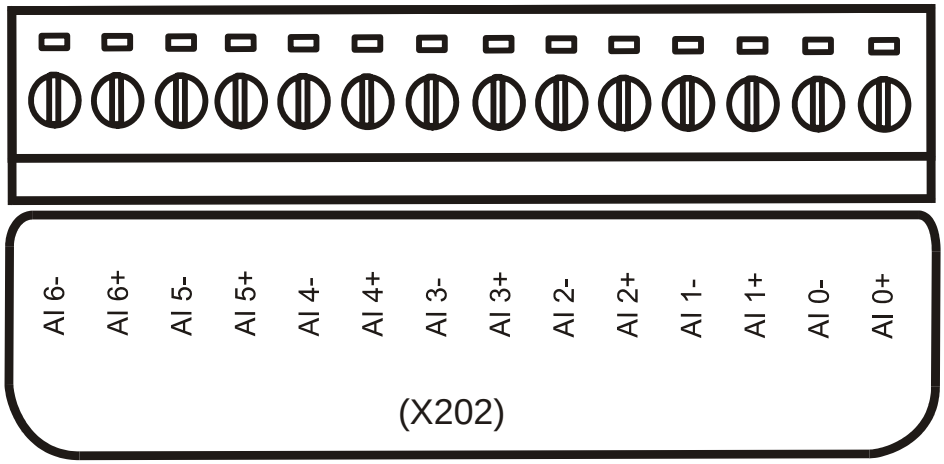
9.3.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG
Power consumption: 0.7W

Analog Input:

- Channel : **7** (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 1800 Hz
- Isolated : none

9.3.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

9.3.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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9.4 X203: AD*2 + DO*6 + DI*2

9.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Power consumption: 0.7W

Analog Input:

- Channel : **2** (Differential)
- Resolution : 12bit
- Input Range/Type : 0 ~ 20mA
- Sampling rate : 1800 Hz

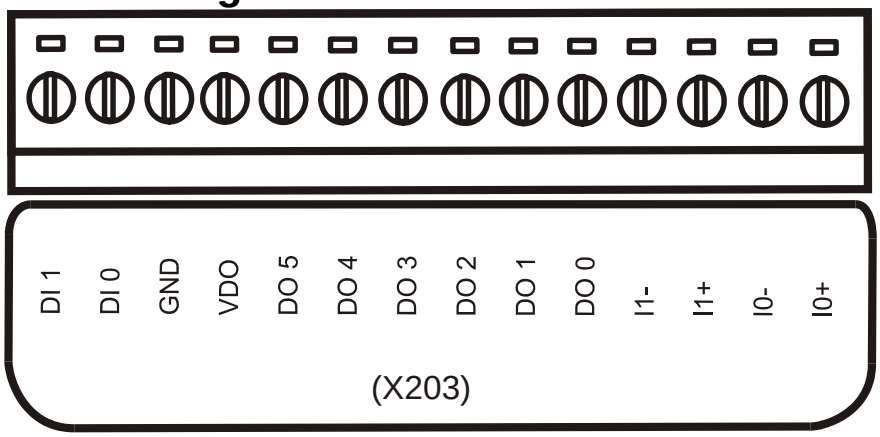
Digital Input :

- Channels: **2**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **6**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

9.4.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.
For Software Installation & Demo Program, Refer to Section 2.2.2

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10. X3xx I/O Expansion Boards

10.1 X300: DA * 2

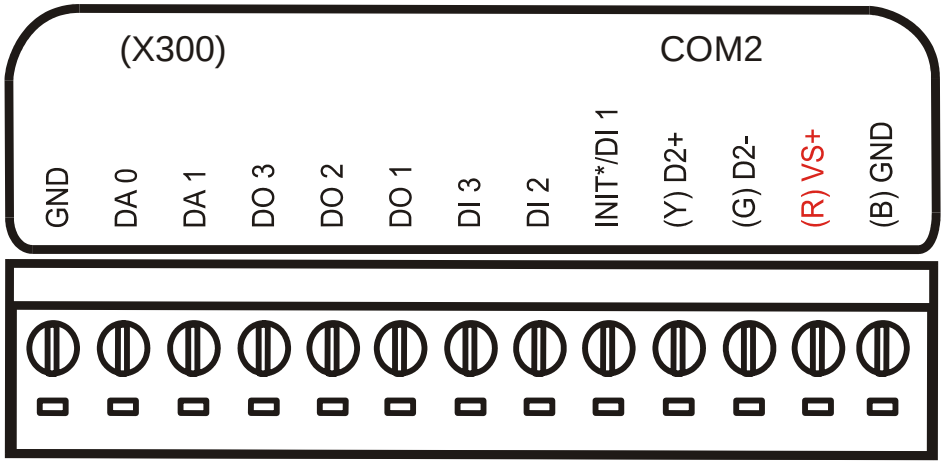
10.1.1 Specifications :

For I-7188XC

Analog Output:

- Channel : **2**
- Resolution : 12bit
- Input Range/Type : 0 ~ 4.095V
- Sampling rate : 650 Hz
- Isolated : none

10.1.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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10.2 X301: DA * 1 + AD * 1

10.2.1 Specifications :

For I-7188XC

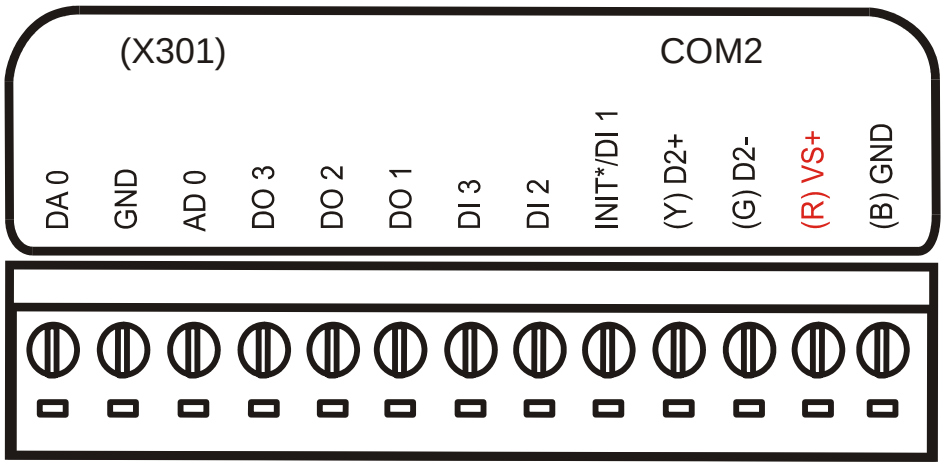
Analog Output:

- Channel : **1**
- Resolution : 12bit
- Input Range/Type : 0 ~ 4.095V
- Sampling rate : 650 Hz
- Isolated : none

Analog Intput:

- Channel : **1** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 2.5V
- Sampling rate : 900 Hz
- Isolated : none

10.2.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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10.2.3 Programming :

void AnalogOutput(int DataIn)

DataIn = 0 – 4095 (Note 4095→ 4.095V)

int AnalogIn(void)

Return value= 0 - 4095

Mapping formula: Vref / 4096 (Note: Vref=2.5v)

For Software Installation & Demo Program, Refer to Section 2.2.2

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10.3 X302: DA * 1 + AD * 1

10.3.1 Specifications :

For I-7188XC

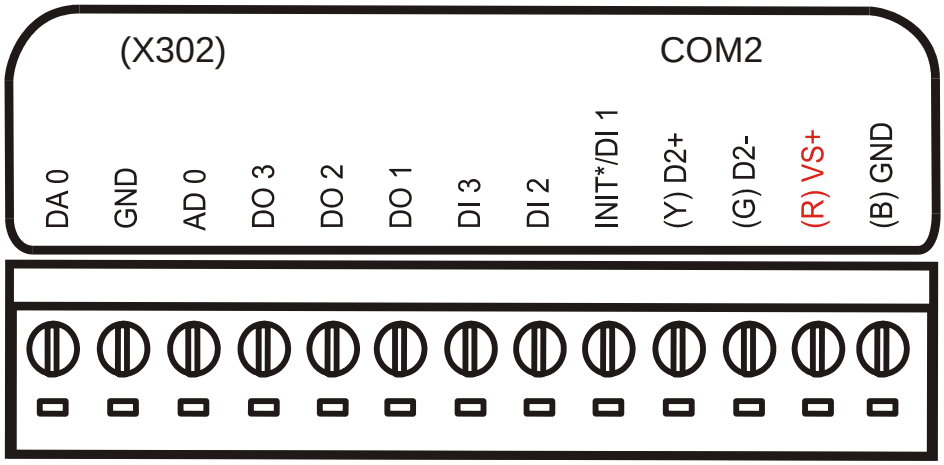
Analog Output:

- Channel : **1**
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 650 Hz
- Isolated : none

Analog Intput:

- Channel : **1** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 900 Hz
- Isolated : none

10.3.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

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10.3.3 Programming :

void AnalogOutput(int DataIn)

DataIn = 0 – 4095 (Note 4095→ 4.095V)

int AnalogIn(void)

Return value= 0 - 4095

Mapping formula: Vref / 4096 (Note: Vref=5v)

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	-5.0V	-0.0V	+0.0V	+5.0V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

thoughput : 1300 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

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10.4 X303: AD*1 + DA*1 + DO*6 + DI*4

10.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : **1**
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Intput:

- Channel : **1** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Input :

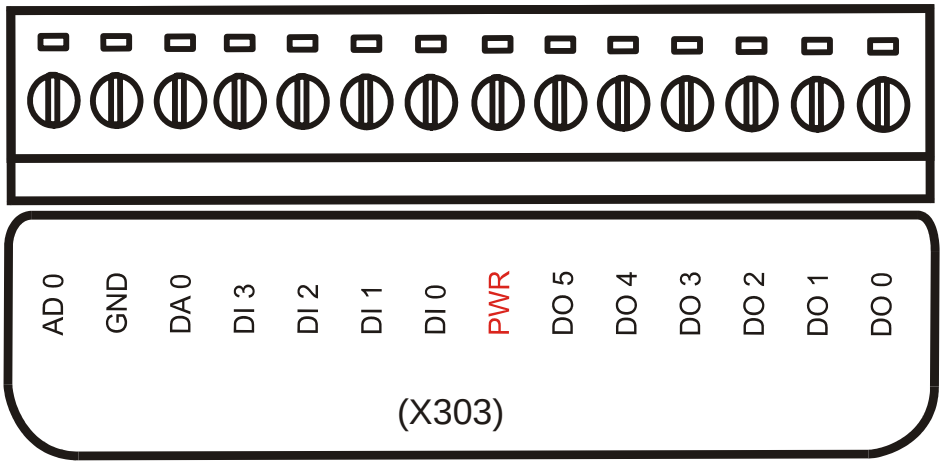
- Channels: **4**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **6**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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10.4.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.4.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	-5.0V	-0.0V	+0.0V	+5.0V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

thoughput : 1300 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

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10.5 X304: AD*3 + DA*1 + DO*4 + DI*4

10.5.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : **1**
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Intput:

- Channel : **3** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Input :

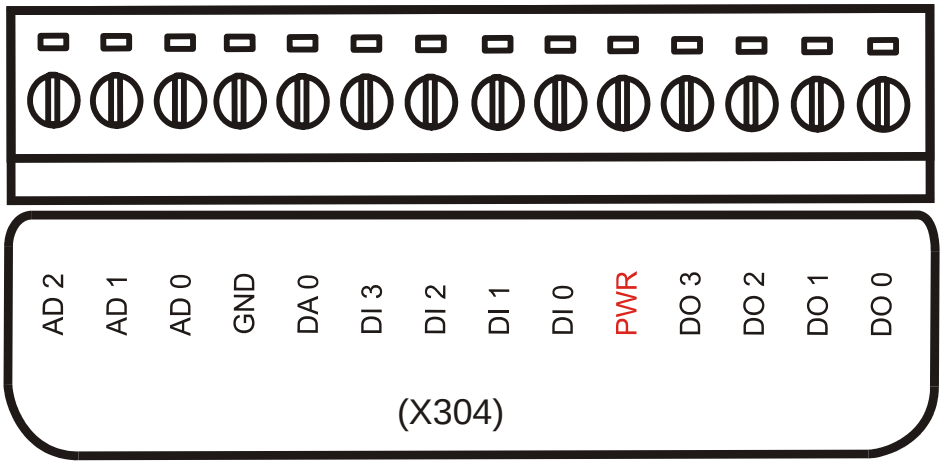
- Channels: **4**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **4**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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10.5.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.5.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	-5.0V	-0.0V	+0.0V	+5.0V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

thoughput : 1300 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

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10.6 X305: AD*7 + DA*1 + DO*2 + DI*2

10.6.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : **1**
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Intput:

- Channel : **7** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : +/- 5V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Input :

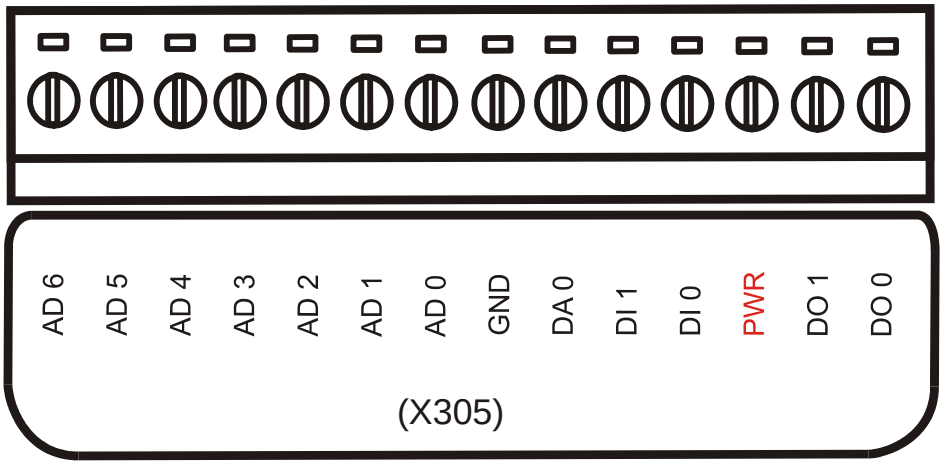
- Channels: **2**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **2**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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10.6.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.6.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	-5.0V	-0.0V	+0.0V	+5.0V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

thoughput : 1300 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

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10.7 X306: AD*2

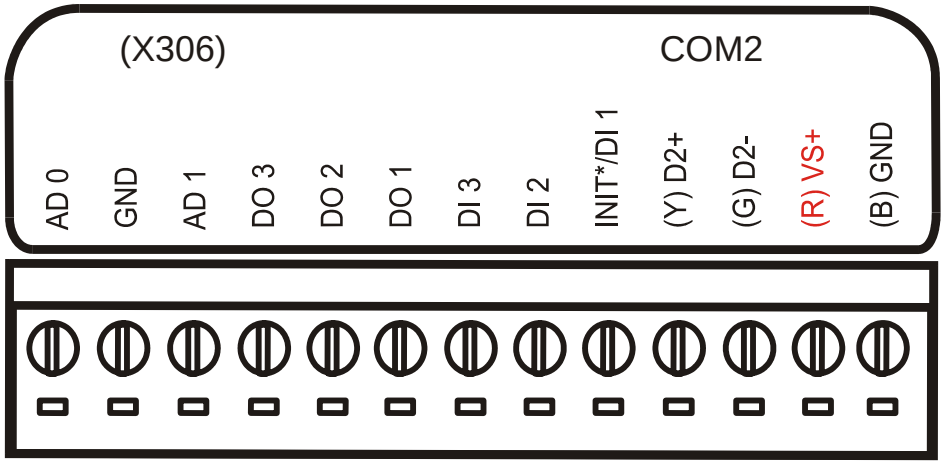
10.7.1 Specifications :

For I-7188XC
Power consumption: 0.4W

Analog Input:

- Channel : **2** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : + / - 10 V
- Sampling rate : 900 Hz
- Isolated : none

10.7.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.7.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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10.8 X307: AD*8

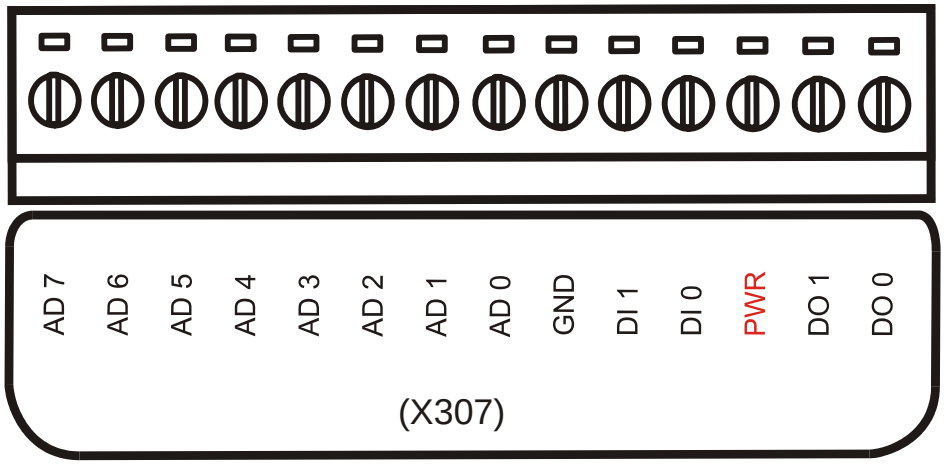
10.8.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG
Power consumption: 0.7W

Analog Input:

- Channel :**8** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : + / - 10V
- Sampling rate : 1800 Hz
- Isolated : none

10.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

10.8.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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10.9 X308: AD*4 + DO*6

10.9.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

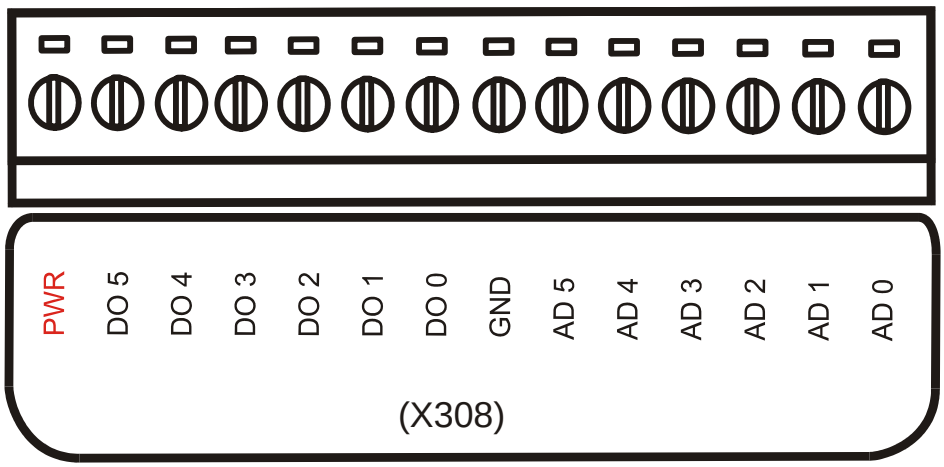
Analog Intput:

- Channel : **4** (Single-Ended)
- Resolution : 12bit
- Input Range/Type : 0 ~ 10V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Output:

- Channels: **6**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

10.9.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

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10.9.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	0V	4.9V	5V	10V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

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10.10 X310: AD*2 + DA*2 + DO*3 + DI*3

10.10.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Analog Output:

- Channel : **2**
- Resolution : 12bit
- Input Range/Type : 0 ~ 10V
- Sampling rate : 1300 Hz
- Isolated : none

Analog Intput:

- Channel : **2** (Differential)
- Resolution : 12bit
- Input Range/Type :
  Ch0 : 0 ~ 20 mA
  Ch1 : 0 ~ 10 V
- Sampling rate : 1800 Hz
- Isolated : none

Digital Input :

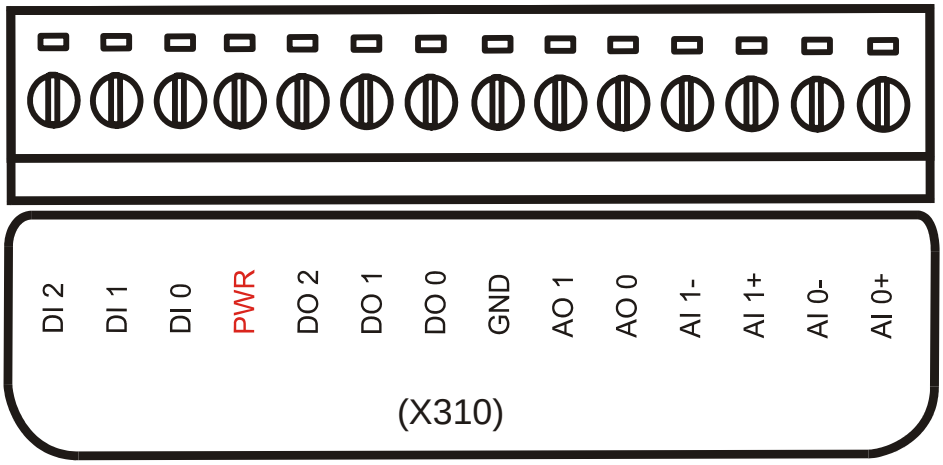
- Channels: **3**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **3**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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10.10.2 Pin Assignment :



Note: Refer to section 3. for A/D, D/A, DI, DO wire connection.

10.10.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

[Software specific]

Input/Output range:	0V	4.9V	5.0V	10V
Decimal integer:	0	2047	2048	4095
Hexadecimal:	000	7FF	800	FFF

[A/D]

sampling rate: 1800 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/A]

thoughput : 1300 data/sec (with floating convertion)

Accuracy==> Typical: +/- 1 LSB (+- 2.4 mV)

Maximum: +/- 2 LSB (+- 4.8 mV)

[D/O]

throughput: can generates 2KHz square wave signals.

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11. X4xx I/O Expansion Boards

11.1 X400:Timer/counter *3

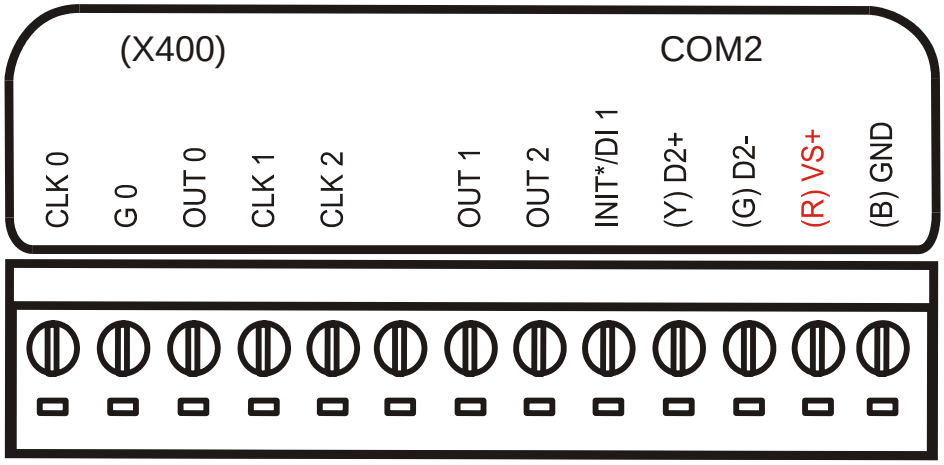
11.1.1 Specifications :

For I-7188XC

Analog Input:

- Channel : 3
  16 bit timer/counter
- Isolated : none

11.1.2 Pin Assignment & Jumper Setting :



Note: You can used 3 channels 16-bit counters or 1 channel 16-bit and 1 channel 32-bit

- **J7:** for counter-0
- **TP0:** Original function on 7188XC
- **TP1**: for counter1, counter2

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Jumper setting for 8254:

	1-2 ON	2-3 ON
CLK0	T1 → CLK0=TO_0	T1 → CLK0=pin1 of J5
G0	T2 → G0=always High	T2 → G0=pin2 of J5
OUT0	OUT0 to INT0 & pin3 of J5	
CLK1	T4 → CLK1=TO_1	T4 → CLK0=pin4 of J5
G1	Always High	
OUT1	OUT1 to T3.1 & T5.1 & T6.1	
CLK2	T3 → CLK2=OUT1	T3 → CLK2=pin5 of J5
G2	Always High	
OUT2	OUT2 to T5.3 & T7.1	

- T1 is used to select internal TO_0 or external signal for CLK0
- T2 is used to select High or external signal for G0
- T3 is used to control 16-bit/32-bit counter. 1-2 select 32-bits counter, 2-3 select two 16-bit counters
- T4 is used to select internal TO_1 or external signal for CLK1
- T5 is used to select OUT1 or OUT2 to INT1
- T6 is used to select OUT1 to pin-7 of J5
- T7 is used to select OUT2 to pin-8 of J5

11.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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12. X5xx I/O Expansion Boards

12.1 X500: RS232 * 1

12.1.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : **1**
- COM3 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Modem control
- Isolated : none

12.1.2 Pin Assignment & Jumper Setting

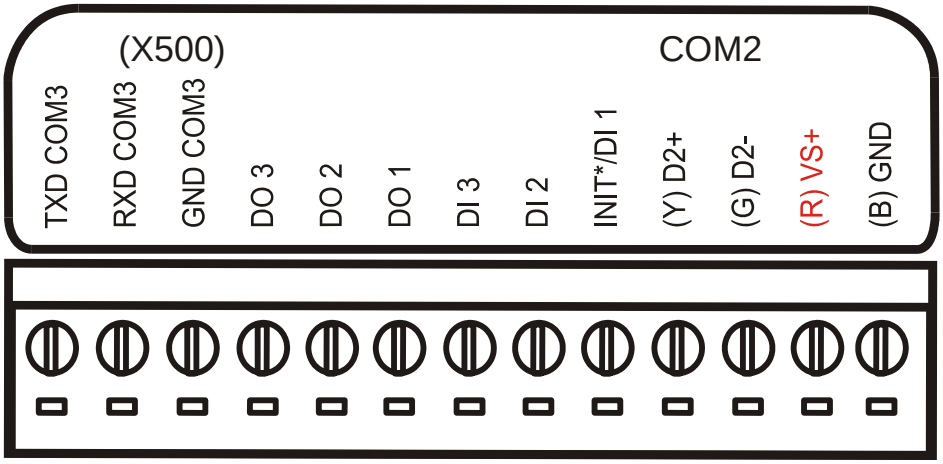
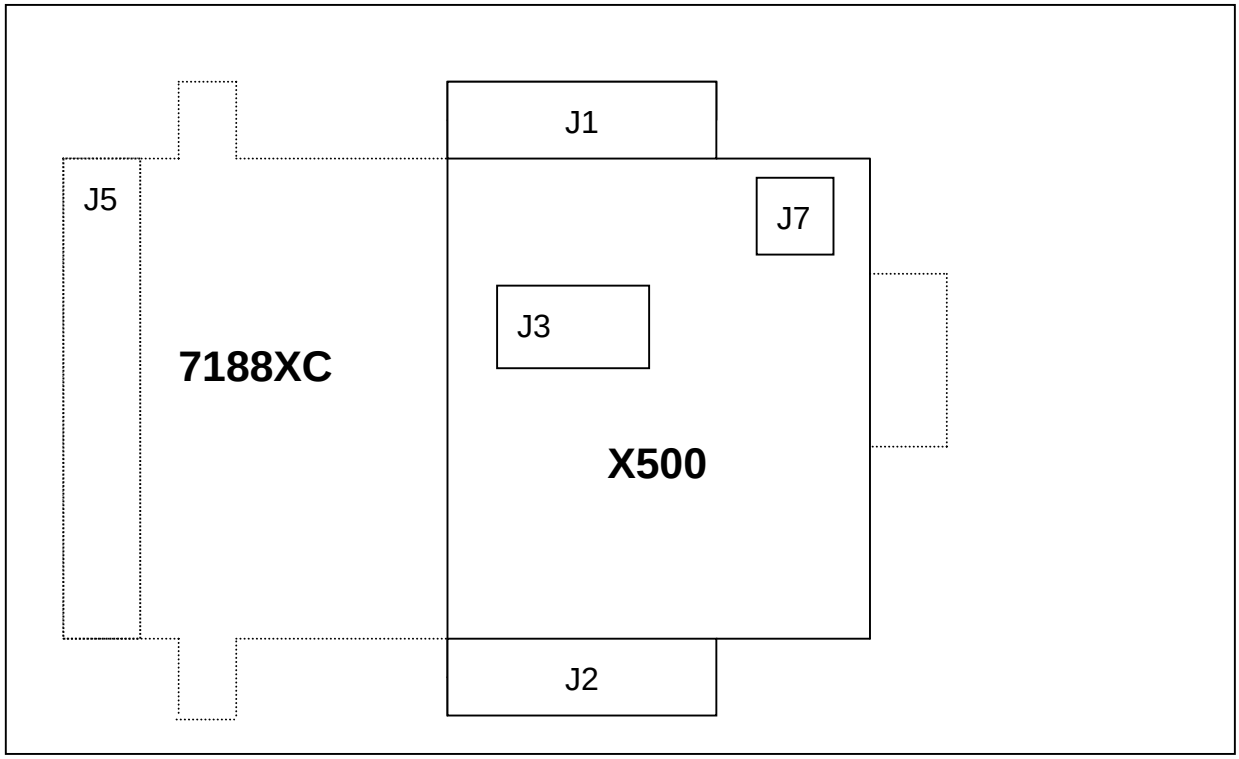


Figure 1

Note: There are two type of functions in X500.

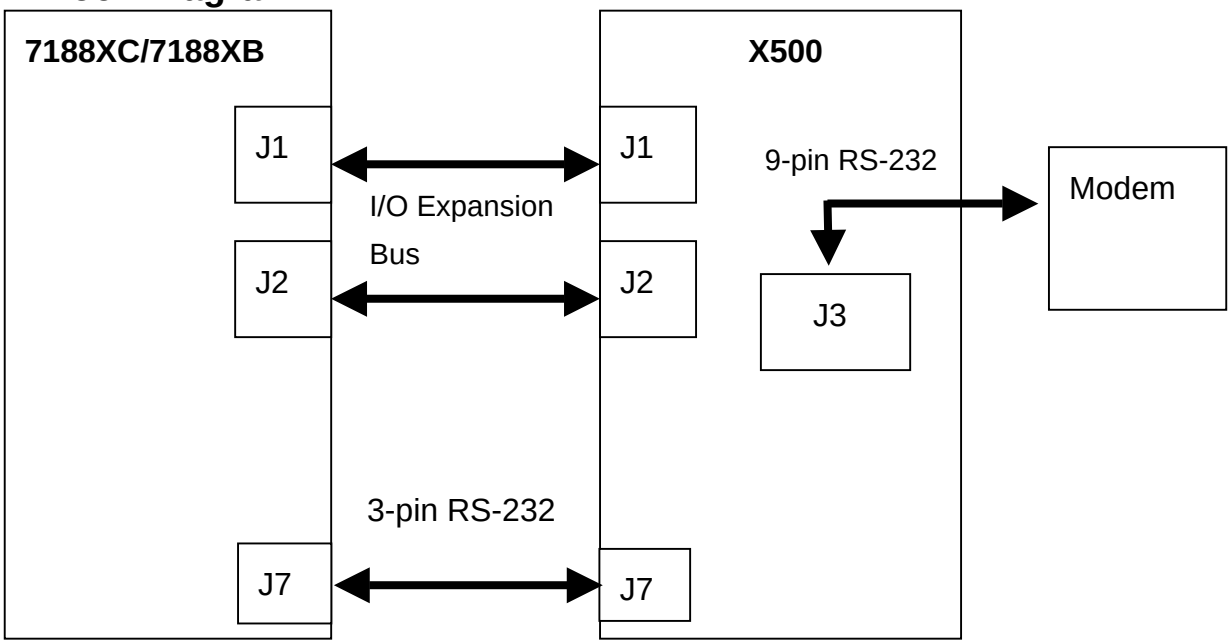
1. COM3 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
   This function without case.
2. COM3 : TXD, RXD, GND
   This function with case.

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- **J1:** I/O expansion bus, connect to J1 of 7188XC
- **J2:** I/O expansion bus, connect to J2 of 7188XC
- **J7:** Three wires of RS-232 (RXD, TXD, GND)
  Pin Assignment : refer to Figure 1 on page 90.
- **J3:** 9-pin connector of RS-232, connect to modem

Block Diagram



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12.1.3 Programming :

Compatible to **COM3** of 7188X software library

int InstallCom3(unsigned long baud, int data, int parity, int stop);
int RestoreCom3(void);
int IsCom3(void);
int ToCom3(int data);
int ToCom3Str(char *str);
int ToCom3Bufn(char *buf,int no);
int printCom3(char *fmt,...);
void ClearTxBuffer3(void);
int SetCom3FifoTriggerLevel(int level);
int SetBaudrate3(unsigned long baud);
int ReadCom3(void);
int ClearCom3(void);
int DataSizeInCom3(void);
int WaitTransmitOver3(void);
int IsTxBufEmpty3(void);
int IsCom3OutBufEmpty(void);

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12.2 X501: RS232 * 1

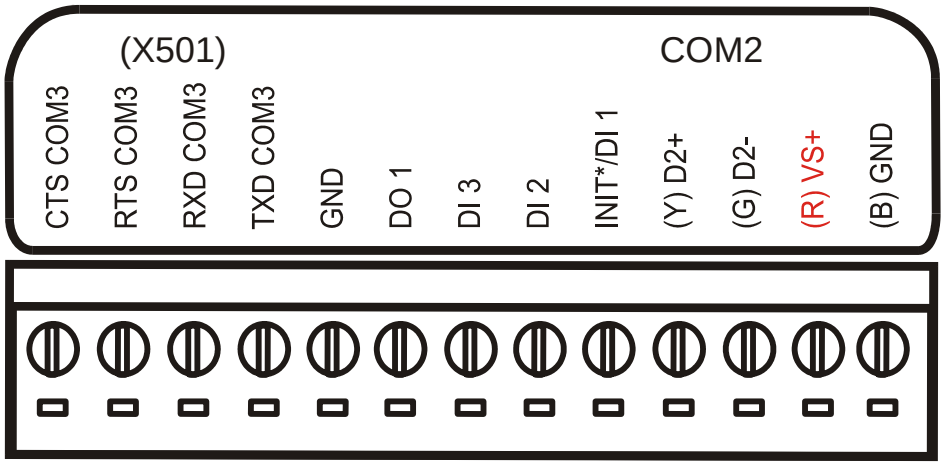
12.2.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : **1**
- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.2.2 Pin Assignment :



12.2.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.3 X502: RS232 * 1

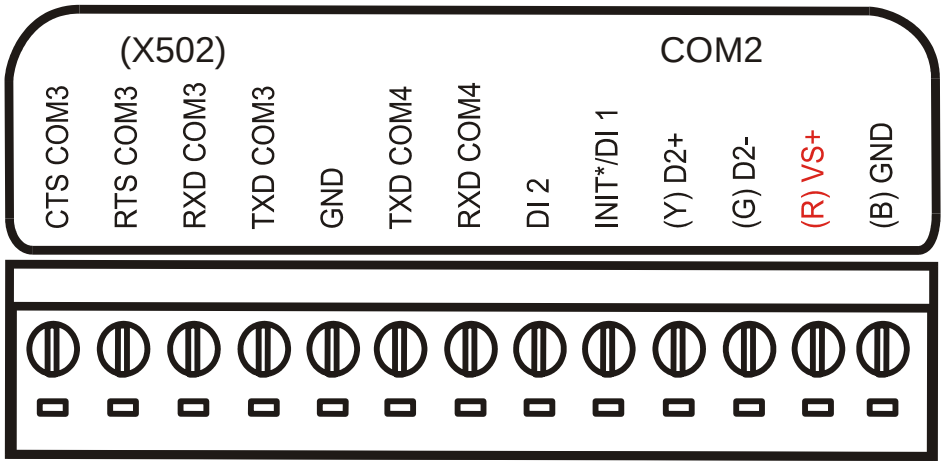
12.3.1 Specifications

For I-7188XC

Parallel I/O :

- RS-232 port : **2**
- COM3 : TXD, RXD, RTS, CTS, GND
- COM4: TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.3.2 Pin Assignment :



12.3.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.4 X503: RS232 * 1

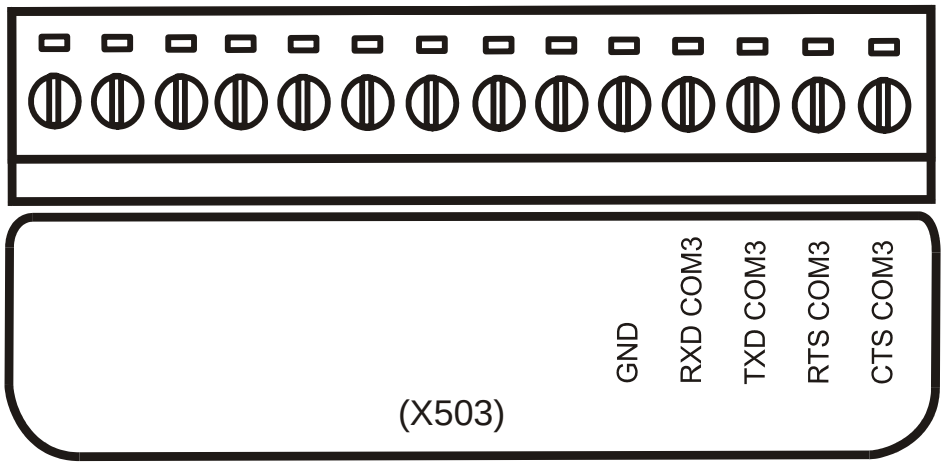
12.4.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- RS-232 port : **1**
- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.4.2 Pin Assignment :



12.4.3 Programming :

I-7188E4 and **X503 + I-7188EX** are software the same.

I-7523 and **X503 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.5 X504: RS232 * 2

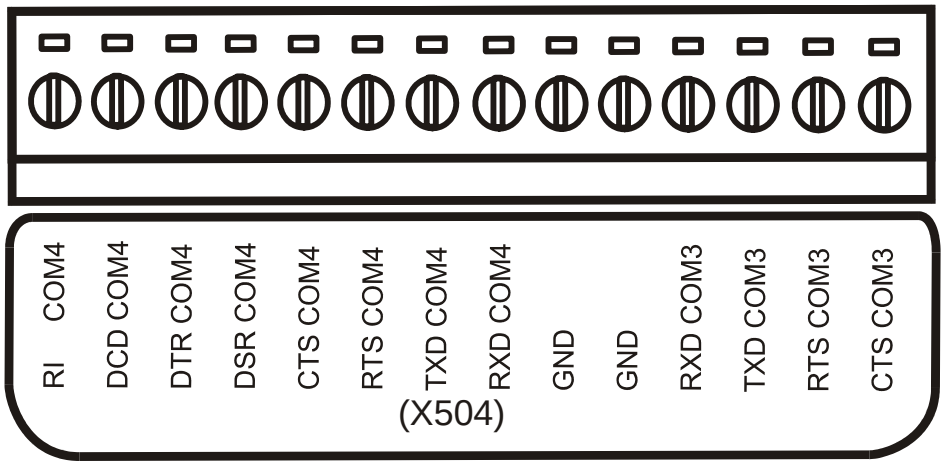
12.5.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- COM4 : TXD, RXD, RTS, CTS, DSR, DTR, DCD, RI, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Modem control
- Isolated : none

12.5.2 Pin Assignment :



12.5.3 Programming :

I-7188E4 and **X504 + I-7188EX** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.6 X505: RS232 * 3

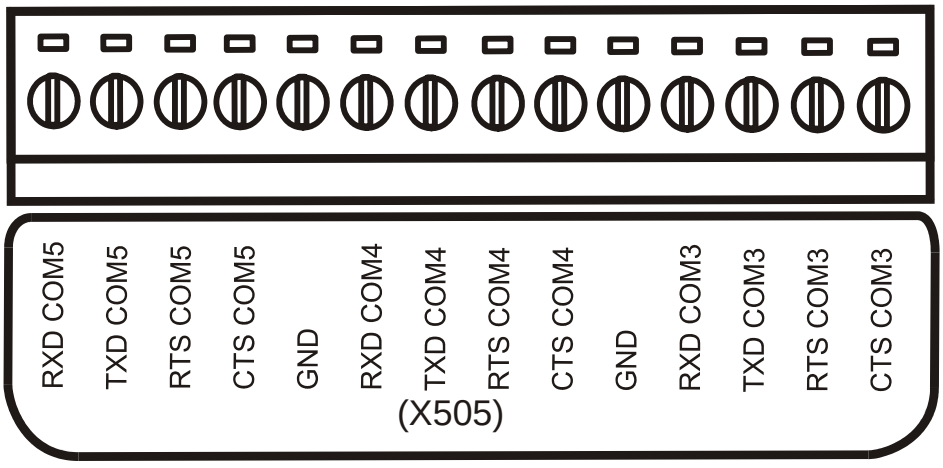
12.6.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- COM4 : TXD, RXD, RTS, CTS, GND
- COM5 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.6.2 Pin Assignment :



12.6.3 Programming :

I-7188E5 and **X505 + I-7188EX** are software the same.

I-7524 and **X505 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.7 X506: RS232 * 6

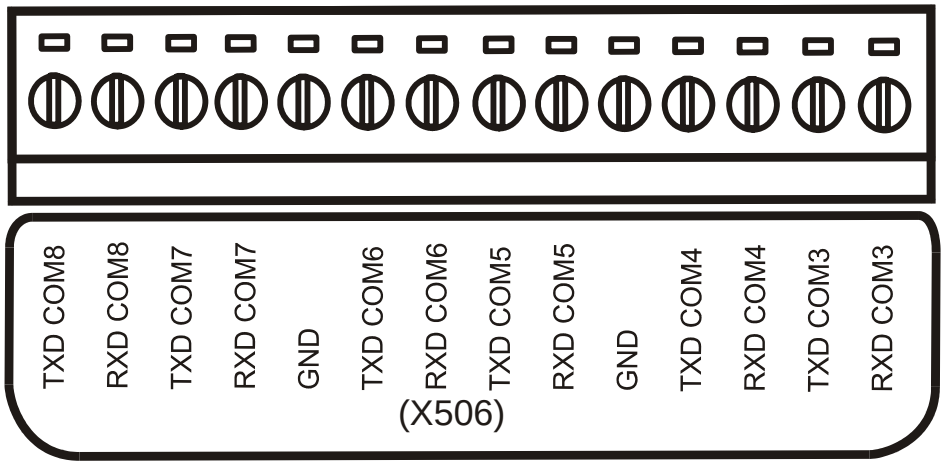
12.7.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- COM7 : TXD, RXD, GND
- COM8: TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.7.2 Pin Assignment :



12.7.3 Programming :

I-7188E8 and **X506 + I-7188EX** are software the same.

I-7527 and **X506 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.8 X507: RS422 * 1 + DO*4 + DI*4

12.8.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TxD+, TxD -RxD+, RxD -
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Digital Input :

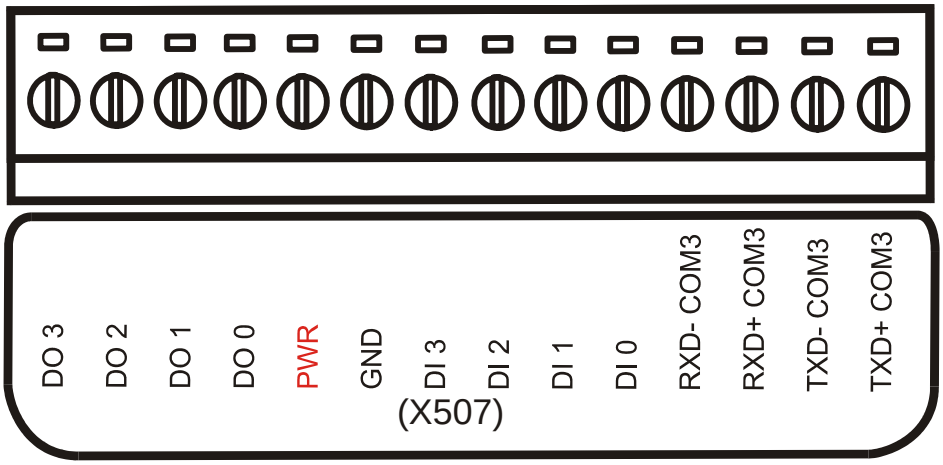
- Channels: **4**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **4**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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12.8.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.8.3 Programming :

I-7188E3 and **X507 + I-7188EX** are software the same.

I-7522A and **X507 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.9 X508: RS232 * 1 + DO*4 + DI*4

12.9.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, RTS, CTS, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Digital Input :

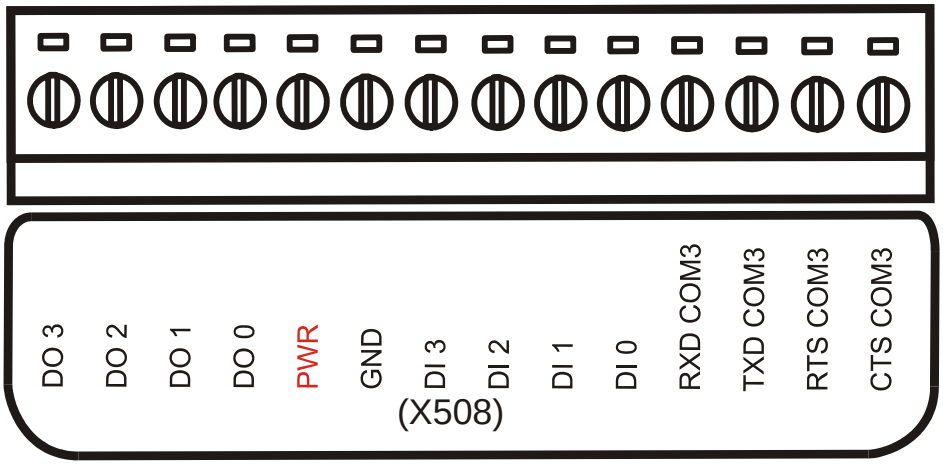
- Channels: **4**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **4**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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12.9.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.9.3 Programming :

I-7188E3-232 and **X508 + I-7188EX** are software the same.

I-7522A and **X508 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.10 X509: RS232 * 2 + DO*4 + DI*4

12.10.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Digital Input :

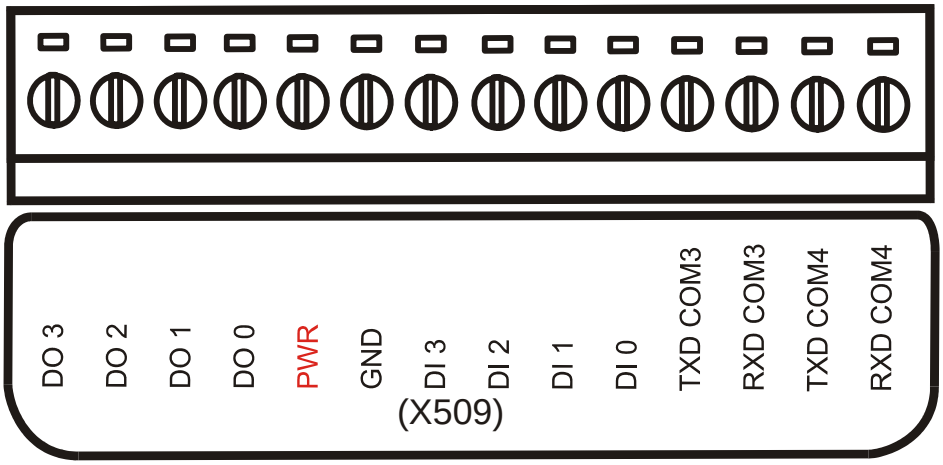
- Channels: **4**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **4**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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12.10.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.10.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.11 X510: RS232 * 1 + DO*5 + DI*5

12.11.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG
EEPROM: 128K * 2 bytes For X510
EEPROM: 128K * 1 bytes For X510-128

Parallel I/O :

- COM3 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Digital Input :

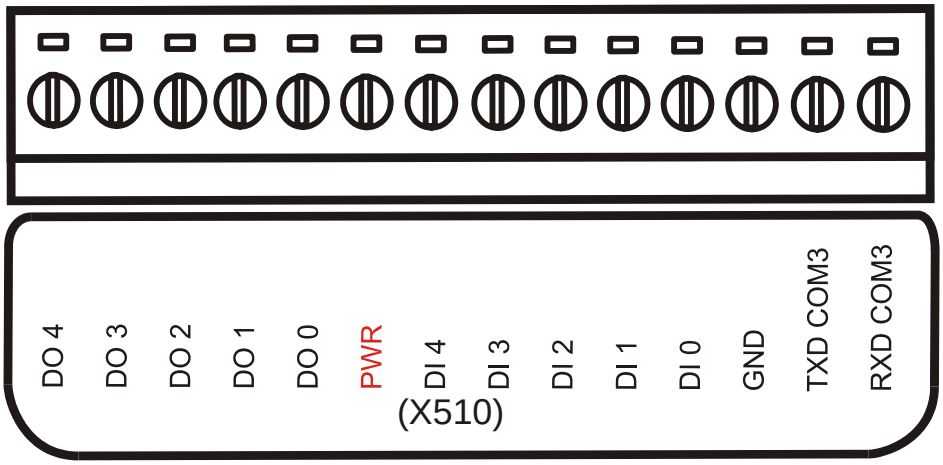
- Channels: **5**
  Input Range / Type: Logic high level (3.5V~30V),
  Logic low level (0V~1V)
- Isolated: none

Digital Output:

- Channels: **5**
- Open-collector Output: 100 mA / 30V max
- Isolated: none

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12.11.2 Pin Assignment :



Note: refer to section 3. for A/D, D/A, DI, DO wire connection.

12.11.3 Programming :

I-7188E3 and **X510 + I-7188EX** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.12 X511: RS485 * 3

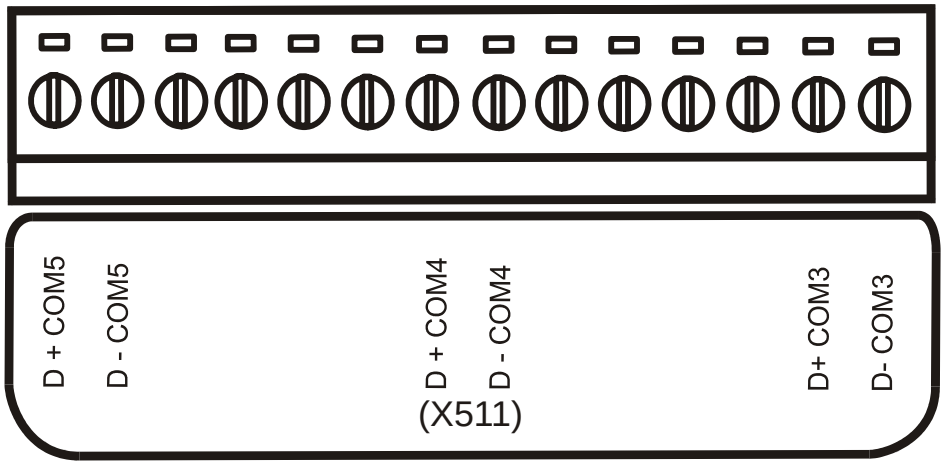
12.12.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : Data+, Data-
- COM4 : Data+, Data-
- COM5 : Data+, Data-
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.12.2 Pin Assignment :



12.12.3 Programming :

I-7188E5 and **X511 + I-7188EX** are software the same.

I-7524 and **X511 + I-7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.13 X512: RS-232 * 4 + RS485 * 1

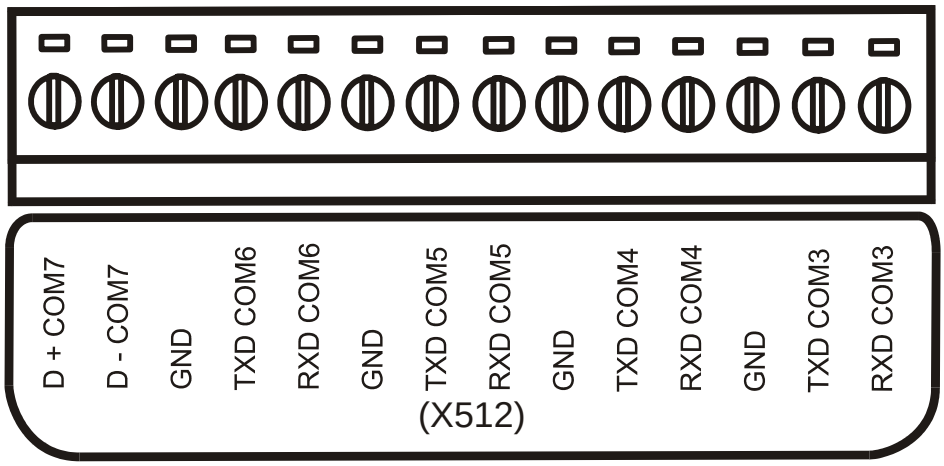
12.13.1 Specifications :

For I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

- COM3 : TXD, RXD, GND
- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- COM7 : Data+, Data-
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

12.13.2 Pin Assignment :



12.13.3 Programming :

I-7188E8 and **X512 + I-7188EX** are software the same.

I-7527 and **X512 + I7188XB** are software the same.

For Software Installation & Demo Program, Refer to Section 2.2.2

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12.14 X560: RS-232 * 3 + 8 M Flash

12.14.1 Specifications :

＊＊ The module without case. ＊＊

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG

Parallel I/O :

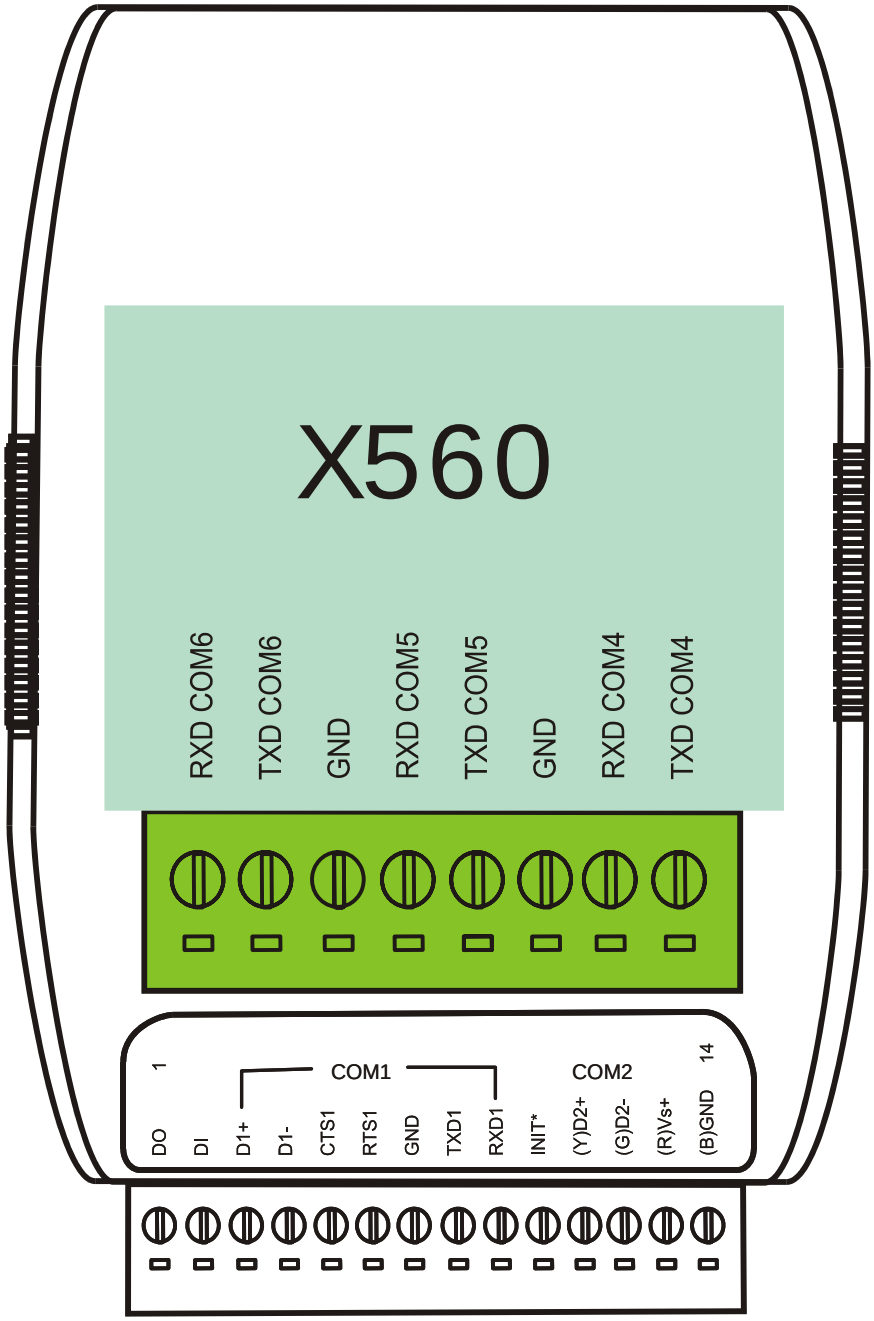
- COM4 : TXD, RXD, GND
- COM5 : TXD, RXD, GND
- COM6 : TXD, RXD, GND
- 16550 compatible
- Internal FIFO : 16 bytes
- Transmission speed: 115.2K BPS max.
- Isolated : none

Storage flash, 8M bytes :

- Endurance : 1,000,000 Program/Erase Cycles
- Data Retention : 10 years

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12.14.2 Pin Assignment :



12.14.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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13. X6xx I/O Expansion Boards

13.1 X600 and X601 : Flash ROM

13.1.1 Specifications

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG
Power consumption: 0.5W

X600: storage flash, 4M bytes
Endurance : 1,000,000 Program/Erase Cycles
Data Retention : 10 years

X601: storage flash, 8M bytes
Endurance : 1,000,000 Program/Erase Cycles
Data Retention : 10 years

13.1.2 Software Library :

```
int   X600_Init(int wBaseAddr, int wType);
int   X600_Reset_FLASH(void);
int   X600_WP_FLASH(char wp);
void X600_Read_FLASH_ID(int *maker, int *device);
void X600_Read_FLASH_Status(int *status);
int   X600_MarkBadPage(unsigned int wAddr);
int   X600_Erase_FLASH(unsigned int wAddr);
int   X600_Erase_FLASH_Unconditional(unsigned int wAddr);
int   X600_Write_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
int   X600_Read_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
```

13.1.3 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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13.2 X607 and X608: SRAM

13.2.1 Specifications

X607 : 128K bytes battery backup
X608 : 512K bytes battery backup

For I-7188XA, I-7188XC, I-7188XB, I-7188XG, I-7188EX, I-7188EG
*** X607 and X608 are support file system. ***
Power consumption: 0.5W

Introduction:
There are two modes of power supplies to SRAM, I-7188(VCC) mode and battery mode. The voltage of the battery is 3 V, the voltage of I- I-7188 mode is 5 V. I-7188 (VCC) is the primary power supply when it is powered on. SRAM will consume the battery power if I-7188 power off.

SRAM requires a minimum of 2.0 V at battery mode. Data loss happens when power voltage is less than 2.0 V. An automatic backup will take place when I-7188 is power off. The battery is replaceable. However, there is a risk to loose data during the process of changing batteries.

Specifications:
1. The minimum data retention supply voltage is 2.0V
2. The X607 can provide 9 years backup time
   (Shutdown 24 hours everyday).
3. The X608 can provide 2 years backup time.
   (Shutdown 24 hours everyday).
4. Operating temperature: +0°C to +70°C

13.2.2 Programming :

For Software Installation & Demo Program, Refer to Section 2.2.2

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