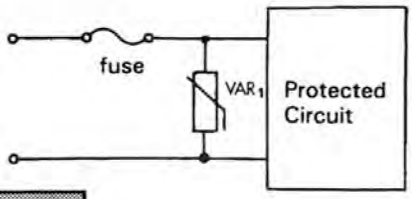
Application Notes

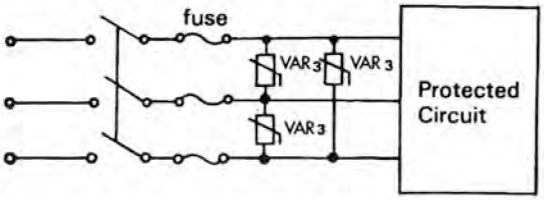
1. Line protection

Line to Line Protection Connections

AC/DC single-phase circuit



AC three phases circuit



Selection of Ratings and Varistor Voltage

Line to Line

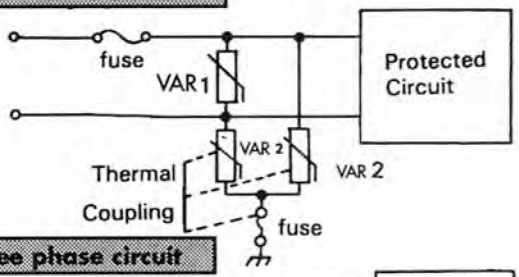
Symbol	Line Voltage	Part Number	
VAR 1	DC 12V	JOOK014	
	DC 24V	JOOK025	
	AC 100V	JOOK130	JOOK140
		JOOK150*	JOOK175*
	AC 120V	JOOK150	JOOK175*
	AC 127V	JOOK175	
	AC 200V	JOOK250	JOOK275
		JOOK300	
	AC 240V	JOOK275	JOOK300*
VAR 3	AC 240V	JOOK275	JOOK300*
		JOOK320	
	AC 265V	JOOK320	
	AC 380V	JOOK510	
	AC 415V	JOOK550	
	AC 460V	JOOK680	
	AC 480V	JOOK680	

Note :

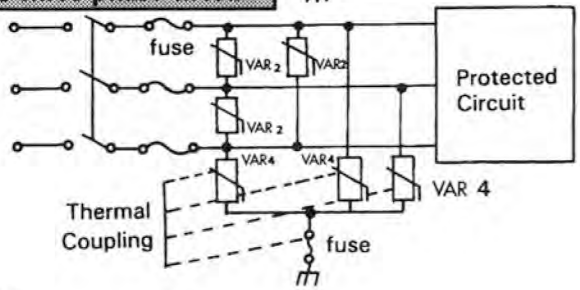
1. Maximum operating voltage shall be lower than Maximum allowable voltage of VAR at any time.
2. VAR's with * are recommended for single phase, 3 wire applications to withstand a temporary over voltage caused by unbanlance load.

Line to Line and Line to Ground Protection Connections

AC/DC single-phase circuit



AC Three phase circuit



Selection of Ratings and Varistor Voltage

Line to Ground

Symbol	Line Voltage	Part Number
VAR 2	AC 100V to AC 220V	JOOK275, JOOK300
	AC 240V	JOOK275, JOOK300 or JOOK460** or higher Varistor Voltage or JOOK1000***
VAR 4	AC 240V	JOOK275 JOOK300 or JOOK460** or higher Varistor Voltage or JOOK1000***

Note :

1. When the 500 V insulation resistance test of the circuits employing VAR is conducted, VAR shall be remove after getting approval from the customer, or VAR * * with the Maximum Allowable Voltage exceeding to test voltage shall be used.
2. When the 1000 V withstanding voltage test is conducted, VAR shall be removed after getting approval from the customer according to the relevant regulations, or VAR * * * with the Maximum allowable exceeding to te test Voltage shall be used.
3. To avoid VAR failure caused by the ground fault, VAR with higher Varistor Voltage listed in the table shall be used for the AC 120 V line to ground application.

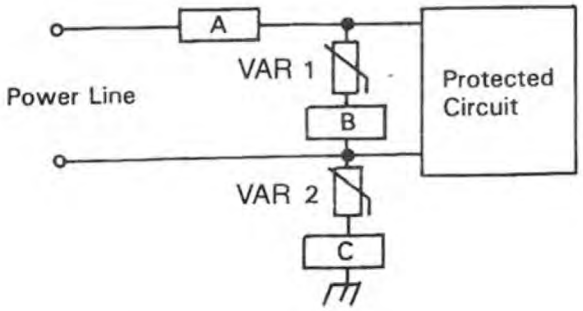
Application examples

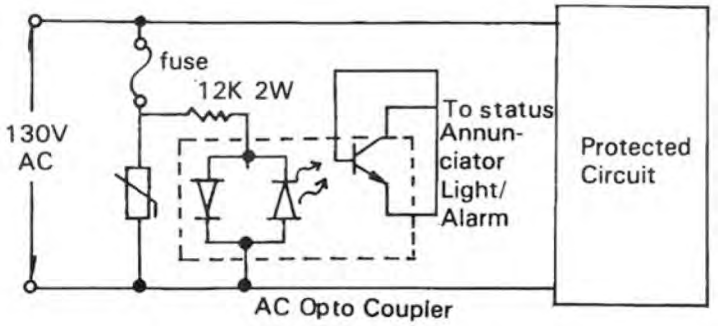
Protected circuit	Location	Part Number
Home Appliances	Indoor	J05K□□□ J07K□□□ J10K□□□
	Outdoor	J10K□□□ J14K□□□ J20K□□□
Consumer Industrial	Indoor, Outdoor	J14K□□□ J20K□□□

Protected circuit	Location	Part Number
Communications Measurements Controls	Indoor	J07K□□□ J10K□□□ J14K□□□
	Outdoor	J10K□□□ J14K□□□ J20K□□□

Caution :

1. A surge excess of the specific Maximum Peak Current may cause short circuit or mechanical damage. The following measures are recommended.





a) Location of the over current protector (circuit breaker or current fuse) shall be in the power line to the circuit (Location A) or in series with VAR (Location B)

Part Number	J05K□□□	J07K□□□	J10K□□□	J14K□□□	J20K□□□
Fuse rating	1 to 2 A	2 to 3 A	3 to 5 A	3 to 10 A	5 to 15 A

b) It is recommended that a fuse listed in the table shall be put in location A or B.
c) In a case that VAR is used in line to ground, the ground fault circuit interrupter shall be applied in locate A or thermally coupled fuse shall be applied in located C.
d) Fuse mounted Type K or Type P are available for VAR 1 and VAR 2 applications.
e) VAR shall not be used near the flamable materials.

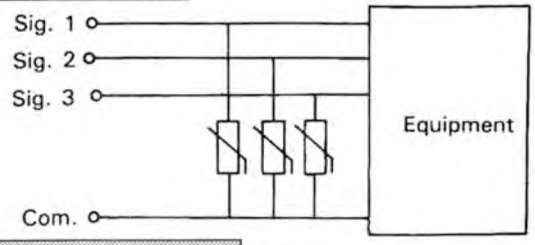
2. When VAR is molded at en-user, molding resin materials shall be carefully selected, otherwise VAR's long term stability could degrade.

3. VAR shall not be used near heat generating device and free from direct sunlight. VAR shall be used within the specified Operating Temperature Range.

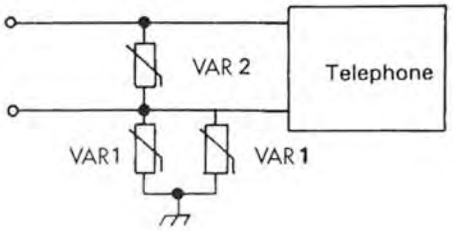
4. VAR shall be free from dust, metal powder, dew and sea wind. A protective box is recommended to prevent the unit from those.

2. Signal line and telephone line surge protection

Signal Lines Circuit



Telephone Lines Circuit



Selection Example

Surge Protection of Signal Line

Signal Line Voltage	Part Number
DC 48V	
DC 100V	

Surge Protection of Telephone Line

VAR	Part Number
VAR 1	J❑❑❑K210
VAR 2	

Note :

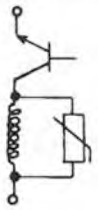
VAR has relatively high capacitance, special attention shall be paid for it in high frequency circuits.

Caution :

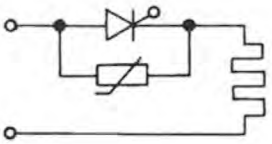
Refer to the power line protection.

3. Switching surge protection, semiconductor protection and contact spark suppression

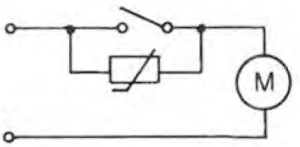
Switching surge protection



Semiconductor protection



Contact spark suppression



Selection Examples

Voltage	Part Number
DC 12V	
DC 24V	
DC 100V	
AC 120V	J❑❑❑K140 J❑❑❑K150 J❑❑❑K175

Note :

1. The Maximum Allowable Voltage to be higher than maximum operating voltage at all time.
2. Energy handling capability of VAR shall be selected by studying switching surge energy from the inductive load.

Caution :

1. Refer to the mentionned caution described in power line protection.
2. The relation between surge current repetition and VAR ratings is drawn in the VAR impulse life characteristics.
3. Capacitor connection in parallel VAR is recommended for a contact spark suppression.