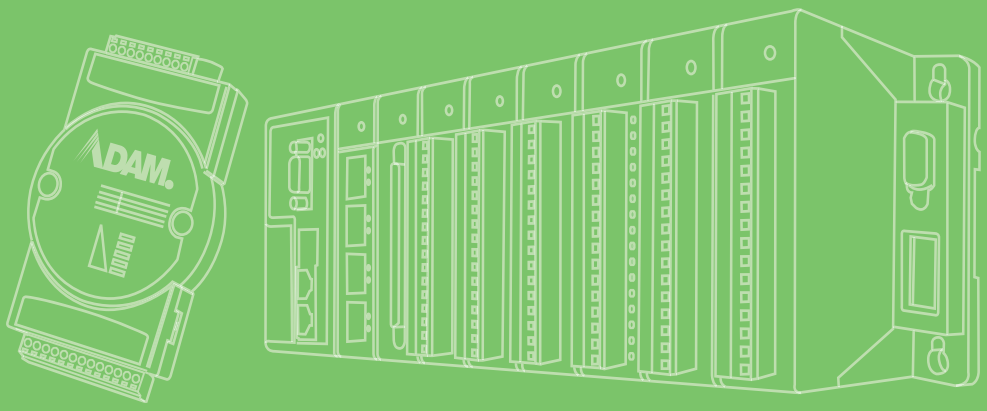

User Manual

ADAM-5000 Series

I/O Modules

ADVANTECH
eAutomation

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2. Call your dealer and describe the problem. Please have your manual, product, and any helpful information readily available.
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5. Write the RMA number visibly on the outside of the package and ship it prepaid to your dealer.

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Declaration of Conformity

CE

This product has passed the CE test for environmental specifications when shielded cables are used for external wiring. We recommend the use of shielded cables. This kind of cable is available from Advantech. Please contact your local supplier for ordering information.

FCC Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

FM

This equipment has passed the FM certification. According to the National Fire Protection Association, work sites are classified into different classes, divisions and groups, based on hazard considerations. This equipment is compliant with the specifications of Class I, Division 2, Groups A, B, C and D indoor hazards.

Technical Support and Assistance

1. Visit the Advantech web site at www.advantech.com/support where you can find the latest information about the product.
2. Contact your distributor, sales representative, or Advantech's customer service center for technical support if you need additional assistance. Please have the following information ready before you call:
   - Product name and serial number
   - Description of your peripheral attachments
   - Description of your software (OS, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Safety Precaution - Static Electricity

Follow these simple precautions to protect yourself from harm and the products from damage.

- To avoid electrical shock, always disconnect the power from your PC chassis before you work on it. Don't touch any components on the CPU card or other cards while the PC is on.

Disconnect power before making any configuration changes. The sudden rush of power as you connect a jumper or install a card may damage sensitive electronic components.

Safety Instructions

1. Read these safety instructions carefully.
2. Keep this User Manual for later reference.
3. Disconnect this equipment from any AC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
4. For plug-in equipment, the power outlet socket must be located near the equipment and must be easily accessible.
5. Keep this equipment away from humidity.
6. Put this equipment on a reliable surface during installation. Dropping it or letting it fall may cause damage.
7. The openings on the enclosure are for air convection. Protect the equipment from overheating. DO NOT COVER THE OPENINGS.
8. Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
9. Position the power cord so that people cannot step on it. Do not place anything over the power cord.
10. All cautions and warnings on the equipment should be noted.
11. If the equipment is not used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
12. Never pour any liquid into an opening. This may cause fire or electrical shock.
13. Never open the equipment. For safety reasons, the equipment should be opened only by qualified service personnel.
14. If one of the following situations arises, get the equipment checked by service personnel:
15. The power cord or plug is damaged.
16. Liquid has penetrated into the equipment.
17. The equipment has been exposed to moisture.
18. The equipment does not work well, or you cannot get it to work according to the user's manual.
19. The equipment has been dropped and damaged.
20. The equipment has obvious signs of breakage.
21. DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -20° C (-4° F) OR ABOVE 60° C (140° F). THIS COULD DAMAGE THE EQUIPMENT. THE EQUIPMENT SHOULD BE IN A CONTROLLED ENVIRONMENT.
22. CAUTION: DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED. REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE RECOMMENDED BY THE MANUFACTURER, DISCARD USED BATTERIES ACCORDING TO THE MANUFACTURER'S INSTRUCTIONS.
23. The sound pressure level at the operator's position according to IEC 704-1:1982 is no more than 70 dB (A).

DISCLAIMER: This set of instructions is given according to IEC 704-1. Advantech disclaims all responsibility for the accuracy of any statements contained herein.

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Chapter 1

Overview

1.1 Introduction

This manual will discuss in detail the specifications, functions and application wiring of the ADAM-5000 series of I/O modules. To organize an ADAM-5510 Series Controller, you need to select I/O modules to interface the main unit with field devices or processes that you have previously determined. Advantech provides the following types of ADAM-5000 I/O modules for various applications so far. Following table is the I/O modules support list we provided for user's choice.

Table 1.1: Supported I/O Module List

Module	Name	Specification	Reference
Analog I/O	ADAM-5013	3-ch RTD input	Isolated
	ADAM-5017	8-ch AI	Isolated
	ADAM-5017P	8-ch AI with independent Input	Isolated
	ADAM-5017H	8-ch High-speed AI	Isolated
	ADAM-5017UH	8-ch Ultra High-speed AI	Isolated
	ADAM-5018	7-ch Thermocouple input	Isolated
	ADAM-5018P	7-ch Thermocouple input with independent Input	Isolated
	ADAM-5024	4-ch AO	Isolated
Digital I/O	ADAM-5050	16-ch DI/O	Non-isolated
	ADAM-5051	16-ch DI	Non-isolated
	ADAM-5051D	16-ch DI w/LED	Non-isolated
	ADAM-5051S	16-ch Isolated DI w/LED	Isolated
	ADAM-5052	8-ch DI	Isolated
	ADAM-5053S	32-ch Isolated DI	Isolated
	ADAM-5055S	16-ch. Isolated DI/O w/LED	Isolated
	ADAM-5056	16-ch DO	Non-isolated
	ADAM-5056D	16-ch DO w/LED	Non-isolated
	ADAM-5056S	16-ch Isolated DO w/LED	Isolated
	ADAM-5056SO	16-ch Iso. DO w/LED (source)	Isolated
	ADAM-5057S	32-ch Isolated DO	Isolated
Relay Output	ADAM-5060	6-ch. Relay output	Isolated
	ADAM-5069	8-ch Relay output	Isolated
Counter/ Frequency	ADAM-5080	4-ch Counter/Frequency	Isolated
	ADAM-5081	4-ch High Speed Counter/Frequency	Isolated
Serial I/O	ADAM-5090	4-port RS232	Non-isolated
	ADAM-5091	4-port RS232 with Share Interrupt	Non-isolated
	ADAM-5095	2-port CAN	Isolated
Storage	ADAM-5030	2-slot SD Storage Module	Non-isolated

1.2 Analog Input Modules

Analog input modules use an A/D converter to convert sensor voltage, current, thermocouple or RTD signals into digital data. The digital data is then translated into engineering units. The analog input modules protect your equipment from ground loops and power surges by providing opto-isolation of the A/D input and transformer based isolation up to 3,000 V_{DC}.

1.2.1 ADAM-5013 3-ch RTD Input Module

The ADAM-5013 is a 16-bit, 3-channel RTD input module that features programmable input ranges on all channels. This module is an extremely cost-effective solution for industrial measurement and monitoring applications. Its opto-isolated inputs provide 3,000 V_{DC} of isolation between the analog input and the module, protecting the module and peripherals from damage due to high input line voltage.

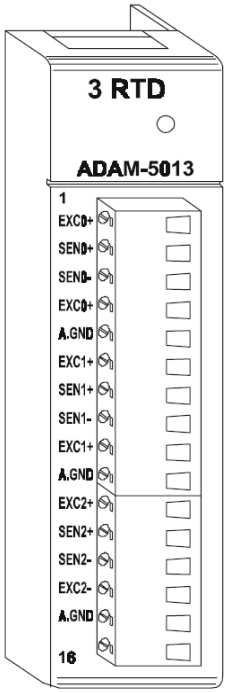


Figure 1.1 ADAM-5013 Module Front View

Application Wiring

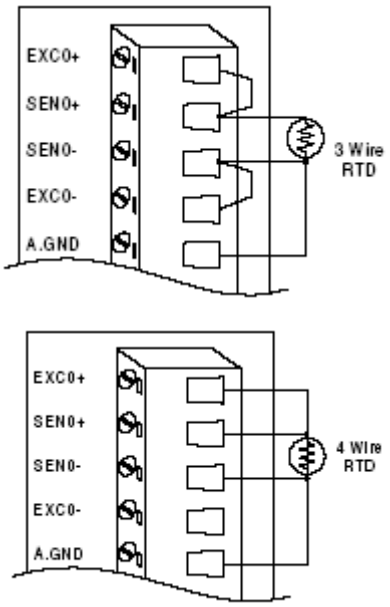


Figure 1.2 RTD Inputs

Technical Specifications of ADAM-5013

Table 1.2: Technical Specifications of ADAM-5013	
Analog input channels	3
Input type	Pt or Ni RTD
RTD type and temperature range	Pt -100 to 100°C a=0.00385
	Pt 0 to 100°C a=0.00385
	Pt 0 to 200°C a=0.00385
	Pt 0 to 600°C a=0.00385
	Pt -100 to 100°C a=0.00392
	Pt 0 to 100°C a=0.00392
	Pt 0 to 200°C a=0.00392
	Pt 0 to 600°C a=0.00392
	Ni -80 to 100°C
	Ni 0 to 100°C
Isolation voltage	3000 V_{DC}
Sampling rate	10 samples/sec (total)
Input impedance	2 MΩ
Bandwidth	13.1 Hz @ 50 Hz 15.72 Hz @ 60 Hz
Input connections	2, 3 or 4 wire
Accuracy	± 0.1% or better
Zero drift	± 0.015°C/°C
Span drift	± 0.01°C/°C
CMR@50/60 Hz	150 dB
NMR@50/60 Hz	100 dB
Power consumption	1.2 W

ADAM-5013 RTD Input Resistance Calibration

1. Apply power to the module and let it warm up for about 30 minutes.
2. Make sure that the module is correctly installed and is properly configured for the input range you want to calibrate. You can use the ADAM utility software to help in this.
3. Connect the correct reference self resistance between the screw terminals of the ADAM-5013 as shown in the following wiring diagram. Table 2 below shows the correct values of the span and zero calibration resistances to be connected. Reference resistances used can be from a precision resistance decade box or from discrete resistors with the values 60, 140, 200 and 440 ohms.

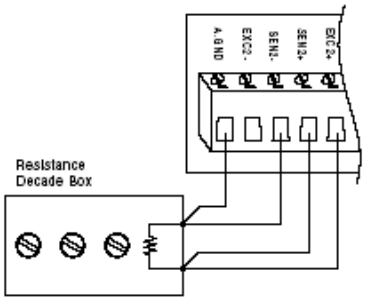


Figure 1.3 Applying Calibration Resistance

4. First, with the correct zero (offset) calibration resistance connected as shown above, issue a Zero Calibration command to the module using the Calibrate option in the ADAM utility software.
5. Second, with the correct span resistance connected as shown above, issue a Span Calibration command to the module using the Calibrate option in the ADAM utility software. Note that the module zero calibration must be completed prior to the span calibration.

Note! *If the above procedure is ineffective, the user must first issue an RTD Self Calibration command $aaSi2 to the module and then complete steps 4 and 5 after self calibration is complete.*

Table 1.3: Calibration Resistances of ADAM-5013

Input Range Code (Hex)	Input Range	Span Calibration Resistance	Zero Calibration Resistance
20	Pt, -100 to 100°C A = 0.00385	140 Ohms	60 Ohms
21	Pt, 0 to 100°C A = 0.00385	140 Ohms	60 Ohms
22	Pt, 0 to 200°C A = 0.00385	200 Ohms	60 Ohms
23	Pt, 0 to 600°C A = 0.00385	440 Ohms	60 Ohms
24	Pt, -100 to 100°C A = 0.003916	140 Ohms	60 Ohms
25	Pt, 0 to 100°C A = 0.003916	140 Ohms	60 Ohms
26	Pt, 0 to 200°C A = 0.003916	200 Ohms	60 Ohms
27	Pt, 0 to 600°C A = 0.003916	440 Ohms	60 Ohms
28	Ni, -80 to 100° C	200 Ohms	60 Ohms
29	Ni, 0 to 100°C	200 Ohms	60 Ohms

1.2.2 ADAM-5017 8-ch Analog Input Module

The ADAM-5017 is a 16-bit, 8-channel analog differential input module that provides programmable input ranges on all channels. It accepts millivolt inputs (±150mV, ±500mV), voltage inputs (±1V, ±5V and ±10V) and current input (±20 mA). The module provides data to the host computer in engineering units (mV, V or mA). This module is an extremely cost-effective solution for industrial measurement and monitoring applications. Its opto-isolated inputs provide 3,000 V_{DC} of isolation between the analog input and the module, protecting the module and peripherals from damage due to high input line voltage. Additionally, the module uses analog multiplexers with active over- voltage protection. The active protection circuitry assures that signal fidelity is maintained even under fault conditions that would destroy other multiplexers. This module can withstand an input voltage surge of 70 Vp-p with ±15 V supplies. The jumpers of ADAM-5017 are designed for current input. Refer to the diagram below for the locations (JP1). Short the pin-head by the jumpers to set the channel to be current mode.

ADAM-5017

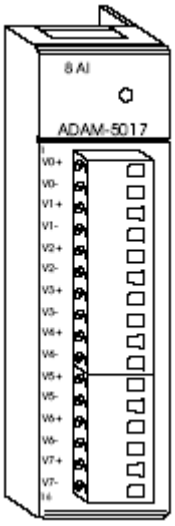


Figure 1.4 ADAM-5017 Module Front View

Application Wiring

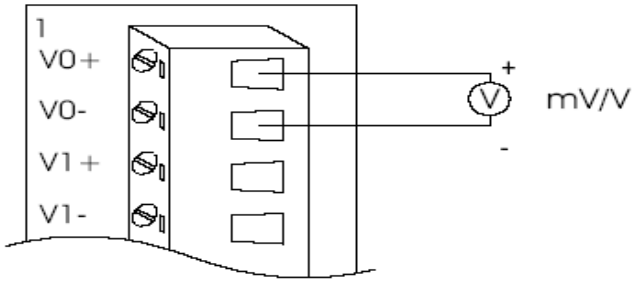


Figure 1.5 Millivolt and Volt Input

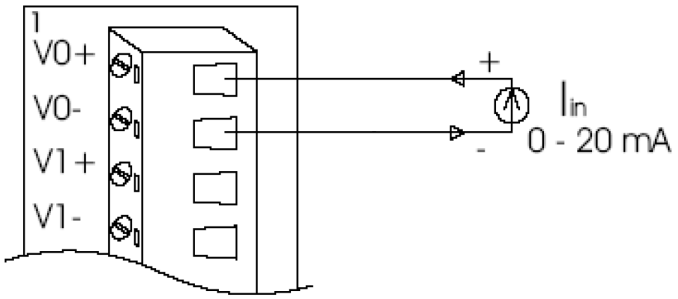


Figure 1.6 Process Current Input

Note! *To keep measurement accuracy please short the channels that are not in use.*

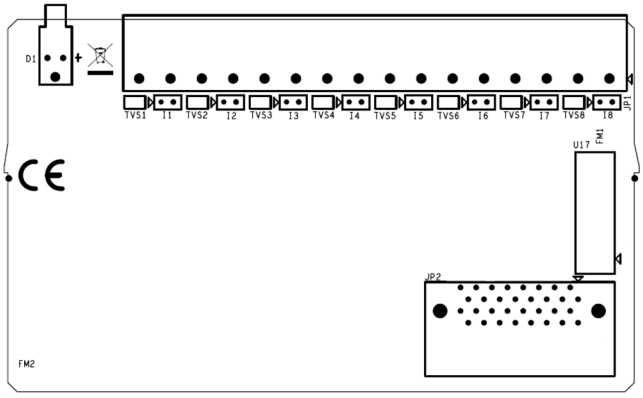


Figure 1.7 Locations of Jumpers

Technical Specifications of ADAM-5017

Table 1.4: Technical Specifications of ADAM-5017	
Analog Input Channels	Eight differential
Input Type	mV, V, mA
Input Range	± 150 mV, ± 500 mV, ± 1 V, ± 5 V, ± 10 V and ± 20 mA
Isolation Voltage	3000 VDC
Sampling Rate	10 samples/sec (total)
Analog Input Signal Limit	15 V max.
Max. allowable voltage difference between two connectors in a module	15 V max.
Input Impedance	2MΩ (voltage input) 120Ω (current input)
Bandwidth	13.1 Hz @ 50 Hz, 15.72 Hz @ 60 Hz
Accuracy	± 0.1% or better
Zero Drift	± 1.5 μV/°C
Span Drift	± 25 PPM/°C
CMR @ 50/60 Hz	92 dB min.
Power Requirements	+ 10 to + 30 VDC (non-regulated)
Power Consumption	1.2 W

1.2.3 ADAM-5017P 8-ch AI with independent Input

The ADAM-5017P is a 16-bit, 8-channel analog differential input and independent configuration module. It accepts millivolt inputs (±150mV, ±500mV, 0~150mV, 0~500mV, 0~1V, 0~5V, 0~10V, 0~15V), voltage inputs (±1V, ±5V, ±10V, and ±20V) and current input (±20 mA, 4~20mA). The module provides data to the host computer in engineering units (mV, V (supports uni-poloar and bipolar) or mA). This module is an extremely cost-effective solution for industrial measurement and monitoring applications. Its high common mode provides 200 VDC, protecting the module and peripherals from damage due to high input line voltage. Additionally, the module uses analog multiplexers with active over-voltage protection. The active protection circuitry assures that signal fidelity is maintained even under fault conditions that would destroy other multiplexers. This module can withstand an input voltage surge of ±60 VDC.

ADAM-5017P

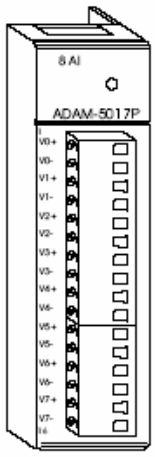


Figure 1.8 ADAM-5017P Module Front View

Application Wiring

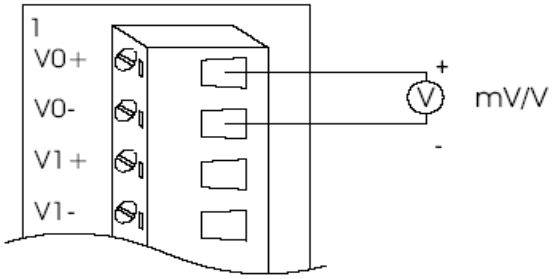


Figure 1.9 Millivolt and Volt Input

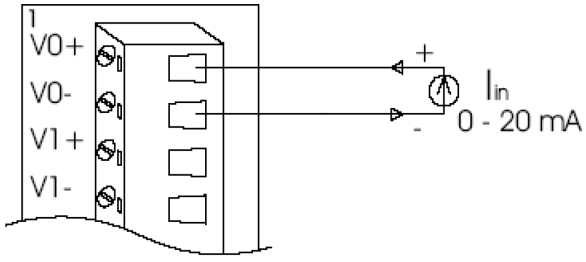


Figure 1.10 Process Current Input

Note! *To keep measurement accuracy please short the channels that are not in use.*

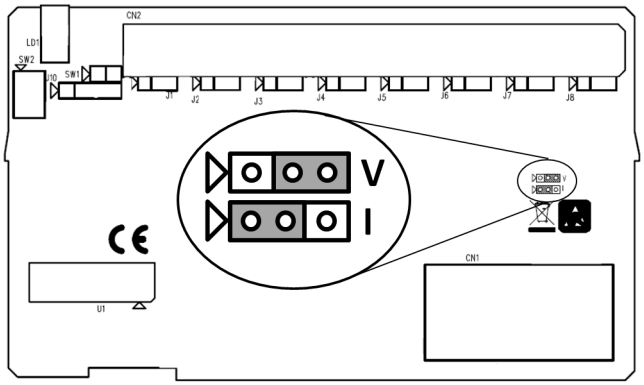


Figure 1.11 Locations of Jumpers

Table 1.5: Technical Specifications of ADAM-5017P	
Analog Input Channels	Eight differential and independent
Input Type	mV, V (uni-polar and bipolar), mA
Input Range	± 150 mV, ± 500 mV, ± 1 V, ± 5 V, ± 10 V, 0~150mV, 0~500mV, 0~1V, 0~5V, 0~10V, 0~15V and ± 20 mA, and 4~20mA
High common mode	200 VDC
Sampling Rate	10 samples/sec (total)
Resolution	16 bits
Over Voltage	±60 VDC
Input Impedance	800KΩ (voltage input) 120Ω (current input)
Built-in TVS/ESD protection	Yes
Accuracy	± 0.1% or better Voltage mode ± 0.2% or better Current mode
Zero Drift	± 6 μV/°C
Span Drift	± 25 PPM/°C
CMR @ 50/60 Hz	92 dB min.
Power Consumption	1.25 W (Max)

1.2.4 ADAM-5017H 8-ch High Speed Analog Input Module

ADAM-5017H is an 8-ch analog differential input module that provides programmable input ranges on each channel. The module provides data to the host microprocessor in engineering units (mV, V or mA) or two's complement format. Its sampling rate depends on the data format received: up to 100 Hz (total). Each input channel has 3000 VDC of optical isolation between the outside analog input line and the module, protecting the module and peripherals from high input line voltages. Additionally, the module uses analog multiplexers with active over-voltage protection. The active protection circuitry assures that signal fidelity is maintained even under fault conditions that would destroy other multiplexers. The analog inputs can withstand a constant 70 Vp-p input with ±15V supplies.

ADAM-5017H

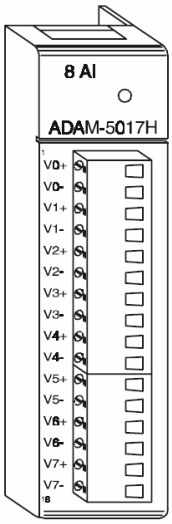


Figure 1.12 ADAM-5017H Module Front View

Application Wiring

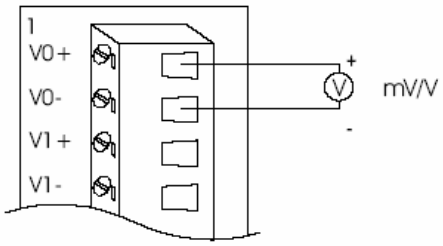


Figure 1.13 Millivolt and Volt Input

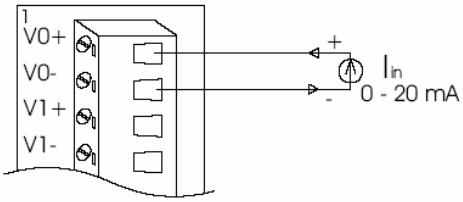


Figure 1.14 Process Current Input

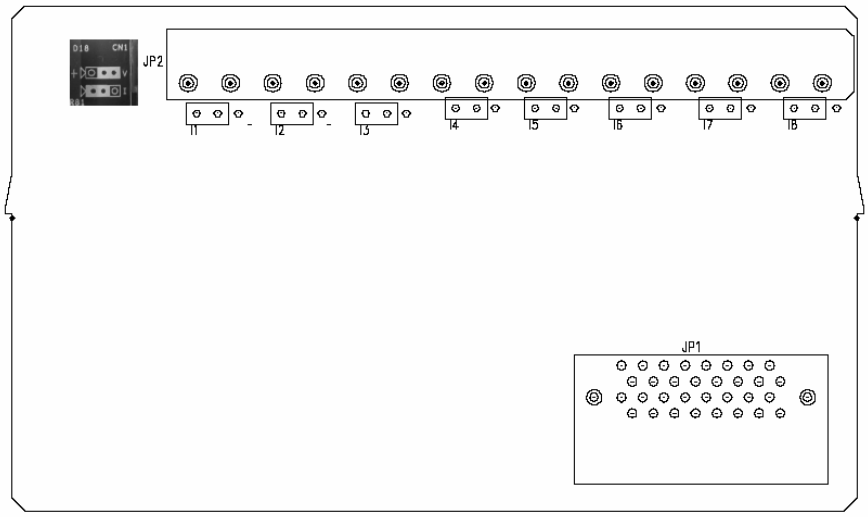


Figure 1.15 Locations of Jumpers

Note! *To maintain measurement accuracy pleases short channels not in use.*

Table 1.6: Technical Specifications of ADAM-5017H	
Analog Input Channels	8 differential
ADC Resolution	12 bits, plus sign bit
Type of ADC	Successive approximation
Isolation Voltage	3000 V_{DC}
Sampling Rate	100 Hz
Input Impedance	2MΩ (voltage input) 120Ω (current input)
Signal Input Bandwidth	1000 Hz for both voltage inputs and current inputs
Analog Signal Range	±15 V max.
Analog Signal Range for any two measured Pins	±15 V max.
Power Requirements	+10 to +30 VDC (non-regulated)
Power Consumption	1.8 W
Accuracy	± 0.1% or better

Table 1.7: ADAM-5017H Input Signal Ranges									
	Input Range	With Over-ranging	Offset Error @ 25°C	Offset Error @ -10 to +70°C	Gain Error @ 25°C	Gain Error @ -10 To +70°C	Offset Drift	Gain Drift	Display Resolution
Voltage Inputs	0 ~ 10 V	0 ~ 11 V	±1 LSB	±2 LSB	±1 LSB	±2 LSB	17 µV/°C	50 ppm/°C	2.7 mV
	0 ~ 5 V	0 ~ 5.5 V	±1 LSB	±2 LSB	±1.5 LSB	±2 LSB	16 µV/°C	50 ppm/°C	1.3 mV
	0 ~ 2.5 V	0 ~ 2.75 V	±1 LSB	±2 LSB	±1.5 LSB	±2 LSB	20 µV/°C	55 ppm/°C	0.67 mV
	0 ~ 1 V	0 ~ 1.375 V	±1 LSB	±2.5 LSB	±2 LSB	±2.5 LSB	20 µV/°C	60 ppm/°C	0.34 mV
	0 ~ 500 mV	0 ~ 687.5 mV	-	±5 LSB	±3 LSB	±3.5 LSB	20 µV/°C	67 ppm/°C	0.16 mV
	± 10 V	±11 V	±1 LSB	±2 LSB	±1 LSB	±2 LSB	17 µV/°C	50 ppm/°C	2.7 mV
	± 5 V	±0 ~ 5.5 V	±1 LSB	±2 LSB	±1.5 LSB	±2 LSB	17 µV/°C	50 ppm/°C	1.3 mV
	± 2.5 V	±0 ~ 2.75 V	±1 LSB	±2 LSB	±1.5 LSB	±2 LSB	20 µV/°C	55 ppm/°C	0.67 mV
	± 1 V	±0 ~ 1.375 V	±1 LSB	±2.5 LSB	±2 LSB	±2.5 LSB	20 µV/°C	60 ppm/°C	0.34 mV
	± 500 mV	±0 ~ 687.5 mV	-	±5 LSB	±3 LSB	±3.5 LSB	20 µV/°C	67 ppm/°C	0.16 mV
Current Inputs	0 ~ 20 mA	22 mA	±1 LSB	±1 LSB	±1.5 LSB	±2 LSB	nA/°C	ppm/°C	5.3 µ
	4 ~ 20 mA	22 mA	±1 LSB	±1 LSB	±1.5 LSB	±2 LSB	nA/°C	ppm/°C	5.3 µ

1.2.5 ADAM-5017UH 8-ch Ultra High Speed Analog Input Module

The ADAM-5017UH is a 12-bit plus sign bit, 8-channel analog differential input module that provides programmable input ranges on each channel. It accepts voltage inputs (±10 V and 0-10 V) and current inputs (0-20 mA and 4-20 mA). The module provides data to the host microprocessor in engineering units (mV, V or mA) or two's complement format. Its sampling rate depends on the data format received: up to 200k Hz (total). Space is reserved for 125-ohm, 0.1%, 10 ppm resistors (See Figure 9). Each input channel has 3000 V_{DC} of optical isolation between the outside analog input line and the module, protecting the module and peripherals from high input line voltages. Additionally, the module uses analog multiplexers with active overvoltage protection. The active protection circuitry assures that signal fidelity is maintained even under fault conditions that would destroy other multiplexers. The analog inputs can withstand a constant 70 Vp-p input with ±15V supplies. The jumpers of ADAM-5017UH are designed for current input.

ADAM-5017UH

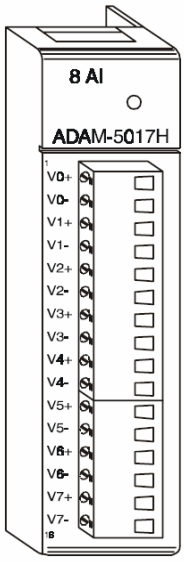


Figure 1.16 ADAM-5017UH Module Front View

Application Wiring

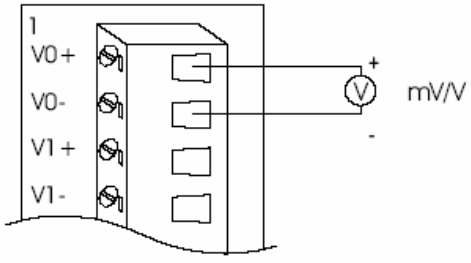


Figure 1.17 Millivolt and Volt Input

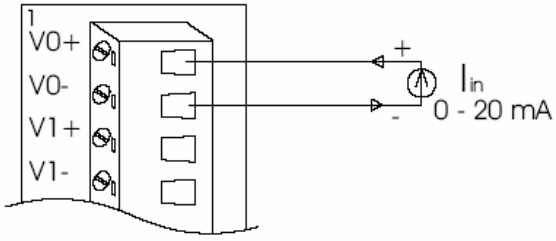


Figure 1.18 Process Current Input

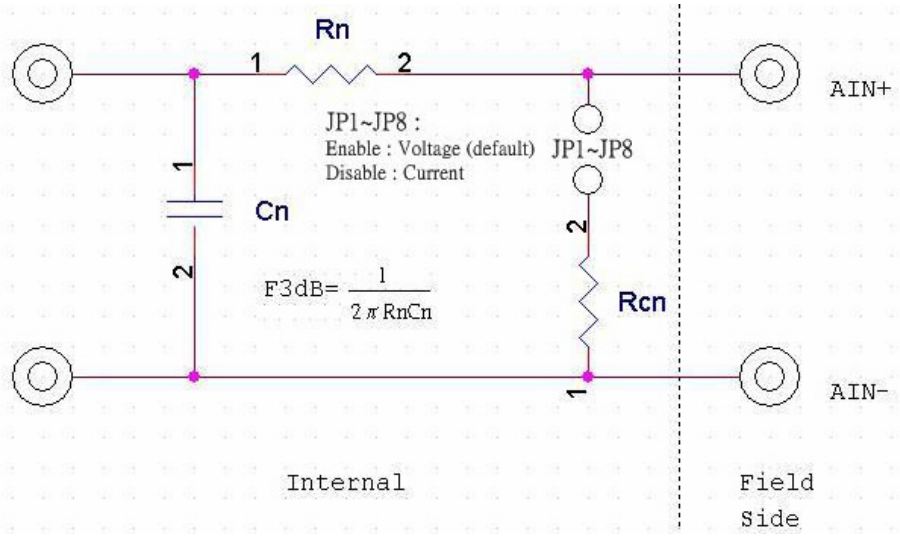


Figure 1.19 Locations of RC Filter Jumper Setting

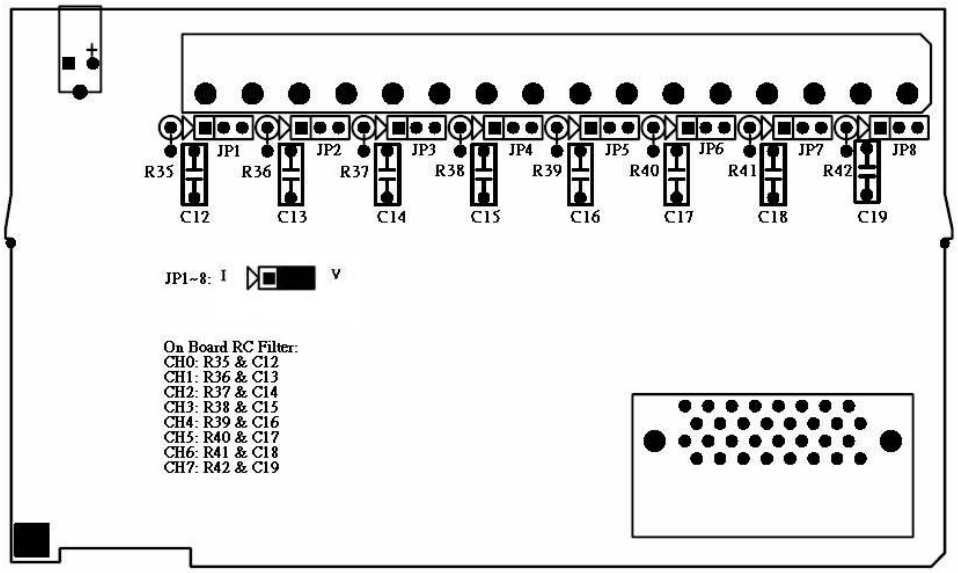


Figure 1.20 Locations of RC Filter Jumper Setting

Note! *To maintain measurement accuracy please short channels not in use.*

Table 1.8: Technical Specifications of ADAM-5017UH	
Analog Input Channels	Eight differential
Resolution	12 bits
Input Type	mV, V, mA
Input Range	+0~10V , ± 10 V , +4~20mA and ± 20 mA
Isolation Voltage	3000 VDC
Sampling Rate	200k samples/sec (single channel) 50k samples/sec (8 channel)
Analog Input Signal Limit	15 V max.
Max. allowable voltage difference between two connectors in a module	15 V max.
Input Impedance	2MΩ (voltage input) 120Ω (current input)
Bandwidth	200kHz
Accuracy	± 0.1% or better
Low or high pass filter	Configured by User
CMR @ 50/60 Hz	92 dB min.
Power Requirements	+ 10 to + 30 VDC (non-regulated)
Power Consumption	1.75 W (typical); 2.2W (max)
Signal Input Bandwidth	200kHz for both voltage and current inputs

Table 1.9: ADAM-5017UH Input Sgnal Ranges						
	Input Range	Offset Error @ 25°C	Offset Error @ -10 to +70°C	Gain Error @ 25°C	Gain Error @ -10 to +70°C	Display Resolution
Voltage Inputs	0 ~ 10 V	±1 LSB	±2 LSB	±1 LSB	±2 LSB	2.7 mV
	± 10 V	±1 LSB	±2 LSB	±1 LSB	±2 LSB	2.7 mV
Current Inputs	0 ~ 20 mA	±1 LSB	±1 LSB	±1.5 LSB	±2 LSB	5.3 μ
	4 ~ 20 mA	±1 LSB	±1 LSB	±1.5 LSB	±2 LSB	5.3 μ

1.2.6 ADAM-5018 7-ch Thermocouple Input Module

The ADAM-5018 is a 16-bit, 7-channel thermocouple input module that features programmable input ranges on all channels. It accepts millivolt inputs (±15 mV, ±50 mV, ±100 mV, ±500 mV), voltage inputs (±1 V, ±2.5 V), current input (±20 mA, requires 125 ohms resistor) and thermocouple input (J, K, T, R, S, E, B).

The module forwards the data to the host computer in engineering units (mV, V, mA or temperature °C). An external CJC on the plug-in terminal is designed for accurate temperature measurement.

ADAM-5018

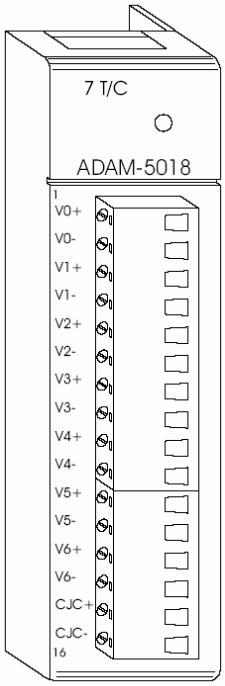


Figure 1.21 ADAM-5018 Module Front View

Application Wiring

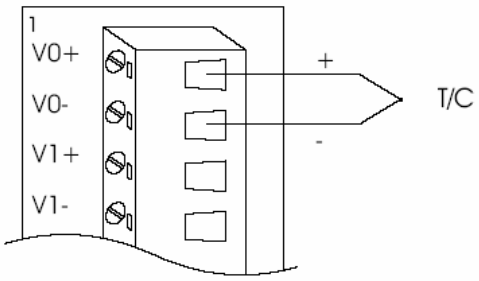


Figure 1.22 Thermocouple Input

Table 1.10: Technical Specifications of ADAM-5018	
Analog Input Channels	Seven differential
Input Type	mV, V, mA, Thermocouple
Input Range	± 15 mV, ± 50 mV, ± 100 mV, ± 500 mV, ± 1 V, ± 2.5 V and ± 20 mA
T/C Type and Temperature Range	J 0 to 760 °C K 0 to 1370 °C T -100 to 400 °C E 0 to 1400 °C R 500 to 1750 °C S 500 to 1750 °C B 500 to 1800 °C
Isolation Voltage	3000 VDC
Sampling Rate	10 samples/sec (total)
Input Impedance	2MΩ
Bandwidth	13.1 Hz @ 50 Hz, 15.72 Hz @ 60 Hz
Accuracy	± 0.1% or better
Zero Drift	± 0.3 μV/°C
Span Drift	± 25 PPM/°C
CMR @ 50/60 Hz	92 dB min.
Power Consumption	1.2 W

1.2.7 ADAM-5018P 7-ch Thermocouple Input Module

The ADAM-5018P is a 16-bit, 8-channel Thermocouple Independent input module that provides programmable input ranges on all channels. It accepts Various Thermocouple inputs (Type J, K, T, E, R, S, B) and provides data to the host computer in engineering units (^{o}C) In order to satisfy various temperature requirements in one module, each analog channel is allowed to configure an individual range for several applications.

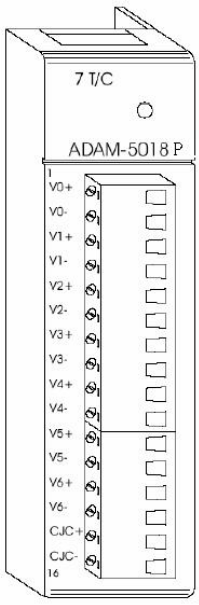


Figure 1.23 ADAM-5018P Module Front View

Application Wiring

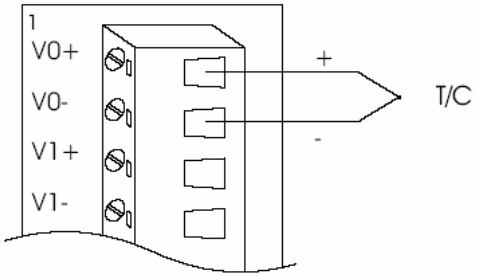


Figure 1.24 Thermocouple Input

Table 1.11: Technical Specifications of ADAM-5018P	
Analog Input Channels	Seven differential & independent thermocouple
Input Type	mV, V, mA, Thermocouple
Input Range	± 15 mV, ± 50 mV, ± 100 mV, ± 500 mV, ± 1 V, ± 2.5 V and ± 20 mA
T/C Type and Temperature Range	J 0 to 760 °C K 0 to 1370 °C T -100 to 400 °C E 0 to 1400 °C R 500 to 1750 °C S 500 to 1750 °C B 500 to 1800 °C
Isolation Voltage	3000 VDC
Sampling Rate	10 samples/sec (Selected by Utility)
Input Impedance	2MΩ (voltage input) 120Ω (current input)
Bandwidth	13.1 Hz @ 50 Hz, 15.72 Hz @ 60 Hz
Accuracy	± 0.1% or better
Zero Drift	± 6 μV/°C
Span Drift	± 25 PPM/°C
CMR @ 50/60 Hz	92 dB min.
Power Consumption	0.5 W

Chapter 2

Analog Output Modules

2.1 Analog Output Modules

2.1.1 ADAM-5024 4-ch Analog Output Module

The ADAM-5024 is a 4-channel analog output module. It receives its digital input through the RS-485 interface of the ADAM-5510 system module from the host computer. The format of the data is engineering units. It then uses the D/A converter controlled by the system module to convert the digital data into output signals.

You can specify slew rates and start up currents through the configuration software. The analog output can also be configured as current or voltage through the software utility. The module protects your equipment from ground loops and power surges by providing opto-isolation of the D/A output and transformer based isolation up to 3000 VDC.

Slew Rate

The slew rate is defined as the slope indicated the ascending or descending rate per second of the analog output from the present to the required.

ADAM-5024

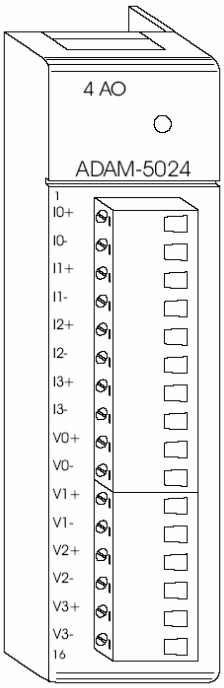


Figure 2.1 ADAM-5024 Module Frontal View

Application Wiring

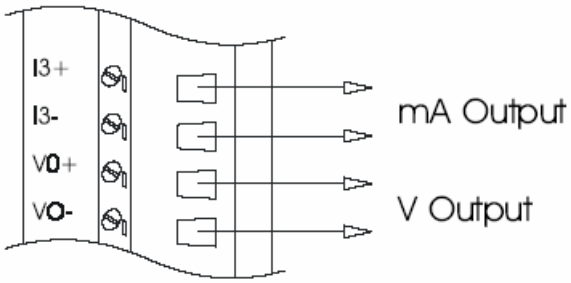


Figure 2.2 Analog Output

Technical Specifications of ADAM-5024

Table 2.1: Technical Specifications of ADAM-5024	
Analog Output Channels	Four
Output Type	V, mA
Output Range	0-20mA, 4-20mA, 0-10V
Isolation Voltage	3000 Vdc
Output Impedance	0.5 Ohms
Accuracy	±0.1% of FSR for current output ±0.2% of FSR for voltage output
Zero Drift	Voltage output: ±30 μV/ºC Current output: ±0.2 μA/ºC
Resolution	±0.015% of FSR
Span Temperature Coefficient	±25 PPM/ºC
Programmable Output Slope*	0.125-128.0 mA/sec 0.0625-64.0 V/sec
Current Load Resistor	0-500 Ohms (source)
Power Consumption	2.5W (Max.)

* This function is only for the ADAM-5000/485 and ADAM-5000E

Chapter 3

Analog I/O Module Calibration

3.1 Analog I/O Module Calibration

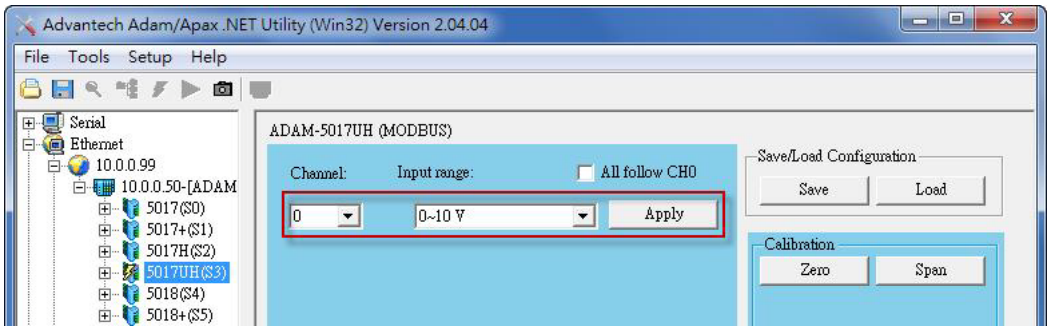
Analog input/output modules are calibrated when you receive them. However, calibration is sometimes required. No screwdriver is necessary because calibration is done in software with calibration parameters stored in the ADAM-5000 analog I/O module's onboard EEPROM. The ADAM-5000 system comes with the ADAM utility software that supports calibration of analog input and analog output. Besides the calibration that is carried out through software, the modules incorporate automatic Zero Calibration and automatic Span Calibration at boot up or reset.

3.1.1 ADAM-5000 Series Analog Input Module Calibration

Modules: ADAM-5017, 5017P, 5017H, 5017UH, 5018, and 5018P

Calibration Steps:

1. Apply power to the ADAM-5000 system that the analog input module is plugged into and let it warm up for about 30 minutes.
2. Ensure that the module is correctly installed and is properly configured for the input range you want to calibrate. You can do this with the ADAM utility software.



3. Use a precision voltage source to apply a span calibration voltage to the module's V0+ and V0- terminals. (See Tables 5-2 and 5-3 for reference voltages for each range.)

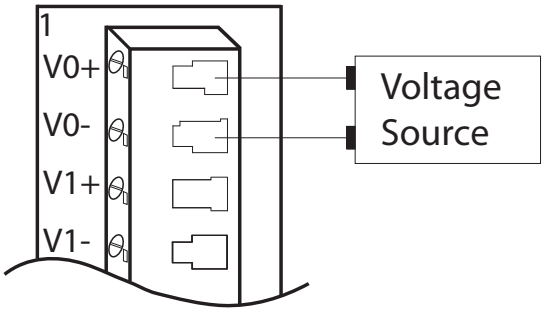
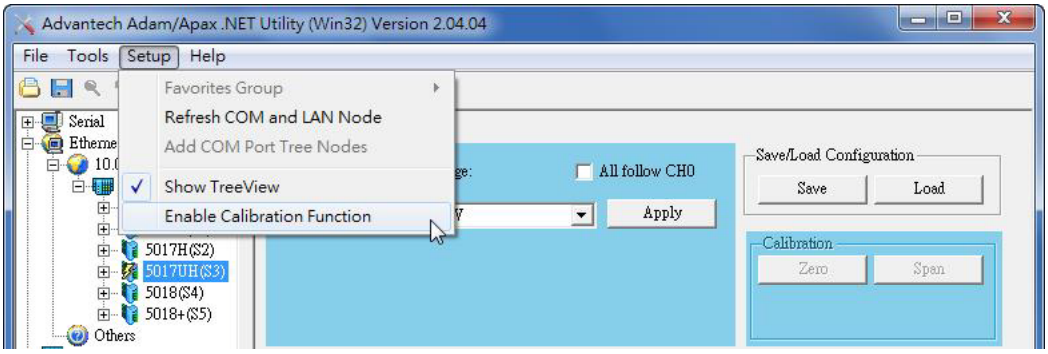
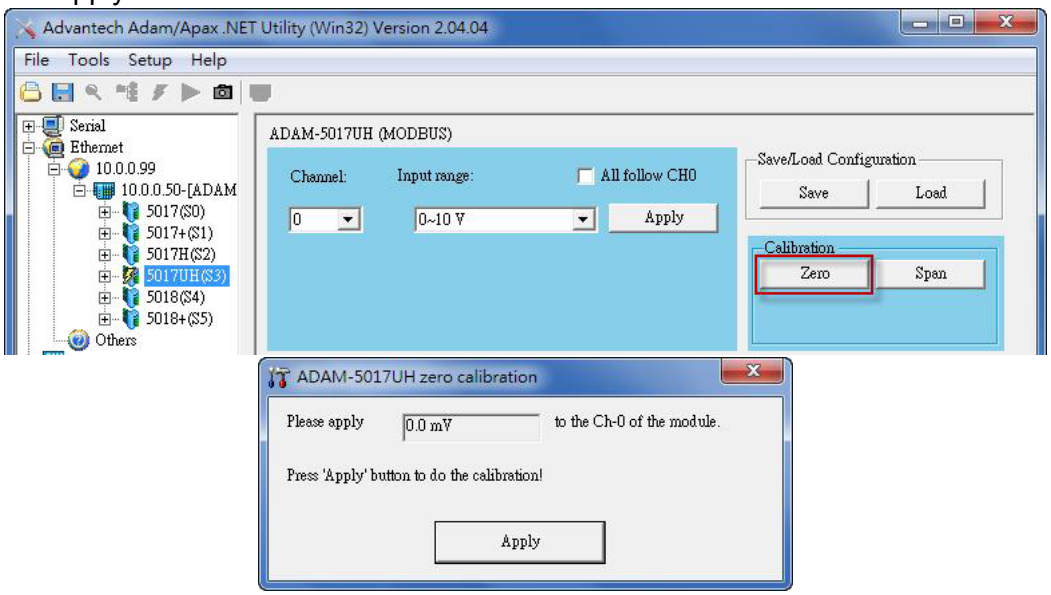


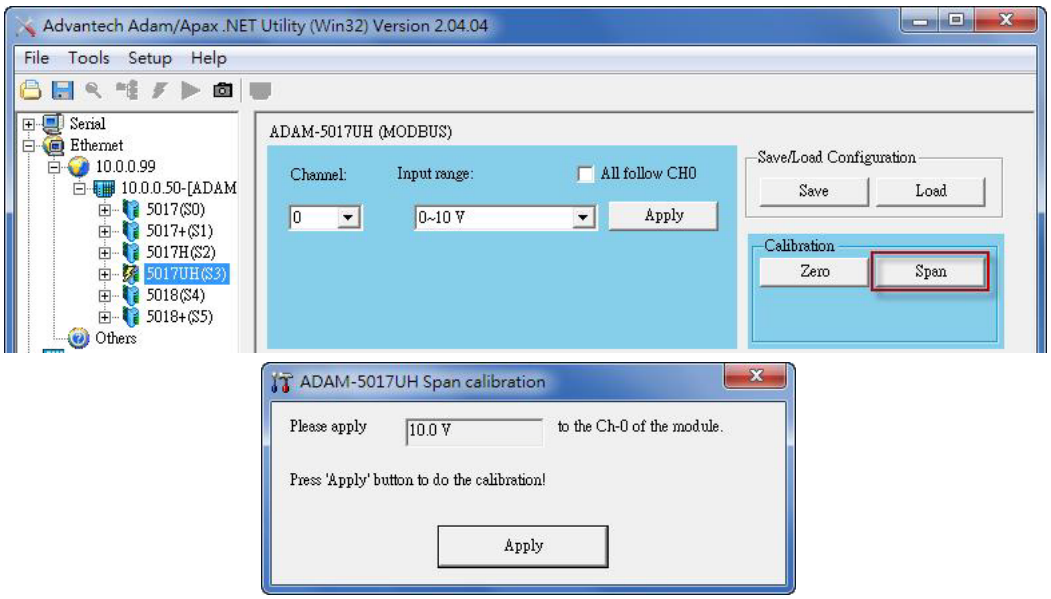
Figure 3.1 Applying Calibration Voltage

4. ”Enable Calibration Function” in “Setup” menu.

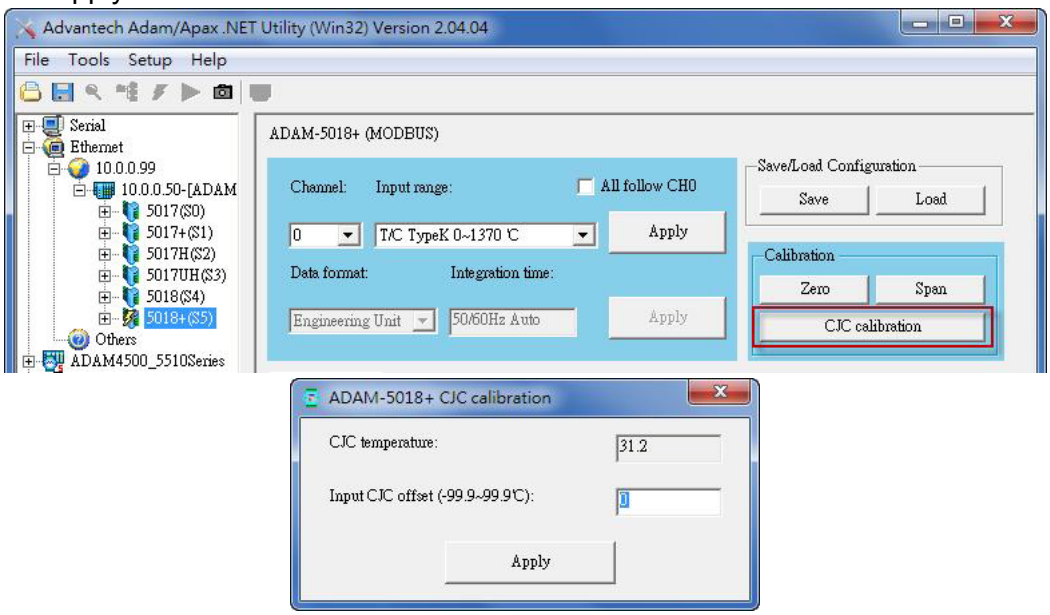


5. Use a precision voltage source to apply a span calibration voltage to the module's V0+ and V0- terminals.
6. Click "Zero" and apply the voltage as pop out windows to the Ch-0 and click "Apply."





7. Click “Span” and apply the voltage as pop out windows to the Ch-0 and click “Apply.”



Note! *Zero calibration and span calibration must be completed before CJC calibration. To calibrate CJC, the thermocouple attached to ADAM-5018 and a standard thermometer should be used to measure a standard known temperature, such as the freezing point of pure water. The amount of offset between the ADAM-5018 and the standard thermometer is then used in the ADAM utility to complete CJC calibration.*

Table 3.1: Calibration Voltage of ADAM-5017/5018			
Module	**Input Range Code (Hex)**	**Input Range**	**Span Calibration Voltage**
5018	00h	±15 mV	+15 mV
	01h	±50 mV	+50 mV
	02h	±100 mV	+100 mV
	03h	±500 mV	+500 mV
	04h	±1 mV	+1 V
	05h	±2.5 V	+2.5 V
	06h	±20 mV	+20 mA (1)
	0Eh	J thermocouple 0 to 1370°C	+50 mV
	0Fh	K thermocouple 0 to 1370°C	+50 mV
	10h	T thermocouple -100 to 400°C	+22 mV
	11h	E thermocouple 0 to 1000°C	+80 mV
	12h	R thermocouple 500 to 1750°C	+22 mV
	13h	S thermocouple 500 to 1800°C	+22 mV
	14h	B thermocouple 500 to 1800°C	+152 mV
5017	07h	Not used	
	08h	ºC ±10 V	+10 V
	09h	±5 V	+5 V
	0Ah	±1 V	+1 V
	0Bh	±500 mV	+500 mV
	0Ch	±150 mV	+150 mV
	0Dh	±20 mA	+20 mV (1)

Table 3.2: Calibration Voltage (ADAM-5017H)			
Module	**Input Range Code (Hex)**	**Input Range**	**Span Calibration Voltage**
5017H	00h	±10 V	+10 V
	01h	0 ~ 10 V	+10 V
	02h	±5 V	+5 V
	03h	0 ~ 5 V	+5 V
	04h	±2.5 V	+2.5 V
	05h	0 ~ 2.5 V	+2.5 V
	06h	±1 V	+1 V
	07h	0 ~ 1 V	+1 V
	08h	±500 mV	+500 mV
	09h	0 ~ 500 mV	+500 mV
	0ah	4 ~ 20 mA	*(1)
	0bh	0 ~ 20 mA	*(1)

Note! *You can substitute 2.5 V for 20 mA if you remove the current conversion resistor for that channel. However, the calibration accuracy will be limited to 0.1% due to the resistor's tolerance.*

Table 3.3: Calibration Voltage of ADAM-5018P			
Module	**Input Range Code (Hex)**	**Input Range**	**Span Calibration Voltage**
5018P	00h	±15 mV	+15 mV
	01h	±50 mV	+50 mV
	02h	±100 mV	+100 mV
	03h	±500 mV	+500 mV
	04h	±1 mV	+1 V
	05h	±2.5 V	+2.5 V
	06h	±20 mV	+20 mA (1)
	07h	4 ~ 20 mA	+16 mA (1)
	0Eh	J thermocouple 0 to 1370°C	+50 mV
	0Fh	K thermocouple 0 to 1370°C	+50 mV
	10h	T thermocouple -100 to 400°C	+22 mV
	11h	E thermocouple 0 to 1000°C	+80 mV
	12h	R thermocouple 500 to 1750°C	+22 mV
	13h	S thermocouple 500 to 1800°C	+22 mV
	14h	B thermocouple 500 to 1800°C	+152 mV

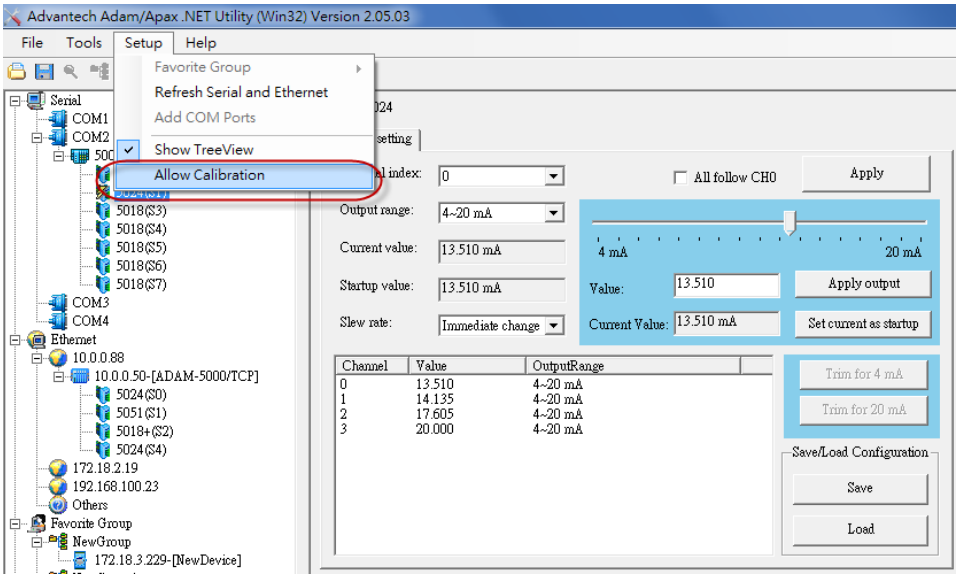
Table 3.4: Calibration Voltage of ADAM-5017UH			
Module	**Input Range Code (Hex)**	**Input Range**	**Span Calibration Voltage**
5017H	08h	±10 V	+10 V
	48h	0 ~ 10 V	+10 V
	46h	0 ~ 20 mA	*(1)
	07h	4 ~ 20 mA	*(1)

Note! *You can substitute 2.5 V for 20 mA if you remove the current conversion resistor for that channel. However, the calibration accuracy will be limited to 0.1% due to the resistor's tolerance.*

3.1.2 Analog Output Module Calibration

The output current of analog output modules can be calibrated by using a low calibration value and a high calibration value. The analog output modules can be configured for one of two ranges: 0-20 mA and 4-20 mA. Since the low limit of the 0-20 mA range (0 mA) is internally an absolute reference (no power or immeasurably small power), just two levels are needed for calibration: 4 mA and 20 mA.

1. Set the ADAM-5000 system to be INITIAL Mode then apply power to the system including the analog output module for about 30 minutes.
2. Ensure that the module is correctly installed and is properly configured for the range you want to calibrate. You can do this by using the ADAM utility software.
3. Before execute the calibration process in the utility, enable the calibration function by checking [Setup -> Allow Calibration]



4. Connect either a 5-digit mA meter or voltmeter with a shunt resistor (250 ohms, .01 % and 10 ppm) to the screw terminals of the module.

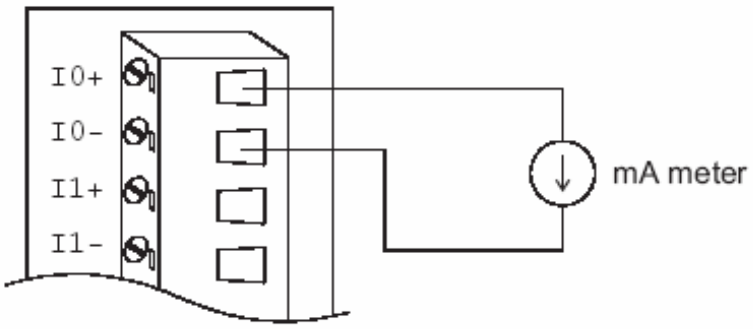


Figure 3.2 Output Module Calibration

5. Issue the Analog Data Out command to the module with an output value of 4 mA.
6. Check the actual output value at the modules terminals. If this does not equal 4 mA, use the "Trim" option in the "Calibrate" submenu to change the actual output. Trim the module until the mA meter indicates exactly **4 mA**, or in case of a voltage meter with shunt resistor, the meter indicates exactly **1 V**. (When calibrating for **20 mA** using a voltage meter and shunt resistor, the correct voltage should be **5 V**.)

7. Issue the 4 mA Calibration command to indicate that the output is calibrated and to store the calibration parameters in the module's EEPROM.
8. Execute an Analog Data Out command with an output value of 20 mA. The module's output will be approximately 20 mA.
9. Execute the Trim Calibration command as often as necessary until the output current is equal to exactly 20 mA.
10. Execute the 20 mA Calibration command to indicate that the present output is exactly 20 mA. The analog output module will store its calibration parameters in the unit's EEPROM.

Chapter 4

Digital Input/Output Modules

4.1 Digital Input/Output Modules

4.1.1 ADAM-5050 16-ch Universal Digital I/O Module

The ADAM-5050 features sixteen digital input/output channels. Each channel can be independently configured to be an input or an output channel by the setting of its DIP switch. The digital outputs are open collector transistor switches that can be controlled from the ADAM-5000. The switches can also be used to control solid-state relays, which in turn can control heaters, pumps and power equipment. The ADAM-5000 can use the module's digital inputs to determine the state of limit or safety switches, or to receive remote digital signals.

Warning! *A channel may be destroyed if it is subjected to an input signal while it is configured to be an output channel.*

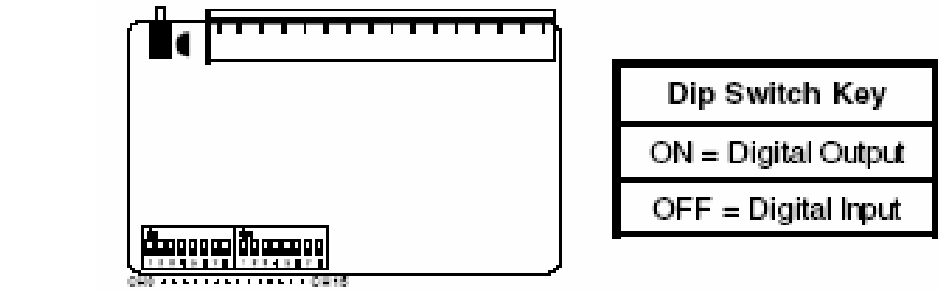


Figure 4.1 DIP Switch Setting for Digital I/O Channel

ADAM-5050

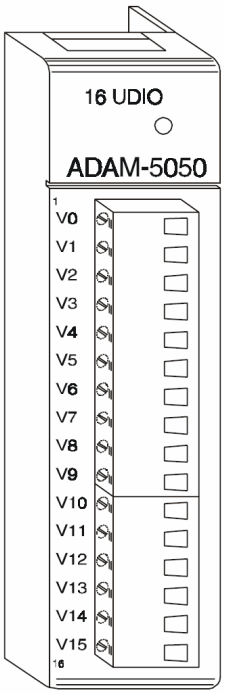


Figure 4.2 ADAM-5050 Module Frontal View

Application Wiring

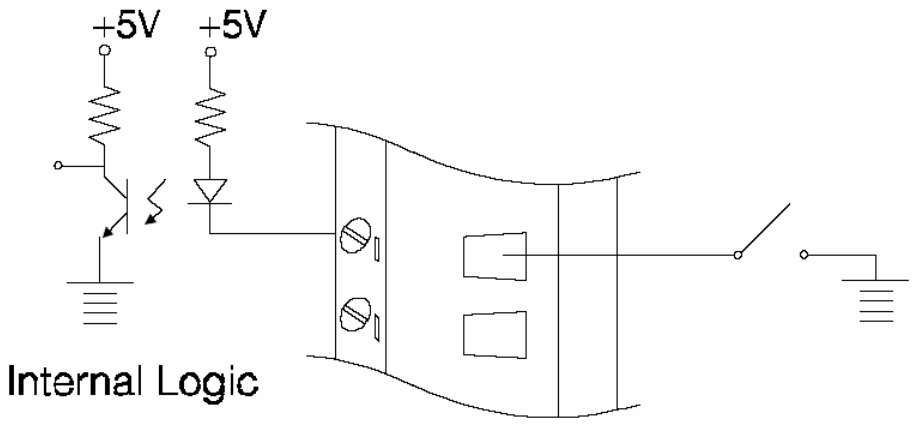


Figure 4.3 Dry Contact Signal Input (ADAM-5050)

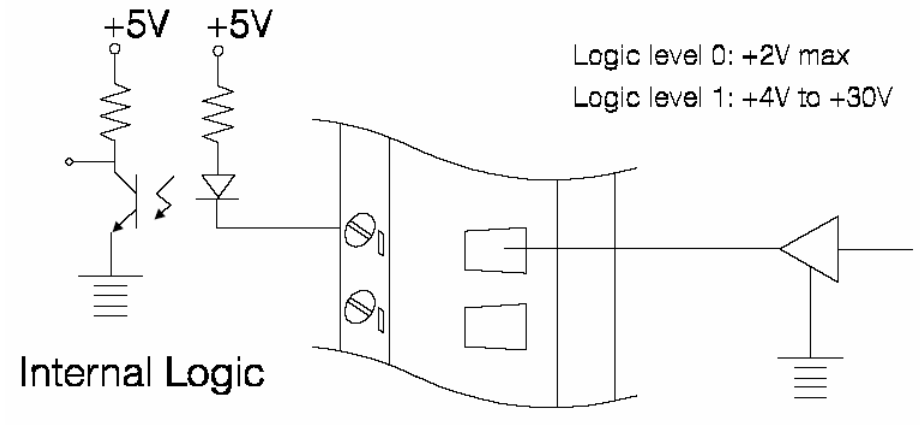


Figure 4.4 Wet Contact Signal Input (ADAM-5050)

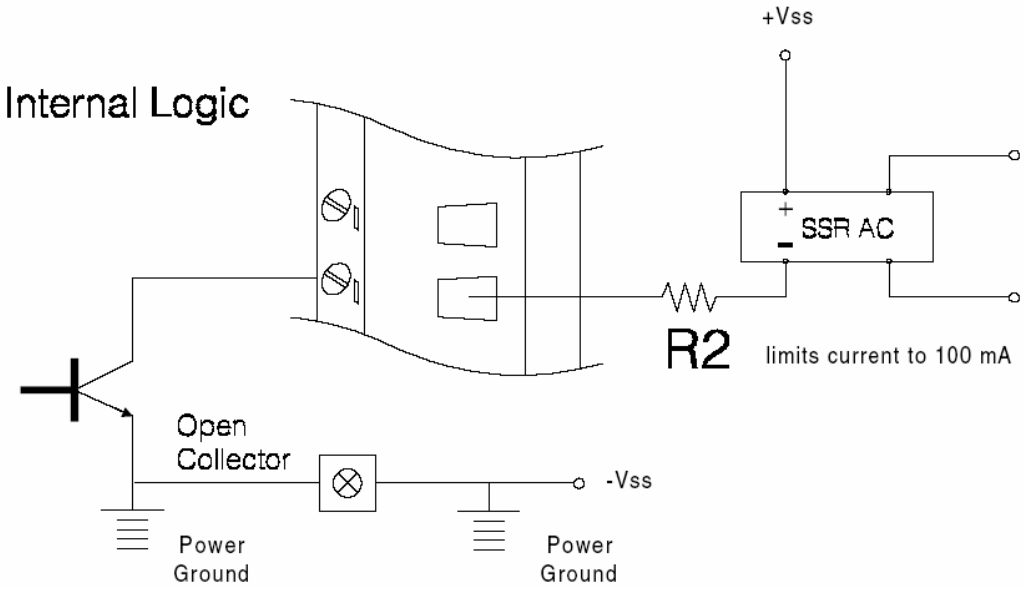


Figure 4.5 Digital Output with SSR (ADAM-5050/5056)

Table 4.1: Technical Specifications of ADAM-5050	
Points	16
Channel Setting	Bitwise selectable by DIP switch
Digital Input	Dry Contact Logic Level 0: close to GND Logic Level 1: open Wet Contact Logic Level 0: +2 V max Logic Level 1: +4 V to 30 V
Digital Output	Open collector to 30 V, 100mA max load
Power Dissipation	450 mW
Power Consumption	0.4 W

4.1.2 ADAM-5051(D) 16-ch Digital Input Module

The ADAM-5051 provides sixteen digital input channels. The ADAM-5510 can use the module's digital inputs to determine the state of limit or safety switches or to receive remote digital signals.

ADAM-5051/5051D

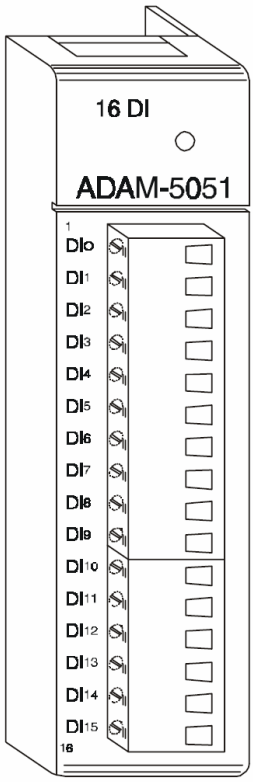


Figure 4.6 ADAM-5051 Module Frontal View

Application Wiring

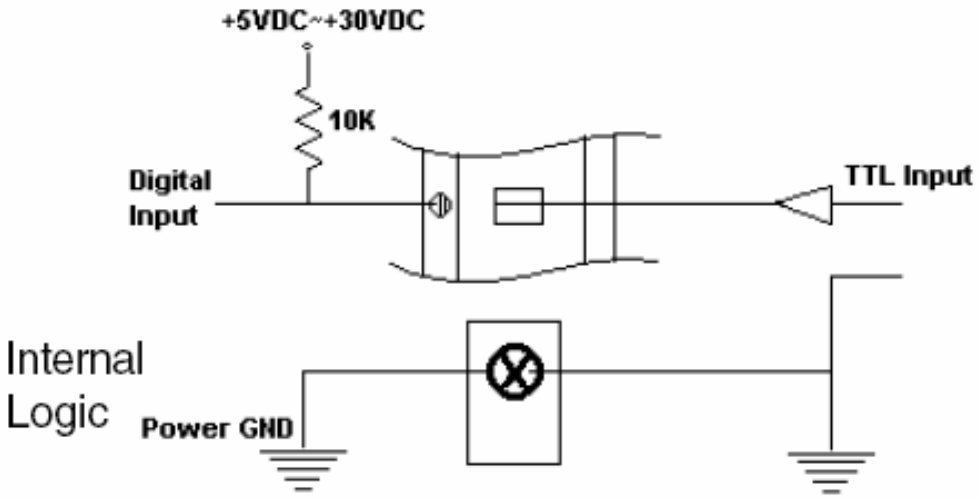


Figure 4.7 TTL Input (ADAM-5051/5051D)

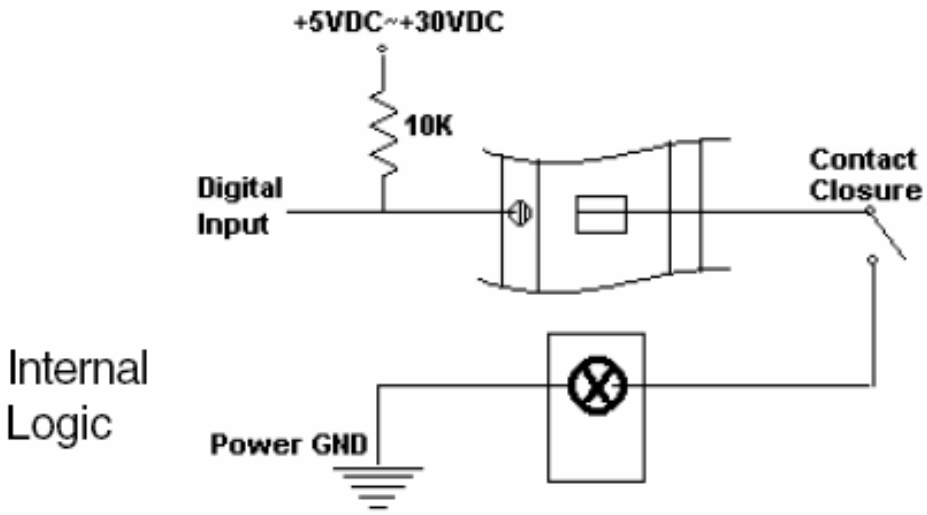


Figure 4.8 Contact Closure Input (ADAM-5051/5051D)

Table 4.2: Technical Specifications of ADAM-5051/5051D	
Points	16
Digital Input	Logic level 0: + 1 V max
	Logic level 1: + 3.5 to 30 V Pull up current: 0.5 mA
	10 k- resistor to + 5 V
Power Consumption	0.3 W
Indicator	ADAM-5051D only

4.1.3 ADAM-5051S 16-ch Isolated Digital Input Module with LED

The ADAM-5051S provides 16 isolated digital input channels for critical environments need individual channel isolating protection. Different from other ADAM-5000 I/O modules, ADAM-5051S designed with 21 pins plug terminal.

ADAM-5051S

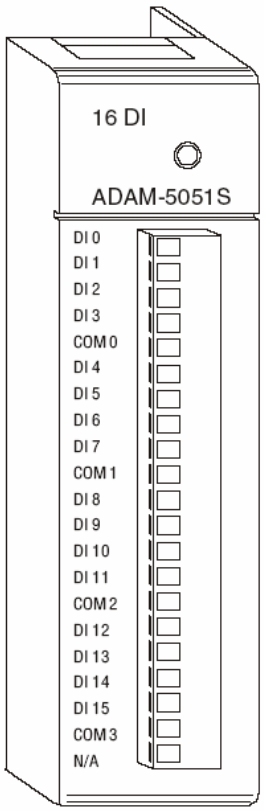


Figure 4.9 ADAM-5051S Module Front View

Application Wiring

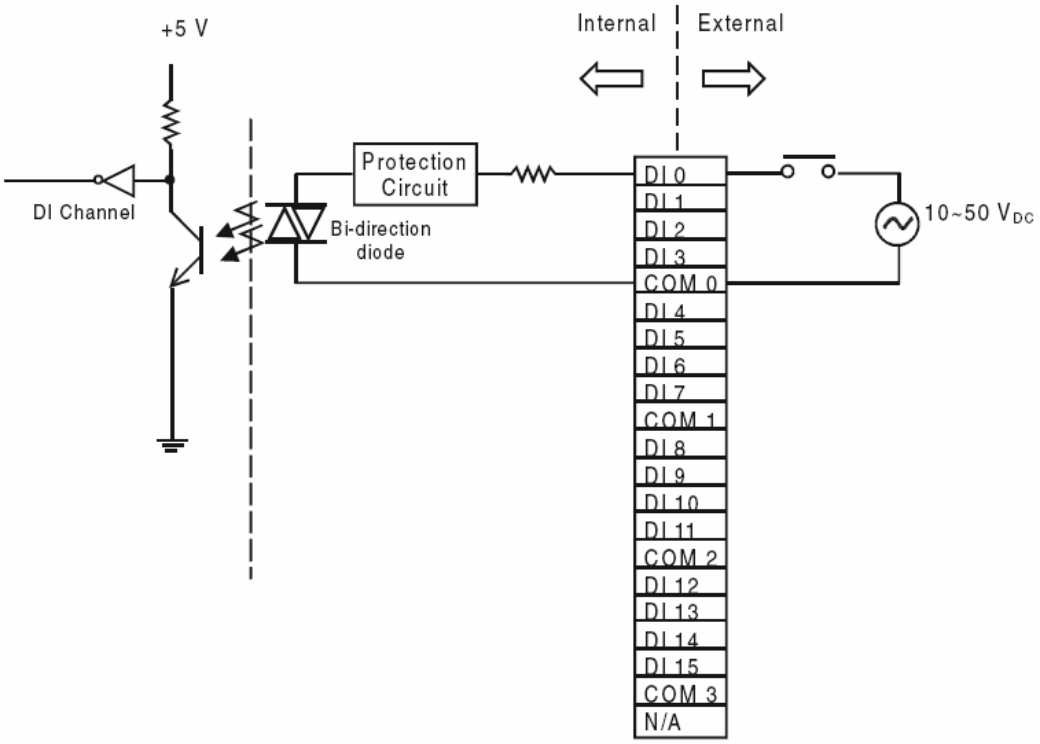


Figure 4.10 ADAM-5051S Module Wiring Diagram

Table 4.3: Technical Specifications of ADAM-5051S	
Point	16 (4-channel/group)
Digital Input	Logic Level 0: + 3 V max Logic Level 1: + 10 to 50 V
Optical Isolation	2500 V_{DC}
Opto-isolator response time	25 µs
Over-voltage Protection	70 V_{DC}
Power Consumption	0.8 W
LED Indicator	On when active
I/O Connector Type	21-pin plug-terminal

4.1.4 ADAM-5052 8-ch Isolated Digital Input Module

ADAM-5052 provides eight fully independent isolated channels. All have 5000 V_{RMS} isolation to prevent ground loop effects and to pre- vent damage from power surges on the input lines.

ADAM-5052

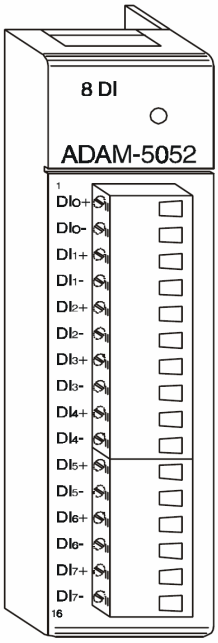


Figure 4.11 ADAM-5052 Module Front View

Application Wiring

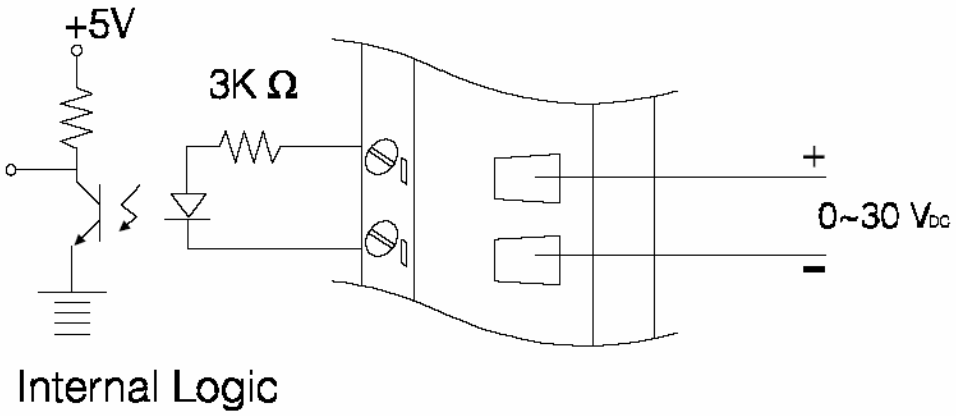


Figure 4.12 Isolation Digital Input (ADAM-5052)

Table 4.4: Technical Specifications of ADAM-5052	
Points	8 Differential
Digital input	Logic level 0: + 1 V max Logic level 1: + 3.5 to 30 V Isolation voltage: 5000 V RMS Resistance: 3 k-/ 0.5 W
Power consumption	0.4 W

4.1.5 ADAM-5053S 32-ch Isolated Digital Input Module

The ADAM-5053S provides 32 isolated digital input channels for critical environments need individual channel isolating protection. Different from other ADAM-5000 I/O modules, ADAM-5053S designed with 40-pin flat cable wiring terminal.

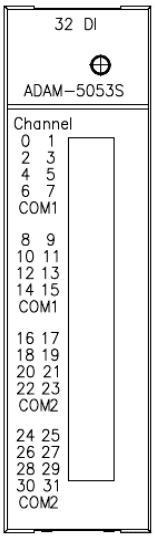
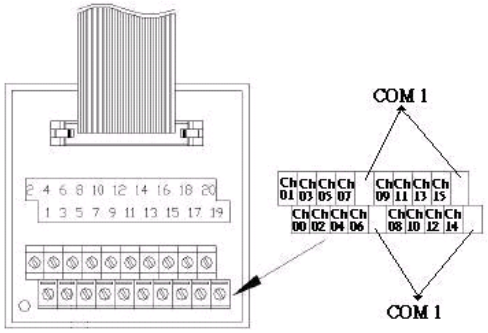


Figure 4.13 ADAM-5053S Module Front View

Application Wiring



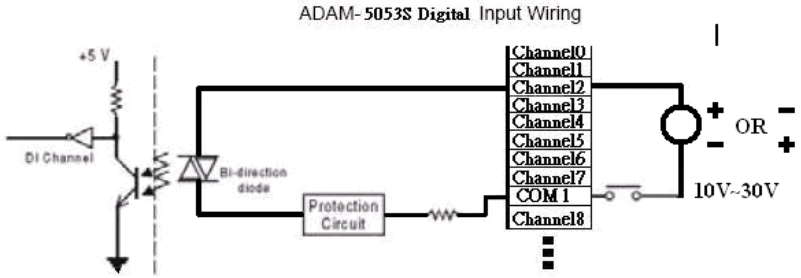


Figure 4.14 ADAM-5053S Module Wiring Diagram

Table 4.5: ADAM-5053S Technical Specifications

Point	32
Digital Input	Logic Level 0: + 5 V max Logic Level 1: 19 to 35 V
Optical Isolation	2500 VDC
Opto-isolator response time	25 µs
Over-voltage Protection	35 VDC
Power Consumption	1 W (max.)
I/O Connector Type	40-pin flat cable wiring terminal

4.1.6 ADAM-5055S 16-ch Isolated Digital I/O Module with LED

The ADAM-5055S provides 8 isolated digital input and 8 isolated output channels for critical environments need individual channel isolating protection. Different from other ADAM-5000 I/O modules, ADAM-5055S designed with 21 pins plug terminal.

ADAM-5055S

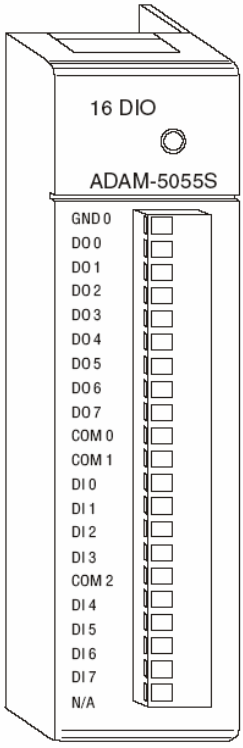


Figure 4.15 ADAM-5055S Module Front View

Application Wiring

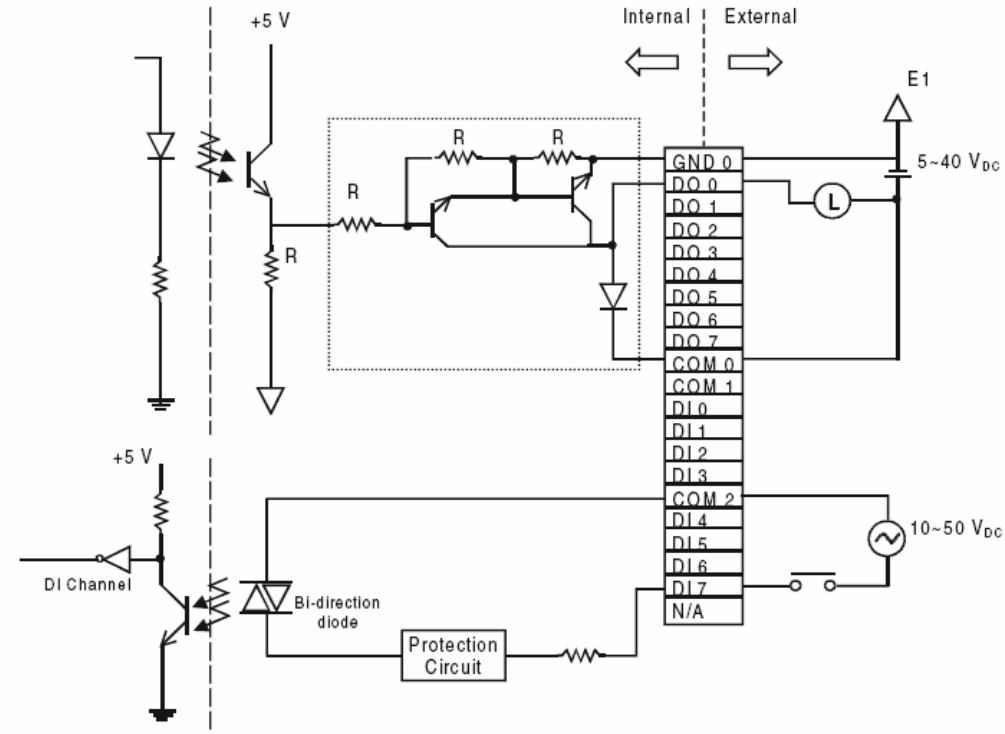


Figure 4.16 ADAM-5055S Module Wiring Diagram

Table 4.6: Technical Specifications of ADAM-5055S	
Points	16
Digital Output	8 (8-channel/group)
Open collector to 40 V	200 mA max load per channel
Optical Isolation	2500 V_{DC}
Opto-isolator response time	25 µs
Supply Voltage	5 ~ 40 V_{DC}
Digital Input	8 (4-ch/group) **Dry Contact** Logic Level 0: open Logic Level 1: close to GND **Wet Contact** Logic Level 0: + 3 V max Logic Level 1: + 10 to 50 V
Dry Contact & Wet contact	Selectable
Optical Isolation	2500 V_{DC}
Opto-isolator response time	25 µs
Over-voltage Protect	70 V_{DC}
Power Consumption	0.68 W
LED Indicator	On when active
I/O Connector Type	21-pin plug-terminal

4.1.7 ADAM-5056(D) 16-ch Digital Output Module w/LED

The ADAM-5056 features sixteen digital output channels. The digital outputs are open-collector transistor switches that you can control from the ADAM-5000 main unit. You also can use the switches to control solid-state relays.

ADAM-5056

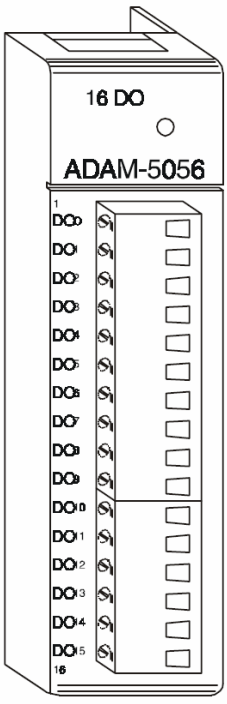


Figure 4.17 ADAM-5056 Module Frontal View

Application Wiring

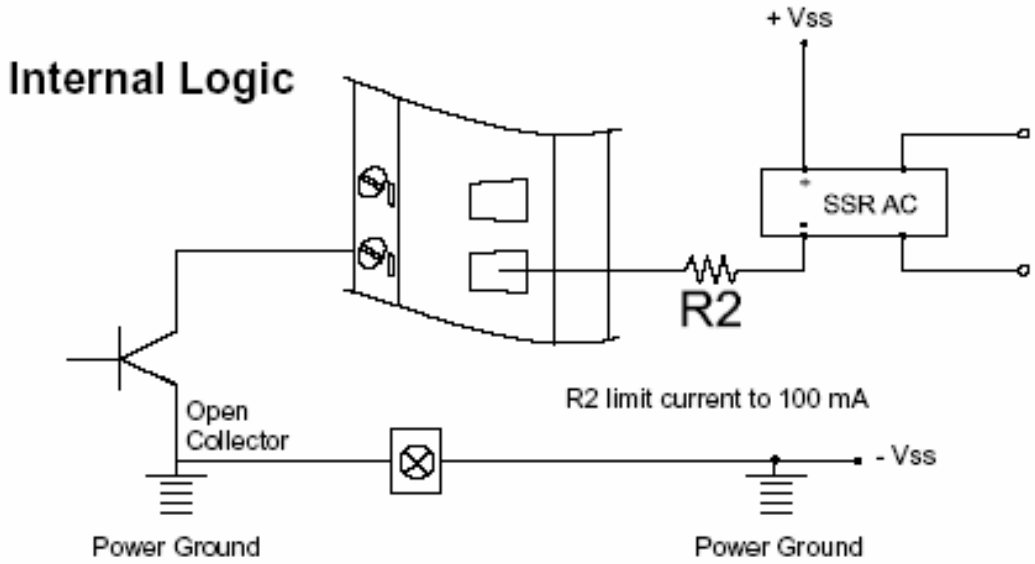


Figure 4.18 Digital Output with SSR (ADAM-5050/5056)

There are 16-point digital input and 16-point digital output modules in the ADAM-5000 series. The addition of these solid state digital I/O devices allows these modules to control or monitor the interfaces between high power DC or AC lines and TTL logic signals. A command from the host converts these signals into logic levels suitable for the solid-state I/O devices.

Table 4.7: Technical Specifications of ADAM-5056	
Points	16
Digital Output	Open collector to 30 V 100 mA max load
Power Dissipation	450 mW
Power Consumption	0.25 W

4.1.8 ADAM-5056S 16-ch Isolated Digital Output Module with LED

The ADAM-5056S provides 16 isolated digital output channels for critical environments need individual channel isolating protection. Different from other ADAM-5000 I/O modules, ADAM-5056S designed with 21 pins plug terminal.

ADAM-5056S

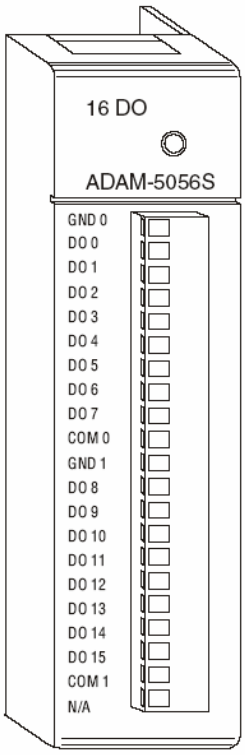


Figure 4.19 ADAM-5056S Module Front View

Application Wiring

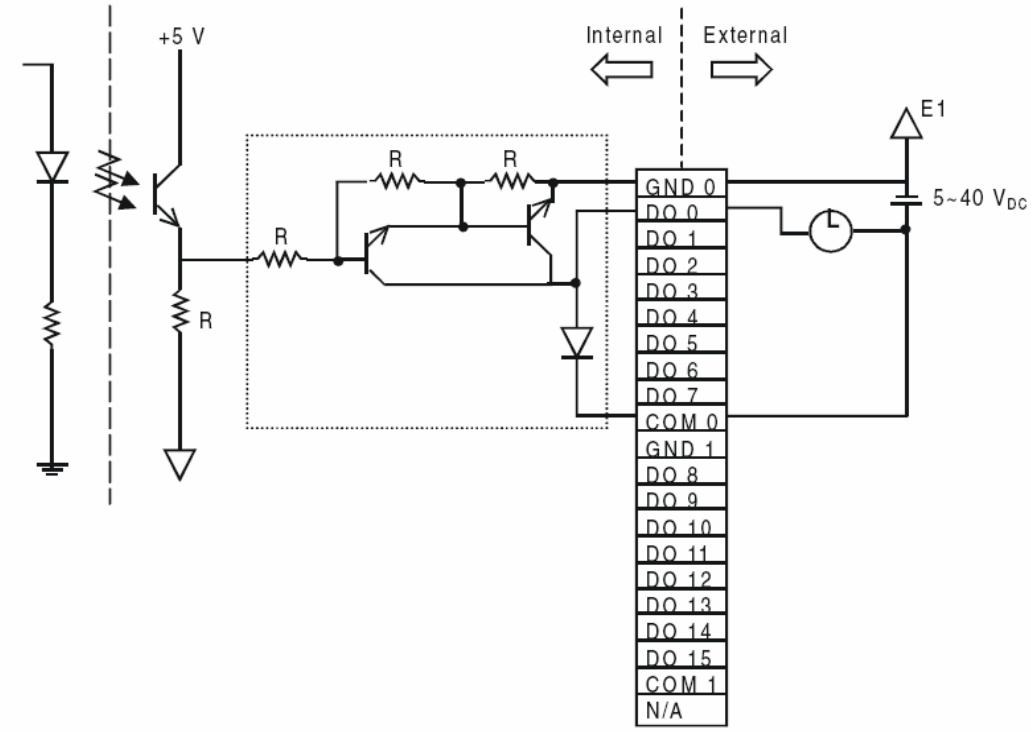


Figure 4.20 ADAM-5056S Module Wiring Diagram

Table 4.8: Technical Specifications of ADAM-5056S	
Points	16 (8-channel/group)
Digital Output	Open collector to 40 V 200 mA max load per channel
Optical Isolation	2500 V_{DC}
Opto-isolator response time	25 µs
Supply Voltage	5 ~ 40 V_{DC}
Power consumption	0.6 W
LED Indicator	On when active
I/O Connector Type	21-pin plug-terminal

4.1.9 ADAM-5056SO 16-ch Isolated Digital Output Module with LED

The ADAM-5056SO provides 16 channels source type isolated digital output for critical environments need individual channel isolating protection. Addition to the source output wiring, all of the specification and command sets are the same with ADAM-5056S.

ADAM-5056SO

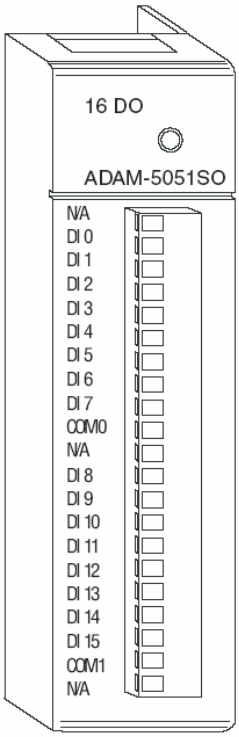


Figure 4.21 ADAM-5056SO Module Front View

Application Wiring

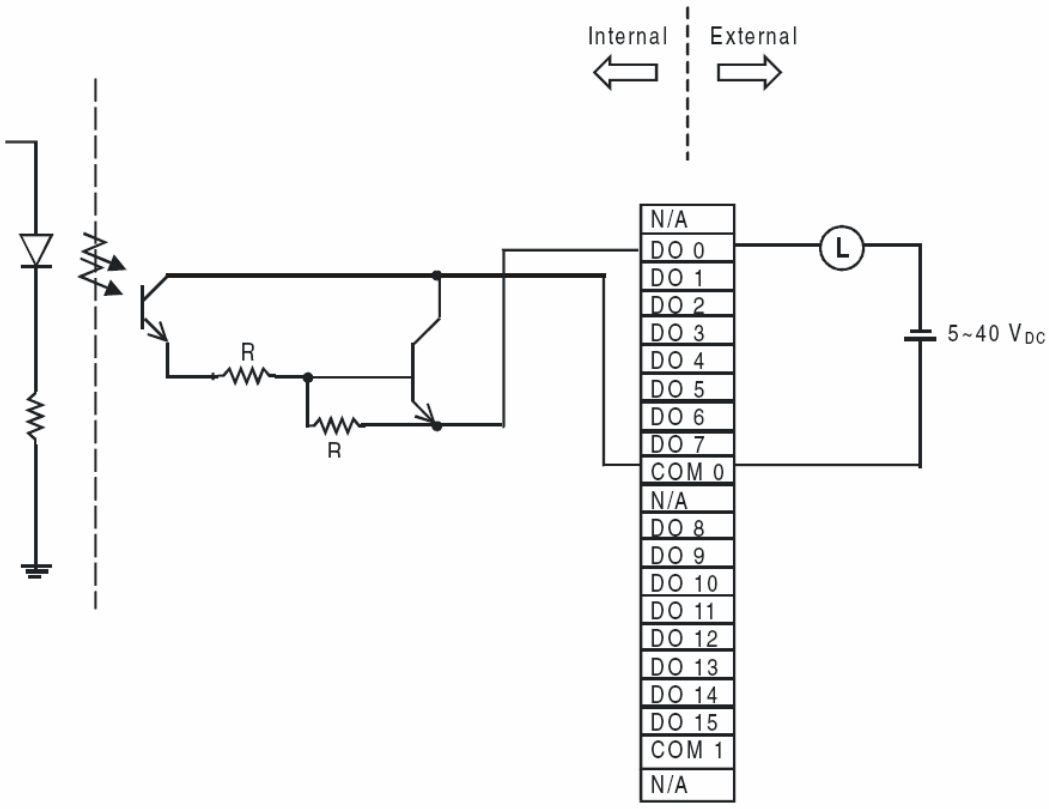


Figure 4.22 ADAM-5056SO Module Wiring Diagram

Table 4.9: Technical Specifications of ADAM-5056SO	
Points	16 (8-ch/group)
Digital Output	Open collector to 40 V 200 mA max load per channel
Optical Isolation	2500 VDC
Opto-isolator response time	25 us
Supply Voltage	5 ~ 40 VDC
Power consumption	0.6 W
LED Indicator	On when active
I/O Connector Type	21-pin plug-terminal

4.1.10 ADAM-5057S 32-ch Isolated Digital Output Module

The ADAM-5057S provides 32 isolated digital output channels for critical environments need individual channel isolating protection. Different from other ADAM-5000 I/O modules, ADAM-5057S designed with 40-pin flat cable wiring terminal.

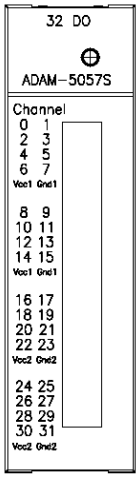


Figure 4.23 ADAM-5057S Module Front View

Application Wiring

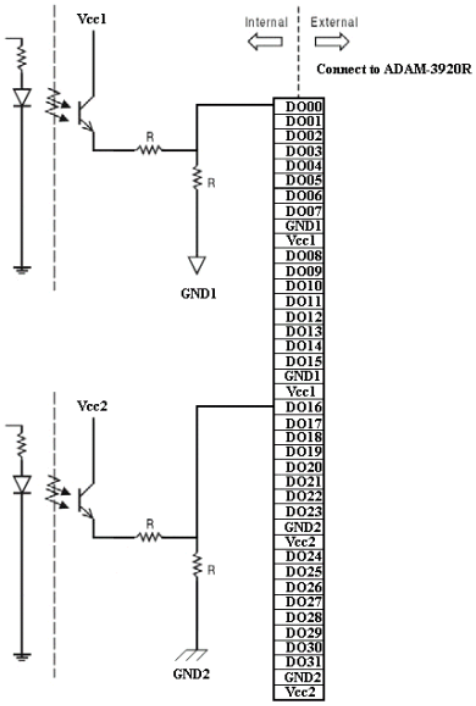


Figure 4.24 ADAM-5057S Module Wiring Diagram

Table 4.10: ADAM-5057S Technical Specification	
Points	32
Digital Output	Contact with ADAM-3920R
Optical Isolation	2500 VDC
Contact Rating	10 A 250VAC, 10 A 30VDC
Power Input	+24 VDC
Power consumption	1 W (max.)
Relay Type	SPST (Form A)
I/O Connector Type	40-pin flat cable wiring terminal

Chapter 5

Relay Output Modules

5.1 Relay Output Modules

5.1.1 ADAM-5060 Relay Output Module

The ADAM-5060 relay output module is a low-cost alternative to SSR modules. It provides 6 relay channels, two of Form A and four of Form C.

ADAM-5060

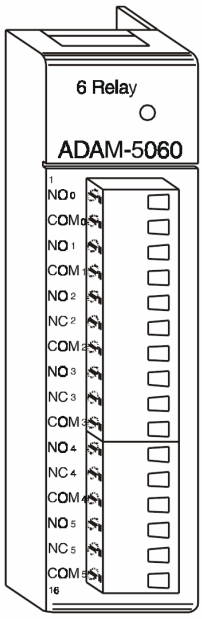


Figure 5.1 ADAM-5060 Module Frontal View

Application Wiring

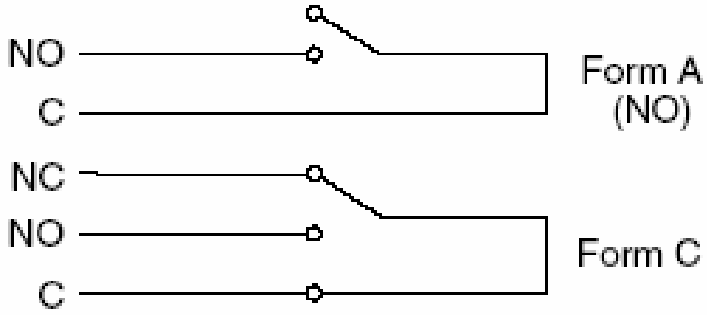


Figure 5.2 Relay Output

Table 5.1: Technical Specifications of ADAM-5060	
Points	6, two Form A and four Form C
Contact rating	AC: 125 V @ 0.6A; 250 V @ 0.3 A DC: 30 V @ 2 A; 110 V @ 0.6 A
Breakdown voltage	500 V_{AC}(50/60 Hz)
Relay on time (typical)	3 ms
Relay off time (typical)	1 ms
Total switching time	10 ms
Insulation resistance	1000 M- min. @ 500 V_{DC}
Power consumption	0.7 W

5.1.2 ADAM-5069 Relay Output Module

The ADAM-5069 relay output module provides 8 relay channels of Form A. Switches can be used to control the relays. Considered to user friendly, the ADAM-5069 also built with LED indicator for status reading easily. And it also provides a choice to clear or keep output status when reset by adjusting a jumper.

Specifications

Number of Output Channel: 8 Form A

Contact Rating:	AC:	250V@5A
	DC:	30V@5A
Breakdown Voltage:		750 VAC (50/60 Hz)
Insulation Resistance:		1000M£[@500VDC
LED Indicator:	On:	Active
	Off:	Non-active
Power Consumption:		0.25W (typical) 2.2W (Max)
Isolation Resistance:		4000 VRMS
Relay response Time: On:		5 ms
	Off:	5.6 ms

Clear or Keep Relay Status when reset (selectable by jumper)

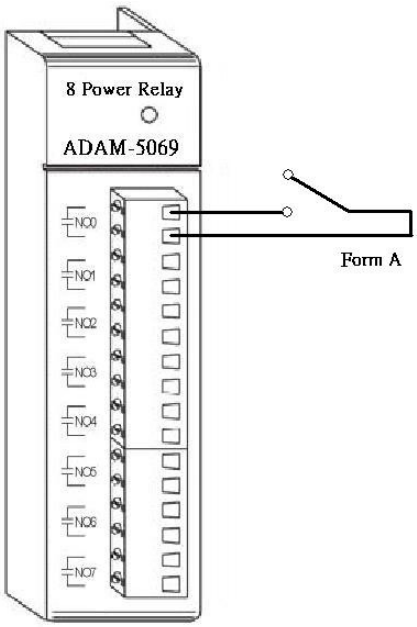


Figure 5.3 ADAM-5069 Module Front View Wiring

Chapter 6

Counter/Frequency Modules

6.1 Counter/Frequency Modules

Compatible ADAM-5000 Series Main Units

ADAM-5080 is a 4-channel counter/frequency module designed to be implemented within the following Advantech ADAM-5000 series main units:

- ADAM-5000/485
- ADAM-5510
- ADAM-5511
- ADAM-5510M
- ADAM-5510E
- ADAM-5510/TCP
- ADAM-5510E/TCP

Note! *Please make sure that the ADAM-5080 counter/frequency module is properly inserted into the compatible main units.*

6.1.1 ADAM-5080 4-ch Counter/Frequency Module

With ADAM-5080 4-Channel Counter/Frequency Module, users can select either counter or frequency mode for data output. ADAM-5080 offers users a variety of very flexible and versatile applications such as below:

Counter Mode or Frequency Mode

If you want to measure the number of input signals for totalizer function, you may use counter mode to measure quantities such as movement and flow quantity. Alternatively, you can also select frequency mode to calculate the instantaneous differential of quantities such as rotating speed, frequency or flow rate, and present them in specific engineering formats.

Up/Down or Bi-direction Function

When operating in counter mode, you can choose either the Up/Down function or the Bi-direction function for different application purposes. The counter will count up or down according to your applications. This counting function helps users obtain the most accurate data.

Alarm Setting Function

While in counter mode, you can set alarm status--Disable and Latch. If you want to disable it, you can select Disable. If Latch status is selected, it means the Alarm status will be "latched" whenever the alarm is being triggered. Once the alarm status being "latched," it will thereafter stay in that triggered state. Users will have to issue a "Clear Alarm Status" command to return the "latched" alarm status back to normal. Users can designate the high-limit value and low-limit value to regulate your alarm behavior through the utility program.

Digital Output Mapping

Users can either run the utility program or issue a "Set Alarm Connection" command to designate a specific digital output module for the alarm signal to be sent through.

ADAM-5080 Module Diagram

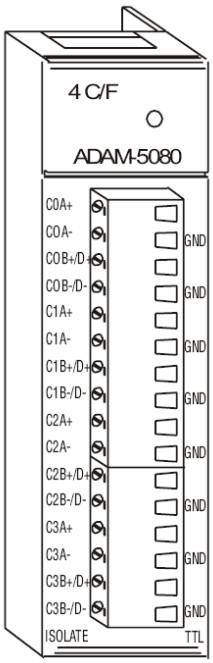


Figure 6.1 ADAM-5080 Module

ADAM-5080 Application Wiring

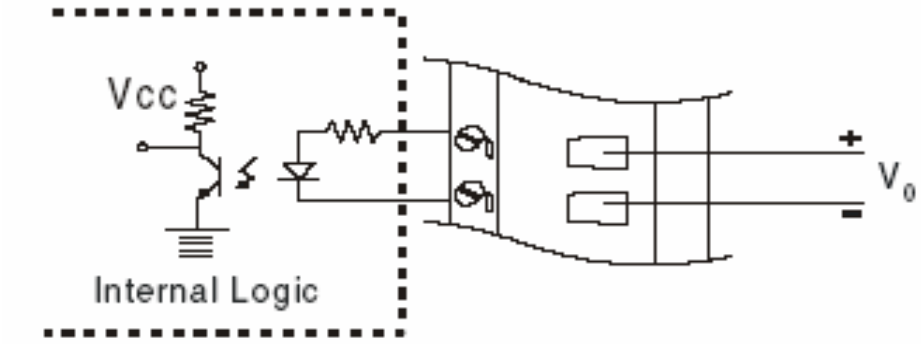


Figure 6.2 Isolated Input Level

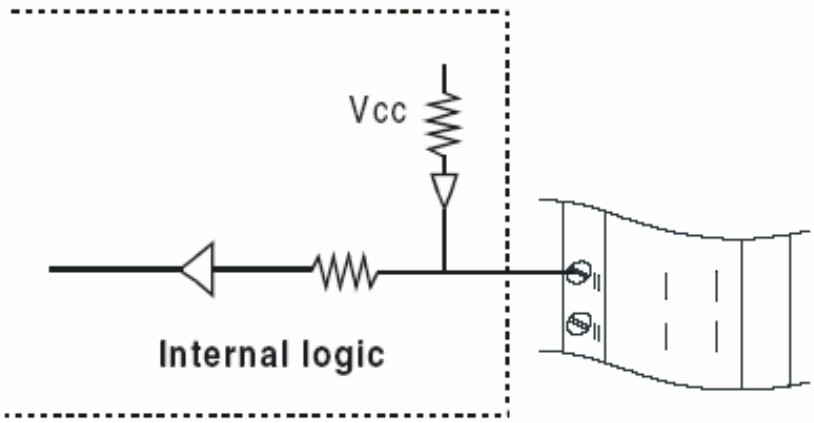


Figure 6.3 TTL Input Level

ADAM-5080 Counter/Frequency Mode Selection

Users can select Bi-direction, Up/Down, Counter or Frequency options as shown below.

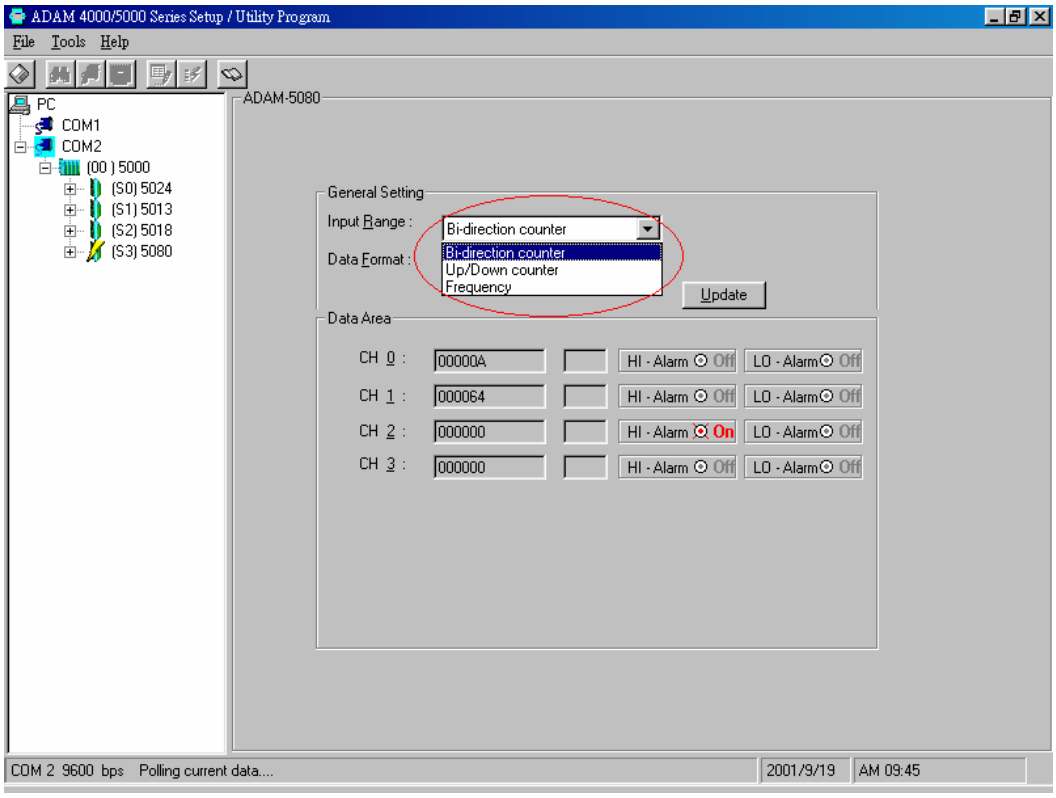


Figure 6.4 Counter / Frequency Mode

Note! *All four channels of ADAM-5080 will operate simultaneously in the mode you have selected. i.e. If you switch the ADAM-5080 to Counter Mode, all four channels will operate in Counter Mode.*

Features -- Counter Mode

Up/Down Counting

The Up/Down Counter Function offers two types of counting: Up Counting (increasingly) and Down Counting (decreasingly). Up Counting: when C0A+ and C0A- sense any input signals, the counter counts up.

Down Counting: when C0B+ and C0B- sense any input signals, the counter counts down. On receiving Up and Down signal simultaneously, the counter will not perform each specific counting accordingly, but will remain at the previous counting value, since these simultaneous signals won't have any effect on counting values.

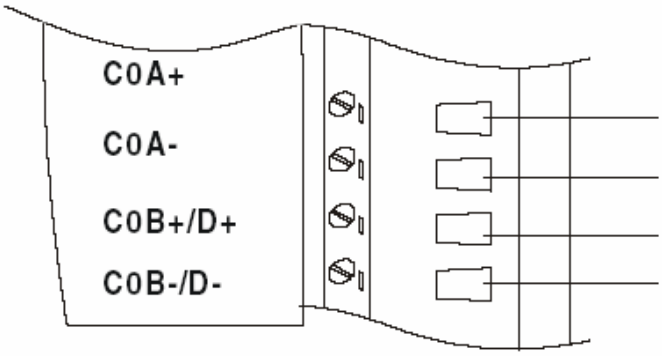


Figure 6.5 Wiring for Up/Down Counting

Note! *If you need only one type of counting, connect C0A+ and C0A- for Up Counting only; or connect C0B+ and C0B- for Down Counting only.*

Bi-direction Counting

For implementing Bi-direction Counting, you need to connect C0B+/D+ and C0B-/D- to implement the control function for Up/Down Counting. Up Counting: when the input signal is within logic level "1", the counter value increases.

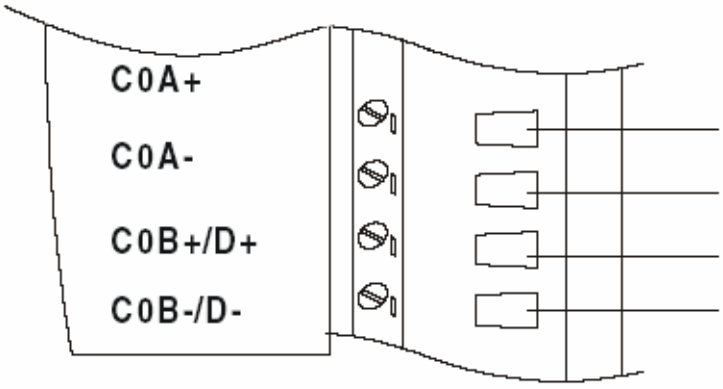


Figure 6.6 Wiring for Bi-direction Counting

Down Counting: when the input signal is within logic level "0", the counter value decreases.

Note! *If users select TTL mode and don't connect C0B+ C0B-, the counter value will increase. If users select Isolated mode and don't connect C0B+ C0B-, the counter value will decrease.*

Features -- Frequency Mode

If users want to select frequency mode, they can only utilize Up Counting type, and can only connect to C0A+ and C0A-.

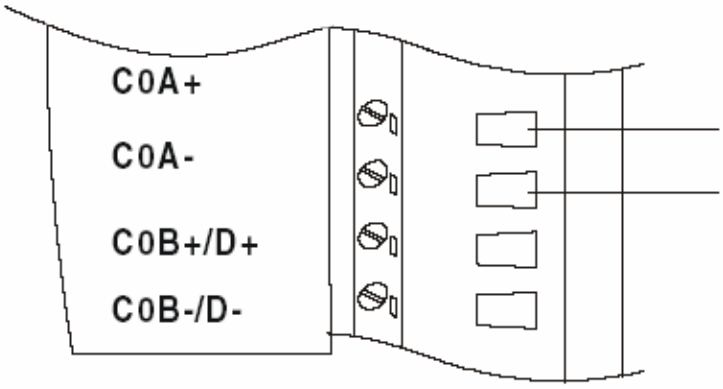


Figure 6.7 Wiring for Frequency Mode

Features -- Alarm Setting

According to your application purposes, you can run the utility program to set different limit values for High/Low Alarm.

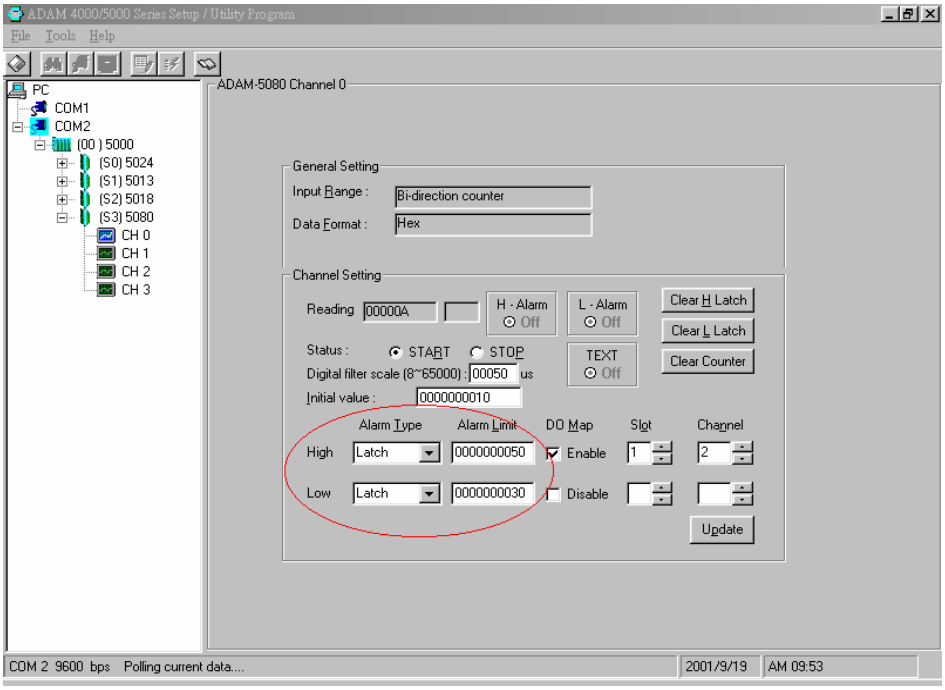


Figure 6.8 Setting Alarm Limit

Setting Initial Counter Value

In order to utilize the alarm, users have to set a high-alarm limit value and/or a low alarm limit value, and a initial value to fulfill the requirements for a basic alarm setting.

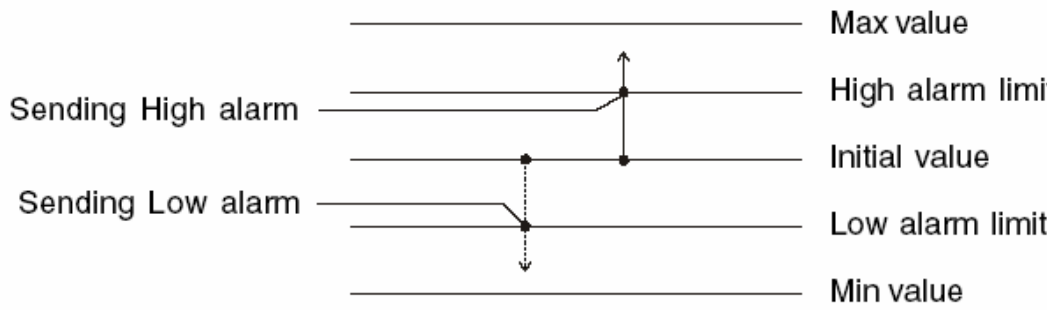


Figure 6.9 Sending Alarm Signal (Recommended Settings)

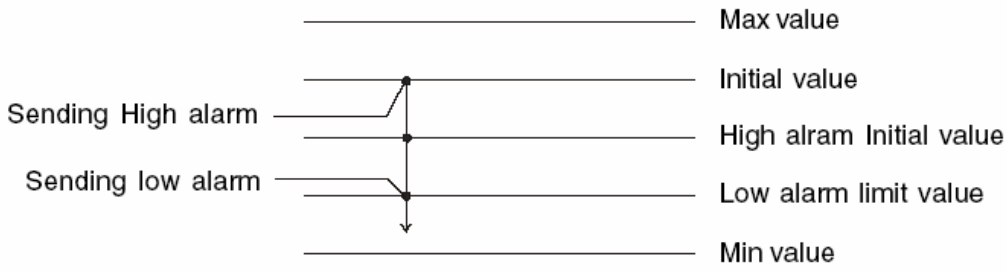


Figure 6.10 Sending Alarm Signal (Not Recommended)

Overflow Value

Overflow value is the number of times the counter value exceeds the Max/Min values you specified. When the counter value exceeds Maxi- mum value, the overflow value increases; when the counter value goes under Minimum value, the overflow value decreases. Besides, when the counter value runs beyond the range of Max/Min value, it will continue counting from the initial value. Furthermore, if users want to check the counter value to see if it is higher or lower than the Max/Min value, they can use the "ReadOverflowFlag" library to gain readout of the over- flow value.

Getting the Totalizer Value

If users want to get the actual counter value, a formula such as follows can facilitate an easy calculation from the initial counter value, overflow value and current counter value:

$$V_{tol} = \{|V_{ini} - V_{min\ (or\ } V_{max)}| + 1\} \times |V_{vf}| + |V_{ini} - V_{cur}|$$

V_{tol} : totalizer value

V_{ini} : initial counter value

V_{min} : min. counter value = 0 (fixed value)

V_{max} : max. counter value = 2_{32} = 4,294,967,295 (fixed value)

V_{vf} : overflow value

V_{cur} : current counter value

Example: If the initial value =10, overflow value =4, min. value = 0, current counter value = 3, the totalizer value could be Totalizer value = {|10 - 0| + 1} x| 4 |+ |10 -3| = 51

Features--Digital Output Mapping

If users want to use Digital Output function, ADAM utility is available for setting specifically which module, channel or slot to receive the alarm signals.

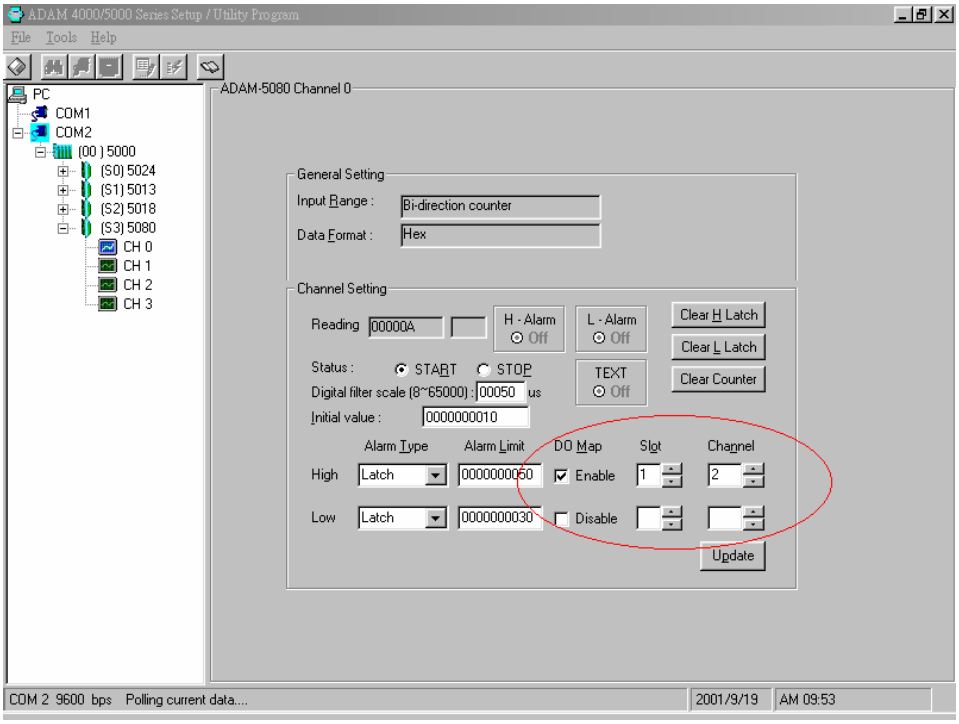


Figure 6.11 Digital Output Mapping

1. High Alarm State--Set Alarm state to "Latch" or "Disable".
2. High Alarm Limit--Set Alarm limit from 0 to 4,294,967,295.
3. High Alarm Output Mode--Enable or Disable D.O. Mapping.
4. High Alarm Output Slot--Users can select D.O Modules such as ADAM-5050, ADAM-5055, ADAM-5056, ADAM-5060, ADAM-5068.
5. High Alarm Output Channel--Select Alarm Output Channel
6. Clear Latch Alarm--Users can select "Enable" or "Disable" option. When selecting "Enable", the latch will be relieved and the alarm state will return to normal. Once the alarm state returns to normal, the Clear Latch Alarm will return to "Disable".

TTL/Isolated Input Level

According to your need, you can select either TTL or Isolated Input Level by setting the configuration for the jumpers. Select the proper jumper settings for either TTL or Isolated Input according to Figure 53. Please note that you must configure all six jumpers to the correct con- figuration for proper function.

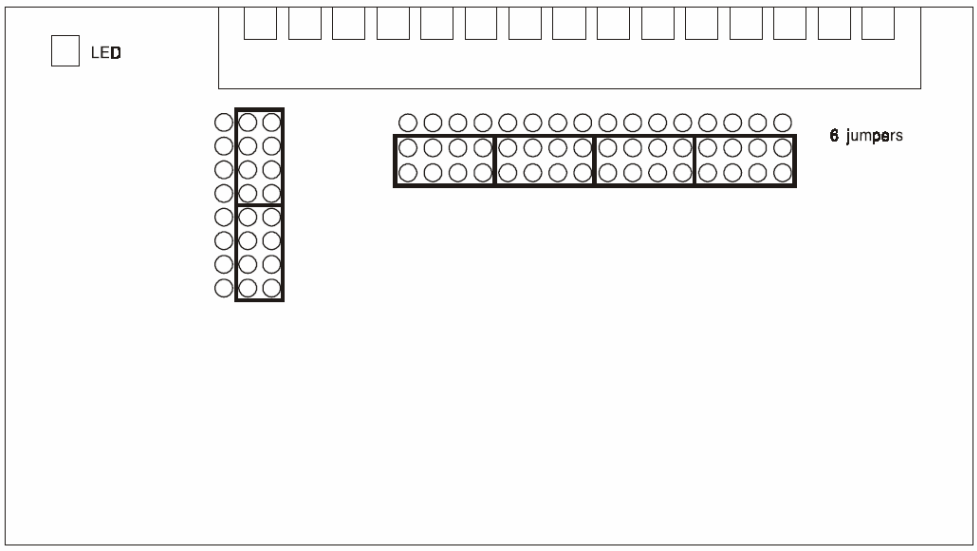


Figure 6.12 Jumper Location on the ADAM-5080 Module

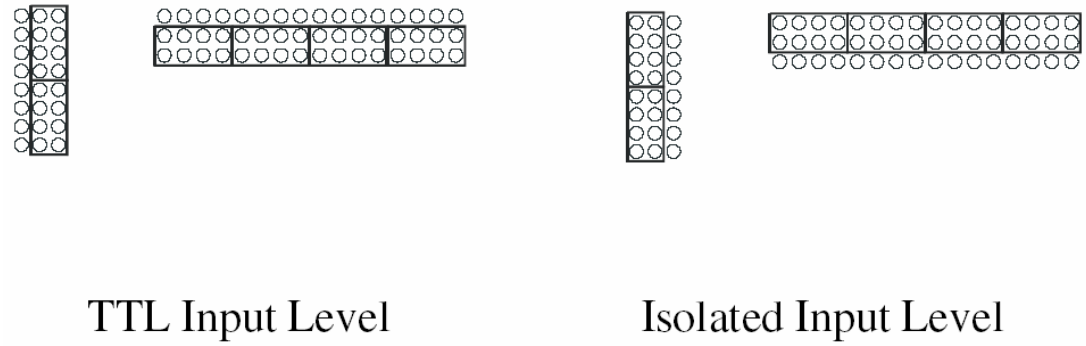


Figure 6.13 TTL/Isolated Input Level Selection

Table 6.1: ADAM-5080 Technical Specifications	
Channel	4
Input Frequency	0.3 ~ 1000 Hz max. (Frequency mode) 5000 Hz max. (Counter mode)
Input Level	Isolated or TTL level
Minimum Pulse Width	500 µ sec. (Frequency mode) 100 µ sec. (Counter mode)
Minimum Input Current	2mA (Isolated)
Isolated Input Level	Logic Level 0 : +1 V_{MAX} Logic Level 1 : + 3.5 V to 30 V
TTL Input Level	Logic Level 0 : 0 V to 0.8 V Logic Level 1 : 2.3 to 5 V
Isolated Voltage	1000 V_{RMS}
Mode	Counter (Up/Down, Bi-direction) Frequency
Programmable Digital Noise Filter	8 ~ 65000 µ sec

ADAM-5081 4-ch High Speed Counter/Frequency Mode Selection

Users can select Bi-direction, Up/Down Counter or Frequency option as shown below.

Note! *This high speed module is only for ADAM-5560 Series and ADAM-5000/485,ADAM-5000E.*

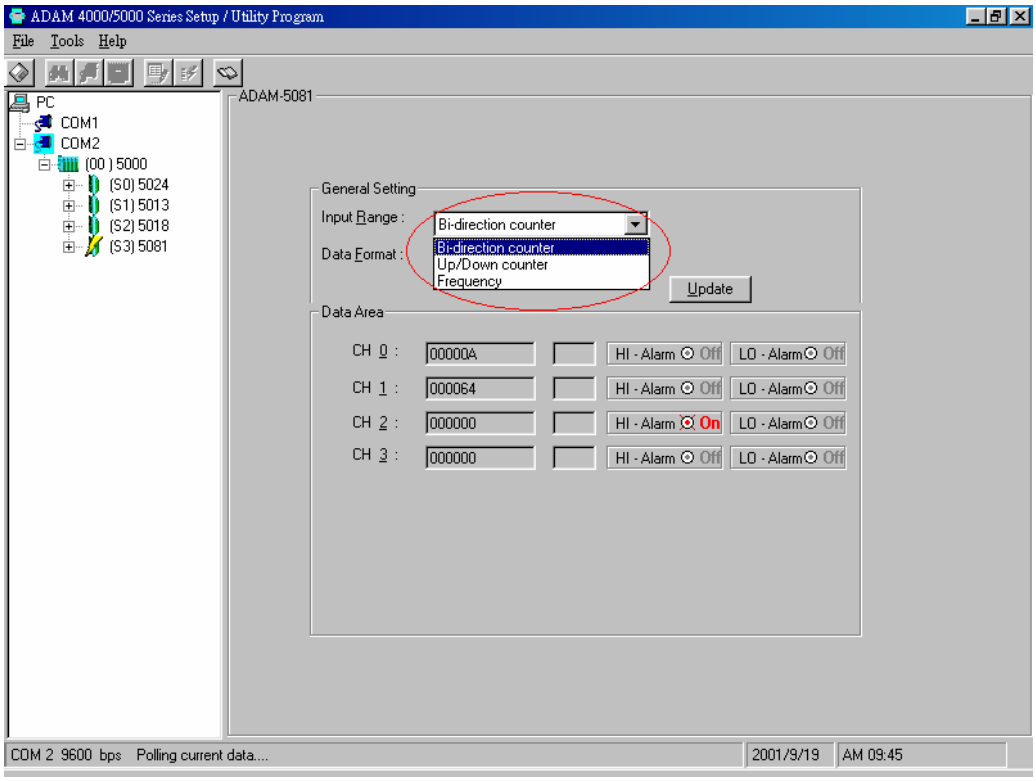


Figure 6.14 Counter / Frequency Mode

Note! *All four channels of ADAM-5081 will operate simultaneously in the mode you have selected. i.e. If you switch the ADAM-5081 to Counter Mode, all four channels will operate in Counter Mode.*

Features -- Counter Mode

Up/Down Counting

The Up/Down Counter Function offers two types of counting: Up Counting (increasingly) and Down Counting (decreasingly). Up Counting: when C0A+ and C0A- sense any input signals, the counter counts up.

Down Counting: when C0B+ and C0B- sense any input signals, the counter counts down. On receiving Up and Down signal simultaneously, the counter will not perform each specific counting accordingly, but will remain at the previous counting value, since these simultaneous signals won't have any effect on counting values.

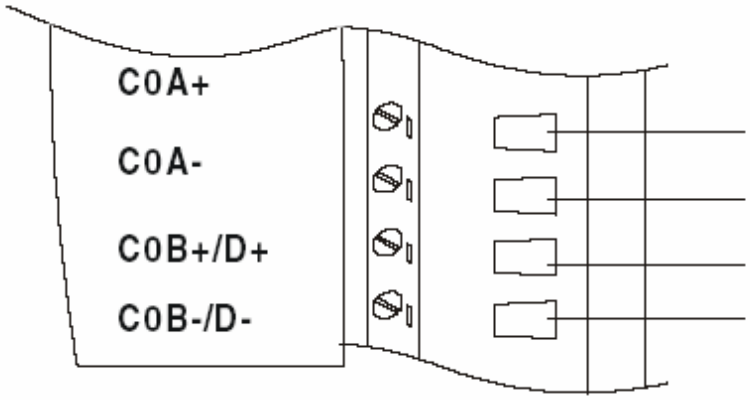


Figure 6.15 Wiring for Up/Down Counting

Note! *If you need only one type of counting, connect C0A+ and C0A- for Up Counting only; or connect C0B+ and C0B- for Down Counting only.*

Bi-direction Counting

For implementing Bi-direction Counting, you need to connect C0B+/D+ and C0B-/D- to implement the control function for Up/Down Counting. Up Counting: when the input signal is within logic level "1", the counter value increases.

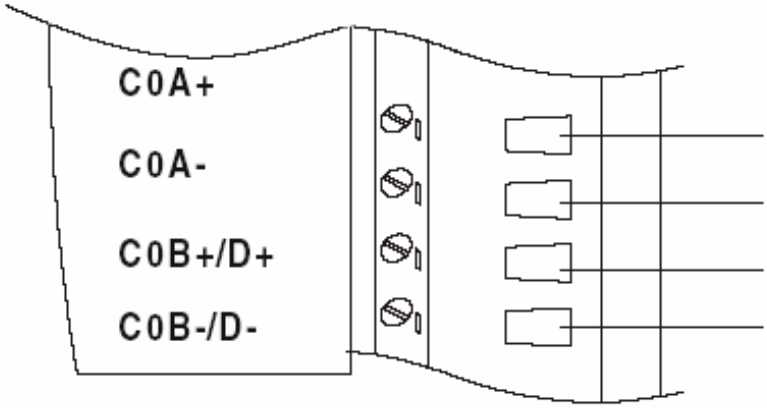


Figure 6.16 Wiring for Bi-direction Counting

Down Counting: when the input signal is within logic level "0", the counter value decreases.

Note! *If users select TTL mode and don't connect C0B+ C0B-, the counter value will increase. If users select Isolated mode and don't connect C0B+ C0B-, the counter value will decrease.*

Features -- Frequency Mode

If users want to select frequency mode, they can only utilize Up Counting type, and can only connect to C0A+ and C0A-.

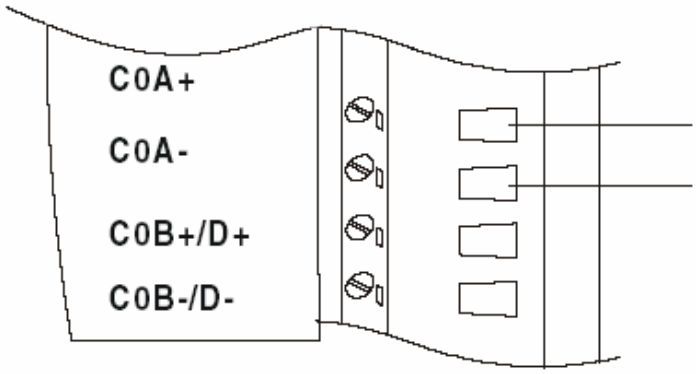


Figure 6.17 Wiring for Frequency Mode

Features -- Alarm Setting

According to your application purposes, you can run the utility program to set different limit values for High/Low Alarm.

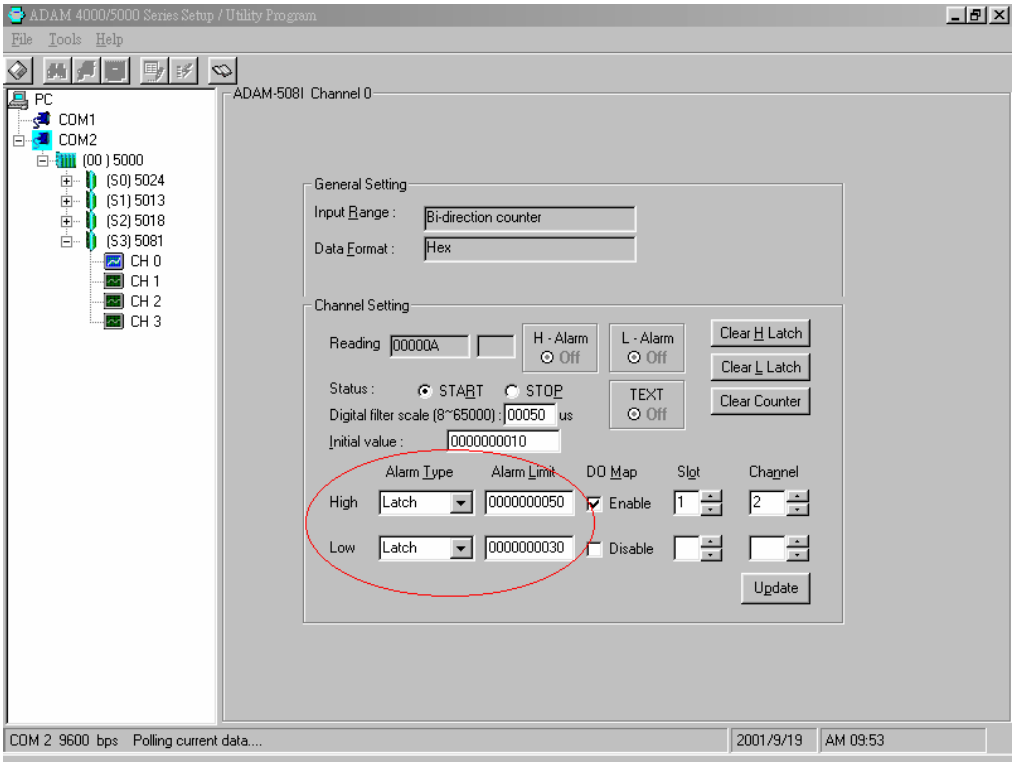


Figure 6.18 Setting Alarm Limit

Setting Initial Counter Value

In order to utilize the alarm function, users have to set a high-alarm limit value and/or a low alarm limit value, and an initial value to fulfill the requirements for a basic alarm setting.

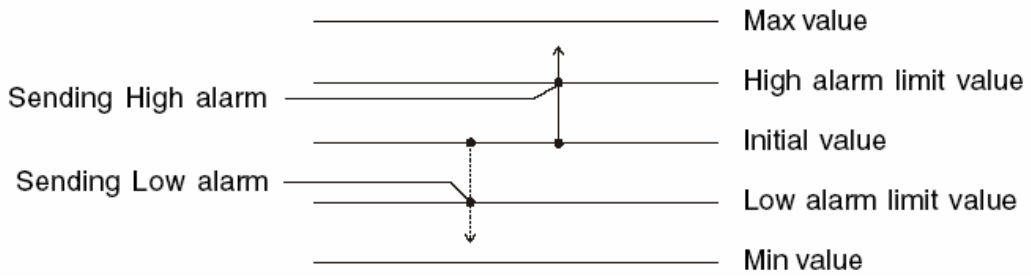


Figure 6.19 Sending Alarm Signal (Recommended Settings)

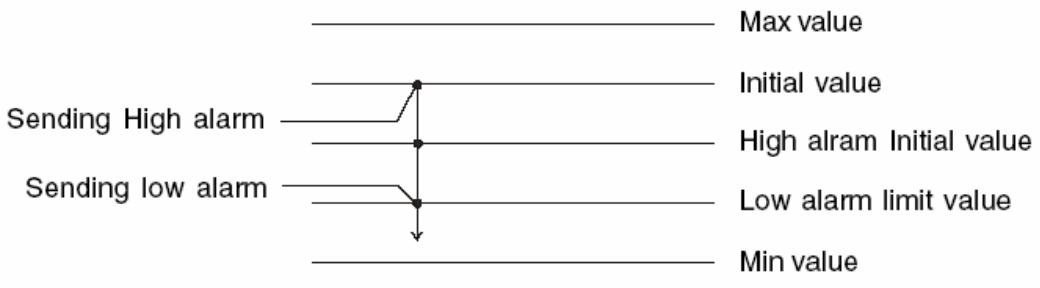


Figure 6.20 Sending Alarm Signal (Not Recommended)

Overflow Value

Overflow value is the number of times the counter value exceeds the Max/Min values you specified. When the counter value exceeds Maxi- mum value, the overflow value increases; when the counter value goes under Minimum value, the overflow value decreases. Besides, when the counter value runs beyond the range of Max/Min value, it will continue counting from the initial value. Furthermore, if users want to check the counter value to see if it is higher or lower than the Max/Min value, they can use the "ReadOverflowFlag" library to gain readout of the over- flow value.

Getting the Totalizer Value

If users want to get the actual counter value, a formula such as follows can facilitate an easy calculation from the initial counter value, overflow value and current counter value:

$$V_{tol} = \{|V_{ini} - V_{min\ (or\ } V_{max)}| + 1\} \times |V_{vf}| + |V_{ini} - V_{cur}|$$

V_{tol} : totalizer value

V_{ini} : initial counter value

V_{min} : min. counter value = 0 (fixed value)

V_{max} : max. counter value = 2_{32} = 4,294,967,295 (fixed value)

V_{vf} : overflow value

V_{cur} : current counter value

Example: If the initial value =10, overflow value =4, min. value = 0, current counter value = 3, the totalizer value could be Totalizer value = {|10 - 0| + 1} x| 4 |+ |10 -3| = 51

Features--Digital Output Mapping

If users want to use Digital Output function, ADAM utility is available for setting specifically which module, channel or slot to receive the alarm signals.

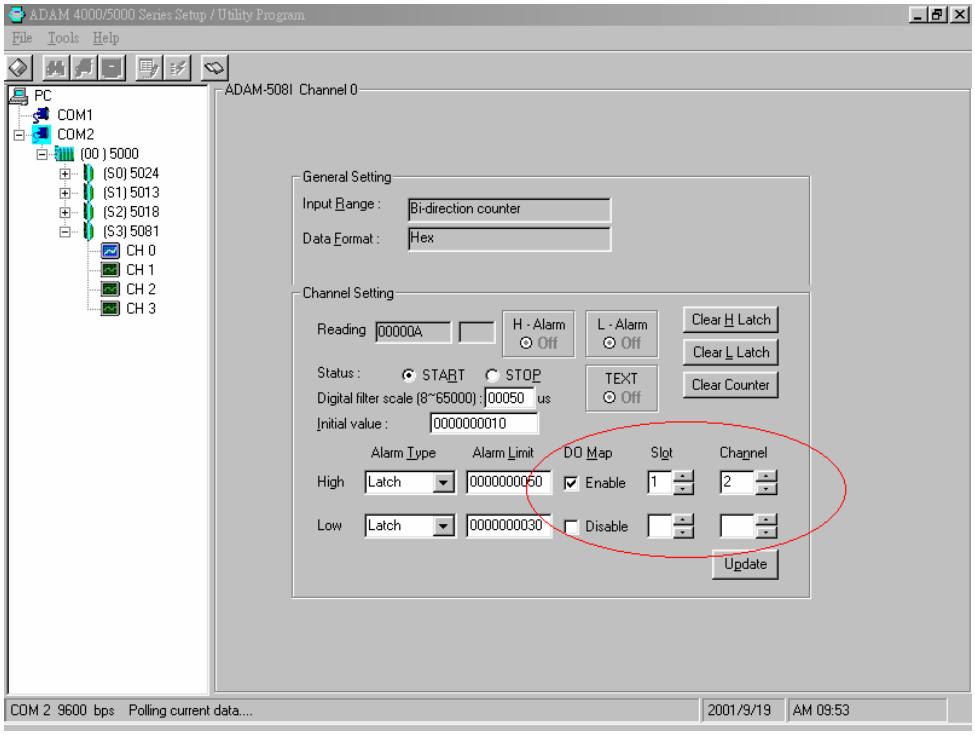


Figure 6.21 Digital Output Mapping

1. High Alarm State--Set Alarm state to "Latch" or "Disable".
2. High Alarm Limit--Set Alarm limit from 0 to 4,294,967,295.
3. High Alarm Output Mode--Enable or Disable D.O. Mapping.
4. High Alarm Output Slot--Users can select D.O Modules such as ADAM-5050, ADAM-5055, ADAM-5056, ADAM-5060, ADAM-5068 for the alarm signal to be sent through.
5. High Alarm Output Channel--Select Alarm Output Channel
6. Clear Latch Alarm--Users can select "Enable" or "Disable" option. When selecting "Enable", the latch will be relieved and the alarm state will return to normal. Once the alarm state returns to normal, the Clear Latch Alarm will return to "Disable".

TTL/Isolated Input Level

According to your need, you can select either TTL or Isolated Input Level by setting the configuration for the jumpers. Select the proper jumper settings for either TTL or Isolated Input according to Figure 63. Please note that you must configure all six jumpers to the correct con- figuration for proper function.

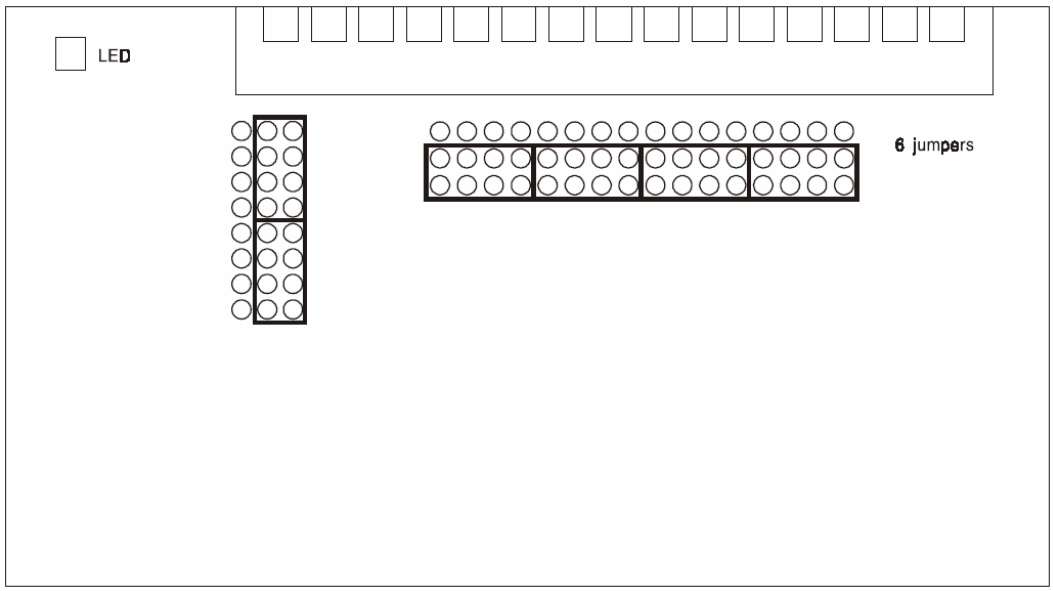


Figure 6.22 Jumper Location on the ADAM-5081 Module

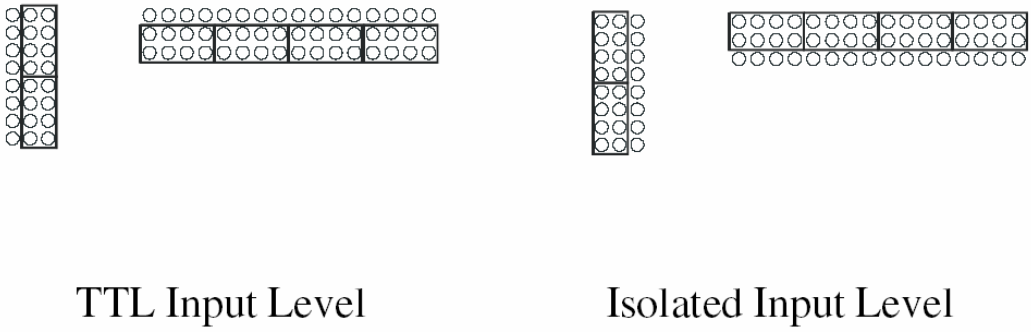
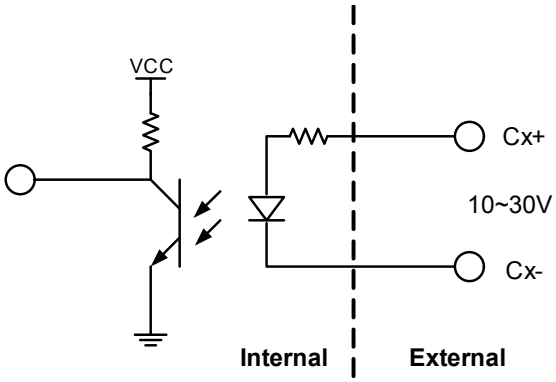
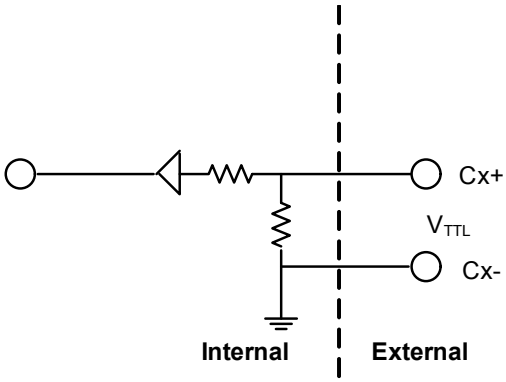


Figure 6.23 TTL/Isolated Input Level Select

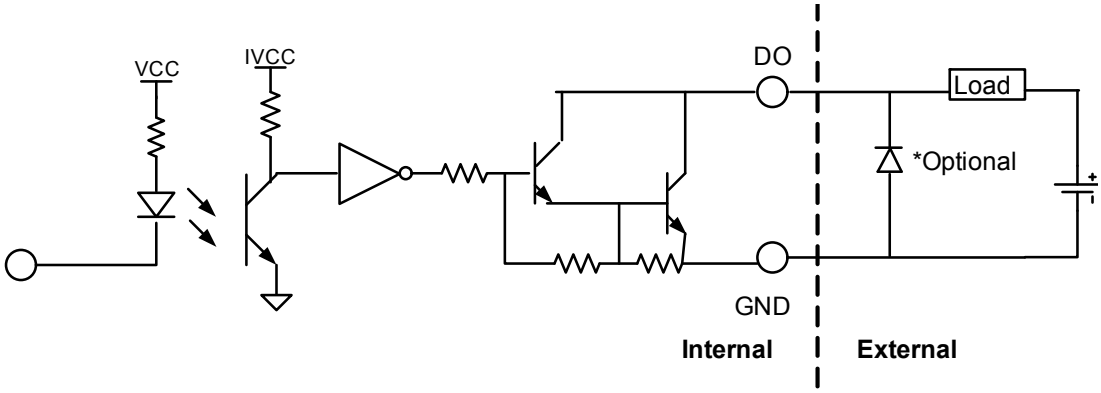
Table 6.2: ADAM-5081 Technical Specifications	
Channel	4
Input Frequency	5 Hz~1 MHz max. (Frequency mode) 1 MHz max. (Counter mode)
Input Level	Isolated or TTL level
Minimum Pulse Width	1 μ sec. (Frequency mode) 1 μ sec. (Counter mode)
Minimum Input Current	2mA (Isolated)
Isolated Input Level	Logic Level 0 : +3 V_{MAX} Logic Level 1 : + 10 V to 30 V
TTL Input Level	Logic Level 0 : 0 V to 0.8 V Logic Level 1 : 2.3 to 5 V
Isolated Voltage	2500 V_{RMS}
Mode	Counter (Up/Down, Bi-direction, up, A/B Phase) Frequency
Programmable Digital Noise Filter	1 ~ 65000 μ sec



Isolated input



TTL input



Isolated DO output

*Add a diode if load is relay

Chapter 7

Serial Modules

7.1 Serial Modules

Compatible ADAM-5000 Series Main Units

The ADAM-5090 is a 4-port RS-232 communication module to be implemented with the following Advantech ADAM-5000 series main units: ADAM-5510 (with library Version V1.10 or above) ADAM-5511 (with library Version V1.10 or above)

7.1.1 ADAM-5090 4-port RS-232 Communication Module

Bi-direction Communication

The ADAM-5090 is equipped with four RS-232 ports, which makes it especially suitable for bi-direction communication. It can simultaneously read data from other third-party devices such as Bar Code and PLC as long as these devices are equipped with a RS-232 interface. Furthermore, the ADAM-5090 can issue commands to control other devices. It is fully integrated with the ADAM-5000, ADAM-5500 and ADAM-4000 series, and transmits data to each other through the RS-232 port. The whole integrated system is an intelligent stand-alone system and can connect and issue commands to control devices such as printers and PLCs in remote factory location.

The ADAM-5090 transmits and receives data by polling communication, and each port can receive up to 128 bytes in the FIFO. For continuous data longer than 128 bytes, please refer to Table 20 for Baud Rate setting to avoid data loss.

Table 7.1: Baud Rate Settings

Baud Rate (bps)	115200	57600	38400	19200	9600	4800	2400
Polling interval (ms)	11.11	22.22	33.33	66.66	133.33	266.66	533.33

Communication Backup Function

With the ADAM-5090 you can implement dual communication channels between your PC and the ADAM system. Even when one of the two communication channels is down, your system can still function through the alternative communication channel. This dual communication channels can be implemented by application software.

ADAM-5090 Module Diagram

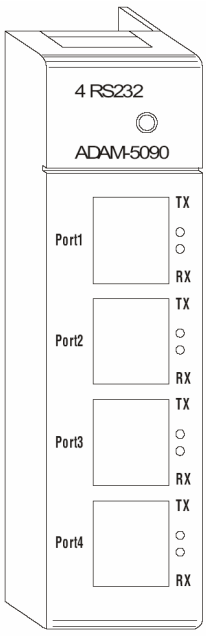


Figure 7.1 ADAM-5090 Module

ADAM-5090 Application Wiring

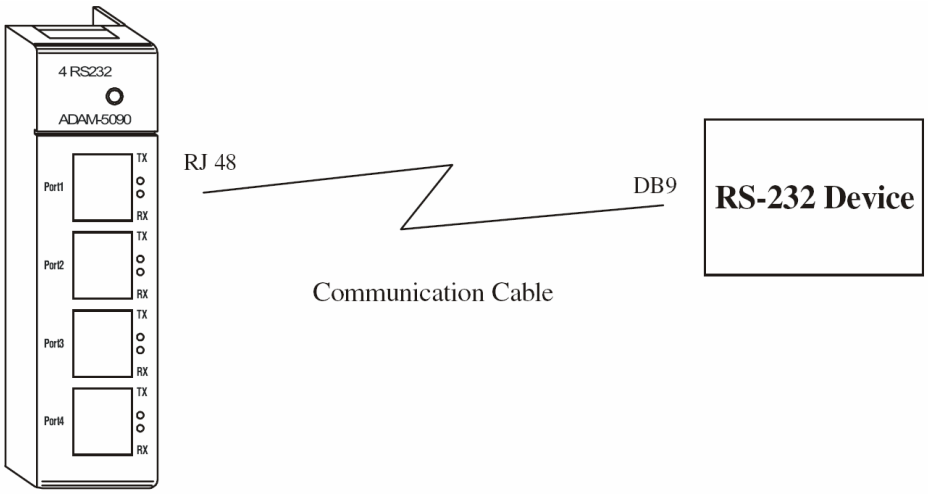


Figure 7.2 ADAM-5090 Application Wiring

Table 7.2: Pin Mapping		
PIN Name	RJ-48	DB9
/DCD	1	1
RX	2	2
TX	3	3
/DTR	4	4
GND	5	5
/DSR	6	6
/RTS	7	7
/CTS	8	8
RI or +5V	9	9
GND	10	X

Table 7.3: ADAM-5090 Technical Specifications	
Function	Provides communication ports for the ADAM-5510 to integrate other devices with communication function into your system
Electrical Interface	4 ports (RS-232)
Communication Rates	4800, 9600, 19200, 38400, 115200bps
FIFO	128 bytes/per UART (Tx/Rx)
Indicator	Tx (Orange), Rx (Green)
Power Required	100mA @ $5V_{DC}$ Default in RI mode (*)

User can define the communication ports with 5VDC output by switching the jumper, and the maximum current output is 400mA.

I/O Slots and I/O Ports Numbering

The ADAM-5090 module provides four RS-232 ports for communication with target devices. The ports are numbered 1 through 4. For programming, the definition of port number depends on the slot number and port number. For example, the second port on the ADAM-5090 in slot 1 is defined to port 12.

Jumper Settings

This section tells you how to set the jumpers to configure your ADAM-5090 module. There are four jumpers on the PC Board. User can choose RI signal or 5V output for each port by setting these jumpers (system default is RI signal).

The following figure shows the location of the jumpers:

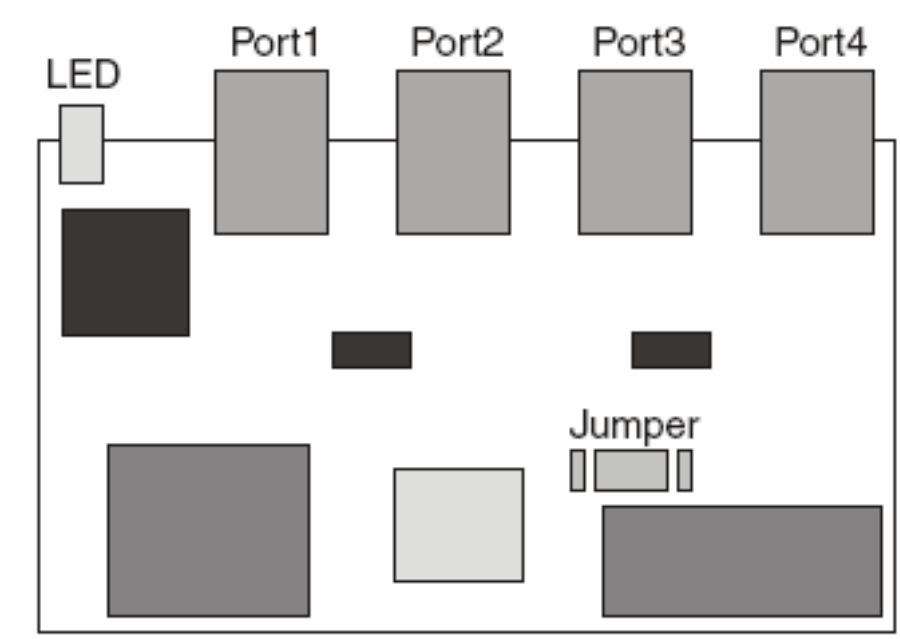


Figure 7.3 Jumper Locations on the CPU Card

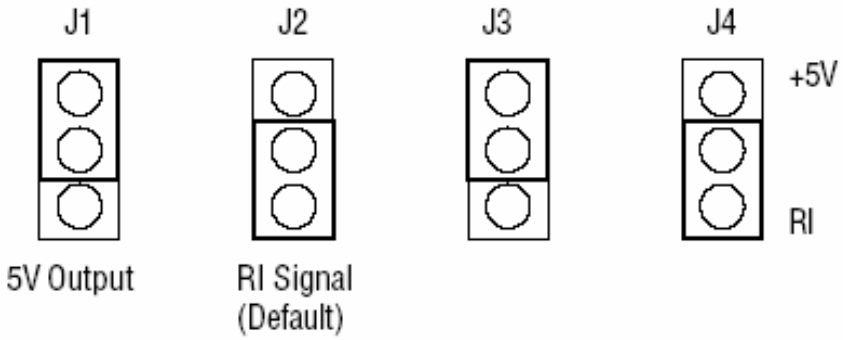


Figure 7.4 Jumper Settings

LED Status of the ADAM-5090 Module

There are two LEDs for each port on the front panel of the ADAM-5090 to display specific communication status:

- Green LED (RX): Data Receiving Status; the LED indicator is on when the port is receiving data.
- Orange LED (TX): Data Transmitting Status; the LED indicator is on when the port is transmitting data.

Configuring Your ADAM-5090 Module

This section explains how to configure an ADAM-5090 module before implementing it into your application.

Quick Start

Step 1: Get your host PC ready, and run the ADAM-5510 Utility Software.

Step 2: Install the ADAM-5090 Module and power on your ADAM-5510 main unit.

Step 3: Download the executable program to the main unit

Step 4: Monitor the ADAM-5090 Module's current status from the PC through the utility software.

A basic example program for the ADAM-5090

```
main ()
{
//Install the port you would like to use. Here we install slot 0, port 1.
port_install(1);
// Here we install slot 2, port 2.
port_install(22);

//Select working port. Here we select slot 0, port 1.
port_select(1);
//Set port data format.
//Here we set the data format of port 1 as lengh:8; parity:0;stop_bit:1. (N81)

port_set_format(1,8,0,1);


//Set port speed. Here we set communication speed of port 1 as 115200 bps.
//(L is necessary)




port_set_speed(1,115200L);


//Enable Port FIFO. Here we enable 128 byte FIFO for port1.
```

```
port_enable_fifo(1);


//After these above settings are enabled, you can apply any other function library to
implement your program.
}
```

—A receive-and-transmit example program for the ADAM-5090

```
main()
{
int err_value, char character port_installed(1)
:
:
port_enable_fifo(1);


//check whether error has been received or not
err_value=port_rx_error(1);


//if error detected, print out the message
if(err_value)
{
 printf("\n Rx Error, The LSR Value=%02X", Err_value)";
}
//check whether FIFO receives data or not; if data received, read a character
if(port_rx_ready(1))

{
character=port_rx(1);
}

//check whether FIFO is empty or not, if empty, send a character
if(port_tx_empty(1));
{
port_tx(1, character)
}
}
```

7.1.2 ADAM-5091 4-port RS-232 Communication Module with share interrupt (Only for ADAM-5560 Series)

Bi-direction Communication

The ADAM-5091 is equipped with four RS-232 ports with share interrupt, which makes it especially suitable for bi-direction communication. It can simultaneously read data from other third-party devices such as Bar Code and PLC as long as these devices are equipped with a RS-232 interface. Furthermore, the ADAM-5091 can issue commands to control other devices. It is fully integrated with the ADAM-5560, and transmits data to each other through the RS-232 port. The whole integrated system is an intelligent stand-alone system and can connect and issue commands to control devices such as printers and PLCs in remote factory location.

The ADAM-5091 transmits and receives data by sharing interrupt communication, and each port can receive up to 128 bytes in the FIFO. For continuous data longer than 128 bytes, please refer to Table 27 for Baud Rate setting to avoid data loss.

Table 7.4: Baud Rate Settings

Baud Rate (bps)	115200	57600	38400	19200	9600	4800	2400
Polling interval (ms)	11.11	22.22	33.33	66.66	133.33	266.66	533.33

Communication Backup Function

With the ADAM-5091 you can implement dual communication channels between your PC and the ADAM system. Even when one of the two communication channels is down, your system can still function through the alternative communication channel. This dual communication channels can be implemented by application software.

ADAM-5091 Module Diagram

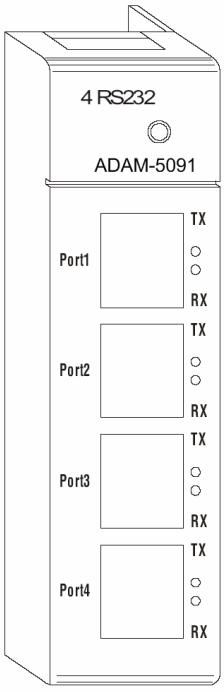


Figure 7.5 ADAM-5091 Module

ADAM-5091 Application Wiring

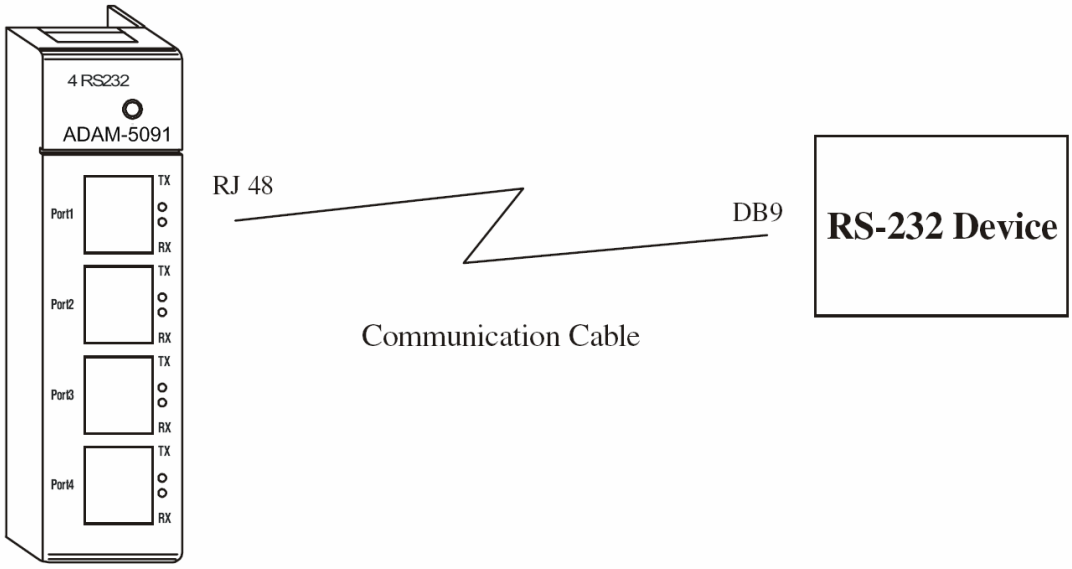


Figure 7.6 ADAM-5091 Application Wiring

PIN Mapping

Table 7.5: PIN Mapping		
PIN Name	RJ-48	DB9
/DCD	1	1
RX	2	2
TX	3	3
/DTR	4	4
GND	5	5
/DSR	6	6
/RTS	7	7
/CTS	8	8
RI or +5V	9	9
GND	10	X

Table 7.6: ADAM-5091 Technical Specifications	
Function	Provides communication ports for the *ADAM-5560* to integrate other devices with communication function into your system
Electrical Interface	4 ports RS-232
Communication Rates	4800, 9600, 19200, 38400, 115200bps
FIFO	128 bytes/per UART (Tx/Rx)
Indicator	Tx (Green), Rx (Red)
Power Required	100mA @ $5V_{DC}$ Default in RI mode (*)

I/O Slots and I/O Port Numbering

The ADAM-5091 module provides four RS-232 ports for communication with target devices. For more information about the number of slot and COM port, you may refer to the section of "ADAM-5091 COM port configuration" in ADAM-5560KW series Manual.

LED Status of the ADAM-5091 Module

There are two LEDs for each port on the front panel of the ADAM-5091 to display specific communication status:

- a. Red LED (RX): Data Receiving Status; the LED indicator is on when the port is receiving data.
- b. Green LED (TX): Data Transmitting Status; the LED indicator is on when the port is transmitting data.

7.1.3 ADAM-5095 2-port CAN Serial Communication Module with isolation protection (Only for ADAM-5560 Series)

ADAM-5095 is a special purpose communication module that offers the connectivity of the Controller Area Network (CAN). With its built-in CAN controllers, the ADAM-5095 provides bus arbitration and error detection with an automatic transmission repeat function. This drastically reduces the chance of data loss and ensures system reliability. The on-board CAN controllers are located at different positions in the memory, and you can run both CAN controllers independently at the same time. With high compatibility, the ADAM-5095 can be used in diverse systems.

ADAM-5095 Diagram

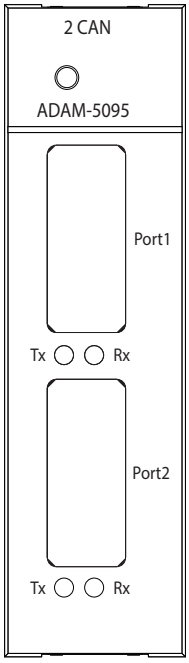
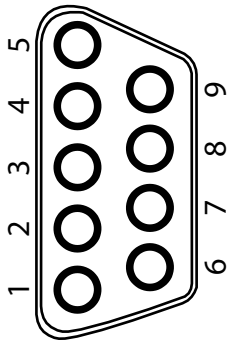


Figure 7.7 ADAM-5095 Module

CAN Serial Port Pin Assignment

Table 7.7: CAN Serial Port Pin Assignment (CAN1 ~ CAN2)

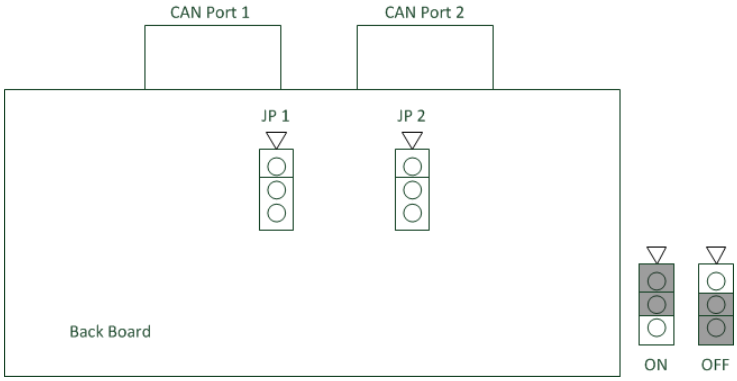
Pin	CAN Signal Definition
1	CAN-L
2	GND
3	
4	
5	
6	
7	CAN-H
8	
9	



Termination Resistor Settings

Terminal resistors are factory installed to allow for impedance matching.These resistors can be enabled by utilizing SW1 and SW2 for each port (shown below). The value of the resistor should equal the characteristic impedance of the signal wires (approximately 120 ohms). The following figure shows resistor placements.

Enable Termination Resistor for CAN1 and CAN2 Ports (SW1 and SW2)

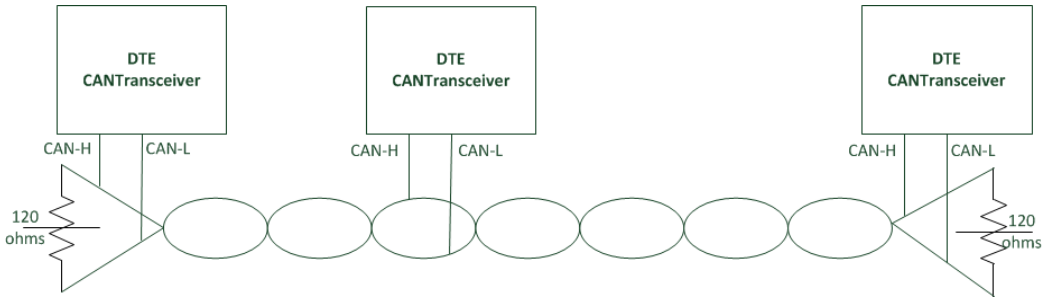


I/O Slots and I/O Ports Numbering

There're two PCI slots on the ADAM-5560 series. If only one ADAM-5095 module is used, no mater which PCI slot is plugged, the port number shown in the Utility would be CAN1 and CAN2. If two ADAM-5095 modules are used, the port number shown in the Utility would be CAN1 and CAN2 for the first PCI slot and CAN3 and CAN4 for the second PCI slot.

CAN Serial Port Wiring

The CAN standard supports half-duplex communication. This means that just two wires are used to transmit and receive data.



Wiring connections are as follows:

Table 7.8: ADAM-5095 DTE Pin Wiring

Pin	ADAM-5095 DTE(DB9-M) Pin Signal	DTE Pin Signal
7	CAN-H	CAN-H
3	GND	GND
2	CAN-L	CAN-L

Maximum Bit Rate vs. Bus Length

For a Controller Area Network, the maximum possible bus length depends on the bit rate. The bit rate can always be slower than the maximum possible speed for a given bus length. Conversely, the bus length can be shorter than the maximum possible bus length for a given transmission speed.

Table 7.9: Maximum Bit rate vs. Bus Length

Bit Rate	Bus Length
1M bps	25m
800k bps	50m
500k bps	100m
250k bps	250m
125k bps	500m
50k bps	1000m
20k bps	2500m
10k bps	5000m

Chapter 8

Storage Modules

8.1 Storage Modules

8.1.1 ADAM-5030 2-slot SD Storage Module with 2x USB2.0

ADAM-5030 is a 2-slot secure digital card storage module that provides 2 USB ports and 2 SD slots. It is fully compliant with USB 2.0 and FAT16 and is also low power consuming, at only 0.5W. According the volume of SD Card, you can extend the memory of your controller up 2 GB.

Compatible with ADAM-5560 Series Main Units

The ADAM-5030 interfaces with the main unit through the PCI bus. The ADAM-5560 series main unit is equipped with a PCI interface connector on 2 slots. Through adapting the ADAM-5030, the ADAM-5560 can extend the storage capacity easily.

The ADAM-5030 can also be extended too two USB2.0 ports. These USB ports act in the same way as the ports on the ADAM-5560 main units.

ADAM-5030 Diagram

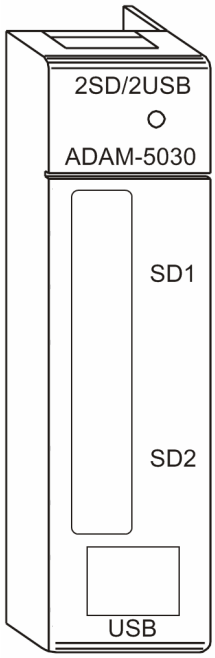


Figure 8.1 ADAM-5030 Module Frontal View

Table 8.1: Technical Specifications of ADAM-5030	
USB Type	USB Rev 2.0 (Compliant)
USB Number	2
Storage Type	SD (Secure Digital Card)
Storage Number	2
Operating Temperature	0~60 (32~140)
Certification	CE
Power Consumption	3 W (Max)
Max Storage	1G (Max) x 2
Format	FAT16
Surge Protection	10kW
Hot Swap	Yes