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1. Introduction

1.1 What is the I/O Expansion Bus?

The Micro PLC w/ Internet is made by EX9188EX/EX9188EX-MTCP & Micro PLC w/ Internet(EX9188EX/EX9188EX-MTCP) 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, UART, Flash memory, battery backup SRAM & other I/O functions. All kinds of I/O functions can be implemented on this bus.

1.2 The power consumption table :

Micro PLC w/Internet	EX9188EX	EX9188EX-MTCP	Note
CPU Module	290mA@5V	290mA@5V	Power consumption of 7-SEG LED is 140 mA
I/O Expansion Board	260mA@5V	260mA@5V	
Total Max.	550mA@5V	550mA@5V	

2. Expansion Board Command Sets:

EX509 series with RS232 *2 port func. which Library & Demo Program is fully compatible with EX9188END/EX9188END-MTCP series .

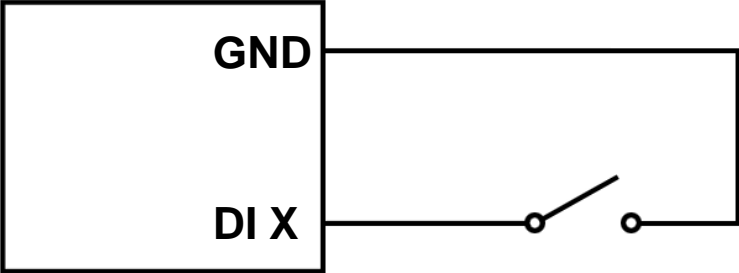
TOPSCCC Xcom_E Support Commands

Command	Explanations	Example	
		Sends to EX9188END-MTCP	Receives from EX9188END-MTCP
30[<i>arg</i>]	Set EX310 DA output	30Nbcd: where N=0: o/p to DA ch0, N=1: o/p to DA ch1, N=2: o/p same Voltage to DA ch0 & DA ch1 bcd: hex value(000~fff) 000:lowest scale (0 V) fff: full scale(10V)	OK
31[<i>arg</i>]	Read EX310 AD input	31N where N=0: AD ch0 (current i/p), N=1: AD ch1 (Voltage i/p),	bcd : hex value (000~fff) 000:lowest scale (0 mA or 0 V) fff: full scale(20mA or 10 V)
40[<i>arg</i>]	Set EX509 or EX310 or EX100 or Ex101 Digital Output	40dd where dd: hex value(00~ff) map to digital o/p bit	OK
41	Read EX509 or EX310 or EX100 or Ex101 Digital Input	41	dd: hex value(00~ff) map to digital i/p bit

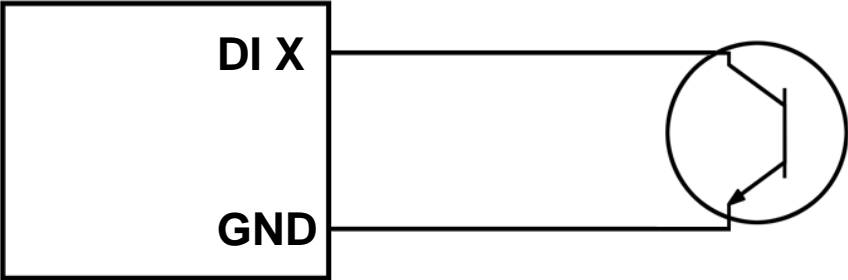
3. Wire Connection :

3.1 Digital Input:

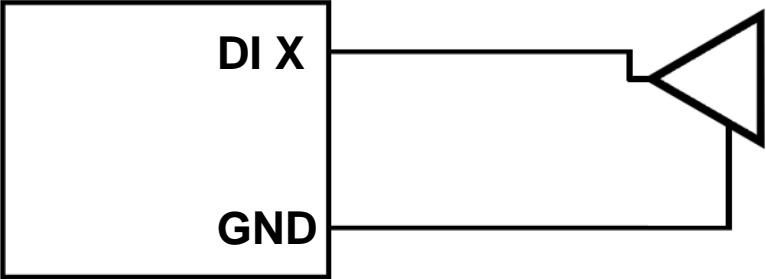
Dry Contact Signal I/P



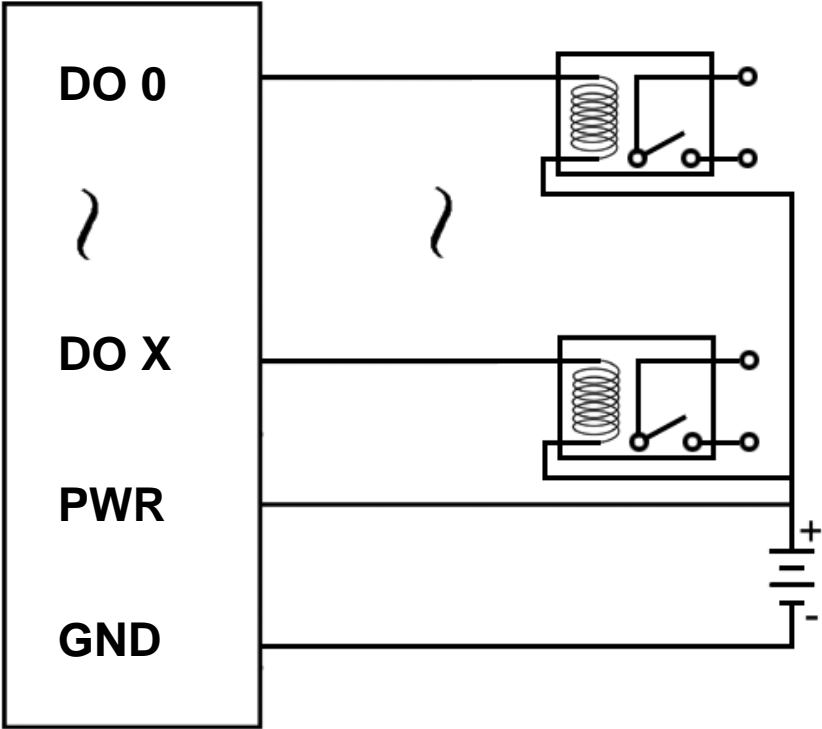
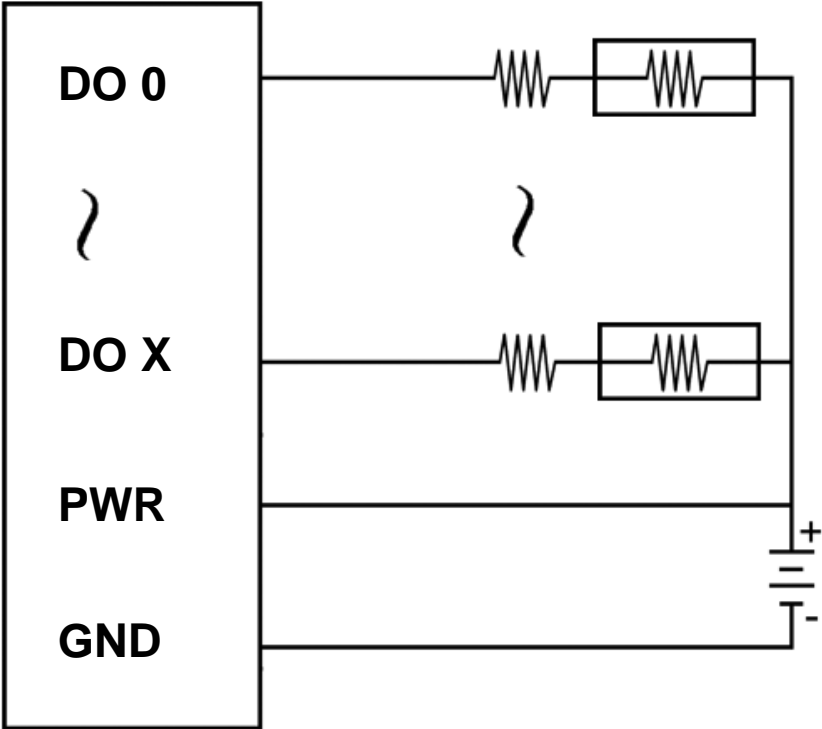
Open Collector Signal I/P



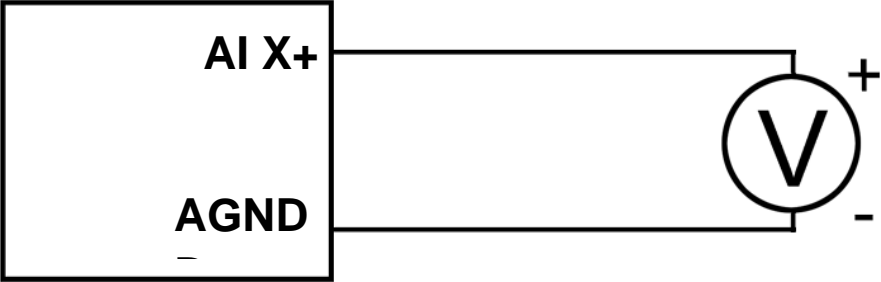
TTL/CMOS Signal I/P



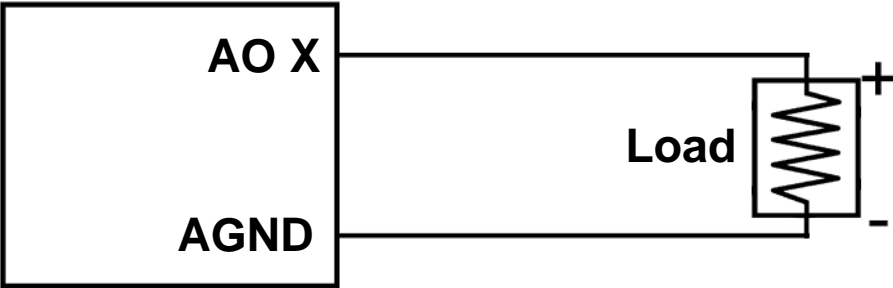
3.2 Digital Output:



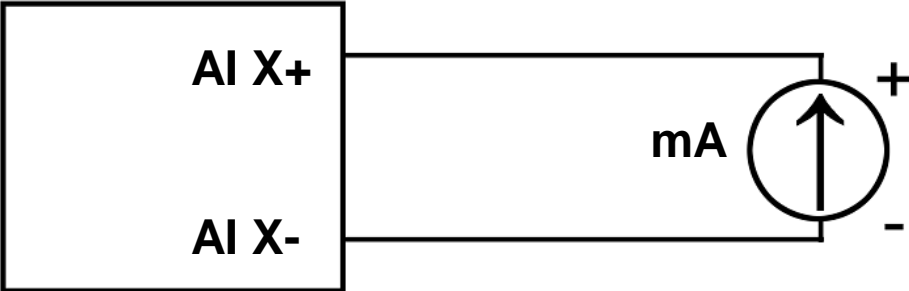
3.3 Voltage Input:



3.4 Voltage Output:



3.5 Current Input:



4. What main board is suitable for I/O Expansion board :

4.1 Micro PLC with Internet

(Modbus/TCP Embedded Controller with I/O Expansion Bus)

EX9188EX-MTCP Features:

Modbus/TCP to multi Modbus/RTU

For Modbus / RTU slave devices

For non-Modbus / RTU serial devices

Support 1*RS232 & 1*485

Ethernet port for TCP/IP features: TCP, UDP, IP, ICMP, ARP, RARP

COM1 can be used to download program and can be RS232 port

Dual Watchdog support for system recovery

CPU 80188, 40MHZ

SRAM 512KB

FLASH ROM 512KB

EEPROM 2KB

RTC / NVRAM

EMBEDDED OS RomDos (Datalight)

Build-in I/O Expansion Bus

Operating Temp -25 ~ 75

Note: Detailed please check Operation Manual of EX9188END series

4.2 Micro PLC w/ Internet

(Embedded Internet communication controller with I/O Expansion Bus)

EX9188EX Features:

Support 1*RS232 & 1*485

Ethernet port for TCP/IP features: TCP, UDP, IP, ICMP, ARP, RARP

COM1 can be used to download program and can be RS232 port

Dual Watchdog support for system recovery

CPU 80188, 40MHZ

SRAM 512KB

FLASH ROM 512KB

EEPROM 2KB

RTC / NVRAM

EMBEDDED OS RomDos (Datalight)

Build-in I/O Expansion Bus

Operating Temp -25 ~ 75

Note: Detailed please check Operation Manual of EX9188END series

5. I/O Expansion Board for option: (Selection Guide)

table:

		RS232	SRAM	Storage Flash	DI	DO	D/A	A/D
EX100					*7			
EX101						*7		
EX310 Series	EX310-1				*3	*2	*2	*2
	EX310-2				*2	*3	*1	*1
	EX310-3				*3	*2	*1	*1
	EX310-4				*2	*3		*2
	EX310-5				*3	*2	*2	
	EX310-6							*1
EX509 Series	EX509-1	*2			*5	*2		
	EX509-2	*2			*4	*3		
	EX509-3	*2			*3	*4		
	EX509-4	*2			*2	*5		
EX603				16M Bytes				
EX604				32M Bytes				
EX607			256K					
EX608			512K					

**P.S. RS232 3-Wire up to 115.2K
 SRAM with Battery Backup.
 D/A Range: 0~10V
 A/D Range: 0~10V/0~20mA**

Note: Detailed please check sec. 6/7/8/9 of Operation Manual of I/O Expansion Board for Micro PLC w/ Internet (EX9188EX/EX9188EX-MTCP)

6. EX100/101 of I/O Expansion Boards

6.1 EX100 (DI*7) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

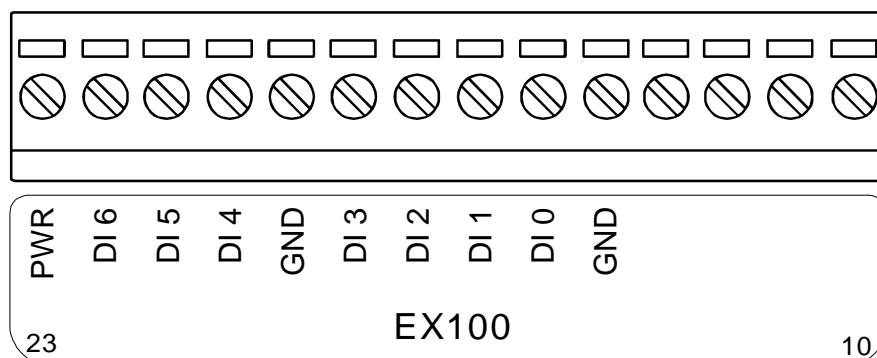
Channels: 7

Input Range / Type: Logic high level (3.5V~30V),

Logic low level (0V~1V)

Isolated: none

6.1 EX100 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

6.2 EX101 (DO*7) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

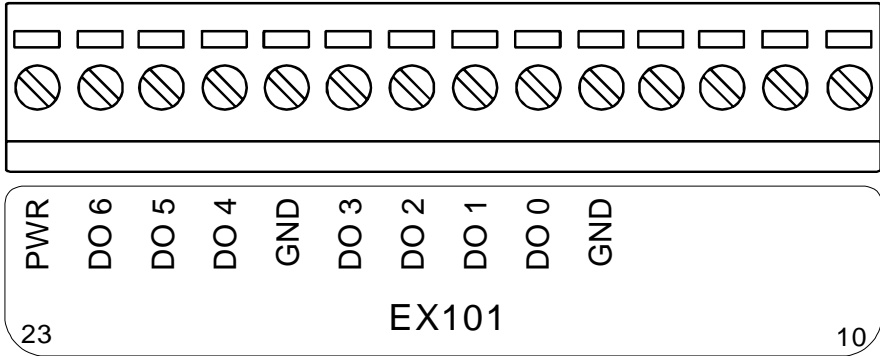
Digital Output:

Channels: 7

Open-collector Output: 100 mA / 30V max

Isolated: none

6.2 EX101 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7. EX310 Series of I/O Expansion Boards

7.1.1 EX310-1 (DI*3 + DO*2 + D/A*2 + A/D*2) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

Channels: 3

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

Analog Output:

Channel : 2

Resolution : 12bit

Output Range/Type : 0 ~ 10V

Sampling rate : 1300 Hz

Isolated : none

Analog Input:

Channel : 2 (Differential)

Resolution : 12bit

Input Range/Type :

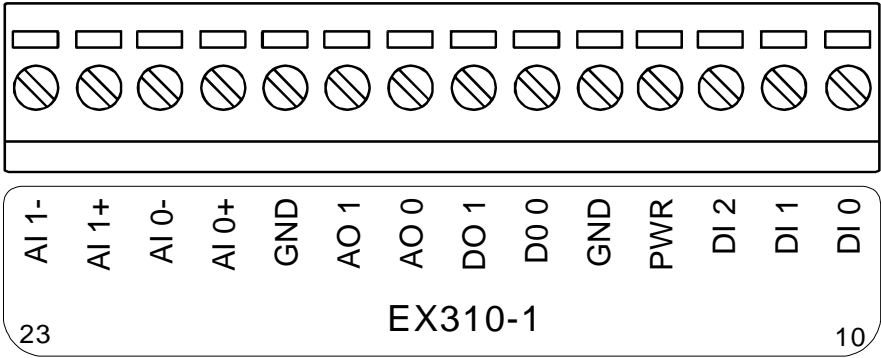
Ch0 : 0 ~ 20 mA

Ch1 : 0 ~ 10 V

Sampling rate : 1800 Hz

Isolated : none

7.1.2 EX310-1 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.2.1 EX310-2 (DI*2 + DO*3 + D/A*1 + A/D*1) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

Channels: 2

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

Analog Output:

Channel : 1

Resolution : 12bit

Output Range/Type : 0 ~ 10V

Sampling rate : 1300 Hz

Isolated : none

Analog Input:

Channel : 1 (Differential)

Resolution : 12bit

Input Range/Type :

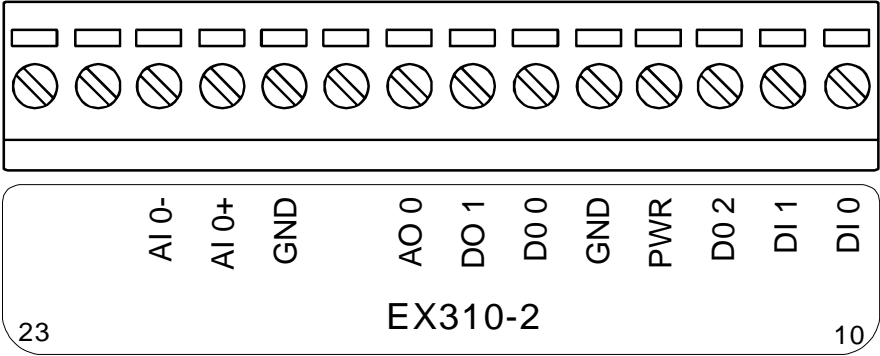
Ch0 : 0 ~ 20 mA

Ch1 : 0 ~ 10 V

Sampling rate : 1800 Hz

Isolated : none

7.2.2 EX310-2 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.3.1 EX310-3 (DI*3 + DO*2 + D/A*1 + A/D*1) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

Channels: 3

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

Analog Output:

Channel : 1

Resolution : 12bit

Output Range/Type : 0 ~ 10V

Sampling rate : 1300 Hz

Isolated : none

Analog Input:

Channel : 1 (Differential)

Resolution : 12bit

Input Range/Type :

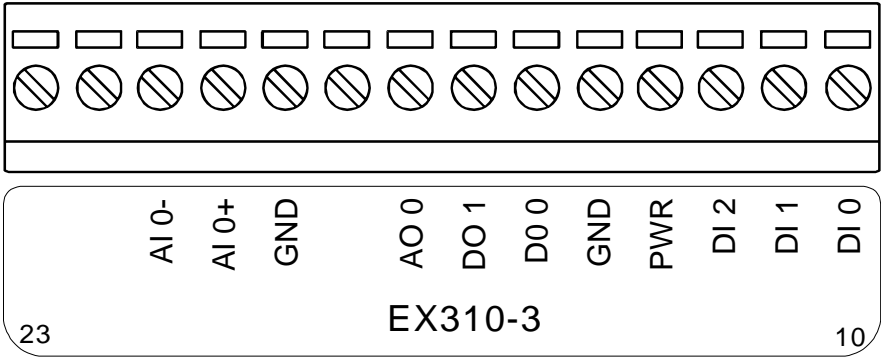
Ch0 : 0 ~ 20 mA

Ch1 : 0 ~ 10 V

Sampling rate : 1800 Hz

Isolated : none

7.3.2 EX310-3 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.4.1 EX310-4 (DI*2 + DO*3 + A/D*2) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

Channels: 2

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

Analog Input:

Channel : 1 (Differential)

Resolution : 12bit

Input Range/Type :

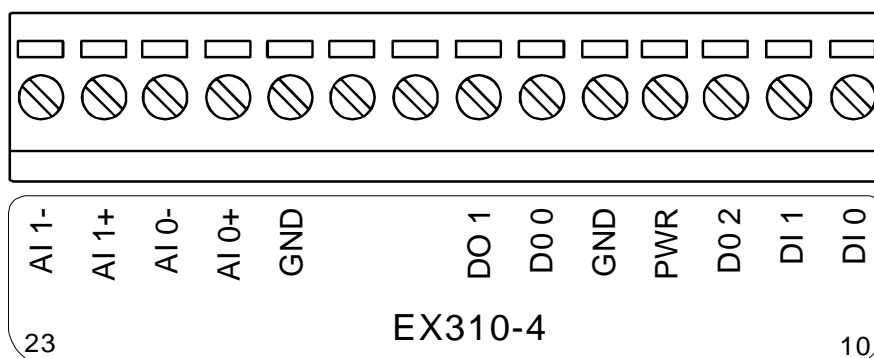
Ch0 : 0 ~ 20 mA

Ch1 : 0 ~ 10 V

Sampling rate : 1800 Hz

Isolated : none

7.4.2 EX310-4 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.5.1 EX310-5 (DI*3 + DO*2 + D/A*2) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Digital Input:

Channels: 3

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

Analog Output:

Channel : 2

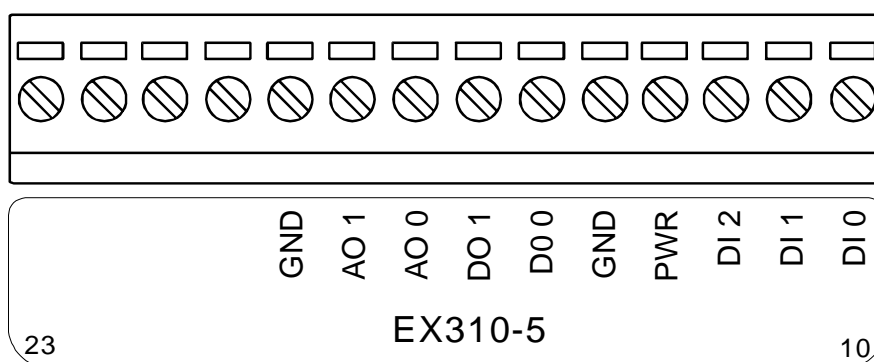
Resolution : 12bit

Output Range/Type : 0 ~ 10V

Sampling rate : 1300 Hz

Isolated : none

7.5.2 EX310-5 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.6.1 EX310-6 (A/D*1) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

Analog Input:

Channel : 1 (Differential)

Resolution : 12bit

Input Range/Type :

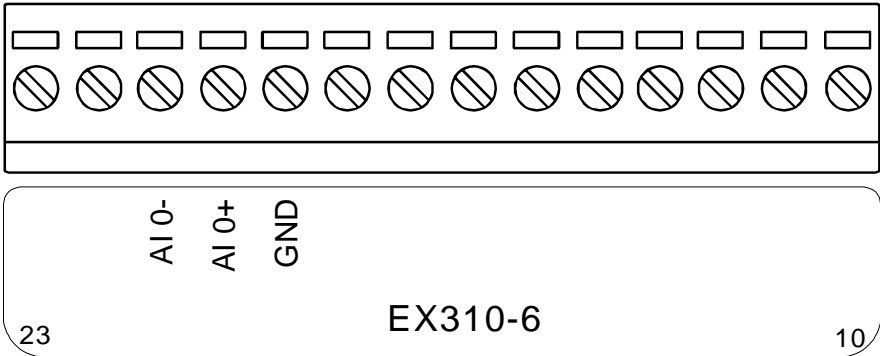
Ch0 : 0 ~ 20 mA

Ch1 : 0 ~ 10 V

Sampling rate : 1800 Hz

Isolated : none

7.6.2 EX310-6 Pin Assignment:



Note: Refer sec. 3 of A/D, D/A, DI, DO wire connection.

7.7 Programming:

For Software Installation & Demo Program, as follows:

Note1: The **DI** default value of BASE is **0**.

Note2: The **DO** default value of BASE is **0**.

[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 conversion)

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

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

[D/A]

throughput : 1300 data/sec (with floating conversion)

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

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

[D/O]

throughput: can generates 2KHz square wave signals.

8. EX509 Series of I/O Expansion Boards

8.1.1 EX509-1 (RS232*2 + DI*5 + DO*2) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

COM Port:

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: 5

Input Range / Type: Logic high level (3.5V~30V),

Logic low level (0V~1V)

Isolated: none

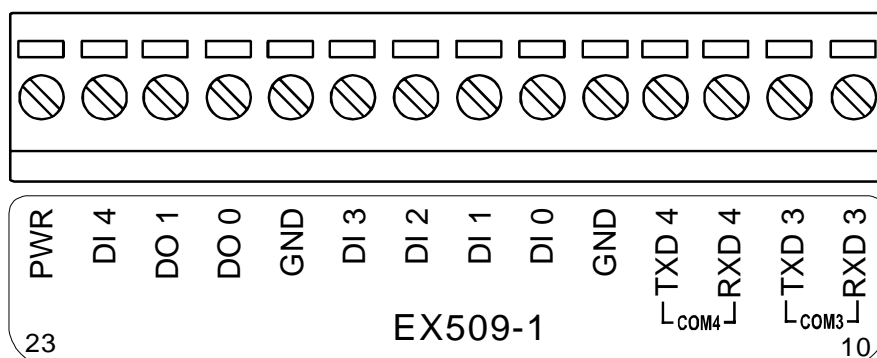
Digital Output:

Channels: 2

Open-collector Output: 100 mA / 30V max

Isolated: none

8.1.2 EX509-1 Pin Assignment:



Note: refer sec. 3 of A/D, D/A, DI, DO wire connection.

8.2.1 EX509-2 (RS232*2 + DI*4 + DO*3) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

COM Port:

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

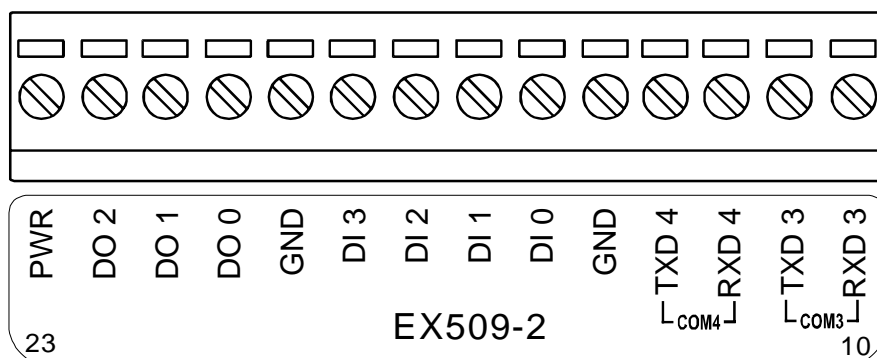
Digital Input:

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

Digital Output:

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

8.2.2 EX509-2 Pin Assignment:



Note: refer sec. 3 of A/D, D/A, DI, DO wire connection.

8.3.1 EX509-3 (RS232*2 + DI*3 + DO*4) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

COM Port:

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

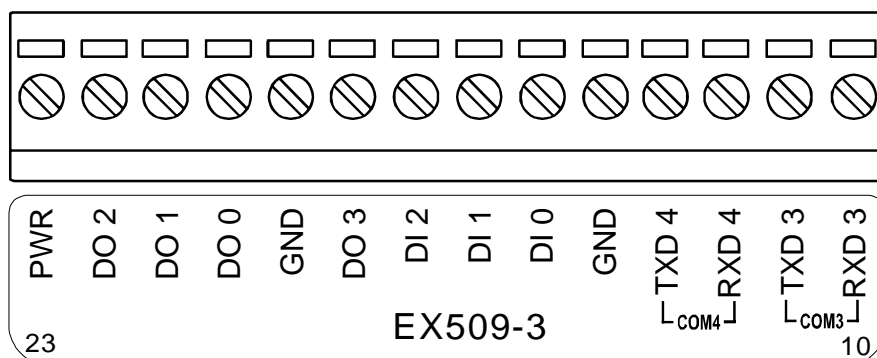
Digital Input:

Channels: 3
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

8.3.2 EX509-3 Pin Assignment:



Note: refer sec. 3 of A/D, D/A, DI, DO wire connection.

8.4.1 EX509-4 (RS232*2 + DI*2 + DO*5) Specifications:

For **Micro PLC w/ Internet (EX-9188EX & EX9188EX-MTCP)**

COM Port:

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

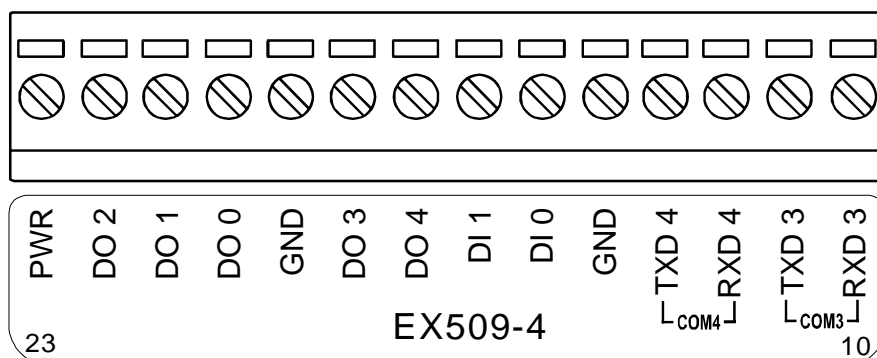
Digital Input:

Channels: 2
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

8.4.2 EX509-4 Pin Assignment:



Note: refer sec. 3 of A/D, D/A, DI, DO wire connection.

8.5 Programming :

For Software Installation & Demo Program Please refer COM3 & COM4 of EX9188A8D & EX9188END-MTCP series software Demo/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);
```

Note1: The DI default value of BASE is 0.

Note2: The DO default value of BASE is 0.

9. EX603/04 of I/O Expansion Board

16MB/32MB of Flash ROM

9.1 Specifications:

For Micro PLC w/ Internet (**EX9188EX/EX9188EX-MTCP**)

EX603: 16M bytes Flash ROM

EX604: 32M bytes Flash ROM

Endurance : 1,000,000 Program/Erase Cycles

Data Retention : 10 years

Power consumption: 0.5W

9.2 Software Library:

```
int EX600_Init(int wBaseAddr, int wType);
int EX600_Reset_FLASH(void);
int EX600_WP_FLASH(char wp);
void EX600_Read_FLASH_ID(int *maker, int *device);
void EX600_Read_FLASH_Status(int *status);
int EX600_MarkBadPage(unsigned int wAddr);
int EX600_Erase_FLASH(unsigned int wAddr);
int EX600_Erase_FLASH_Unconditional(unsigned int wAddr);
int EX600_Write_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
int EX600_Read_FLASH(unsigned int wAddr, char buf1[], char buf2[]);
```

9.3 Programming :

For Software Installation & Demo Program, as follows:

10. EX607/EX608: 256KB/512KB SRAM w/ Battery

10.1 Specifications:

For Micro PLC w/ Internet (EX9188EX/EX9188EX-MTCP)

EX607 : 256K bytes w/ battery backup

EX608 : 512K bytes w/ battery backup

*** EX607 and EX608 are support file system ***

Power consumption: 0.5W

Introduction:

There are two modes of power supplies to SRAM, EX9188(VCC) mode and battery mode.

The voltage of the battery is 3 V, the voltage of EX9188 mode is 5 V.

EX9188 (VCC) is the primary power supply when it is powered on.

SRAM will consume the battery power if EX9188 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 EX9188 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 EX607 can provide 7-8 years backup time (Shutdown 24 hours everyday).
3. The EX608 can provide 7-8 years backup time. (Shutdown 24 hours everyday).
4. Operating temperature: +0°C to +70°C

10.2 Programming:

For Software Installation & Demo Program, as follows: