

**NuDAQ<sup>®</sup>**

**ACL-7125**

**8 Relay & 8 Isolated DI Card**

**User's Guide**



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Product Model			
Environment to Use	OS: _____ Computer Brand: _____ M/B: _____ CPU: _____ Chipset: _____ BIOS: _____ Video Card: _____ Network Interface Card: _____ Other: _____		
Challenge Description			
Suggestions to ADLINK			

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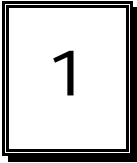
# How to Use This Guide

This manual is designed to help you use the ACL-7125. It describes how to operate the ACL-7125 card to meet your application requirements. It is divided into five chapters:

- **Chapter 1**, "Introduction," gives an overview of the product features, applications, and specifications.
- **Chapter 2**, "Installation," describes how to install the ACL-7125. The layout of ACL-7125 is shown, where the DIP switch setting for base address, and jumpers setting for input configuration are specified.
- **Chapter 3**, "Registers Format," describes the registers format and how to program the digital input and output channels on the ACL-7125.
- **Chapter 4**, "Operation Theorem," gives an overview of ACL-7125's relay outputs and isolation inputs.
- **Chapter 5**, "Troubleshooting," describes how to use DOS DEBUG utility to verify the functionality of ACL-7125.







# Introduction

The ACL-7125 - Relay Actuator and Isolated D/I card is a digital I/O card with ISA bus interface for industrial applications.

This card provides 8 relay actuators and 8 opto-isolated digital input channels. Among the eight relays, four relays are in Form C (R0~R3) and four relays are in Form A (R4~R7). The relays are suitable for power signal ON/OFF control, matrix switchers, and multiplexer devices. The status of each relay output is reflected by a LED. When the relay is energized, its corresponding LED will turn ON, otherwise it is OFF.

There are 8 non-polarity digital input channels, each of them can be set with RC filter or without RC filter. All channels are isolated and suitable for collecting digital inputs in noisy environments.

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## 1.1 Features

The ACL-7125 Relay Actuator and Isolated DI Card provide the following advanced features:

- 8 relay actuator outputs with on board relay driving circuits
- 8 opto-isolated digital inputs
- LED indicators to show activated relays
- Jumper-selectable AC-filter/non-AC-filter input signals

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## 1.2 Applications

### ◆ Industrial ON/OFF control

- External high power relay driving, Signal switching
- Laboratory automation
- Industrial automation
- Switch contact status sensing, limit switch monitoring

---

## 1.3 Specifications

### ◆ Relay Outputs

- Relay Type: Double-Pole-Double-Throw (DPDT)
- Number of Relays: 8 (R0~R4 are in Form C; R5~R7 are in Form A).
- **Contact Rating:** 0.5A @ 120VAC; 1A @ 24VDC
- **Breakdown Voltage:** 1000 V AC or DC (minimum)
- Contact Type: Bifurcated
- **Insulation Resistance:** 100M $\Omega$  Max.
- **Relay ON/OFF Time:** 5 m sec. (typical); 10 m sec (maximum)
- **Life Expectancy:** > 10 million operations at full load
- **Coil Voltage:** +12V @33mA for each relay; total 0.264 A if all relay Are energized.

### ◆ Isolated Inputs

- Number of channels: 8
- **Opto-Isolator:** PC-814 or compatible
- **Input Signal Type:** AC (don't care polarity) or DC
- **Input Voltage:** up to 24V<sub>DC</sub> or 24V<sub>AC</sub> 50 ~1,000 Hz
- Threshold Voltage: 2.4V<sub>DC</sub>
- **Input Current:** 20 mA (maximum)

---

## 2 · Installation

- **Input Resistor:** 1.2 K $\Omega$
  - **Isolation Voltage:** 2500Vrms channel-to-ground
  - **Response Time:** 20  $\mu$ sec without AC Filter, 2.2 ms with AC Filter
- ◆ **General Specifications**
- **I/O Connectors:** One 37-pin Female D-type connector,
  - **Bus Interface:** 16-bit ISA Bus
  - **Operating Temperature:** 0° C ~ 55° C
  - **Storage Temperature:** -20° C ~ 80° C
  - **Humidity:** 5 ~ 90%, non-condensing
  - **Dimension:** 148mm(L) X 107mm(W)
- ◆ **Power Consumption**
- **+5Vdc:** 130 mA typical
  - **+12Vdc:** 180 mA maximum, all relays are energized

---

## 1.4 Software Supporting

The ACL-7125 is programmed using simple 8-bit I/O port commands. Users can use high level language, such as BASIC, C, or PASCAL, or low-level language, such as assembly to program the board. For the programming under Windows or LabView, please contact your dealer to purchase ACLS-DLL1 or ACLD-LVIEW.

### ACLS-DLL1

For easily program the board under Windows environment, we also provide ACLS-DLL1, which include the DLL for Windows 95/98/NT. With ACLS-DLL1, you can use compilers such as VB, VC/C++, or Delphi.

### ACLS-LVIEW

For easily link the ACL-7125 with LabView of National Instrument. ACLS-LVIEW includes the Vis of the ACL-7125 under for Windows 3.1/95/98 and NT.

# 2

## Installation

This chapter describes how to install the ACL-7125. The following procedures show the installation procedures:

1. Check what you have.
2. Check the PCB and check the location of jumper and switch.
3. Setup the jumpers according to the operation theorem.
4. Installation the DOS software library if necessary.

---

### 2.1 What You Have

In addition to this *User's Manual*, the package includes the following items:

- ◆ **ACL-7125 Relay Actuator & Isolated D/I Card**
- ◆ **DB-37 male connector assembly**
- ◆ **ADLINK CD**

If any of these items is missing or damaged, contact the dealer from whom you purchased the product. Save the shipping materials and carton in case you want to ship or store the product in the future.

---

## 2.2 Unpacking

Your ACL-7125 card contains sensitive electronic components that can be easily damaged by static electricity.

The card should be done on a grounded anti-static mat. The operator should be wearing an anti-static wristband, grounded at the same point as the anti-static mat.

Inspect the card module carton for obvious damage. Shipping and handling may cause damage to your module. Be sure there are no shipping and handling damages on the module before processing.

After opening the card module carton, extract the system module and place it only on a grounded anti-static surface component side up.

Again inspect the module for damage. Press down on all the socketed IC's to make sure that they are properly seated. Do this only with the module place on a firm flat surface.

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**Note: DO NOT APPLY POWER TO THE CARD IF IT HAS BEEN DAMAGED.**

---

**You are now ready to install your ACL-7125.**

---

## 2.3 PCB Layout

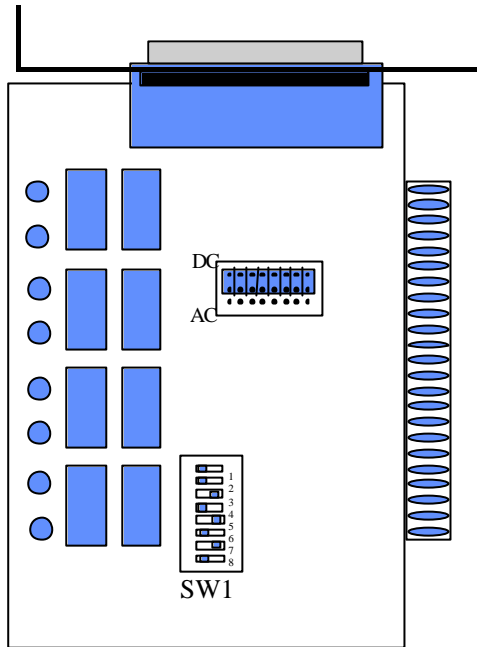


Figure 2.1 ACL-7125 PCB Layout Drawing

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## 2.4 Jumper and DIP Switch Description

You can change the ACL-7125's channels and base address by setting jumpers and DIP switches on the card. The card's jumpers and switches are preset at the factory. Under normal circumstances, you should not need to change the jumper settings. A jumper switch is closed (sometimes referred to as shorted) with the plastic cap inserted over two pins of the jumper. A jumper is open with the plastic cap inserted over one pin of the jumper or the cap removed.

## 2.5 Base Address Setting

The ACL-7125 requires two consecutive address locations in I/O address space. The base address of the ACL-7125 is restricted by the following conditions.

1. The base address must be within the range 200hex to 3FFhex.
2. The base address should not conflict with any PC reserved I/O.address. Please check Appendix A of I/O address map.
3. The base address should not conflict with any other add-on card's address.

The ACL-7125's I/O port base address is selectable by an 8 position DIP switch SW1 (refer to Figure 2.1). The address settings for I/O port from 200Hex to 3FFHex are described in Table 2.1 below. The default base address setting **Hex 2A8** is shown in Figure 2.2 on next page.

### SW1 : Default Base Address = 0x2A8

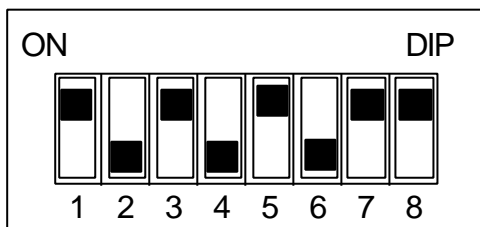


Figure 2.2 Default Base Address Setting

I/O port address(hex)	1 A8	2 A7	3 A6	4 A5	5 A4	6 A3	7 A2	8 A1
200-201	ON	ON	ON	ON	ON	ON	ON	ON
:								
(*) 2A8-2A9	ON	OFF	ON	OFF	ON	OFF	ON	ON
:								
2E8-2E9	ON	OFF	OFF	OFF	ON	OFF	ON	ON
2F8-2F9	ON	OFF	OFF	OFF	OFF	OFF	ON	ON
3E8-3E9	OFF	OFF	OFF	OFF	ON	OFF	ON	ON
3FE-3FF	OFF	OFF	OFF	OFF	OFF	OFF	OFF	OFF

(\*): default setting

Note: A1,...,A8 are corresponding to PC address lines

**Table 2.1 Address Setting Table**

<b>How to Define the Base Address for ACL-7125?</b>											
The DIP1 to DIP8 in the switch SW1 are one to one corresponding to the PC bus address line A8 to A1. A0 is always 0 and A9 is always 1. If you want to change the base address, you can only change the values of A8 to A1 (shadow area of below diagram). Following is an example, which shows you how to define the base address as <b>Hex 2A8</b> .											
Base Address: <b>Hex 2A8</b>											
<u>2</u>			<u>A</u>					<u>8</u>			
1	0		1	0	1	0		1	0	0	0
A9	A8		A7	A6	A5	A4		A3	A2	A1	A0



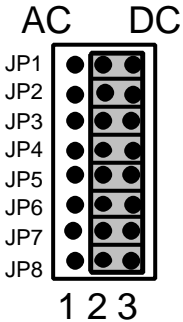
## 2.6 Input Signal Type Setting

There are 8 jumpers (JA0 to JA7) associated with each digital input channel for configuring the channel as *AC-Filter* or *Non-AC-Filter* input.

JUMPER	INPUT SIGNAL
JA0	DI0
JA1	DI1
JA2	DI2
JA3	DI3
JA4	DI4
JA5	DI5
JA6	DI6
JA7	DI7

Table 2.2 Digital Input Signals Type Setting Table

Each digital input channel and their corresponding jumper are shown in the Table 2.2. The default setting of the input signal selection is **Non-AC-Filter** (DC signal input), which is shown as below:



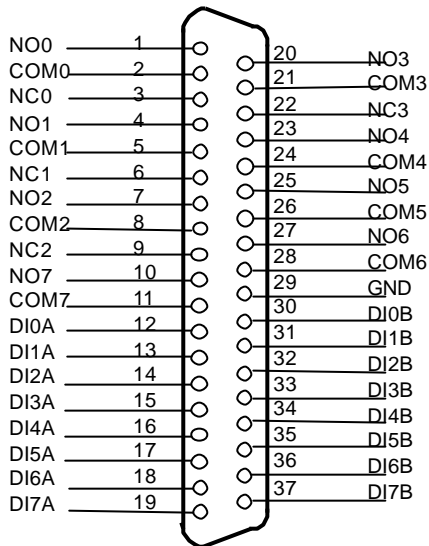
Input Signal Selection	AC-Filter (AC Input)	Non-AC-Filter (DC Input)
Jumper JP1 ~ JP8	1-2	2-3 (Default)

Figure 2.3 Default Input Signal Type Setting

---

## 2.7 Connector Pin Assignments

The pin assignments of the 37-pin D type female connector are described as following:



**Figure 2.4 Pin Assignments**

### Legend:

1. DI<sub>n</sub>A / DI<sub>n</sub>B - digital input low, channel n (input signal is not polarity sensitive).
2. NC n - normal close pin of relay n.
3. NO n - normal open pin of relay n.
4. COM n - common pin of relay n.
5. GND - ground of PC.

---

## 2.8 DOS Software Library Installation

To install the DOS library software and utilities, please follow the following installation procedures:

1. Put *ADLINK CD* into the appropriate CD-ROM drive.
2. Type the following commands to change to the card's directory (X indicates the CD-ROM drive):

```
X:\>CD \NuDAQISA\7125
```

3. Execute the setup batch program to install the software:

```
X:\NuDAQISA\7125>SETUP
```

After installation, all the files of *ACL-7125 Library & Utility for DOS* are stored in C:\ADLINK\7125\DOS directory.

# 3

## Registers Format

In this chapter, the registers format of ACL-7125 is specified. The C and BASIC language I/O instructions are also included.

---

### 3.1 Registers Map

The ACL-7125 requires 2 consecutive addresses in the I/O address space, one is for relay output, and the other is for digital input. The following table (Table 3.1) shows the location of each register and driver relative to the base address, and its description.

Location	Read	Write
BASE + 0	Read Back the Output Status	Relay Output
BASE + 1	Isolated Digital Inputs	Not Used

\* BASE: the base address value set by SW1

**Table 3.1 I/O Port Address Map**

---

## 3.2 Relay output & Read Back Register

To control the status of relay output, you have to write control value to the (BASE + 0) address. Logical high value (equal to 1) energizes a relay while logical low data (equal to 0) turns the relay off.

**Address: BASE + 0**

**Attribute: read and write**

**Data Format:**

Bit	7	6	5	4	3	2	1	0
Base + 0	DO7	DO6	DO5	DO4	DO3	DO2	DO1	DO0

The following examples are in BASIC, C and Assembly programming, and we assume a base address of 2A8h.

**For examples:**

**( BASIC Language)**

```
10  BASE = &2A8      ` set base address to 2A8
20  OUT  BASE, &H81  ` R0 and R7 turn ON
```

**(C Language)**

```
BASE = 0x2A8;
outp( BASE, 0x81 );
```

**(Assembly)**

```
MOV  DX, BASE      ` Load DX with base address
OUT  DX, AL        ` Write AL out to a port
```

The status of the relay output can be monitored by reading back the BASE + 0 byte as show below:

```
10  STATUS = INP(BASE)    ( BASIC Language)
status = inp( BASE);      ( C Language)
```

---

### 3.3 Digital Input Register

The digital input states are read as a single byte from the port at base address + 1h. Each of the eight bits within the byte corresponds to a particular digital input.

**Address: BASE + 1**

**Attribute: read only**

**Data Format:**

Bit	7	6	5	4	3	2	1	0
Base + 0	DI7	DI6	DI5	DI4	DI3	DI2	DI1	DI0

To get the status of these input channels using the BASIC, C, and Assembly language, the programming style is as follows.

```
10  BASE = &2A8
20  Value = INP(BASE+1)      ' ( BASIC Language)

BASE = 0x2A8;
value = inp( BASE +1);      ( C Language)

MOV  DX, 0x2A8
IN   AL, DX                  ( Assembly)
```

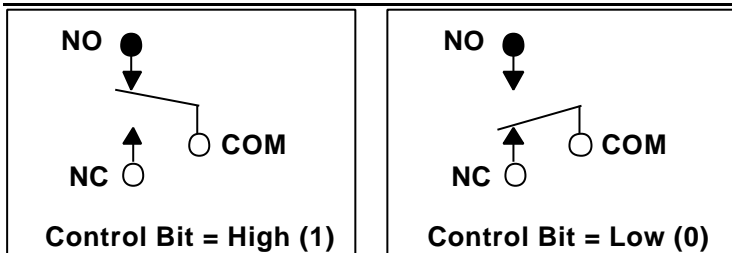
# 4

## Operation Theorem

### 4.1 Using Relay Output

The ACL-7125 contains two types of relay: Form C and Form A. The relay R0 ~ R3 are form C relays, and R4 ~ R7 are Form A relays. The difference between these two types of relay are shown as following:

#### 1. Form C Relays: ( R0 ~ R3)



Form C relay has three contacts: NC (Normal Close), NO ( Normal Open), and COM( Common). The COM post, located at the middle, can make contact either NO post or NC post. When the control bit is high (1), the COM post and NO post are contacted. If the control bit is low (0), the COM post and NC post make contact.

In normal power-up and reset, the relay is in **low** status.

## 2. Form A Relays: (R4 ~ R7)

Form A relay only has two contacts: NC (Normal Close) and COM (Common). The COM post can make contact either NO post or not contact NO post. When the control bit is high (1), the COM post and NO post are contacted. If the control bit is low (0), the COM post and NO post does not make contact.

In normal power-up and reset, the relay is in **low** status.

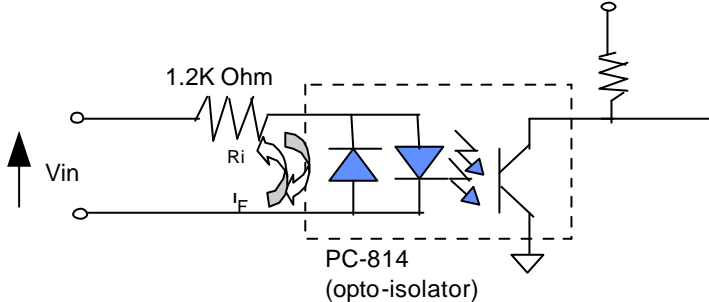
The relay output contacts are rated for a maximum of 0.5A at 120VAC (resistive), 1A 24VDC, or 0.3A 60VDC. Users should reduce these ratings for inductive loads. For more detailed information of relay contact, please refer Appendix B.

---

## 4.2 Using Isolated Input

The ACL-7125 has 8 identical opto-isolated input channels. The circuit diagram of the isolated input channel is shown in the following diagram. The digital input is first routed through a photo-coupler (PC-814), so that the connection is not polarity sensitive whether used on AC or DC voltage.

In addition, a single-pole filter with a time constant about 5ms is used to filter when the AC inputs passed through.



The normal input voltage range for high state is 3 to 24VAC or DC. The normal input range can be extended by changing the resistor ( $R_i$ ) to limit the current ( $I_F$ ) through the PC-814 opto-isolator to about 10mA. . The exact resistor value to replace the original resistor  $R_i$  ( $1.2K\ \Omega$ ) can be calculated by the following formula.

$$V_{in} = I_F \times R_i$$

$$P_w = V_{in} \times I_F$$



**For example,** if the input voltage is 110V, then the  $R_i$  should be replaced by

$$R_i = 110 \text{ (V)} / 0.01 \text{ (A)} = 11 \text{ K}\Omega$$

$$P_w = 110 \text{ (V)} \times 0.01 \text{ (A)} = 1.1 \text{ W}$$

# 5

## Troubleshooting

If your ACL-7125 can not work properly, use the information in this chapter to isolated the problem. You can use the DOS debug program to verify the functionality of your ACL-7125 card. The verification procedures are as follows.

---

**Note:** Before doing the following procedures, please make sure that inspect your ACL-7125 is not damaged and your computer system is in proper operation.

---

1. Make sure the base address, which is set by DIP switch SW1, is set as Hex 2A8. Please refer section 2.5.
2. Plug your ACL-7125 into your PC slot, and turn the power on.
3. In DOS environment, execute DOS DEBUG utility.

```
C> DEBUG <cr>
```

4. Using the following instructions to evaluate ACL-7125's I/O functions.
  - O 2A8 FF All relay are energized and all LEDs will be turn on
  - O 2A8 00 All relay are OFF and all LEDs will be turn off

Prepare some input signals and connect them with your ACL-7125 card, and check its input status.

- I 2A9' the input status will be read

If you get any incorrect results, such as the LEDs does not turn on or off, or the input status does not match with your input signals. Please contact your agent for extra service.

---

**Note** : Before returning your ACL-7125 card for repair, please call your agent at first.

---

# Appendix A. I/O Port Address

The ACL-6126 requires 16 consecutive addresses in the PC's I/O address space. The starting address (Base) is selected on the DIP switch SW1 ( see Section 2.5). The following table (Table 4.1) shows the location of each register and its description.

<b>Location</b>	<b>Mode</b>	<b>Description</b>
Base + 0	Write	D/A #1 high byte data
Base + 1	Write	D/A #1 low byte data
Base + 2	Write	D/A #2 high byte data
Base + 3	Write	D/A #2 low byte data
Base + 4	Write	D/A #3 high byte data
Base + 5	Write	D/A #3 low byte data
Base + 6	Write	D/A #4 high byte data
Base + 7	Write	D/A #4 low byte data
Base + 8	Write	D/A #5 high byte data
Base + 9	Write	D/A #5 low byte data
Base + 10	Write	D/A #6 high byte data
Base + 11	Write	D/A #6 low byte data
Base + 12	Write	D/O Bit 8-15
Base + 13	Write	D/O Bit 0-7
Base + 14	Read	D/I Bit 8-15
Base + 15	Read	D/I Bit 0-7

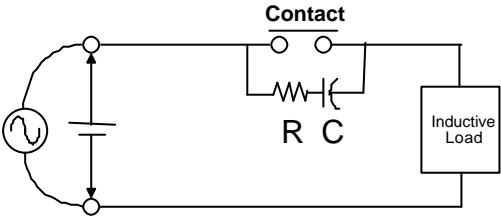
# Appendix B. Relay Contact Protection Circuits

The contacts are the most important elements of relay constructions. Contact performance is conspicuously influenced by contact material, and voltage and current values applied to the contacts.

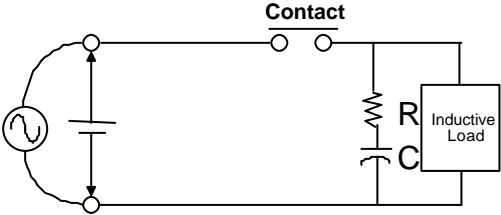
Another important issue is contact protection, a right contact protection circuit can suppress the counter EMF to a low level. However, note that incorrect use will result in an adverse effect. Typical contact protection circuits are given below:

## 1. RC Circuit

This circuit is suitable for DC application. If the load is a timer, leakage current flows through the RC circuit causing faulting operation.



The below circuit is suitable for both AC and DC applications. If the load is a relay or solenoid, the release time lengthens. Effective when connected to both contacts if the power supply voltage is 24V or 48V and the voltage cross the load is 100 to 200V.



**Device Selection:**

As a guide in selecting R and C,

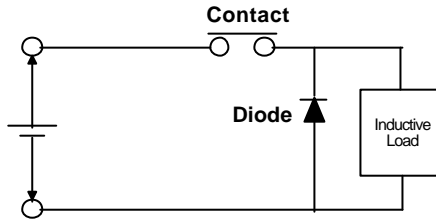
R: 0.5 to 1  $\Omega$  per 1V contact voltage

C: 0.5 to 1  $\mu$ F per 1A contact current

Value varies depending on the properties of the capacity C acts to suppress the discharge when the contacts open. Resistor R acts to limit the current when the power is turned on the next time. Test it to confirm. Use a capacitor with a breakdown voltage of 200 to 300V. Use AC type capacitors (non-polarized) for AC circuits.

**2. Diode Circuit**

This circuit is suitable for DC application. The diode connected in parallel causes the energy stored in the coil to flow to the coil in the form of current and dissipates it as joule heat at the resistance component of the inductive load. This circuit further delays the release time compared to the RC circuit.

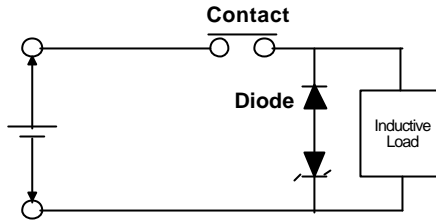


**Device Selection:**

Use a diode with a reverse breakdown voltage at least 10 times the circuit voltage and a forward current at least as large as the load current. In electronic circuits where the circuit voltages reverse breakdown voltage of above 2 to 3 times the power supply voltage.

### 3. Diode & Zener diode Circuit

This circuit is also suitable for DC application. Effective when the release time in the diode circuit is too long.

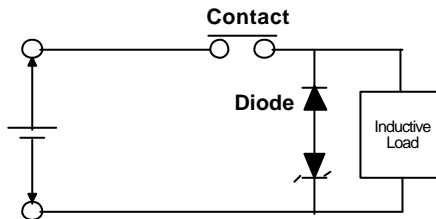


Device Selection:

Use a zener diode with a zener voltage about the same as the power supply voltage.

### 4. Varistor Circuit

This circuit is also suitable for both AC & DC applications. Using the stable voltage characteristics of the varistor, this circuit prevents excessively high voltages from being applied across the contacts. This circuit also slightly delays the release time. Effective when connected to both contacts of the power supply voltage is 24 or 48V and the voltage across the load is 100 to 200 V.



# Product Warranty/Service

ADLINK warrants that equipment furnished will be free from defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, we shall, at our option, either repair or replace any product that proves to be defective under normal operation.

This warranty shall not apply to equipment that has been previously repaired or altered outside our plant in any way as to, in the judgment of the manufacturer, affect its reliability. Nor will it apply if the equipment has been used in a manner exceeding its specifications or if the serial number has been removed.

ADLINK does not assume any liability for consequential damages as a result from our product uses, and in any event our liability shall not exceed the original selling price of the equipment. The remedies provided herein are the customer's sole and exclusive remedies. In no event shall ADLINK be liable for direct, indirect, special or consequential damages whether based on contract of any other legal theory.

The equipment must be returned postage-prepaid. Package it securely and insure it. You will be charged for parts and labor if the warranty period is expired or the product is proves to be misuse, abuse or unauthorized repair or modification.