Proximity Switches

Order code	Manufacturer code	Description
60-0530	2202-1917-060	COMPACT SPDT REED SWITCH
60-0532	2502-1513-060	COMPACT SPST REED SWITCH (RC)
60-0524	8602-0551-020	SUBMINIATURE SPDT REED SWITCH (RC)
60-0526	2302-3336-020	SUBMINIATURE 20VA SPDT REED SWITCH
60-0528	2502-3717-020	MINIATURE SPST REED SWITCH (RC)
60-0515	RI-03A	MINATURE SPST REED SWITCH (RC)
60-0520	8601-0211-015	MICROMIN.SPST REED SWITCH (RC)
60-0522	2502-2322-020	SUBMINIATURE SPST REED SWITCH (RC)

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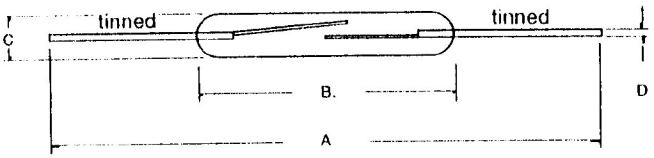
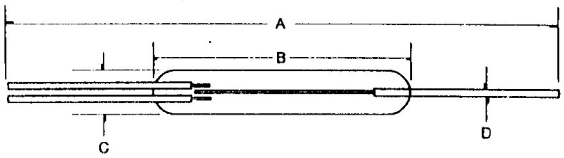
Reed Switches

PARAMETERS Rapid Order Code			60-0520	60-0522	60-0524	60-0526	60-0528	60-0530	60-0532	60-0515
Contact Form			A	A	C	C	A	C	A	A
Contact Material			Rh	Rh	Rh	Rh	Rh	Rh	Rh	Rh
Switching Capacity	max.	W/VA	1	10	3	20	40	60	120	10
Switching Voltage	max.	Vac	24	100	30	150	440	400	1500	140
Switching Current	max.	A	0.1	0.5	0.2	1.0	2.0	1.0	3.0	0.5
Carrying Current	max.	A	0.3	1.0	0.5	2.0	3.0	2.0	5.0	-
Dielectric Strength	min.	Vdc	150	250	200	200	1000	1000	1000	-
Contact Resistance	max.	mOhm	150	150	100	100	80	100	80	120
Insulation Resistance	min.	Ohm	10^9	10^{10}	10^9	10^9	10^{11}	10^9	10^{11}	10^4
Pull-In Sensitivity		AT	10-30	15-35	15-30	15-30	30-50	40-80	75-95	14-70
Drop-Out Sensitivity	min.	AT	5	5	5	5	15	20	30	6-32
Switching Time	max.	ms	0.6	1.8	1.0	2.0	2.0	4.0	3.5	-
Bounce Time	max.	ms	0.3	0.2	1.5	0.6	0.5	0.5	0.5	-
Release Time	max.	ms	0.05	0.05	0.05	0.02	0.10	0.15	0.2	-
Resonance Frequency	typ.	Hz	7500	5000	-	-	4200	-	900	-
Operating Frequency	max.	Hz	500	200	200	250	300	100	100	-
Vibration	35g	Hz	2000	2000	2000	2000	2000	500	500	-
Shock	11ms	G	30	50	50	50	50	50	50	-
Capacitance	typ.	pF	0.2	0.7	1.5	0.8	0.5	1.0	0.8	-
Operating Temp. Range		°C	-40 to +150	-40 to +150	-40 to +150	-40 to +150	-40 to +150	-40 to +150	-40 to +150	-40 to +150
DIMENSIONS										
Total Length	A max.	mm/inch	36/1.41	55/2.16	52/2.05	55/2.16	55/2.16	70/2.75	29/3.11	46/1.81
Glass Length	B max.	mm/inch	10/0.39	14/0.55	14/0.55	14/0.55	18.5/0.72	36/1.41	52/2.05	15/0.6
Glass Diameter	C max.	mm/inch	2.0/0.08	2.3/0.09	2.54/0.1	.2/0.086	2.6/0.1	5.6/0.22	5.4/0.21	2.54/0.1
Wire Diameter	D max.	mm/inch	0.4/0.015	0.5/0.2	0.5/0.2	0.35/0.014	0.7/0.027	2.5/0.1	2.5/0.1	0.6/0.023



CONTACT FORM A



CONTACT FORM C

Contact Protection

Overloads, even of short duration, can materially damage a reed switch. The effect of this may not be immediately visible but the number of operations before failure will be seriously reduced. Suitable contact protection must therefore be utilised on all switched loads other than purely resistive loads. In the case of DC inductive loads this protection can take the form of a suitable diode connected across the load as shown in Fig. 1. The foregoing method is totally unsuitable for AC inductive loads therefore resistance networks must be employed. These may be connected across the load as shown in Fig. 2.

Switching powers and life expectancy of reed contacts are normally given for resistive loads.

Lamp Loads

The cold resistance of filament lamps is commonly 1/7th to 1/10th of the hot resistance. A danger exists, therefore, that a reed switching this type of load will weld due to the high surge current. The contacts can be protected with a series resistor designed to reduce the surge to a safe level.

D.C. Inductive Loads

The simplest method of suppressing DC inductive circuits is a diode wired across the load. With the diode in circuit the back EMF is directed through the diode instead of the switch. The diode chosen must have a forward current rating at least as high as the steady current of the circuit in question.

AC Inductive Loads

The most commonly used suppression for A/C inductive loads is the R/C network. The NOMOGRAPH (overleaf) can be used for calculation of the values of capacitance and resistance. Alternatively the following formulae may be used:

$$C = \frac{I^2}{10} \ \mu F$$

$$R = \frac{E}{10\left(1 + \frac{50}{E}\right)}$$

Where I = load current prior to contact opening.
E = Source voltage immediately prior to contact closing.

Drive Circuit Protection

In certain circumstances the back EMF caused by the collapse of the magnetic field when the coil drive is switched off may damage semiconductor circuitry. A protective diode across the coil is a satisfactory method of reducing these effects.

Contact Material

Normally plated or spluttered ruthenium on diffured gold for low and stable contact resistance and improved performance.

Operating Temperature Range

Recommended maximum operating range -55 to +125°C

Storage Temperature Range

Higher temperature excursions up to 150°C may be permissible.
Contact Sales Office for more information.

Vibration

Philips Switches are tested in accordance with IEC 68-2-6, test FC (acceleration 10G, below cross-over frequency 57 to 62Hz amplitude 0.75mm, frequency range 10 to 2000Hz duration 90 minutes).

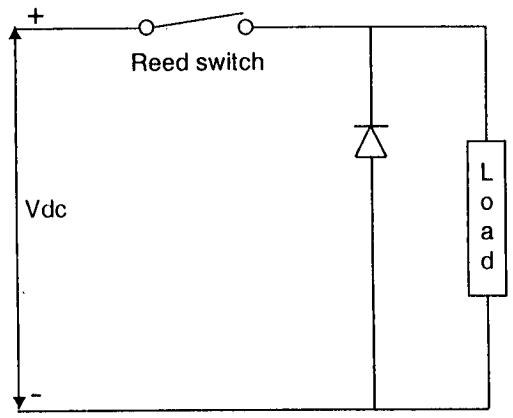


FIG. 1

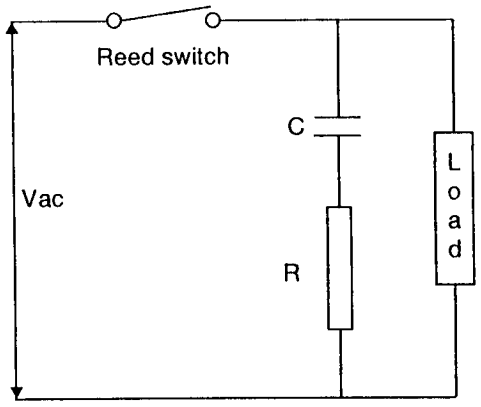
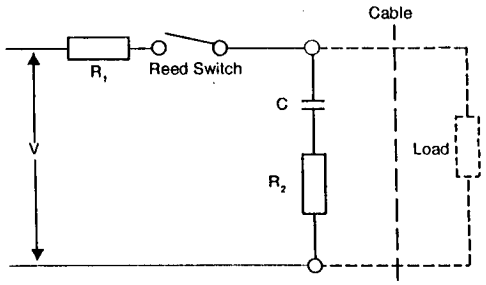


FIG. 2

Capacitive Loads

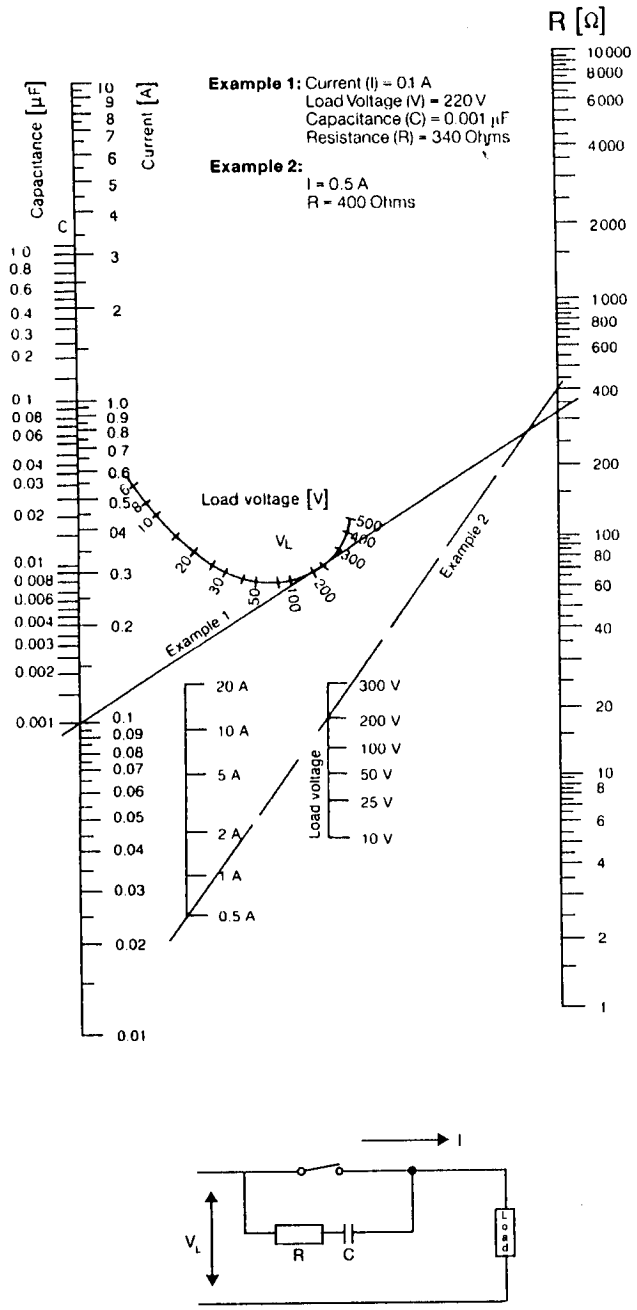
Unlike inductive loads, capacitive and lamp loads are prone to high inrush currents which can lead to faulty operation and even contact welding.
When switching charged capacitors (including cable capacitors) a sudden current surge can occur, the intensity of which is determined by the capacity and length of the connecting leads to the switch. This inrush peak can be reduced by a series of resistors. The value of these resistors is dependent on the particular application, but should be as large as possible to ensure that the inrush current is held within the allowable limits.



The above diagram illustrates a resistor/capacitor network for protecting a reed switch against high inrush currents. R_1 and/or R_2 are used dependent on circuit conditions.

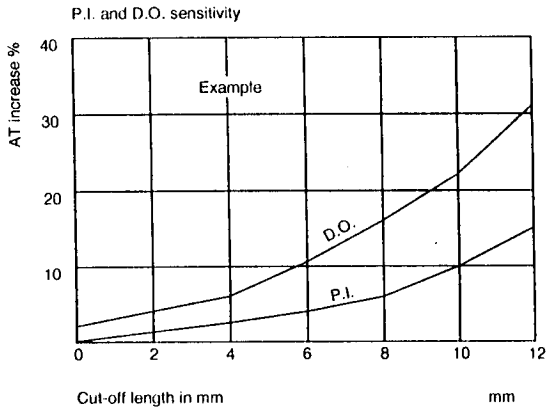
Inductive Loads

The following nomograph can be used for determining contact arc suppression for inductive loads.

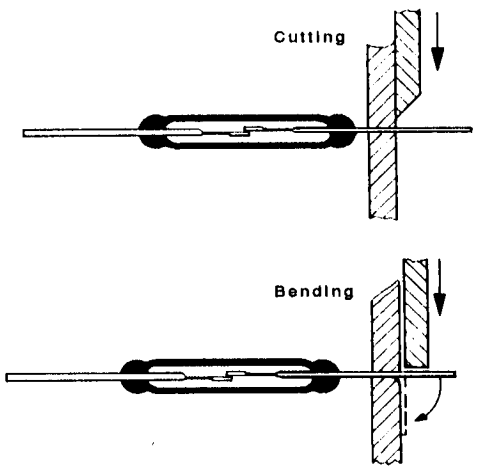


Cutting and Bending

As the reed blades are part of the magnetic circuit of a reed switch, shortening the leads results in increased pull-in and drop-out values.



When cutting or bending reed switches, it is important that the glass body is not damaged. The cutting or bending point should be no closer than 3mm to the glass body and the lead should be supported between the cutting or bending point and the glass envelope.



MAGNETS

The material used for reed switch magnets is generally either ALNICO (an aluminium nickel cobalt alloy) or a ceramic (barium ferrite or another metal oxide). Due to their specific magnetic characteristics, the two types of magnets differ in shape: ALNICO magnets are usually bar magnets with a length/diameter ratio of 3/1 to 4/1; oxide magnets are generally disc or moulded magnets. Also important to note is the difference in temperature coefficient: ALNICO: 0.02%/K, oxide: 0.2%/K

ELECTRICAL SPECIFICATION

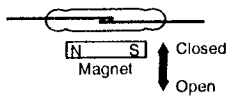
Switching voltage, current and power rating.
The listed values are absolute limits. If any of these values are exceeded a reduction in life expectancy will result. If inductive, capacitive and tungsten filament lamp loads are switched life expectancy will be reduced.
Contact protection will reduce electromagnetic interference and rapid contact wear.
Suppressing diodes with inductive loads may cause extreme contact wear.

Life Expectancy
The life expectancy of a reed switch is typically at least 10^6 operations at nominal load.
At minimum loads the life expectancy can exceed 5×10^8 operations.
Mechanical life expectancy is 10^9 operations (minimum).

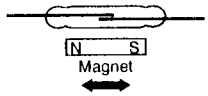
MAGNET ACTUATION

Actuation of Reed Switches with a Permanent magnet:

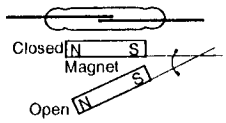
A magnet moved perpendicularly towards and away from a reed switch turns it off and on once.



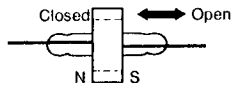
A magnet moved parallel to a reed switch operates the switch one to three times.



A magnet swung towards and away from a reed switch operates it once.



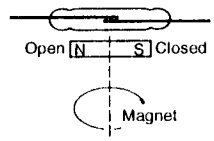
A ring magnet moved parallel to the reed switches axis operates it from one to three times.

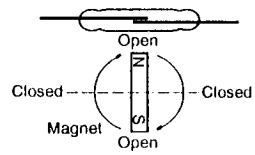


Ring magnet

Rotation

Examples of switching through rotational movement:





Indirect Actuation: Shielding

With the stationary arrangement of a reed switch and magnet, the contact reeds are closed. Should the magnetic field be diverted away from the reed switch by a shield of ferro-magnetic material placed between the switch and the magnet, the contacts will open. When the shield is removed, the contact reeds become magnetically actuated and close.