Welcome to PHOENIX CONTACT

Relays
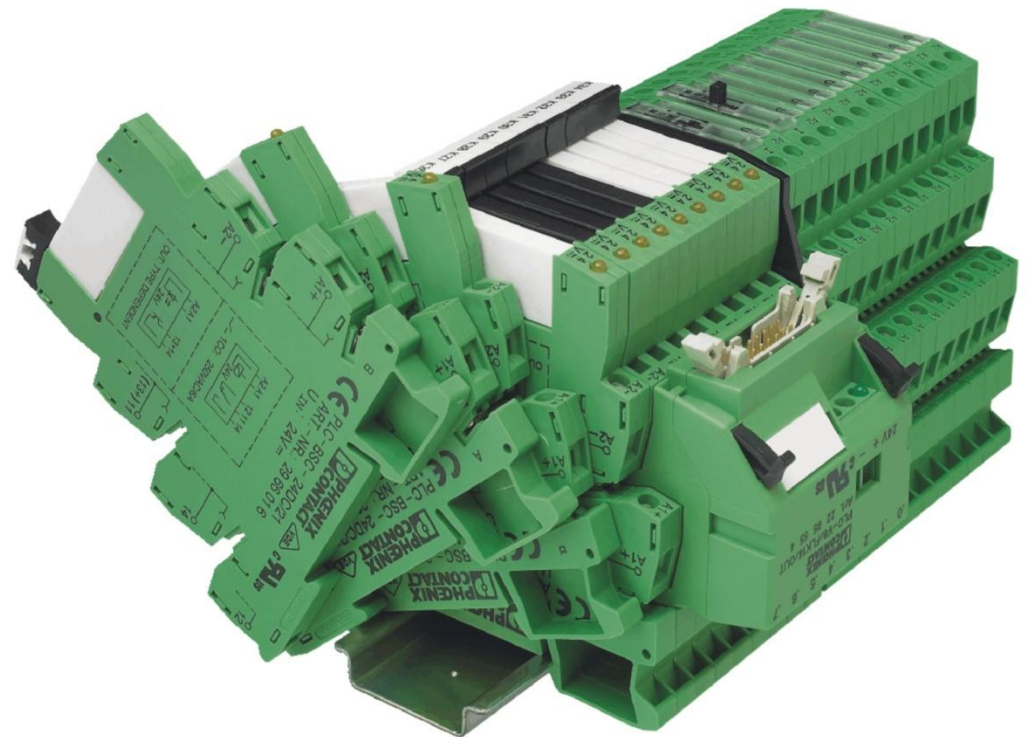
January 30, 2009
by Arnold Offner

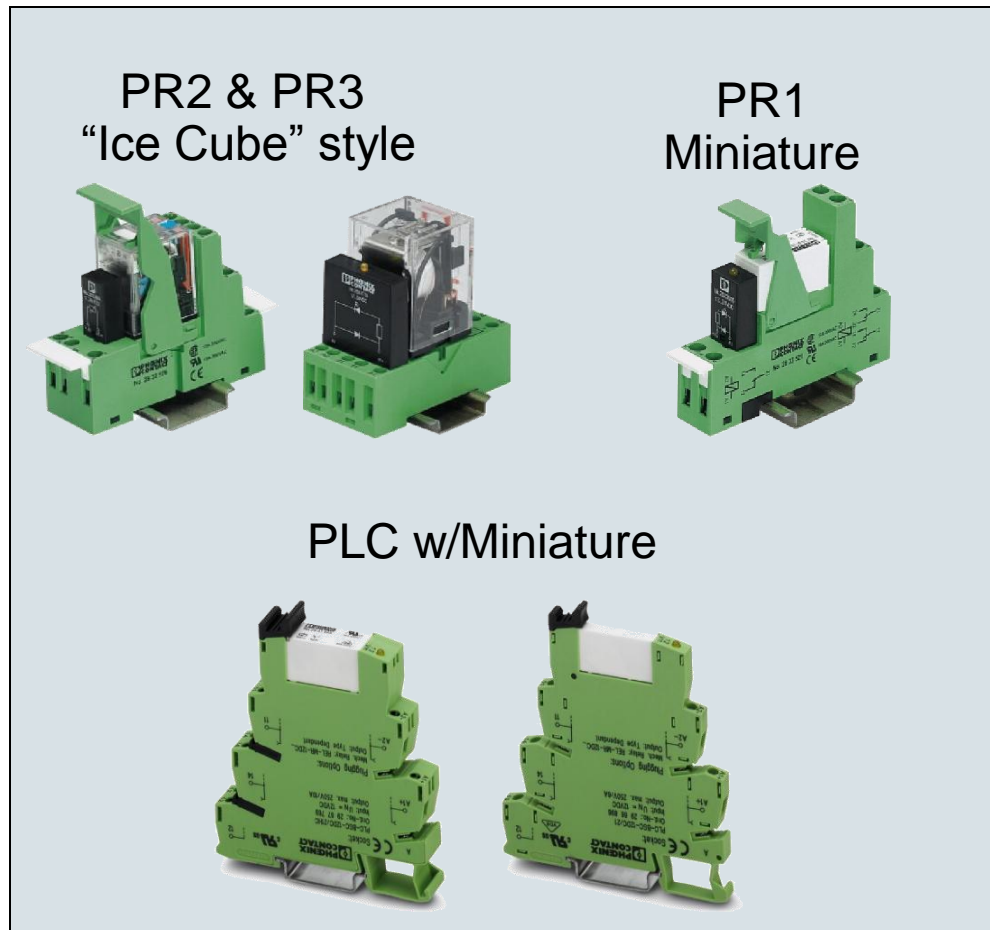PHŒNIX CONTACT

INSPIRING INNOVATIONS

Relays

- **Relay Types**

- **Basic Functionality**

- **Load Types**

- **Application Types**

Relay Types

Electromechanical

• A switching device with moving contacts which are energized by a magnetic field.

PR2 & PR3
"Ice Cube" style

PR1
Miniature

PLC w/Miniature

Normally Closed

Single Pole

Normally Open

A1
A2

Control Voltage

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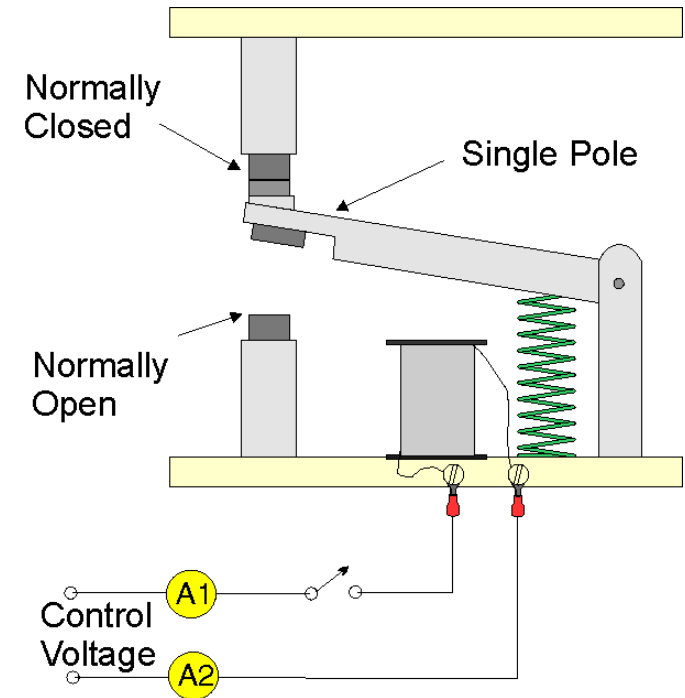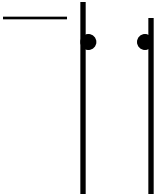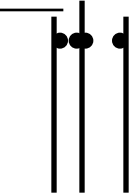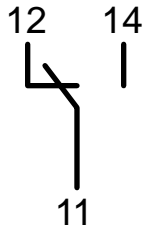
Relay Types

• A switching device with no contacts (moving parts) and switches entirely by electronic means.

A1   13

A2   14

ELR   PR1   PLC

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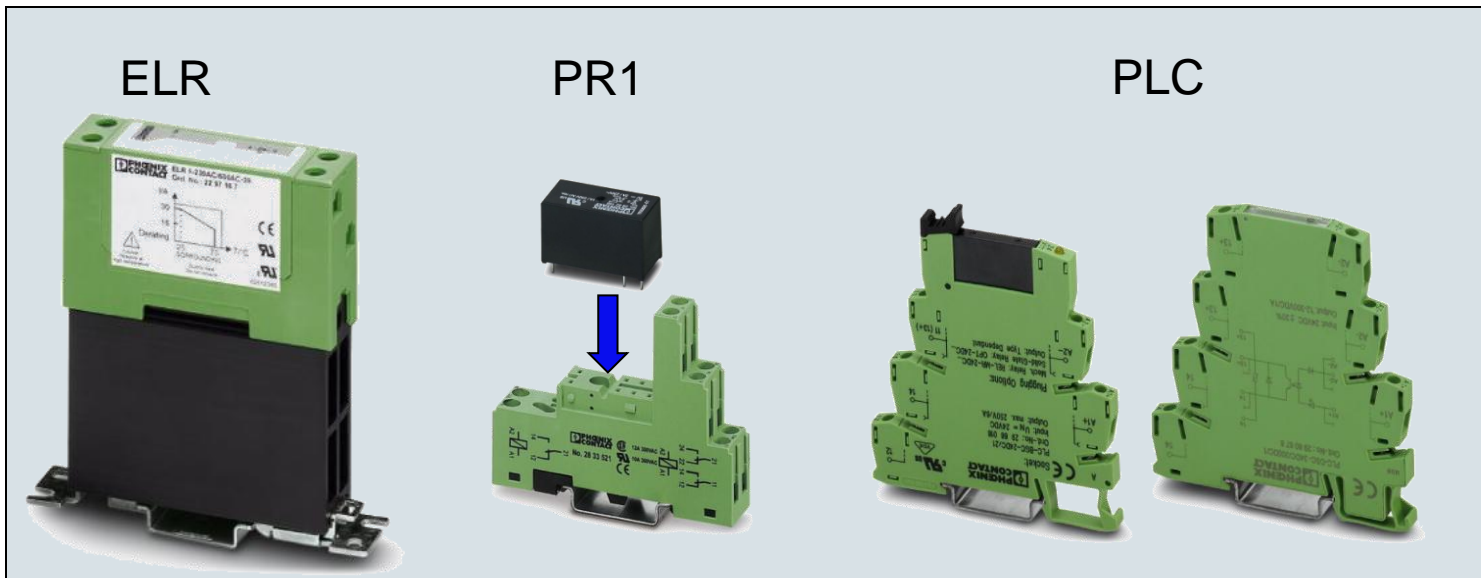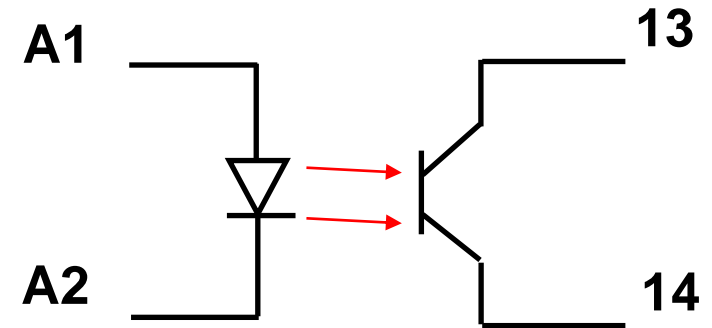
Relay Types

Contact types

Designation	Number Designation	Contact Picture	Schematic Symbol
Normally Open NO (Form A)	1		13 / 14
Normally Closed NC (Form B)	2		12 / 11
Single Pole Double Throw SPDT (Form C)	21		12 14 / 11

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INSPIRING INNOVATIONS

Relay Types

Contact types

▪ Single pole, double throw	(SPDT)	
▪ Double pole, double throw	(DPDT)	
▪ Three pole, double throw	(3PDT)	
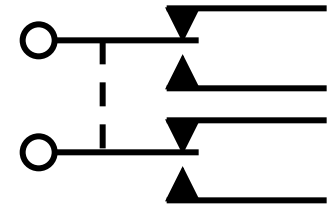
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INSPIRING INNOVATIONS
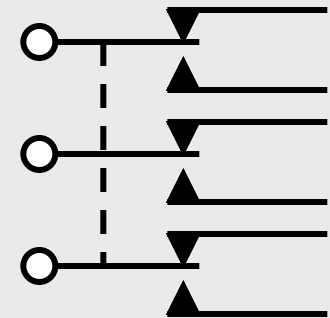
Relay Types

Technical and economic comparison: Electromechanical vs. Solid State Relay

Criteria		SSR	EMR
Switching of different loads (AC/DC)		--	+
Switching capacity	DC load	+	+
Switching capacity	AC load	-	++
Switching frequency		++	--
Vibration and shock resistance		++	o
Reliability		++	+
Electrical service life		++	- ... +
Costs		-	+
Power dissipation / heating		-	+
Electrical isolation in the output		--	++
Contact bouncing		++	--

Advantage

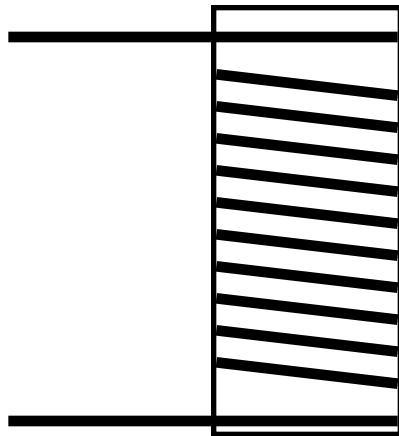Disadvantage

PHŒNIX CONTACT
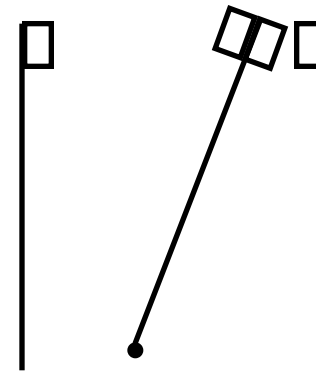*INSPIRING INNOVATIONS*

Basic Functionality   **Electromechanical**
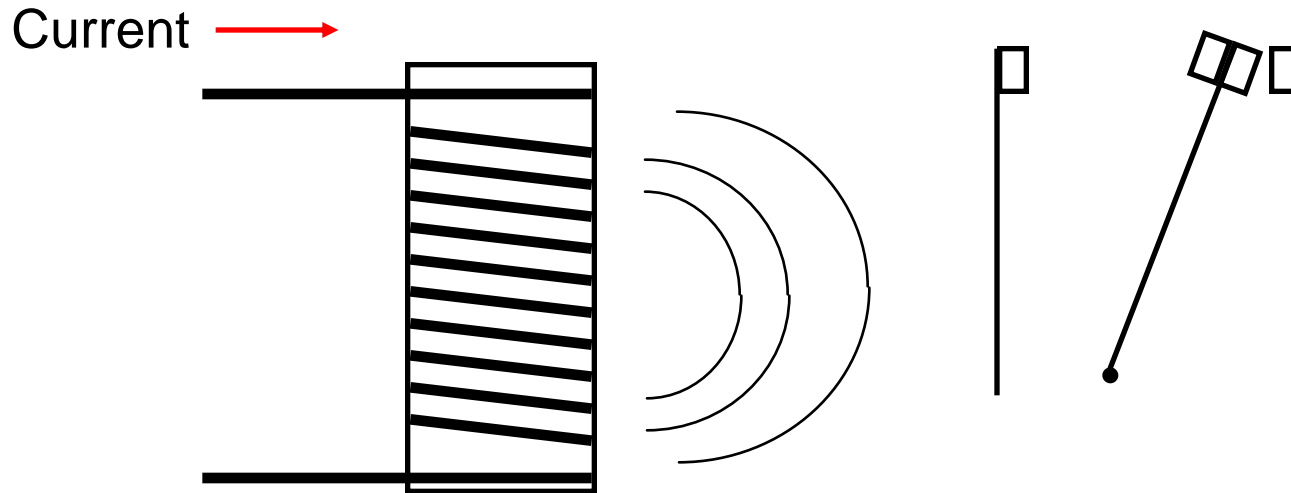
Relay - An Electrically Actuated Switch
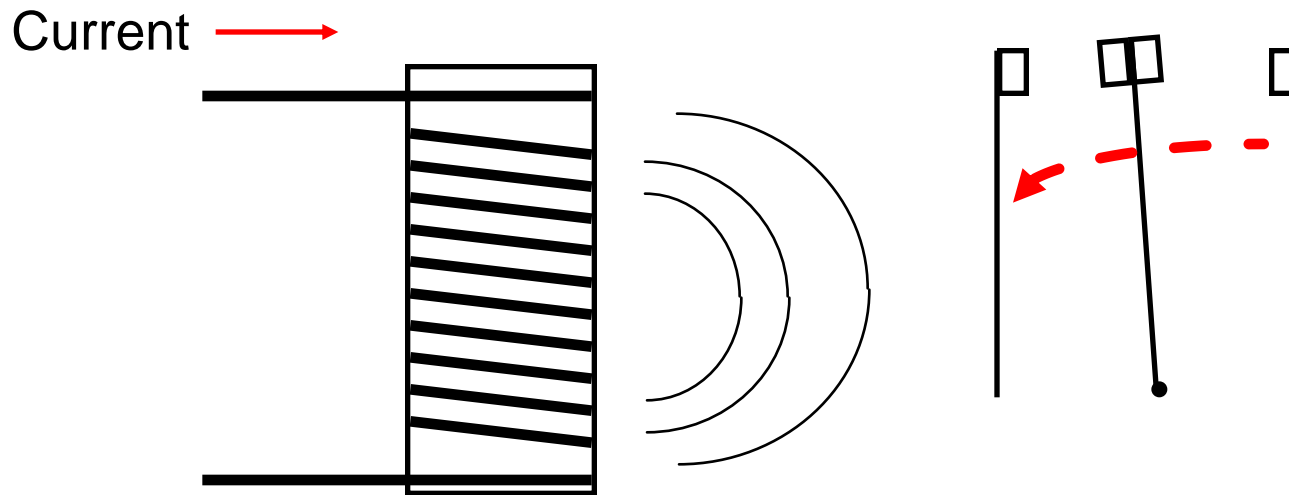
Coil

Contacts

Basic Functionality

Electromechanical

Current

Current through the coil produces
a magnetic field.

Basic Functionality

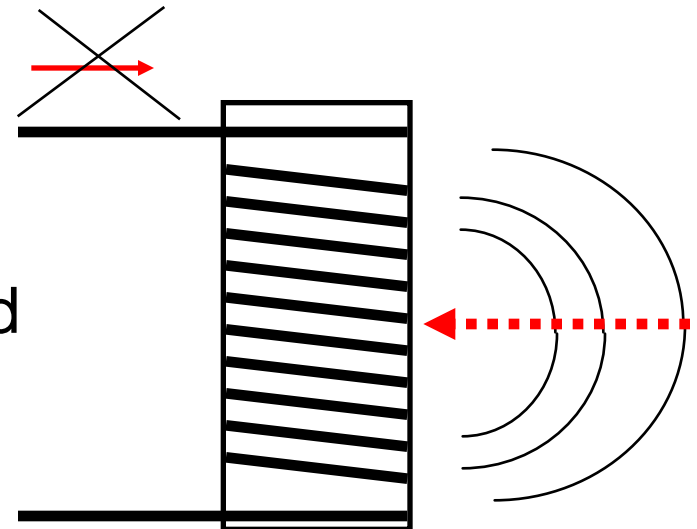Current

Magnetic force pulls on the moving contact causing it to change states.

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Basic Functionality

Electromechanical

Coil Inductive Kickback

No Current

The relay coil is an inductive load
for the driving device

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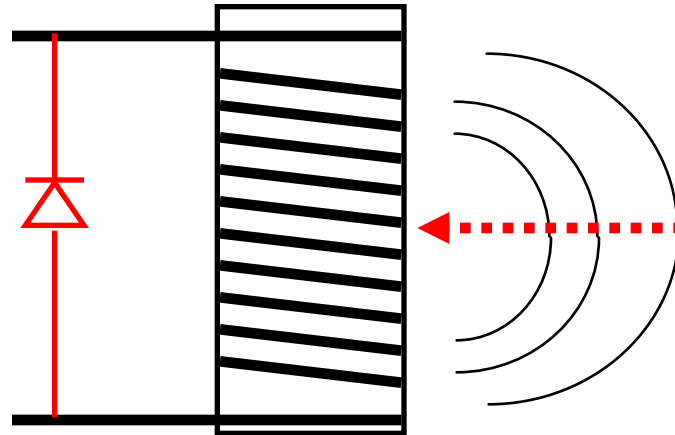
INSPIRING INNOVATIONS

Electromechanical
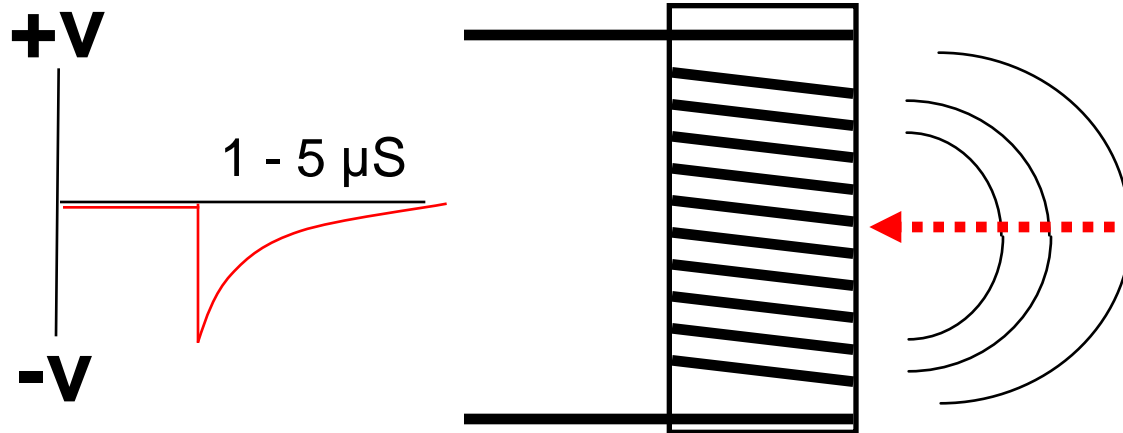
The collapsing magnetic field causes
a high voltage spike on the coil.

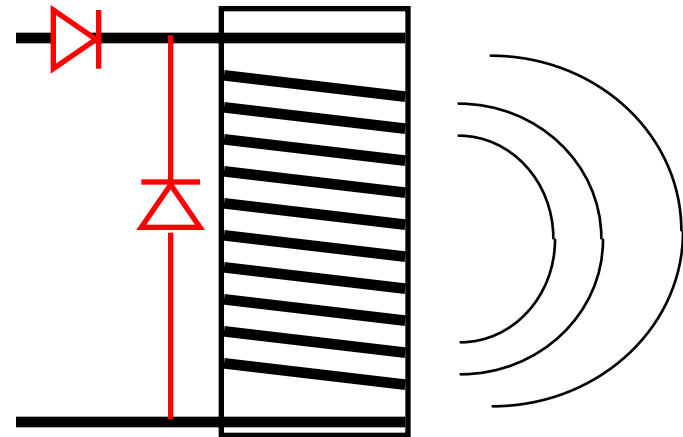# Basic Functionality   Electromechanical
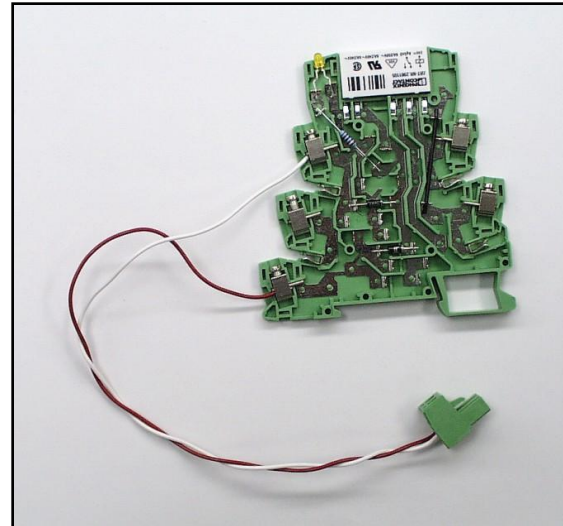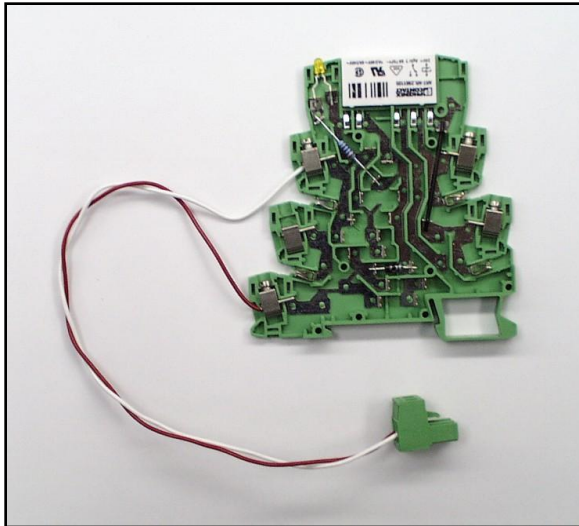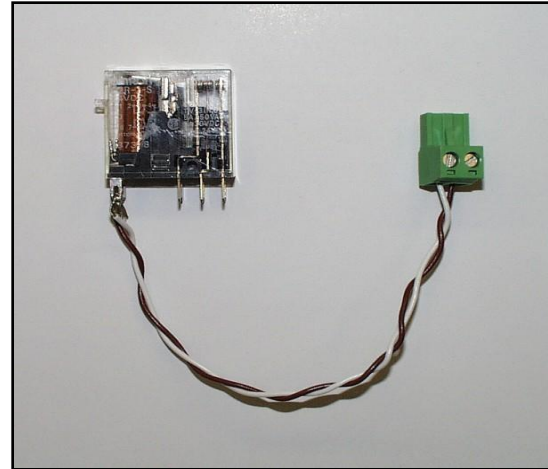
Protect the controls !

Basic Functionality

Polarity Protection

Protect the Coil !

Inductive Kickback

P&B KUEP-3D15-24 Ice cube style relay

Omron G2R-2-S 24DC Ice cube style relay
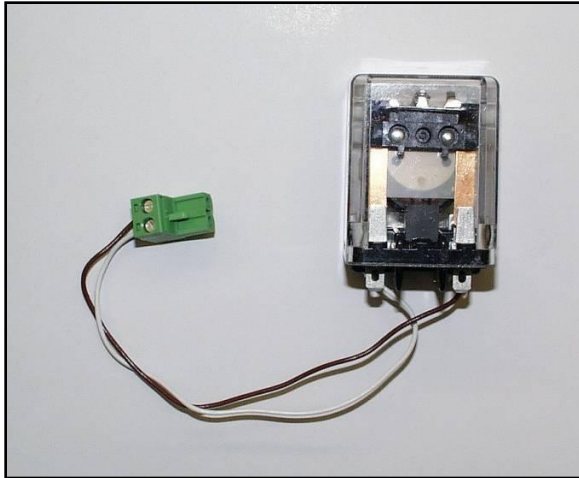
Tek Stop: Single Seq 10.0kS/s

Δ: 83 V
@: −107 V

1→

Ch1   50.0 V   M5.00ms Ch1 ⅃   −27 V
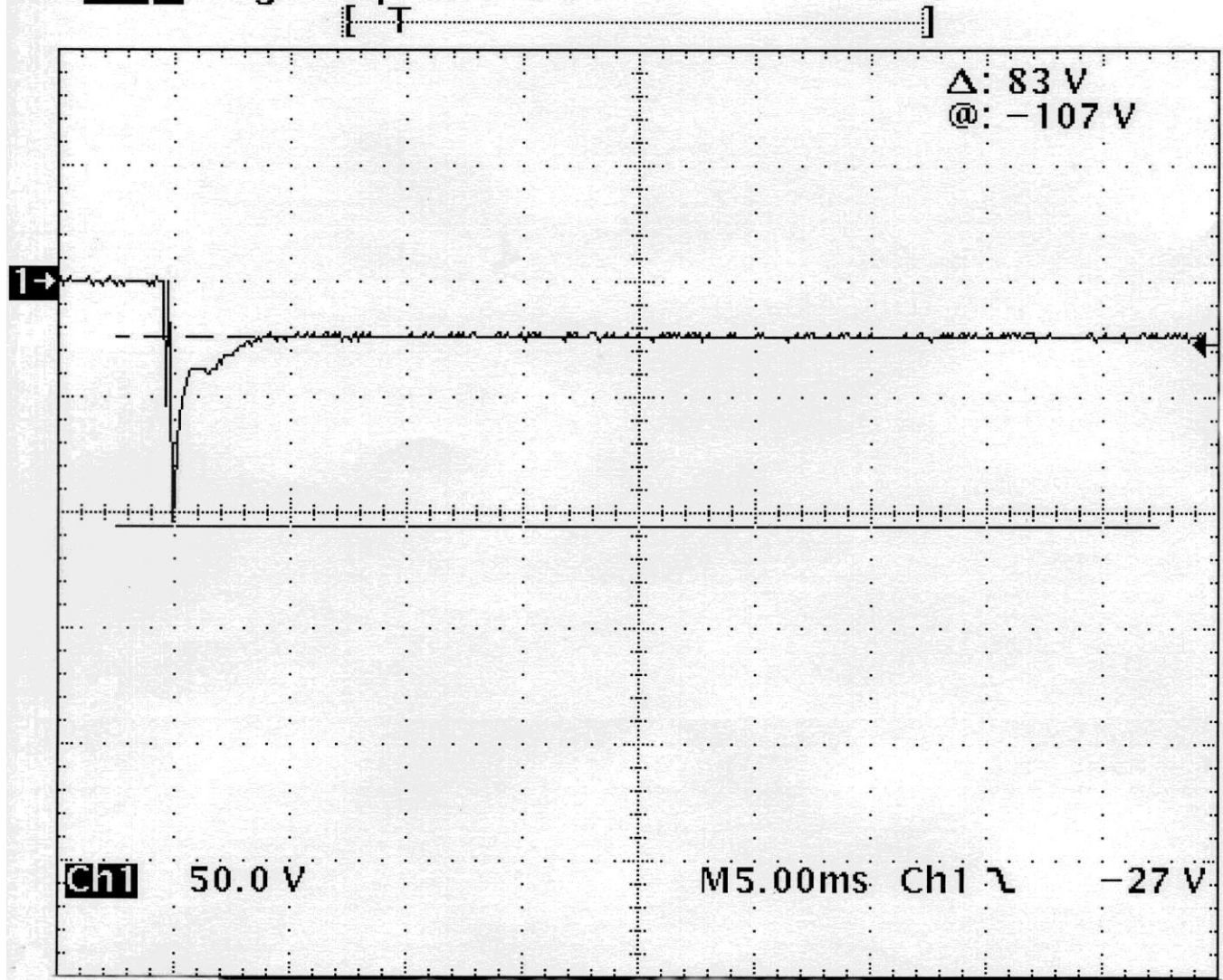
PLC-RSC-24DC/21 w/o inductive kickback diode

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INSPIRING INNOVATIONS
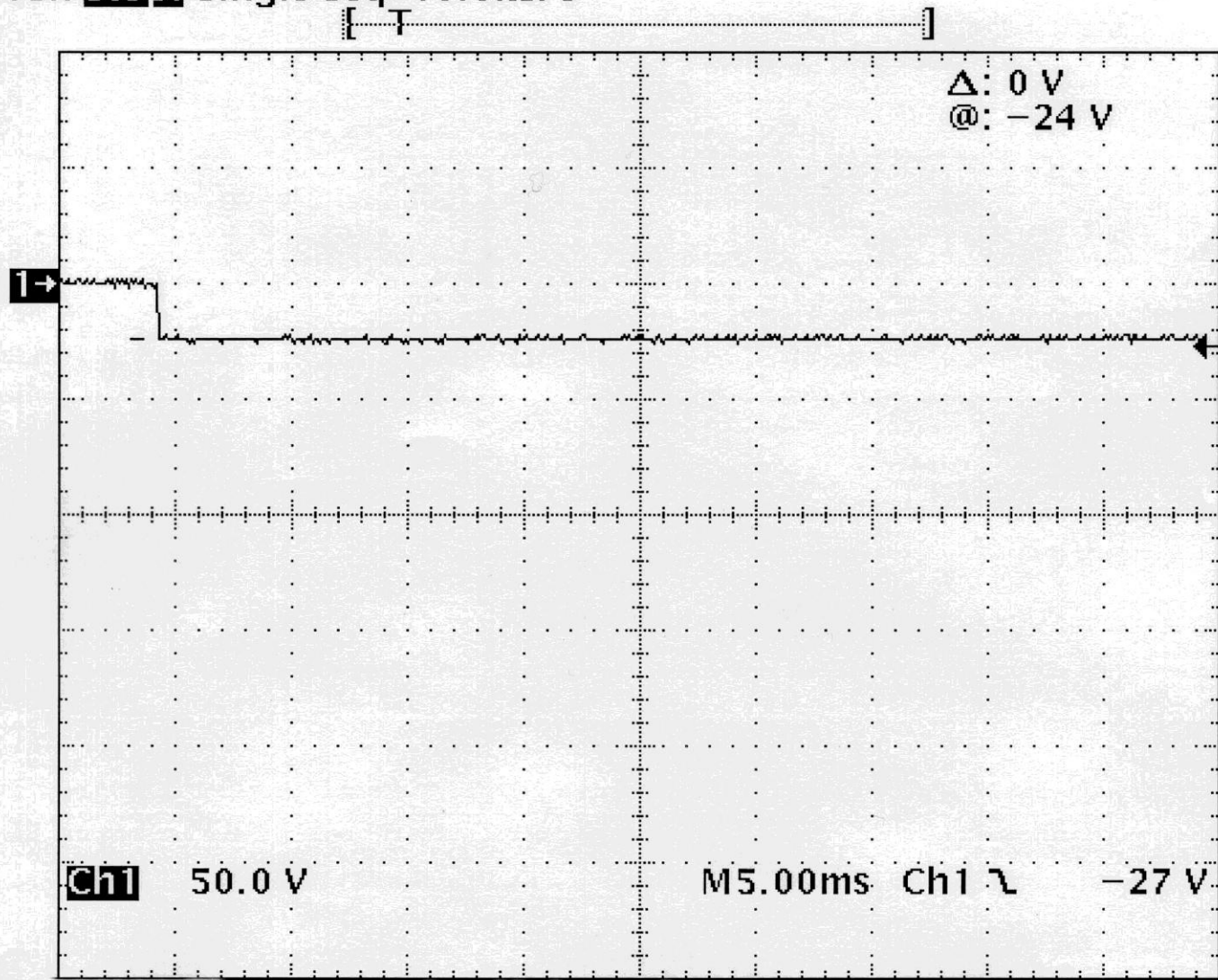
PLC-RSC-24DC/21 with inductive kickback diode

PLC-RELAY

■Base contains:

- – LED
  - – Operation indication
- – Reverse polarity diode
- – Kickback diode
- – Bridge rectifier

Contact Load Types

What is the Application/Load?

- Resistive
- Capacitive
- Inductive
- Solid state

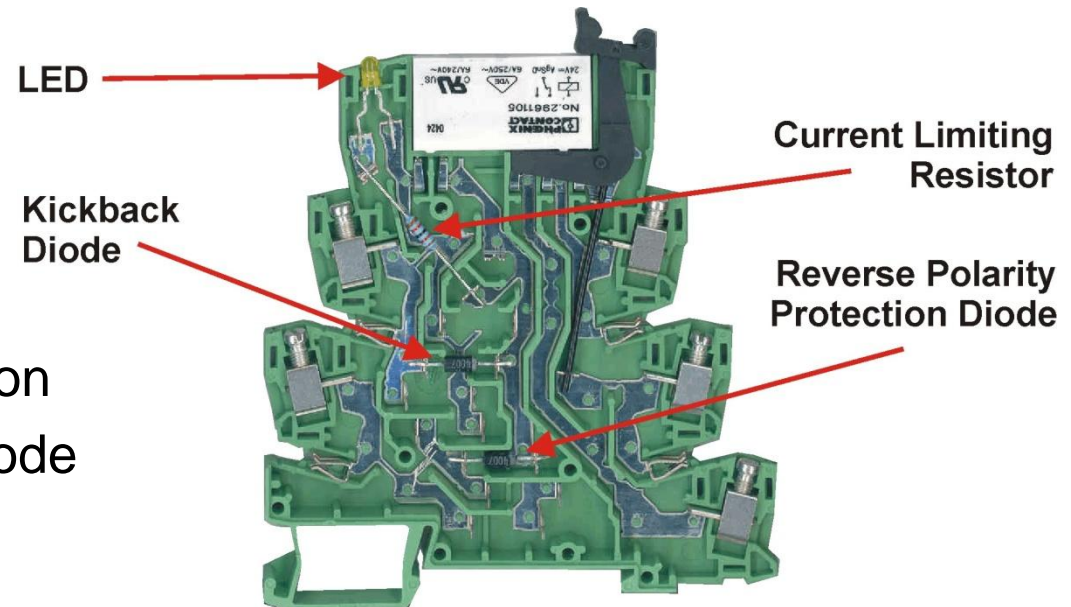# Contact Load Types

- Incandescent lighting
- Electric heating elements
- Resistive loads generate heat

Contact Load Types
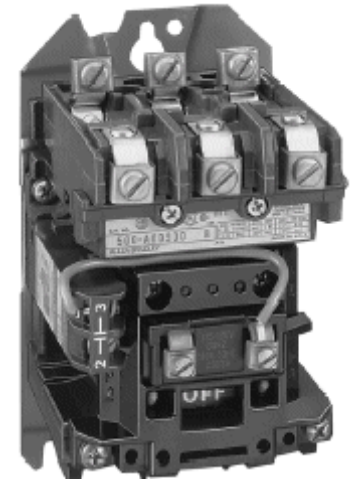
Capacitive Loads

Capacitive = In-rush

- High current is demanded when voltage is first applied
- Types
  - Long transmission lines (wire distance adds capacitance)
  - Tungsten lamps (In-rush load, temperature sensitive)
  - Solenoids
  - Arc suppression
    MOV's (Metal-Oxide Varistors) are capacitive
  - Power supplies
  - DC to DC converter (PLC)
  - AC motors (high inrush & inductive)
    - Especially with a capacitive start circuit

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Contact Load Types   Inductive Loads

- Motors (in-rush & inductive for AC)
- Solenoids
- Contactor Coils
- **Relays**
- Chokes & transformers

- Inductors stores energy!
  - When the relay opens the circuit, the inductor will oppose the change in current (& collapse Magnetic Field)
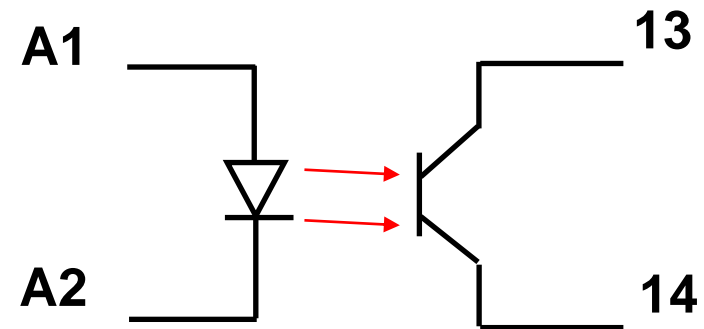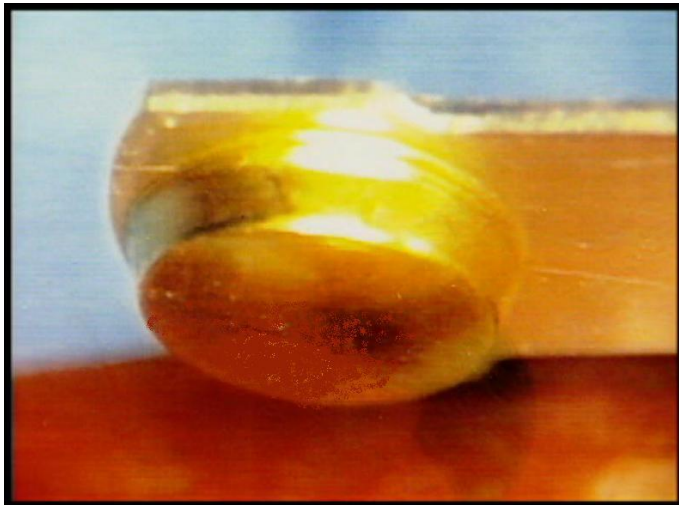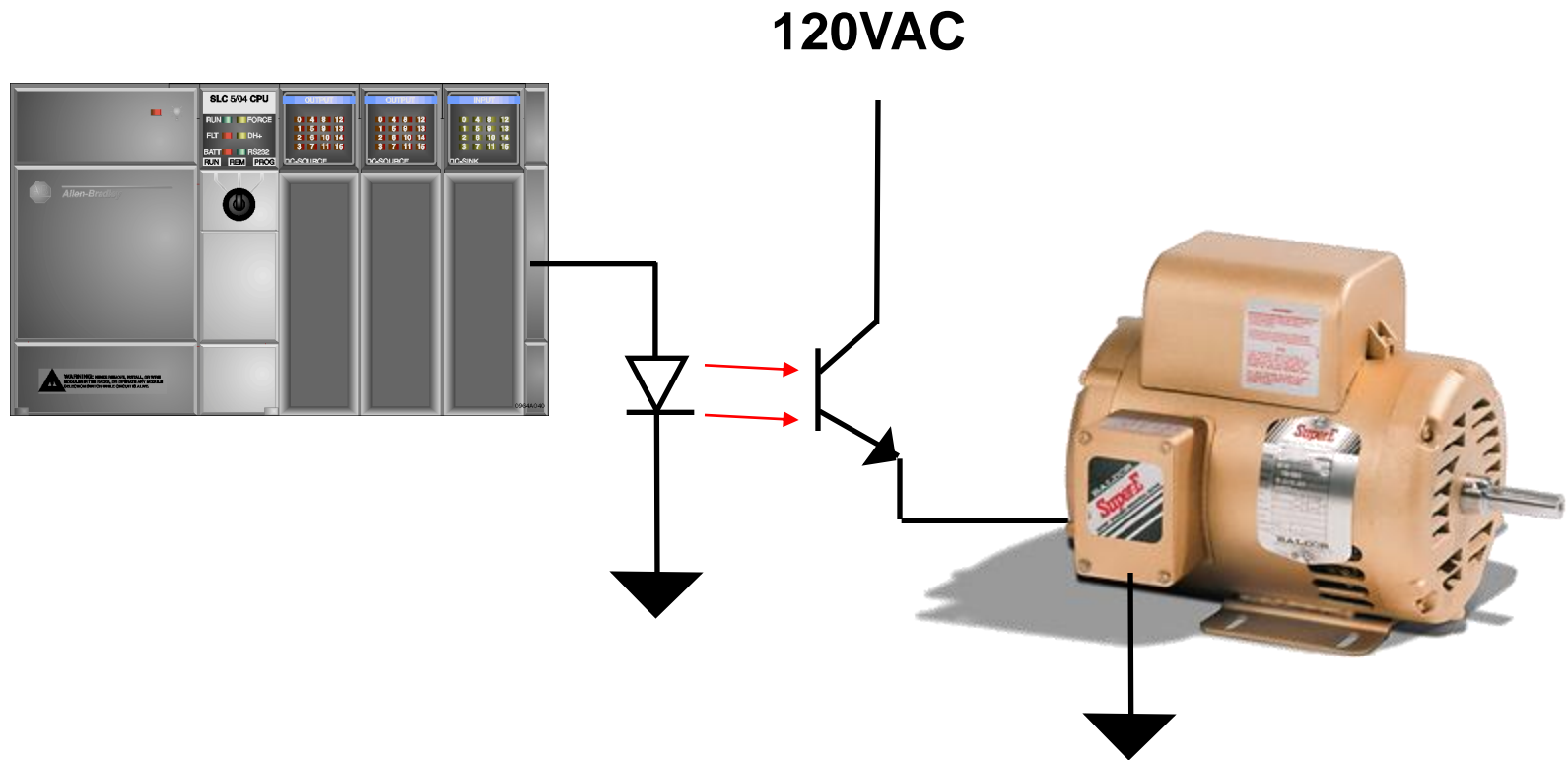
Contact Load Types

- PLC Input
- SSR

A1 ──────── **13**

A2 ──────── **14**

Application Types

120VAC
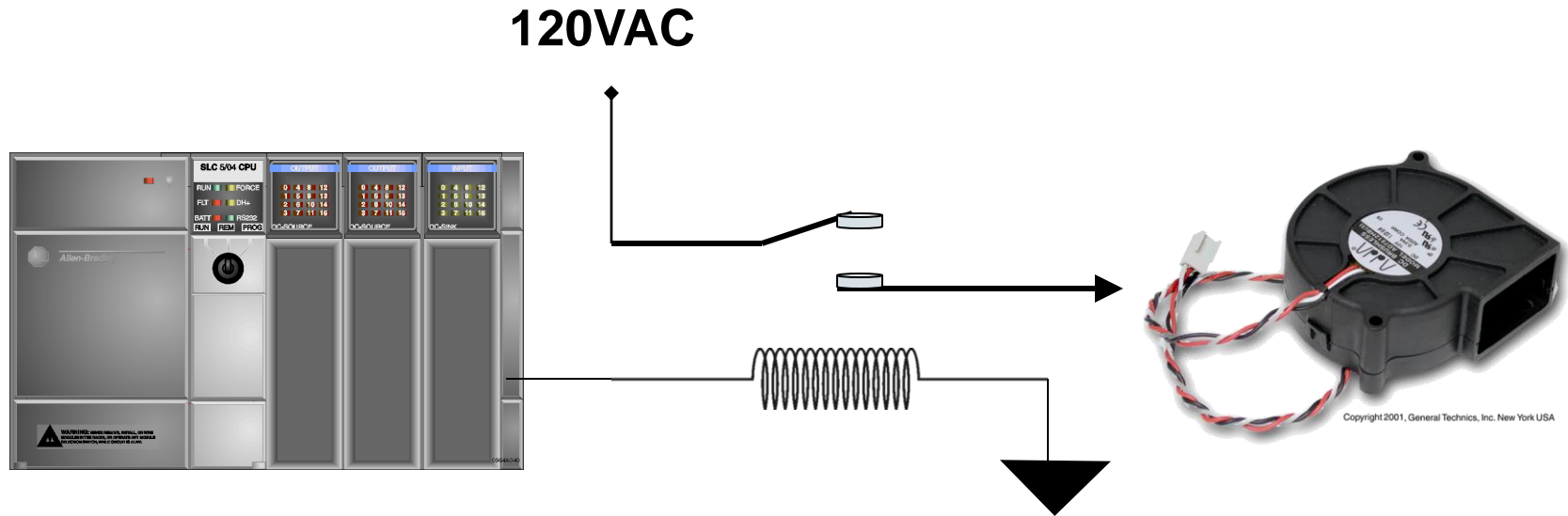

PLC with 24Vdc 500mA outputs.
Application: Control 120Vac, 20A motor

Application Types   Voltage Conversion
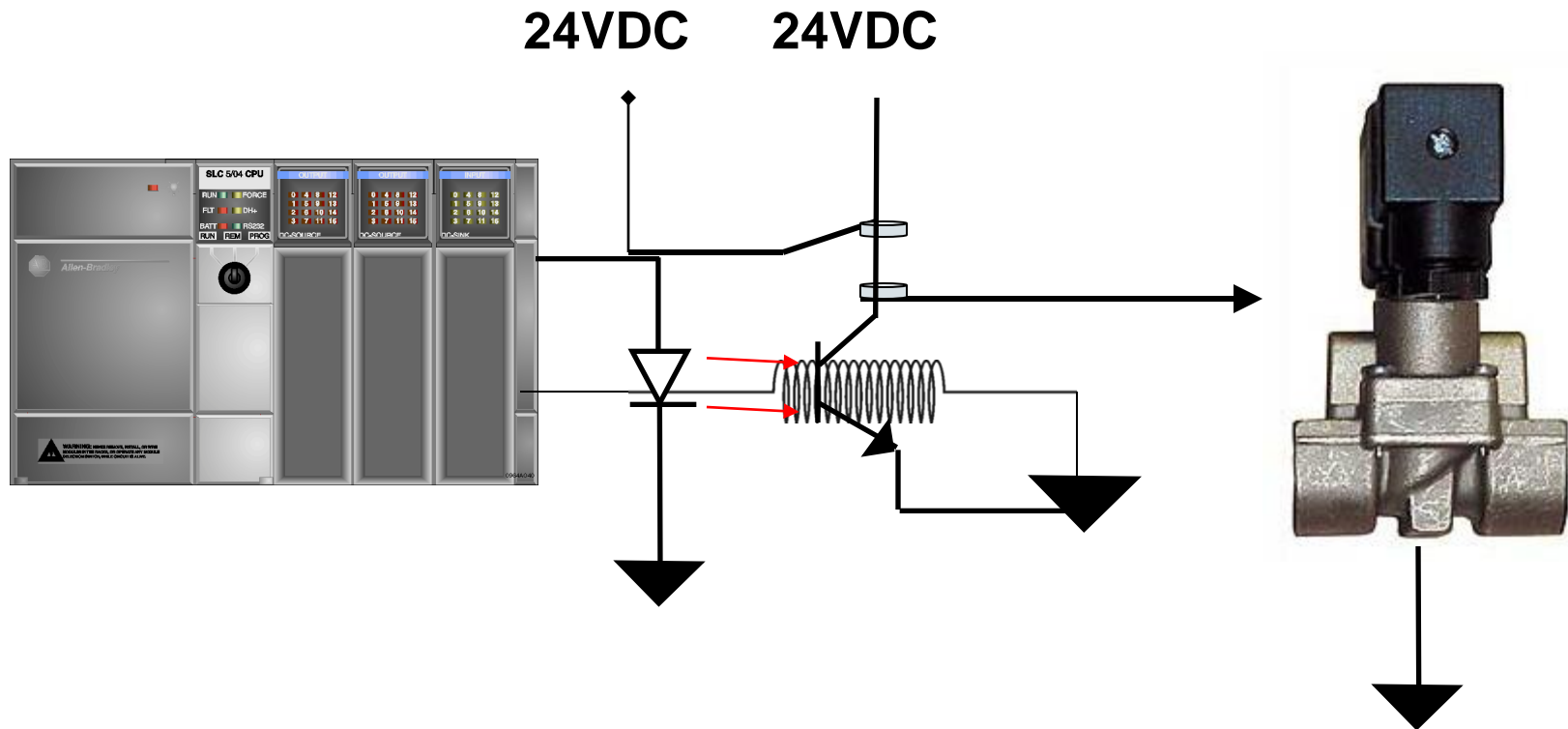
120VAC

PLC with 24Vdc, 500mA outputs.
Application: Control 120Vac,500ma blower

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Application Types

24VDC   **24VDC**

PLC with 24Vdc, 500mA outputs.
Application: Control 24Vdc, 500mA valve solenoid

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Thank You
for
your Attention