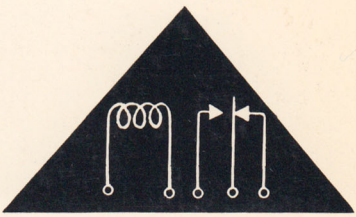
# DESIGNERS'

# HANDBOOK & CATALOG

## OF

## REED AND MERCURY WETTED CONTACT RELAYS



MAGNECRAFT ELECTRIC CO.

SECOND EDITION
$1.00

# DESIGNERS' HANDBOOK AND CATALOG OF REED AND MERCURY WETTED CONTACT RELAYS

This handbook has been compiled and written by the Application Engineering Section of Magnecraft Electric Company. This department will welcome the opportunity of offering its technical assistance in the design of reed relay or other relay applications.

**MAGNECRAFT ELECTRIC CO.**
**5575 N. Lynch Avenue**
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Although every reasonable care has been taken in preparation of this handbook, no responsibility is assumed for inaccuracy or consequences of using the information presented. The information contained in this handbook does not convey to the purchaser of the relays described any license under the patent rights of the Magnecraft Electric Company or others.

First Edition, November 1966
Second Edition, April 1967

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# PREFACE

Starting in 1951, Magnecraft relays have been used in practically every segment of the electrical—electronic industry.

Since 1961, the Magnecraft Electric Company has been developing and producing a wide range of dry reed and mercury wetted contact relays. As we have received an ever increasing number of inquiries from our customers concerning the use of reed and mercury wetted contact relays, we undertook the preparation of this handbook to aid the circuit designer and engineer who is responsible for specifying the correct type of relay for a given application.

This handbook is intended for you, the user.

If you are interested in relay technical information other than reed relays, we invite you to send for our technical literature on the broad line of Magnecraft relays which includes such relays as:

1. Telephone Type Relays
2. General Purpose Relays
3. Coaxial Relays (R.F. Switching)
4. Time Delay Relays
5. Hermetically Sealed Relays
6. Power Relays
7. Latching Relays
8. Sensitive Relays
9. Crystal Can Relays
10. Mil-Spec Relays
11. High Voltage Relays
12. High Speed Relays

If you should have any questions relating to the material in this handbook, or any other relay application questions, please do not hesitate to contact the Sales Department or the Application Engineering Department of Magnecraft Electric Company. We will be most happy to discuss your relay application with you at any time.

H. D Steinback
President

# ACKNOWLEDGMENTS

The information appearing in this handbook has evolved over a period of years from the work of many people at Magnecraft Electric Company. Special recognition should be given to the following individuals who have contributed greatly in the obtaining of test information, assembling of data, editorial assistance, format design and art work.

John E. Deimel, Wiley D. Greenwood, George M. Neeno, George R. Pfarr, Herbert D. Steinback, Morton S. Steinback, Robert N. Swedberg, William M. Vaughn.

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# I. GLOSSARY OF REED RELAY TERMS

### INTRODUCTION

The following definitions and terms are those which are commonly used with reed relays and associated circuitry. For more general definitions refer to the National Association of Relay Manufacturers "Engineers Relay Handbook," published by the Hayden Publishing Company, Section #1. The following terms and definitions, in general, are the same as those appearing in the above reference. In some cases, different terminology has been used which is more appropriate to reed relays, rather than relays in general.

### DEFINITIONS AND TERMS

#### A

**Ambient temperature**—The temperature of the medium (usually air) surrounding the relay and into which the heat from electrical and magnetic losses in the relay is dissipated.

**Ampere turns**—The product of the number of turns in an electromagnetic coil and the current in amperes passing through the coil.

**Arc, contact**—The electrical (current) discharge that occurs between mating contacts when the circuit is being disestablished.

**Armature spring**—The movable contact spring of a combination. This member is also sometimes referred to as the swinger spring.

**Auxiliary contacts**—Contacts used to operate a visual or audible signal to indicate the position of the main contacts, establish interlocking circuits, or hold a relay operated when the original operating circuit is opened.

**Auxiliary relay**—A relay that operates in response to the opening and closing of its operating circuit in order to assist another relay or device in the performance of a function. Sometimes used for a relay, actuated by a master relay, that controls secondary circuit functions such as signals, lights, or other devices. A slave relay.

#### B

**Bias, electrical**—An electrically produced force tending to move the movable, or armature, contact towards a given position.

**Bias, magnetic**—A steady magnetic field applied to the magnetic circuit of a relay.

**Bias, mechanical**—A mechanical force tending to move the movable, or armature, contact towards a given position.

**Binary**—A system of numerical notation that utilizes the Base 2 (rather than the Base 10 as in the common decimal system).

**Bi-stable contacts**—A contact combination in which the movable contact remains in its last operated position until the magnetic polarity of the coil is reversed.

**Bit**—A single electrical impulse or unit of information represented by a mark or space. The smallest unit of any binary digital code. The smallest particle of electrical information that can be transmitted or processed.

**Bobbin**—A spool upon which a coil is wound.

**Break**—The opening of closed contacts to interrupt an electrical circuit.

**Break-before-make contacts**—Contacts that interrupt one circuit before establishing another.

**Bridging—(1) Normal bridging:** The normal make-before-break action of a make-break or Form D contact combination. This type of action is commonly obtained with certain types of mercury wetted reed and mercury wetted contact reed relays. **(2) Abnormal bridging:** The undesired closing of open contacts caused by a metallic bridge or protrusion developed by arcing.

**Bridging contact**—A contact combination designed to provide bridging.

#### C

**Chatter, contact**—The undesired vibration of mating contacts during which there may or may not be actual physical contact opening. If there is no actual opening but only a change in resistance, it is referred to as dynamic resistance and appears on the screen of an oscilloscope having adequate sensitivity and resolution as "grass." Chatter may result from contact impingement during normal relay operation and release, improperly filtered DC, or from external shock and vibration.

**Close-differential relay**—A relay having its drop-out value specified close to its pick-up value.

**Coil**—An assembly consisting of one or more magnetic windings, usually wound over an insulated bobbin or spool, or self-supporting, with terminals or necessary lead wires.

## GLOSSARY OF REED RELAY TERMS

**Coil, bifilar wound**—Two or more windings with the wire of each winding alongside the other, matching turn for turn.

**Coil, concentrically wound**—A coil with two or more insulated windings, wound one over the other.

**Coil (winding) mean temperature**—The average temperature of an energized coil winding as determined by a measurement of its DC resistance.

**Coil (winding) power dissipation**—The electrical power (watts) consumed by the energized winding or windings of a coil. For most practical purposes this is calculated from $I^2R$ of the specific case.

**Coil (winding) resistance**—The total terminal-to-terminal resistance of a coil at a specified temperature. A tolerance of measured value from a nominal specified resistance is usually allowed.

**Compliant (contact) spring**—A contact spring that can, and is intended to, move appreciably when contacted by a mating contact spring.

**Contacts**—The surfaces of current carrying members at which electrical circuits are opened or closed.

**Contacts, break-make**—A contact combination in which one contact opens its connection to another contact and then closes its connection to a third contact. Same as transfer contacts. A "C" contact combination.

**Contacts, double throw**—A contact combination having two positions, as in break-make, make-break, and the like.

**Contacts, dry circuit—(1)** Contacts that neither break nor make current. **(2)** Erroneously used for low level contacts.

**Contacts, low capacitance**—A type of contact construction providing low inter-contact capacitance.

**Contacts, low level**—Contacts that control only the flow of relatively small currents in relatively low-voltage circuits, for example, alternating currents and voltages encountered in voice or tone circuits, direct currents in the order of microamperes, and voltages below the softening voltages of record for various contact materials (that is, 0.080 volts for gold, 0.25 volts for platinum, and the like). Also defined as the range of contact electrical loading where there can be no electrical (arc transfer) or thermal effects and where only mechanical forces can change the conditions of the contact interface.

**Contacts, make-break**—See Bridging Contacts. A "D" contact combination.

**Contacts, movable**—The member of the contact pair that is moved directly by the actuating system. In reed type of relays the movement is caused directly by magnetic attraction. This member is also referred to as the armature (contact) spring, or swinger spring.

**Contacts, nonbridging**—A contact arrangement in which the opening contact opens before the closing contact closes.

**Contacts, normally closed**—A contact pair which is closed when the relay is unenergized. A "B" contact combination.

**Contacts, normally open**—A contact pair that is open when the relay is unenergized. An "A" contact combination.

**Contacts, stationary**—The member of a contact pair that is not moved by the actuating system.

**Contacts, transfer**—Sometimes used for contacts break-make. A Form "C" contact combination.

**Contact arrangement**—The number and types of contact combinations of a relay.

**Contact Bounce**—The intermmitent and undesired opening of closed contacts, or closing of open contacts, of a relay, due to the following causes: **(1)** Internally caused contact chatter due to impingement of the mating contacts. **(2)** Externally caused contact chatter due to shock impact experienced by the relay or the apparatus of which it is a part, or from external vibration transmitted to relay thru its mounting.

**Contact force**—The pressure exerted between two contacts when the contacts are in their closed position.

**Contact gap**—The distance between a pair of mating relay contacts when the contacts are open, same as contact separation.

**Contact load**—The electrical power demands encountered by a contact set in any particular application.

**Contact miss**—Failure of a contact mating pair to establish the intended circuit electrically. This may be a circuit resistance in excess of a specified maximum value.

**Contact rating**—The electrical power handling capability of relay contacts under specified environmental conditions and for a prescribed number of operations.

## GLOSSARY OF REED RELAY TERMS

**Contact resistance**—The electrical resistance of operated contacts as measured at their associated terminals of the relay.

**Contact transfer time**—The interval between opening of the closed contact and closing of the open contact of a break-make contact combination.

**Contact weld**—(1) The point of attachment of a contact to its support when accomplished by resistance welding. (2) A contacting failure due to fusing of contacting surfaces under load conditions to the extent that the contacts fail to separate when expected to do so.

**Contact wipe**—The scrubbing action between mating contacts resulting from contact over-travel or follow.

### D

**De-energization**—The removal of power from a relay coil. Also commonly used to indicate a change in applied coil power adequate to produce a drop-out of the contacts.

**Differential relay**—A relay with multiple windings that functions when the voltage, current, or power difference between the windings reaches a predetermined value. The power difference may result from the algebraic addition of the multiple inputs.

**Double wound coil**—A coil or winding consisting of two parts wound on the same bobbin or form.

**Drop-out, measured**—The value of current or voltage at which the relay restores to its unoperated position.

**Drop-out specified**—The specified value of current or voltage at which the relay must have restored to its unoperated position.

**Duty-cycle**—A statement of energized and de-energized time in repitious operation, for example, 2 seconds on, 6 seconds off, and the like.

**Dynamic contact resistance**—A change in contact electrical resistance due to a variation in contact pressure on contacts mechanically closed.

### E

**Electrostatic shield**—A metallic shield or foil, usually grounded, used between reed switches, between a reed switch and coil, or between adjacent relays, to minimize cross-talk effects.

**Energization**—The application of power to a relay coil. With respect to an operating coil winding use of the word commonly assumes enough power to operate the relay fully, unless otherwise stated.

### F

**Final actuation time**—The time interval from coil energization to the complete functioning of the last contact combination to be operated on pickup, or the last combination to be restored to normal on drop-out.

### I

**Impregnated coils**—Coils that have been permeated with an electric grade varnish or other protective material to protect them from mechanical vibration, handling, fungus, and moisture.

**Insulation resistance**—Resistance of insulation measured (in ohms) at a specified DC voltage and under ambient conditions, after current becomes constant. The resistance to leakage current of an intended insulator.

**Intermittent-duty relay**—A relay which must be de-energized at intervals to avoid excessive temperature, or a relay that is energized at regular or irregular intervals, as in pulsing.

### M

**Make**—The closure of open contacts to complete an electrical circuit.

**Make-before-break contacts**—Double-throw contacts so arranged that the moving contact established a new circuit before disrupting the old one.

**Minimum (reliable) current**—As applied to relay contacts, the range at which there is insufficient energy under arcing conditions at the mating contact surfaces to insure good contacting for the kind of contact material, shape, and forces employed. A test for minimum current is specified in some military specifications.

### N

**Nominal voltage**—A single value of voltage (or a narrow voltage range) falling within the allowable operating voltage range of the relay.

**Nonbridging**—A term used to describe a contact transfer in which the movable contact leaves one contact before touching the next.

## GLOSSARY OF REED RELAY TERMS

**Noncompliant (contact) spring**—A contact spring that cannot, and is not intended to, move appreciably when contacted by a mating contact spring.

**Normal condition**—The de-energized condition of the relay.

**Normal Position**—The usual de-energized position of contacts, open or closed, due to spring tension or magnetic polarity.

### P

**Percent break**—The portion of an electrical impulse during which no current flows, expressed as a percentage of the total impulse time.

**Percent make**—The portion of an electrical impulse during which current flows, expressed as a percentage of the total impulse time. Sometimes referred to as dwell.

**Pickup, measured**—The value of current or voltage at which the contacts assume their fully operated position.

**Pickup, specified**—The current or voltage at or below which the contacts must assume their fully operated position.

**Pole, double**—A term applied to a contact arrangement to denote that it includes two separate contact combinations, that is, two single pole contact assemblies.

**Pole, single**—A term applied to a contact arrangement to denote that all contacts in the arrangement connect in one position or another to a common contact.

**Pull-in**—Sometimes used for pickup.

### R

**Relay**—Most simply defined as an electrically controlled device that opens and closes electrical contacts to effect the operation of other devices in the same or another electrical circuit.

**Release**—Sometimes used for drop-out.

### S

**Saturation**—The condition attained in a magnetic material when an increase in field intensity produces no further increase in flux density. A degree of saturation (soak) may be specified as a reference point when a relay is being tested for various electrical parameters.

**Sensitivity**—Pick-up, specified, expressed in terms of power, such as milliwatts.

**Single-side-stable contact**—A contact combination in which the movable contact releases from the operated position when the coil current falls below the drop-out value.

**Spring, contact**—In general terminology this is a current carrying spring, usually a flat leaf type member, to which the contacts are fastened. In the case of reed type of relays the reed elements themselves may not have contacts fastened to them, but the contacting surfaces may consist of only a plated area.

### T

**Temperature correction**—The factor used to convert a measured value coil resistance at a known temperature (such as 25°C) to a calculated resistance value at some other temperature.

**Throw, double**—A term applied to a contact arrangement to denote that contacting is effected in both the operated and nonoperated position, for example, a contact form such as a break-make or transfer.

**Throw, single**—A term applied to a contact arrangement to denote that contacting is effected in only one position and not the other, for example, a normally closed or normally open contact.

**Time, bridging**—The time that contacts in transit are electrically connected during pickup or dropout.

**Time, contact bounce**—The time interval from initial actuation of a contact to the end of bounce brought about during pickup or dropout or from external causes.

**Time, operate**—The time interval from coil energization to the functioning time of the last contact to function. Where not otherwise stated, the functioning time of the contact in question is taken as its initial functioning time (that is, it does not include contact bounce time).

**Time, release**—The time interval from coil de-energization to the functioning time of the last contact to function. Where not otherwise stated, the functioning time of the contact in question is taken as its initial functioning time (that is, it does not include contact bounce time).

**Time, transfer**—The time interval between opening the closed contact and closing the open contact (and vice versa) of a break-make contact combination.

### W

**Wiring, bias**—An auxiliary winding used to produce an electrical bias.

**Wire, magnet**—Any coated conductor used to wind an electromagnetic coil in order to develop and maintain a magnetic field under prescribed conditions.

# II. PRINCIPLES OF OPERATION

## REED AND MERCURY WETTED RELAYS

### INTRODUCTION

This section describes the basic principles of operation of dry reed, mercury wetted reed and mercury wetted contact switching capsules. In general, all of the switch capsules described here are available in many of the relay styles described in Section III entitled Relay Styles and Characteristics. The basic principles of operation of the switching capsule is independent of the mechanical construction of the complete relay. The following types of relays are described here:

1. *Dry Reed, 1 Form A Mechanically Biased*
2. *Dry Reed, 1 Form C Mechanically Biased*
3. *Dry Reed, 1 Form C Magnetically Biased*
4. *Dry Reed, 1 Form B Magnetically Biased*
5. *Mercury Reed, 1 Form A Mechanically Biased*
6. *Mercury Reed, 1 Form B Magnetically Biased*
7. *Mercury Reed, 1 Form C Magnetically Biased*
8. *Mercury Wetted Contact Mechanically Biased*

### RELAY OPERATION

In all cases, it should be recognized that the operation of these switch capsules depends upon the application of an appropriate magnetic field for operation. This magnetic field can be obtained by the use of a coil surrounding the capsule, by the use of an appropriately located external permanent magnet, or by any other external magnetic field. For the purpose of this discussion of dry reed, mercury wetted reed and mercury wetted contact switching capsules we will only consider those cases where the unit is operated by a coil in a complete relay structure.

### SWITCH CAPSULE OPERATION

**Dry Reed Switches** *Introduction:* All basic dry reed switch capsules consist of solid metallic contact members sealed in a glass envelope. In all types the contact members are made of magnetic materials. In the majority of dry reed switch capsules the actual points of contact switching are appropriately plated with various precious metals such as gold, rhodium, silver, etc. In some cases the contacting points may be inlayed into the magnetic material, or metallic contacts may be welded or brazed, in a manner similar to that used on conventional relays. The contact switching members are carefully positioned inside a glass tube which is fused to these magnetic members to maintain specific contact spacings. The entire glass capsule is filled with an atmosphere for the appropriate contact switching conditions. (This could typically be one atmosphere of an inert gas, such as dry nitrogen, for the more common switches, or a high vacuum for high voltage switches.) As the contacts are in a closely controlled atmosphere any further deterioration due to atmospheric conditions is not possible with reed switches. Therefore, the contacts themselves are able to withstand extremely adverse environmental conditions such as humidity, low pressure due to high attitudes, salt spray, and so on. The only limitations are due to the mechanical construction of the external parts of the reed leads, or the external relay structure. The external magnetic reed members are either plated, electro-tinned, or hot tin dipped to allow ease of solderability to relay terminals.

**Type of Switches** *1 Form A Mechanically Biased:* These types of units are pictured in Figure 1. Two basic types of construction are commonly used. The switch indicated in Figure (1A) has magnetic material reed leads of identical size and shape with a gap located in approximately the center of the reed capsule. Both members are compliant and have approximately the same amount of flexure on the presence of an appropriate magnetic field. Upon application of current to the relay coil a magnetic field is established as indicated in Figure (1B). As the current increases the North pole at the tip of one of the reed members and the South pole at the tip of the other reed member will attract due to magnetic action. With the proper magnetic field the contacts will close and exert the required amount of force to maintain proper circuit reliability. For reliable contact switching at full life at rated loads, it is essential that this type of switch have appropriate overdrive and not merely "make" the contacts. Dry reed relays are so designed to establish a magnetic field which will cause the contacts to have this overdrive and function properly.

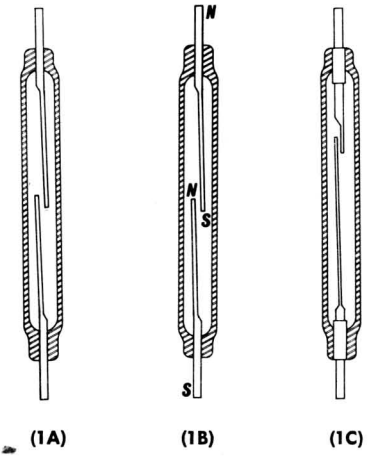


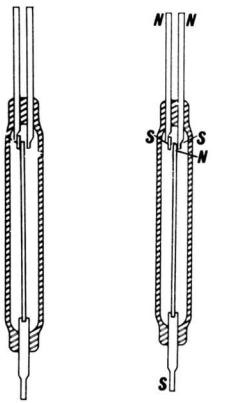

FIG. 1 DRY REED—1 FORM A MECHANICALLY BIASED

The reed leads are held in their nonoperating position by the mechanical placing of the reeds when fused in the glass capsule. Proper spacing is maintained to allow contact gaps as required for the application. Upon removal of the coil current the reed leads will return to their nonoperated position due to the tension of the reed leads.

The other version of the 1 Form A dry reed, mechanically biased, is illustrated in Figure (1C). This is known as an offset gap switch. This type of unit has a compliant member as the movable contact and a non-compliant member as a stationary contact. The magnetic operation of this type of switch is similar to that described above for the center gap switch except that only the movable contact member would move and the stationary contact does not move due to magnetic action.

## PRINCIPLES OF OPERATION

*1 Form C Mechanically Biased:* The 1 Form C, single pole double throw, dry reed switch is illustrated in Figure (2A). This unit makes use of a compliant reed, which is actuated by a magnetic force, and two non-compliant stationary contacts. In this mechanically biased construction the movable reed is so positioned prior to the fusing of the glass that a specific amount of pressure is exerted upon the normally closed contacts, and the normally open contacts are spaced a specific distance from the movable contacts. The normally closed contact has a pad of non-magnetic material welded or brazed to it so that the magnetic attraction of the movable reed to the normally closed contact is kept to a minimum.

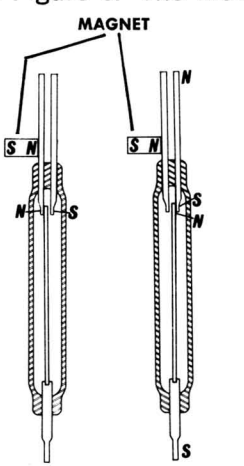



(2A) (2B)

FIG. 2 DRY REED—1 FORM C MECHANICALLY BIASED

Upon application of an appropriate magnetic field polarities are established as indicated in Figure (2B). As the field increases, the normally open contact exerts a stronger attraction to the movable contact than does the normally closed contact. The movable contact is attracted to the normally open contact and the contacts close. Upon removal of the magnetic field the movable contact returns to its normal position due to the mechanical tension in the movable reed member.

*1 Form C Magnetically Biased:* The 1 Form C, single pole double throw, magnetically biased dry reed switch capsule is illustrated in Figure 3. The movable reed member is of a compliant magnetic material and similar to that in the mechanically biased switch. Both stationary contacts are fixed and symmetrical. The movable reed is normally center stable. That is, the stationary contacts are set to a predetermined spacing and the movable contact is placed approximately at a mid-point between the two stationary contacts prior to fusing of the glass to the reed leads. A permanent magnet is used in conjunction with this reed and held in an appropriate position to hold the movable reed against one of the stationary contacts, which becomes the normally closed contact. This biasing magnet may be placed in various different locations and only one typical location is shown in Figure 3.




(3A) (3B)

FIG. 3 DRY REED 1 FORM C MAGNETICALLY BIASED

With the relay coil un-energized, the biasing magnet has established magnetic polarities on the reed leads as shown in Figure (3A). Upon energization of the relay coil a magnetic field is established as indicated in Figure (3B). The combination of the magnetic fields, which were established by the biasing magnet and which is established when the relay coil is energized, causes

the movable contact to move from the normally closed position and to close the normally open contact. As in the single pole single throw type of switch an appropriate amount of overdrive above the actual pull-in point is recommended in order to establish the contact pressure necessary for life at full contact ratings.

Upon de-energization of the coil the movable reed will be attracted to the stronger magnetic pull associated with the normally closed contact, due to the biasing magnet, and the contacts will reclose.

This type of relay is polarity sensitive and will only operate when a voltage of proper polarity is applied to the relay coil.

*1 Form B Mechanically Biased:* This unit has the same operation as the Form C mechanically biased unit described above, except that the normally open contact external lead is not wired directly into the relay circuit.

*1 Form B Magnetically Biased:* The 1 Form B, single pole single throw normally closed dry reed switch capsule makes use of a 1 Form A type of reed unit as described above but has a biasing magnet associated with it. This unit is illustrated in Figure 4. The biasing magnet is placed in an appropriate location adjacent to the switch capsule or reed leads. The location of the magnet would depend upon the physical construction of the relay involved. The field strength of the magnet is maintained at a level so that the proper contact pressures are exerted between the two contacts to maintain proper contact rating.

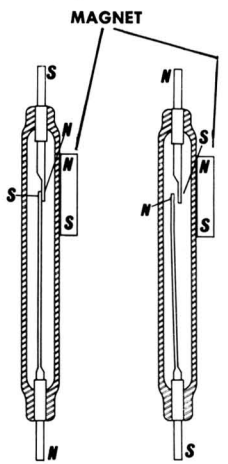



FIG. 4 DRY REED—1 FORM B MAGNETICALLY BIASED

The biasing magnet establishes magnetic polarity of the reed members as illustrated in Figure (4A). Upon energization of the coil a magnetic field is established as is indicated in Figure (4B). This magnetic field opposes the magnetic field established by the biasing magnet and the contacts open due to spring tension of the movable contact. Relays of this type are so designed that application of the nominal voltage to the relay will cause proper contact gap for switching rated contact load.

This type of unit is polarity sensitive and a voltage of the proper polarity must be applied to the coil for the relay to operate. It is also necessary that an appropriate amount of voltage be applied in order to maintain the proper contact gap. However, if excessive voltage is applied to the coil, the magnetic field caused by the coil will eventually equal the magnetic field caused by the biasing magnetic. Any magnetic field generated by the coil greater than this value will cause the movable reed to once again be attracted to the normally closed contact and eventually the contacts will reclose. Therefore, it is essential that units of this type be operated within the recommended voltage limitations.

**Mercury Wetted Reed Switches** *Introduction:* Mercury wetted reed relays, in general, operate on the same basic magnetic principles as described above for dry reed relays. However, the reed contact members within the capsule are completely wetted, or coated with a film of liquid mercury at the point of contact switching and a pool of mercury is maintained in the bottom of the switch. It is essential that these units only be operated in the vertical position. In all mercury wetted reed relays, the movable contact member is completely wetted with mercury and mercury is supplied to the mating contact surfaces by capillary action, similar to the wick of a kerosene lamp. The top contact of a mercury wetted reed switch is fully wetted with mercury at the contacting end which mates with the movable contact. In all cases, the type of mercury used is of a special formulation to allow proper wetting and the internal atmosphere of the capsule is that which is compatible for use with liquid mercury.

**Types of Switches** *1 Form A Mechanically Biased:* This type of switch is illustrated in Figure 5. It has two compliant magnetic reed members. The lower member, which is immersed in a mercury pool in the vertical position, is completely wetted with mercury. The contacting end of the upper reed is wetted with mercury. Special processes are necessary to obtain the proper wetting action of the mercury on these reed surfaces.

The operation of this switch is similar to the 1 Form A dry reed described above. The significant difference between the dry reed switch and the mercury wetted reed switch is that upon each operation of the mercury wetted switch the surface to surface contact is created by liquid mercury. Therefore, essentially a "new" contact makes contact with each operation of the relay. This allows greatly increased contact ratings over a dry reed switch of the same general type of configuration. Another advantage of this switch in comparison to the dry reed switch is that the relay has no contact bounce due to the damping effect of the liquid mercury surfaces upon contact mating.

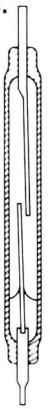


FIG. 5

MERCURY REED 1 FORM A MECHANICALLY BIASED

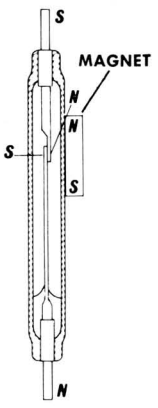



FIG. 6

MERCURY REED 1 FORM B MAGNETICALLY BIASED

*1 Form B Magnetically Biased:* The 1 Form B mercury wetted reed switch capsule operates similarly to the 1 Form B dry reed switch capsule described above. Again, it makes use of the standard 1 Form A capsule and an associated biasing magnet. Cautions regarding the use of over and under voltages would apply to this switch as well as to the dry reed switch. This switch is illustrated in Figure 6. Magnetic operation is similar to the 1 Form B magnetically biased dry reed.

*1 Form C Magnetically Biased:* The Form C mercury wetted reed switch is only available in a magnetically biased version. This unit is illustrated in Figure 7.

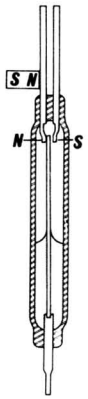



FIG. 7

MERCURY REED 1 FORM C MAGNETICALLY BIASED

The switch capsule has a movable reed which is mechanically center stable and stationary contacts which are symmetrical. The biasing magnet may be placed in various locations, depending upon the packaging of the specific relay. The magnetic operation of this relay is identical to that of the 1 Form C magnetically biased dry reed. In the 1 Form C mercury wetted reed the movable reed member is completely coated or wetted with mercury. Each of the stationary contacts has a precious metal contacting surface which, in turn, is also mercury wetted, allowing the significant increase in contact ratings of this over the dry reed. As in all type of mercury wetted reeds, this unit is completely free from contact bounce when the biasing magnet has been magnetized to the proper level. The value of this flux field determines the pull-in point, operate time and other parameters of the unit. The contacts of this unit are so spaced that upon operation of the relay the mercury film breaks and does not bridge to the normally closed contact before the normally open contacts function. This unit, as all mercury wetted reed switches, must be operated in the vertical position. Also, due to the biasing magnet proper coil polarity must be maintained.

*1 Form D Magnetically Biased:* This unit is identical to the 1 Form C mercury wetted reed capsule described above, except that the contact gaps have been appropriately spaced and the mechanical configuration set such that the mercury film bridges between the movable and normally closed contact until the normally open contact has functioned. This allows make-before-break contact switching action. All other comments regarding the Form C mercury wetted switches would apply to this unit.

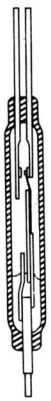


FIG. 8

MERCURY WETTED CONTACT MECHANICALLY BIASED

**Mercury Wetted Contact Switches** *Introduction:* The mercury wetted contact switch capsule shown in Figure 8 is quite distinctive from the mercury wetted type described above. It does not make use of the reed members themselves for actual contact mating, but has appropriately chosen material welded to the reed members to allow proper contact operation and provide capilary paths for the mercury. This unit is also equipped with two normally closed stationary contacts and two normally open stationary contacts. The movable contact member is so positioned prior to the fusing of the glass that a specific amount of pressure is exerted against the normally closed contacts. This spring pressure also returns the unit to the normal position upon de-energization of the coil.

This unit is capable of switching higher voltages and currents than the mercury wetted reed type of switch described above due to the extremely high pressure within the switch capsule and the use of completely different types of contacting members which support the mercury film.

**Types of Switches** *2 Form D Mechanically Biased:* For 2 Form D switching each stationary contact is separately wired in the circuit and the movable reed member is used as a common swinger, or armature spring, for contact actuation. This unit provides bridging of the mercury to allow a make-before-break action.

*1 Form D Mechanically Biased:* This type of unit makes use of the same switch capsule described above, except that the two normally closed stationary contacts are wired together and the two normally open stationary contacts are wired together. This allows twice the amount of current to be handled by the relay than in the 2 Form D version. In order to obtain full contact ratings of this type of switch it is essential that the recommended arc suppression be used.

## III. REED AND MERCURY WETTED REED STYLES AND CHARACTERISTICS

### INTRODUCTION

This section is intended to assist the relay user in determining the style of relay best suited to his requirements and to obtain information on the various characteristics of the type of relay indicated. The various principle styles and characteristics of Magnecraft reed and mercury wetted reed relays are listed in alphabetical order. The styles shown below are based on a single outstanding characteristic. Possibly other types and characteristics could have been added. It should be recognized that a given type of relay will probably have various salient features which will allow it to be categorized in three or four types of basic styles.

### STYLES

**Axial Lead Reed Relays** Axial lead relays are a mechanical configuration of reed relays in which terminals of the switching members are brought out parallel to the center line of the coil; the coil terminals may or may not be brought out in the same direction. Another way of defining this type is to indicate that the terminals are brought out along the major axis of the reed relay. Its major advantage lies in ease of assembly for either manual or automatic soldering. Its configuration is similar to that of a resistor or capacitor and can be wired into the assembly in essentially the same manner. It gives versatility in terminal spacing for PC board applications. Examples of axial lead reed relays are Class "101", "102" and "103" open style and encapsulated style shown on pages 36 through 41. In general, any of the various types of switch capsules described in Section II can be made available in an axial lead construction.

**Bi-Stable Relays** Bi-Stable relay is another term for describing a latching reed relay (see latching reed relay).

**Cross Point Relays** Cross Point reed relays represent the individual relay assembly within a system of relays generally referred to as a matrix system. They may provide one or more reed switch contacts. Contacts actuate in response to the sum of two inputs; contact actuation will not be affected by one input alone. This type of operation is usually obtained by the use of a dual coil winding. Various types of Magnecraft relays can be used for cross point relay switching.

**Encapsulated Relays** Encapsulated reed relays are those relays in which the switch, coil and terminal assembly are encased in an electrical insulating compound to provide excellent environmental and mechanical protection to the reed relay assembly. The encapsulated reed relay can be made available in a variety of mechanical configurations such as the axial lead or printed circuit configurations described in this listing. Standard Magnecraft encapsulated relays include the Class "101EP", "104EP" and "105EP" shown on pages 40 and 41, Class "101PC", "102PC", "103PC", "104PC" and "131PC" shown on pages 43 through 47, and the Class "136PC" shown on page 71.

**Electrostatic Shielded Relays** Electrostatic shielded reed relay is an assembly in which a grounded metallic element (or shield) surrounds the switch element. The shield reduces stray pickup from the vicinity of the contacts resulting in a lower contact noise level. Typical electrostatic shielded relays are shown on pages 74 and 75.

**Enclosed Relays** Enclosed reed relays are units which have a cover over the basic reed and coil configuration. Enclosures can be used to provide magnetic shielding, to provide mechanical protection, or to facilitate in mounting of the unit. The covers of various types of enclosed relays may or may not be removable. Examples of enclosed relays includes the MPC series shown on pages 49 through 66, "136CP" shown on page 72, the "103CP" shown on page 73 and the "102V" shown on pages 68 and 69.

**Hermetically Sealed Relays** Hermetically sealed reed relays are assemblies contained within a gas tight enclosure that has been sealed by fusion or other comparable means to ensure a low rate of gas leakage over a long period of time. A recognized inherent advantage of reed relays is that the switch capsule is hermetically sealed in an inert gas. However, under certain conditions, to meet extreme environmental conditions, you may want to utilize a complete, hermetically sealed enclosure around the entire assembly.

**High Insulation Resistance** High insulation resistance reed relays have switch capsules selected for maximum insulation resistance across contacts. In addition, the insulating components of the reed relay assembly have high insulating qualities and minimum moisture absorption. Relays of this construction yield insulation resistance across open contacts greater than $1 \times 10^{12}$ ohms.

**High Speed Relays** High speed relays have special configurations and designs for fastest possible operating speed. No specific operate time has been established on an industry wide basis to qualify a relay as having high speed operation. However, it is generally felt that relays having an operate time under one millisecond can be considered high speed relays. The fastest possible operating speed is available on the miniaturized type of units. However, under appropriate operating conditions many different types of reed and mercury wetted relays can be obtained for fastest possible operating speed. Operating speed is normally a function of the energizing circuit. High overdrive, intermittent or pulsing operation, use of series resistors, and other means can all contribute to decreasing the operating speed of a relay in a given circuit.

For minimum operating speeds the Magnecraft Class "101" and "105" type of reed relays specified in Section VII are recommended though other types can be made for faster operations under certain sets of specific conditions.

**High Voltage Relays** High voltage reed relays are specifically designed to switch voltages greater than that normally associated with reed relay switching. In general, this may be considered as approximately 500 volts. This division of high voltage switching at the 500 volt level is a general, industry

accepted, arbitary classification. The Magnecraft Class "102V" relay illustrated on pages 68 and 69 is specifically designed for high voltages up to 5000 volts. This type of relay is designed to meet the switching conditions by the use of a contact capsule having an extremely high vacuum with appropriate contact spacing and having terminals so located on special insulating materials with a mechanical construction allowing minimum possible leakage currents.

**Latching Reed Relays** Latching reed relays are available in two basic types. The electromagnetic type makes use of two separate windings: one for energizing the relay and the other for holding the contacts in their energized position. The hold winding may be actuated on the contacts of the relay itself or by contacts of subsequent relays.

The magnetic type makes use of a permanent magnet to hold the contacts in position to which they are switched. Removal of coil power does not cause the contacts to return to their original position. The contacts will remain in the last switched position until polarity is reversed either by reversing polarity to a single winding or by application of voltage to a second winding. One of the prime advantages of this type of relay is that during power failure contacts remain in their last actuated state. For example, counting circuits will not lose a count because of power loss.

By the use of a dual winding coil almost any Magnecraft reed or mercury wetted relay can be made as an electromagnetic type of latching relay. The Class "103LMPC," shown on page 67, makes use of magnetic latching and is available as a stock unit.

**Low Capacitance Relays** Low capacitance relays are units which are specially constructed and have selected reeds to minimize capacitive coupling between open contacts of a given relay and between that relay and other circuit components. Grounded electrostatic shields are commonly used with these types of relays to minimize capacitive coupling effects. Various types of relays can be obtained for minimum capacitance. In general, the miniature and micro-miniature units, with appropriate shielding, yield the best results.

**Low Contact Noise Relays** Low contact noise reed relays are special reed switches designed to provide low noise voltages when measured immediately after contact closure. Actual values of noise voltage depend upon bandwidth and the time following contact closure when measurements are made.

**Low Thermal Voltage Relays** Low Thermal voltage reed relays represent a package consisting of reed switches and assembly techniques which provide low thermal voltages at varying duty cycles and ambient temperatures.

**Magnetically Shielded Relays** Magnetic shielded reed relays contain a protective sheath that confines the coil's magnetic field to the immediate area of the relay, greatly reducing magnetic interaction with adjacent relays or components. At the same time the reduced air return path reluctance of the relay makes the relay coil respond to lower power levels.

All of the Magnecraft "MPC" types of relays are equipped with a metal cover for magnetic shielding. In addition, essentially any type of Magnecraft reed or mercury wetted relay can be furnished with magnetic shield of a special low reluctance alloy for the maximum possible shielding.

**Memory Relays** Memory reed relays are latching reed relays (see latching reed relay).

**Microminiature Size Relays** Microminiature size relays use a switch capsule of approximately 3/8" length and 0.09" diameter. Its greatest advantage is in increasing the density of packaging for designs calling for the smallest possible packaging available. It is also faster in operate and release times than the miniature unit. The Class "105EP" shown on page 41 and the Class "105MPC" shown on page 66 are examples of standard Magnecraft microminiature reed relays.

**Miniature Size Relays** Miniature size relays use a switch capsule approximately 3/4" long with a glass diameter of approximately 0.1". Its greatest advantage is that it allows greater density of packaging in critical locations calling for smaller size. In general, it is a faster device than the standard size relay. The miniature size relays manufactured by Magnecraft Electric Company are designated as the Class "101" and "104" series for dry reeds and the "131" series for mercury wetted reeds. These are available in many different types of constructions indicated in Section VII of this Handbook.

**Multiple Coil** Multiple coil reed relays have two or more coils to meet specific types of circuit function. These are most commonly used to provide "pick and hold" functions for fast operating speed and minimum holding power, to obtain polarity sensitive relays, and for use in latching. Multiple coil windings are most commonly available as either bifilar winding or concentric windings. Multiple coils can be used on essentially all of the Magnecraft reed and mercury wetted relays.

**Open Style Relays** Open style reed relays consist essentially of the simplest form of reed relay in which each switch capsule is surrounded by an electromagnetic coil. Class "101," "102" and "103" shown on pages 36 through 39 are examples of standard Magnecraft open style relays.

**Plug-in Relays** Plug-in reed relays offer designers a replaceable feature in their circuits. The usual configuration takes the form of a standard tube socket type of connection either in the octal style or in miniature styles. Examples of Magnecraft plug-in relays are the Class "136CP" mercury wetted contact shown on page 72 and the Class "103CP" dry reed shown on page 73.

**Polarized Relays** Polarized reed relays may or may not be latching relays. A polarized relay has its contacts maintained by a continuous field provided by a permanent magnet. The attitude of the contacts may be changed by a field set up electromagnetically and is directly dependent upon the direction of coil current flow.

**Power Relays** Power reed relays are a somewhat relative term as used in conjunction with reed and mercury wetted contact relays. In general, reed relays are typically thought of as devices switching up to possibly 1 ampere at 15 volt-amperes. It may arbitarily be stated that units capable of switching power levels higher than this could be considered power reed relays. The Magnecraft Class "102RMPC" shown on page 70 is designed for switching up to 100 watts of power at 3 amperes maximum. Normally this power level has, in the past, only been available on general purpose and telephone type relays but is now available in low profile printed circuit packages.

**Printed Circuit Relays** Printed circuit reed relays are mechanical reed relay configurations, particularly adapted to printed circuit board application or mounting. All terminals extend out from one side usually vertical to the major axis of the relay to allow mounting on a flat plane. Its major advantage is that it permits insertion into the board without any forming or bending of the leads. Normally, these units are available in single or multiple pole units. They can be open types or encapsulated types.

All of Magnecraft printed circuit relays make use of separate terminals which are firmly mounted into an appropriate terminal board or coil form so that the reed leads themselves are not used for direct insertion into the printed circuit board. This prevents the reed leads from being subjected to stresses which would transmit to the reed capsule and disrupt adjustment stability or cause cracking of the glass. Various types of printed circuit relays are available such as the "PC" types shown on pages 42 through 48 and the "MPC" types shown on pages 49 through 66. These are available for both dry reed and mercury wetted reed units.

**Pulse Relays** Pulse reed relays combine one pulse and one holding coil operating one or more reed switches. In this sense it is a variation or another form of a latching relay. The holding coil does not have sufficient power to operate a switch but keeps it operated after the pulse coil has received the proper signal. The pulse coil operates the switch independent of the holding coil, from a signal which is additive to the flux generated by the holding coil.

**Pressurized Reed Relays** Pressurized reed relays contain switch capsules bearing an internal pressure greater than atmospheric. Advantages are increased dielectric withstanding voltages and increased contact ratings. The atmospheres are generally inert and of the same kind found in standard reed switches.

**Sensitive Relays** Sensitive relays are units which exhibit greater sensitivity than the standard units for a given size and construction. There is no generally accepted standard on sensitivity from a power viewpoint. By selection of special reeds and proper construction methods many types of reed relays

can be made to exhibit greater sensitivity than the usual type either with or without de-rating of the contacts, or in some cases by only de-rating the maximum breakdown voltage due to decreased contact gaps.

Examples of sensitive reed relays are indicated on pages 76, 77 and 78.

**Standard Size Relays** Standard size relays are those that make use of reed capsules approximately 2″ long, not including the leads, and 0.2″ diameter. If your design has no critical weight or size factors, you can specify the standard size relay and achieve your switching functions at the lowest possible cost. In general, the standard size package has greater switching current capabilities than smaller packages and the smaller the package, the smaller the current handling capacity. It also provides flexibility in other operating parameters and characteristics.

Magnecraft manufactures many different types of relays using standard size reed capsules. These are available in the axial lead style, printed circuit style, encapsulated style and so on.

**Vacuum Relays** Vacuum relays are units in which the switch capsule has been evacuated to a very low absolute pressure. Contacts operated in this type of atmosphere have high voltage switching capability. The Class "102V" relays shown on pages 68 and 69 are examples of Magnecraft vacuum relays.

**Special Purpose Relays** Almost all of the categories of reed relays listed above were once considered special purpose. Today, enough widespread application has occurred to establish specific names for the distinguishing configuration characteristics or operational characteristics of the relay. Normally relays not falling into one of the above classifications may be labeled a special purpose relay until its acceptance becomes widespread enough for it to enter the ranks of those generally accepted as representative of a specific type.

On page 79 are illustrated certain custom built designs manufactured by Magnecraft for specific applications. These units are only illustrative of the many types of variations that are possible in reed relays.

# IV. APPLICATION AND DESIGN CONSIDERATIONS

## REED AND MERCURY WETTED RELAYS

### INTRODUCTION

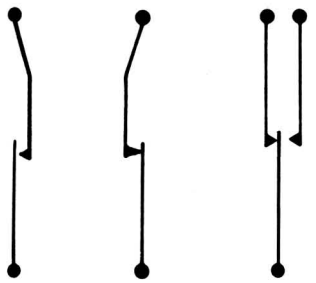
The various types of reed relays described in this handbook indicate the great versatility of both contact switching capabilities and types of packaging. The unique features of reed relays have caused it to be widely accepted for many types of circuit switching. Therefore, the idea of selecting a reed relay to fill all types of switching applications may be very enticing. However, the specific application should still determine the style and type of switching method best suited for a particular designer's requirement.

For example, if complete sealing of the contact switching members and switching speeds in the millisecond range is not needed a general purpose or telephone type relay may well be the best economic choice for multiple pole switching. If closed circuit resistance in the fractional ohm range and open circuit resistance in the multiple megohm range is not needed, but extremely fast switching speed is needed, a solid state type of switching could well be the best choice. The circuit designer should, therefore, consider the various parameters needed for his application and attempt to choose the proper component which is most suitable.

Listed below are various operating characteristics and design information which can prove helpful in determining the various parameters of reed type relays to meet specific design applications.

### OPERATING CHARACTERISTICS AND DATA

**Basic Contact Forms** Figure 9 illustrates the basic contact forms used with reed and mercury wetted contact relays. These are Form A, Form B and Form C. The Form C contact symbol indicated usually refers to a single pole, double throw contact with a break-before-make contact switching action. In certain types of mercury wetted reed relays Form D, make-before-break contacts are available. It has become conventional to show these with the same symbol as the Form C contact, while in more typical relay nomenclature, a different symbol is indicated. In this handbook these contacts have been refered to as SPDT (M-B) to indicate their make-before-break action. Other SPDT contacts would indicate standard break-before-make switching action.



FORM A FORM B FORM C

FIG. 9 SCHEMATICS OF BASIC CONTACT FORMS

**Multiple Contact Relays** At the present, reed contact switches are only available with a single contact form enclosed in an individual glass envelope. The various types of basic switches have been described in the section on principles of operation. Multiple contacts are not available within a single glass switch.

However, it has become quite common to combine two or more basic switches in one coil form for multiple contact relays. While this can be accomplished on many of the types of relays shown in this handbook, it is possibly best illustrated by the standard size "MPC" shown on pages 49 through 66. This type of relay is available up to a maximum of seven Form A contacts or four Form C contacts. In addition, various combinations are available such as 1A3C, 2A2C, 4A1C, etc.

In addition to combining contact forms, reed switches with various contact ratings can be combined in one package. For example in one given package the basic standard Form A switch rated at 15 volt-amperes at 1 ampere could be combined with a power switch rated at 100 volt-amperes at 3 amperes and a high voltage switch capable of switching up to 5,000 volts. This truly gives the reed relay the type of versatility formerly only available in telephone type relays and similar devices.

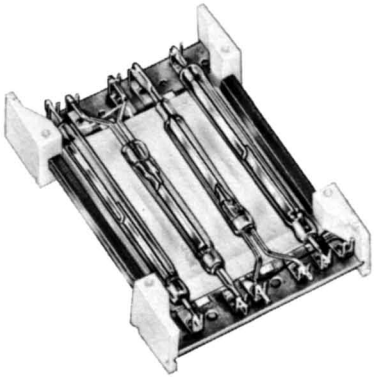


FIG. 10 CROSS SECTION OF MPC PACKAGE SHOWING 2A2C COMBINATION

An important consideration of the use of multiple contact relays is the cost savings which can be obtained by the use of these devices. One single relay containing two single pole double throw switches for a total of double pole double throw contacts will exhibit a considerable cost saving over two individual relays with single pole double throw contacts.

**Contact Ratings** The various relays described in section VII have rated contact loads indicated. These contact ratings are based on the use of the most commonly used switches available on stock or standard relays. It must be remembered that many types of reed switches are available which allows the designer to obtain the best possible contact switch for the particular load.

The most commonly used contact material for reed switches would be gold, rhodium, and various proprietary alloys. These switches are also available with silver, tungsten, and various precious metals, and the choice of the particular contact material can definitely give optimum life for a given load.

The contact ratings shown for reed and mercury wetted contact relays are to be considered as definitely maximum values. Not only must the maximum current and voltage be considered but the volt-ampere rating (the product of the maximum current and voltage at the time of switching) must also be considered. The contact ratings specified for the various types of relays are designed to yield the typical life figures indicated. If a given relay is operated at lower levels than this maximum contact rating, extended life can normally be expected. For example, the contact rating of the standard single pole, double throw switch used on relays such as the "103MPC" shown on page 54 is rated at 10 volt-amperes at 0.5 ampere maximum or 250 volts maximum,

resistive load. At this maximum rating a typical life expectancy would be 25,000,000 operations. At approximately half this rating the life expectancy would be 50,000,000 operations. At a relatively low contact level, the life expectancy could well exceed 100,000,000 operations.

However, it should not be felt that the contact life could be derated by the use of heavier contact switching. On the more conventional relays it is very common to have derated life with overload switching conditions. For example, a typical telephone type relay with 5 ampere contacts may have a life expectancy of approximately 300,000 operations at 5 amperes. At a level of 7 or 8 amperes the typical life expectancy might well be 100,000 operations. In the case of reed relays, the maximum contact ratings indicated should definitely be considered a maximum and should not be exceeded in either the steady state or transient switching condition.

In order to obtain maximum contact life it is necessary that any transient voltages or currents be kept within the maximum specified. In any case, appropriate arc suppression will always yield longer contact switching life.

**Contact Resistance** For the various types of relays indicated in Section VII of this handbook, typical contact resistance figures are given. These figures are based on measurements using standard Kelvin Bridge Methods of determining the contact resistance as measured at the relay terminals.

The apparent contact resistance which appears at the terminals when measured at a very low levels of currents and voltages can deviate considerably from these values. This is an inherent characteristic of any metallic switching contact and must be considered when using low level circuits.

On dry reed relays the contact resistance of a given relay may vary from operation to operation during the life of the relay. Therefore, if stability of contact resistance is important in a given circuit it is recommended that a mercury wetted reed relay or a mercury wetted contact relay be used. These types of relays will normally have stability of contact resistance within 10% of the initial value during the life of the relay.

**Sensitivity** The sensitivity of the various standard relay packages manufactured by Magnecraft Electric Company are listed for each type in Section VII of the Handbook. This sensitivity, expressed in milliwatts of power at the nominal voltage, is based on that required for stock relays, and is established to provide proper overdrive of the contacts, a satisfactory contact gap for proper dielectric strength, and maximum reliability combined with economy.

In general, relays with greater sensitivity can be obtained for all of the types of relays indicated. This increase in sensitivity would normally not necessitate any derating of the contacts. However, for maximum sensitivity it is necessary in some cases to reduce the dielectric strength capabilities across the switching contacts by lowering the contact gaps. Examples of minimum sensitivity relays, available in standard packages, are illustrated on pages 76, 77 and 78.

On relays having standard sensitivity requirements the coil has been designed so all of the relays will pull in at 85%, or less, of the nominal voltage at 25° C. In general, these coils are also designed to permit at least a 25% over-voltage to be applied to the coil continually without causing damage. When it is required that units pull in at a lower value than this, the relays operate over a wide temperature range, or when over-voltages can be present, the manufacturer should so be notified.

**Operate and Release Time** The operate and release times indicated for the various standard relays shown in Section VII are based on a typical relay tested at the nominal voltage at room temperature. This number should not be construed as a maximum condition, but a typical value indicating the order of numbers of operate and release time, in milliseconds, on a typical stock relay.

In general, the smaller the relay the faster the operating time. For fastest possible operating speeds the micro-miniature types shown on Pages 41 and 66 are recommended. The standard size switches are typically slower than the miniature or micro-miniature types.

Faster operating speeds can normally be obtained by the selection of a minimum ampere turn pull-in reed and can be available by a sorting process. For the fastest possible operating speeds, the use of series resistance and higher applied voltages will yield the best conditions. For example, a standard miniature Form A relay will have an average operate time of approximately 1 millisecond. If a resistor, having resistance equal to the coil resistance is put in series with a relay, and a voltage of twice the coil nominal voltage is applied to the complete circuit, a reduction in operate time can be obtained. The greater the series resistance and the higher the overdrive voltage, the faster the operate time. However, an absolute minimum operating time occurs on all types of relays regardless of driving conditions.

The release times specified are based on the relay being operated at nominal voltage at room temperature and the circuit opened through the use of a high impedance contact switch of some sort. This time also is based on no other series or parallel elements being connected into the coil circuit. As diodes and similar devices are commonly used across relay coils for arc suppression of preceding contacts, it must be remembered that the use of these elements can appreciably delay the release time of the relay.

**Contact Bounce** All types of solid metallic contacts normally exhibit some contact bounce. This is true of reed relays as well as conventional general purpose and telephone type relays. This contact bounce is normally caused by impingement of the mating contacts. In general, the contact bounce of a normally open contact on operation of the relay is considerably less than the contact bounce of a normally closed contact on the release of the relay. The values shown for the various relays in Section VII represent typical con-

tact bounce caused by the inherent mechanical construction of the relay. Reduced contact bounce can be obtained by a sorting process.

In the circuits where absolutely no contact bounce would be permitted the use of a mercury wetted reed relay or mercury wetted contact relay would be required. These types of relays will inherently switch contacts with absolutely no bounce if the unit is properly, mechanically constructed and has the proper magnetic biasing, when required. The contact interfaces, which are covered with a film of liquid mercury, absorb the shock of operation and the contacts will not open electrically, but remain closed after initial closing.

**Insulation Resistance** In the manufacture of the basic reed switch the parts are carefully cleaned, assembled under closely controlled conditions, and the unit is filled with an inert gas. Because of this, the insulation resistance of the basic reed switch is quite high. The insulation resistance across open contacts is typically $10^{11}\,\Omega$ or greater.

However, in normal manufacture and handling, and when the reed switch is built into an assembly, various parallel insulation paths are established. Therefore, the insulation resistance of a reed relay, measured at the terminals, can be expected to be lower than that which is obtained on the basic reed switch. For most of the many types of Magnecraft Electric Company relays shown in Section VII, a typical insulation resistance of $10^{9}\,\Omega$, or greater can be expected. However, as this parameter is not normally tested on a 100% basis, it is recommended that when leakage can be a problem in a given circuit the required insulation resistance is specified. By the use of proper insulating materials and closely controlled manufacturing techniques many of the standard types of relays can be obtained with insulation resistance as high as $10^{12}\,\Omega$, or greater. This figure would represent measurements made on a clean relay at normal room temperature and humidity. If, subsequently, the relay is subjected to dust or dirt, or to high humidity conditions, insulation resistance measurements lower than this would be expected.

**Contact Capacitance** As the reed leads present parallel metallic surfaces at the contacting end in their open position, a measurable capacitance across the contacts is obtained on any type of reed relay. In addition, measurable capacitance is also obtained from the coil to the reed leads. Depending upon the type of mechanical construction and size of the unit, capacitances from approximately 0.5 pf to 5.0 pf are obtained across open contacts. With a given relay construction the capacitance between open contacts and the coil, with the relay not energized, is usually about twice the value of the open contact capacitance. With the contacts closed and the coil energized the capacity from contacts to coil is about four times the value of the open contact capacitance. These are general "rules of thumb" and if inter-capacitance coupling is important in a given application, it is recommended that the maximum value, and points of measurements, be specified.

**Electrostatic Shielding** In certain applications it is necessary to reduce stray pickup of RF noise and similar undesirable elements from the contacts of a

reed relay. This can be accomplished by a non-magnetic metallic shield which surrounds the switch capsule and is fastened to an appropriate grounding pin or terminal. Normally this shield is placed between the reed switch and the coil. On multiple contact relays it is also common to have each of the individual switch elements shielded and in turn have all of these switches shielded from the coil and have this shield grounded. In addition, the shield will prevent the generated noise, which can be associated with arcing of the reed switch contacts, from affecting other elements closely adjacent to the relay in the circuit.

**Magnetic Shielding** In the section of Principles of Operation we described in detail how all reed switch capsules depend upon the application of an appropriate magnetic field for operation. This magnetic field can be obtained from the use of the normal relay coil surrounding the capsule, the use of an appropriately located external permanent magnet or from any other external magnetic field. Therefore, a reed relay could be operated falsely in the presence of a strong enough external magnetic field. This magnetic field could be caused by another relay closely adjacent to the reed relay or another component such as a transformer.

In order to reduce the possibility of a false contact operation the relay can be covered with a protective shielding of magnetic material. For example, all of the Magnecraft "MPC" type of relays are equipped with a metal cover for magnetic shielding. In addition, essentially any type of Magnecraft reed or mercury wetted relay can be furnished with a magnetic sheld of a special low reluctance alloy for the maximum possible shielding.

In addition to shielding the reed relay from external fields the shield confines the relay coil magnetic field to the immediate area of the relay and introduces a reduced air return reluctance path which increases the sensitivity of the relay.

**Contact Protection** The opening of relay contacts in an inductive load normally produces a high transient voltage. For example, it is not unusual for a 24 volt DC circuit to produce transients in excess of 1,000 volts. Certain other loads, such as motor loads and lamp loads, will have inrush currents upon contact closure considerably higher than the steady state value. Inrush currents of 10 times steady state currents are common in lamp loads.

The contact ratings of all types of reed relays should be taken to indicate the maximum value at the time of switching of the current, voltage and the volt-amperes. These values should not be exceeded in either the steady state or transient conditions. Therefore, in circuits where transient conditions can exist the use of arc suppression or quenching is necessary. To obtain maximum life under any switching conditions arc suppression is recommended. Certain relays, such as the mercury wetted contact relays shown on pages 47, 56, 57, 58, 59 and 65, require arc suppression in order to obtain the contact rating values indicated.

Various types of arc suppression are commonly used, the more typical types being diodes, resistor-capacitor networks, zener diodes, non-linear voltage sensing resistors which exhibit high impedance to low voltages and low impedance to high voltages, and certain special devices designed specifically for arc suppression. The choice of type of arc suppression and the particular values to use depend upon the specific application involved. These transient conditions should be considered in all cases, and appropriate arc suppression used when necessary. The manufacturer of a reed relay can commonly give "rules of thumb" for a specific product, but it is very difficult to generalize on the proper type of arc suppression which would cover most cases.

Magnecraft Electric Company will be happy to assist the user in a recommendation for arc suppression. However, once the general type of arc suppression has been determined and approximate values are established, it is usually recommended to actually view the switching of the contacts on an ocsilloscope and adjust the arc suppression as needed to obtain optimum results.

**Environmental Conditions** Reed and mercury wetted relays are normally ideal types of devices for operation in adverse environmental conditions as the contact switching elements themselves are completely hermetically sealed. However, depending upon the environmental conditions consideration must be given to the packaging to obtain the greatest reliability.

The material chosen for construction in Magnecraft relays are those which give the best possible results under normal operating conditions of electrical and electronic equipment. For extremely adverse conditions completely hermetically sealed relays, or similar constructions may be recommended.

# V. HOW TO SPECIFY A REED AND MERCURY WETTED RELAY

## INTRODUCTION

When specifying a relay for purposes of quotation requests or ordering, there are two basic rules which the user should always follow. First, include all necessary requirements which would apply for the given application. Second, exclude all unnecessary or superfluous requirements which would not be needed in the given application.

There are certain minimum requirements which must be known for the manufacturer to properly interprete quotation requests or orders. Without this minimum information the manufacturer must either "second guess" or else delay the processing of the quotation request or order by checking back with the user for the additional information. However, over-specifying, and calling out parameters which are not needed will only increase the price of the unit and the required delivery time.

The easiest way to order a relay is to review the stock and standard types shown in the Product Data Section of this handbook. When the user determines that one of these units will meet his requirements from the specifications given, ordering simply by the Magnecraft part number will allow the fastest possible processing of the inquiry or order. Where certain modifications of stock or standard relays would be needed to meet application requirements many customers commonly specify the stock part number or standard catalog number and specify the required changes.

## MINIMUM SPECIFICATIONS

If the user cannot readily determine from the stock and standard relays listed which would best suit his application, or he would prefer to have the manufacturer recommend a unit rather than directly specify a particular configuration, the following is the minimum information which is needed in order to determine the best unit for the application.

**Basic Relay Type, Size and Mounting** Calling out the basic relay type (such as Magnecraft Class "103MPC") can be helpful. However, many times the Relay Application Engineer may feel that a similar but slightly different unit would be best and if the user would specify the maximum overall size and type of mounting, a recommendation of the best relay for the application can be made.

**Contact Forms and Load** It is absolutely essential that the required contact forms (such as single pole, double throw or three pole, single throw normally open) and the contact load are specified. The information on the contact load should include not only the steady state currents and voltages, but also the nature of the load (inductive, lamp load, etc.) and any transient conditions which may exist, such as inrush currents or transient voltages. This will allow the Relay Application Engineer to choose the best possible contact material and type of reed switch for the specific load involved.

## HOW TO SPECIFY A RELAY

**Coil Voltage and Power Requirements** It is essential that the Relay Application Engineer know the nominal coil voltage of the relay to determine the proper resistance and sensitivity to use. If there are any specific requirements as to maximum available power, this should be specified. It should also be specified if the relay requires a pull-in at some percentage below the nominal voltage, or if the relay must operate over a temperature range other than normal room temperature.

## DETAIL SPECIFICATIONS

It is common for many relay users to have relay specifications shown on one of their detailed drawings. These detailed specifications must include the minimum information indicated above and also any other specific information which might apply in the given application. Again, it should be borne in mind to exclude any unnecessary specifications for purposes of economics and delivery.

## RELAY CHECK LIST

Various types of specification check lists have been derived for specific products and can be used to advantage when determining the necessary relay parameters. Magnecraft Electric Company has prepared a general relay application form which can be applicable for any type of relay, as well as reed and mercury wetted types. This form is shown in Figure 11 on page 80. Completion of this form (with an indication that certain parameters are not important, as well as the values of the parameters that are important) will allow the relay Application Engineer to process your inquiry or order with maximum possible speed.

# VI. TESTING PROCEDURES

## INTRODUCTION

To obtain proper correlation of tests between companies, or between various testing stations in a given company, it is essential that standardized testing procedures and conditions be followed. The purpose of the following is to indicate the standard procedures, test conditions and precautions used by Magnecraft Electric Company in testing reed, mercury wetted reed and mercury wetted contact relays.

## PROCEDURES

Testing procedures used for checking any type of relay should be those established by the National Association of Relay Manufacturers in the ***Engineers' Relay Handbook** Chapter 8. If some method or procedure other than that specified is desired it should be so indicated as part of the specific relay requirements.

## TEST CONDITIONS

Unless otherwise specified, the standard referenced conditions for testing of relays manufactured by Magnecraft Electric are:

(1) Temperature: 25°C
(2) Relative Humidity: 20% to 50%
(3) Normal Atmospheric Pressure in Chicago, Illinois

## PRECAUTIONS

In general, the standard testing procedures indicated above are applicable to reed and mercury wetted relays. However, in the testing of these devices certain specific precautions should be followed.

**(1) Dielectric Strength** In Section VII of this Handbook values are indicated for dielectric strength testing between open contacts and between contacts and coil. It should be noted that at no time should a potential be applied across open contacts greater than that specified. This can seriously damage the reed switch and cause degradation of performance.

**(2) Contact Continuity** In testing for pick-up, drop-out, and other parameters, it is necessary that some sort of indicating device be used to determine the proper functioning of the contacts and contact continuity. This indicating device must not subject the contacts to any value of current, voltage, or voltamperes greater than the rating for a given reed switch. For example, small 6.3 volt lamps are commonly used for testing contact functioning. While these lamps draw approximately ⅛ ampere steady state current, inrush currents greater than one ampere are common. Therefore, appropriate series resistance must be used to limit the current flow to a value below the maximum contact rating specified for a given reed switch.

**(3) Contact Resistance** For the various types of relays indicated in Section VII of this Handbook, typical contact resistance figures are given. These figures are based on measurements using standard Kelvin Bridge methods to determine the contact resistance as measured at the relay terminals. The apparent contact resistance obtained when measured at very low levels of current and/or voltage can deviate considerably from these values. This is an inherent characteristic of any metallic switching contact and must be considered.

**(4) External Magnetic Fields** As all reed and mercury wetted relays are effected in their operation by relatively small magnetic fields it is necessary that all testing of these types of devices be performed in an area free from any strong external magnetic fields. Reed relays are normally tested individually. While interaction between adjacent relays can be relatively small, or insignificant, depending upon construction, the manufacturer should be notified if the relays will be tested when closely mounted together on printed circuit boards or in similar locations. Possibly magnetic shielding would be recommended in some of these types of applications.

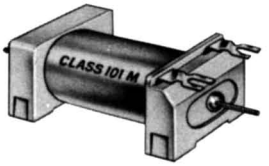
**(5) Position Sensitivity** Dry reed relays are, in general, not position sensitive. However, all types of mercury wetted reed and mercury wetted contact relays are position sensitive. In testing of these relays the units must be vertical (or not more than 30° from the vertical in the worst condition) and the proper end of the relay must be in an up position relative to gravity.

*Engineers' Relay Handbook Sponsored by The National Association of Relay Manufacturers Published by Hayden Book Company, Inc. New York

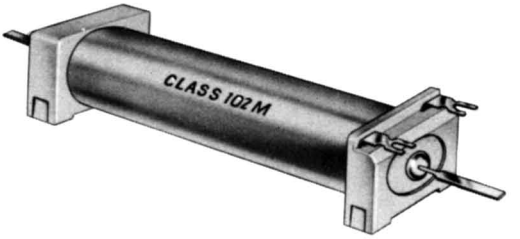
# VII. PRODUCT DATA SECTION (CATALOG)

# OPEN STYLE MOLDED DRY REED RELAYS

## Construction Data and Special Ordering



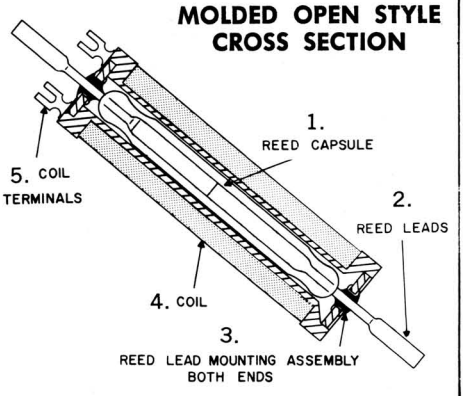

MINIATURE




STANDARD SIZE

Aside from the many standard features found in regular open style reed relays, such as permanent protection of contacts from dust, contamination or tampering, faster operating speed and simplicity of construction, the Open Style Molded Dry Reed Relays feature a new advantage not found in other low cost reed relays of this type. The reed leads are fastened tightly to the molded bobbin to provide stress relief that minimize forces being exerted to the glass capsule during soldering operations. The molded nylon bobbin with rugged coil terminal inserts eliminate possibility of shorts.

**MOLDED OPEN STYLE CROSS SECTION**



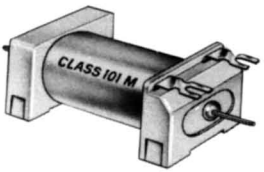

### MOLDED OPEN STYLE

1. **Reed Capsule** contacts are hermetically sealed with inert gas in glass capsule to completely protect them from dust, contamination, moisture or tampering.
2. **Reed Leads** are gold plated or tinned for ease in soldering connecting lead wires.
3. **Reed Lead Mounting Assembly** provides fastening reed lead to bobbin for stress relief to minimize forces being exerted to glass capsule during soldering.
4. **Coil** is accurately wound on specially designed one-piece molded bobbin insulated for excellent dielectric characteristics.
5. **Coil Terminals** are molded into bobbin to give maximum strength and avoid shorts and open connections. Terminals are tinned for ease of soldering.

# OPEN STYLE MOLDED DRY REED RELAYS

## SPST-NO 12 Volt-Amperes At 0.25 Amp.

### CLASS 101M MINIATURE



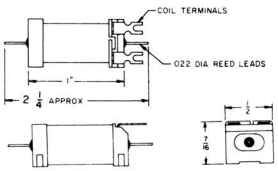

SPST-NO
(1 FORM A)
DRY REED RELAY

### SPECIFICATIONS

**CLASS 101M SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC maximum, resistive
**Nominal Coil Power:** 600 mw
**Operate Time:** 1 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 0.5 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 0.7 pf average
**Typical Life at Rated Load:** 5 million operations —longer at reduced loads

### DIMENSIONS



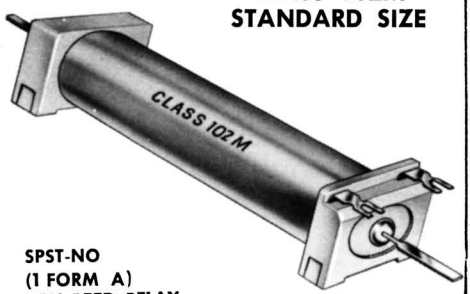

### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W101MX-1 | — | 6 VDC | 100 | |
| W101MX-2 | — | 12 VDC | 250 | 600 |
| W101MX-3 | — | 24 VDC | 500 | mw |
| W101MX-4 | 9 | — | 2500 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

## SPST-NO 15 Volt-Amperes At 1 Amp.

### CLASS 102M STANDARD SIZE



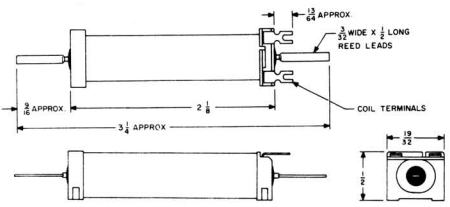

SPST-NO
(1 FORM A)
DRY REED RELAY

### SPECIFICATIONS

**CLASS 102M SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC maximum, resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 3 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 1 ms average
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 0.9 pf average
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads

### DIMENSIONS




### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W102MX-1 | 40 | — | 100 | |
| W102MX-2 | — | 6 VDC | 200 | 300 |
| W102MX-3 | — | 12 VDC | 500 | mw |
| W102MX-4 | — | 24 VDC | 2000 | |
| W102MX-5 | 5.5 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

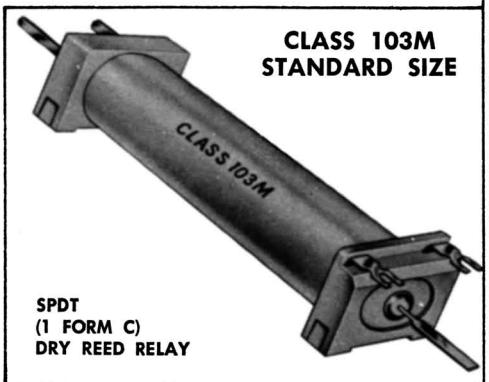
# OPEN STYLE MOLDED DRY REED RELAYS

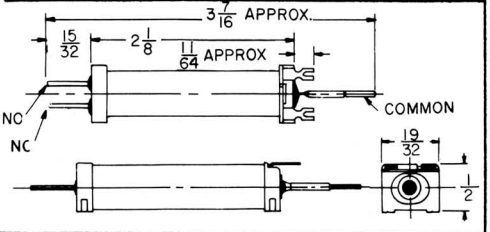
## SPDT 10 Volt-Amperes At 0.5 Amp.

### SPECIFICATIONS

**CLASS 103M STANDARD SIZE REED RELAY**

**Contact Combination:** SPDT (Form C)
**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC maximum, resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 2 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Normally open contacts less than 0.5 ms average, Normally closed contacts 4 ms average on release
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 3.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads




### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W103MX-1 | — | 6 VDC | 200 | |
| W103MX-2 | — | 12 VDC | 500 | 300 |
| W103MX-3 | — | 24 VDC | 2000 | mw |
| W103MX-4 | 5.5 | — | 5000 | |

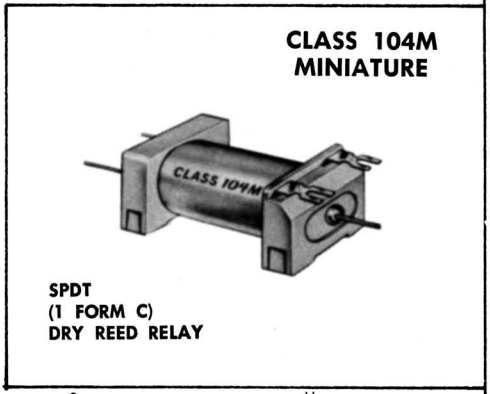
*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

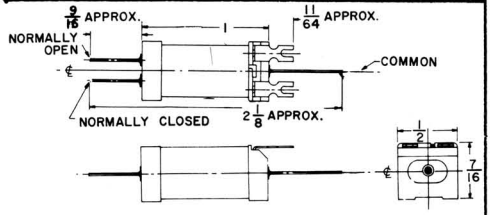
## SPDT 3 Volt-Amperes At 0.25 Amp.

### SPECIFICATIONS

**CLASS 104M MINIATURE REED RELAY**

**Contact Combination:** SPDT (Form C)
**Contact Load Rating:** 3 Volt-Amperes maximum at 0.25 amp. max. or 28 VAC maximum, resistive
**Nominal Coil Power:** 600 mw
**Operate Time:** 1 ms average
**Release Time:** 1 ms average
**Contact Bounce:** Normally open contacts less than 0.5 ms average, Normally closed contacts 2 ms average on release
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 1.3 pf average
**Typical Life at Rated Load:** 10 million operations—longer at reduced loads



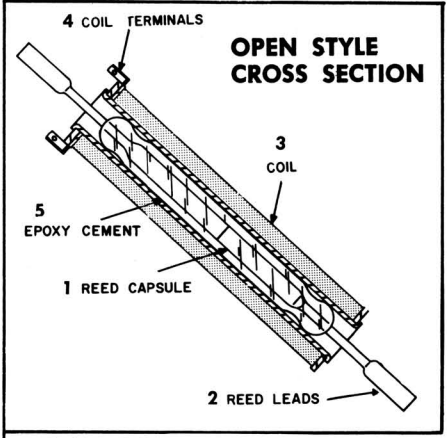

### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W104MX-1 | — | 6 VDC | 100 | |
| W104MX-2 | — | 12 VDC | 250 | 600 |
| W104MX-3 | — | 24 VDC | 500 | mw |
| W104MX-4 | 9 | — | 2500 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# OPEN STYLE DRY REED RELAYS

## Construction Data and Special Ordering




1. **Reed Capsule** contacts are hermetically sealed with inert gas in glass capsule, completely protected from dust and contamination.
2. **Reed Leads** are gold plated or tinned for ease in soldering connecting lead wires. (Note: Care should be taken in soldering to avoid exerting stresses on glass capsule.)
3. **Coil** is accurately wound on fabricated bobbin.
4. **Coil Terminals** are securely fastened to bobbin assembly and hot tinned for ease in soldering.
5. **Epoxy Cement** rigidly positions glass capsule in coil bobbin assembly.

**STANDARD COIL CHARACTERISTICS**

| | 101 SPST-NO Open Style | | 102 SPST-NO 103 SPDT Open Style | |
|---|---|---|---|---|
| Wire | *Ohms | Turns | *Ohms | Turns |
| 27 | 1.5 | 380 | 4 | 920 |
| 28 | 2.0 | 400 | 7 | 1060 |
| 29 | 3.0 | 500 | 11 | 1400 |
| 30 | 5.5 | 680 | 18 | 1700 |
| 31 | 9.5 | 900 | 30 | 2300 |
| 32 | 14 | 1150 | 45 | 2760 |
| 33 | 22 | 1300 | 70 | 3280 |
| 34 | 36 | 1700 | 100 | 4000 |
| 35 | 60 | 2200 | 175 | 5190 |
| 36 | 90 | 2750 | 200 | 5300 |
| 37 | 100 | 2650 | 450 | 8400 |
| 38 | 225 | 4500 | 500 | 8400 |
| 39 | 250 | 4130 | 1200 | 14600 |
| 40 | 500 | 6200 | 2000 | 18000 |
| 41 | 1000 | 9200 | 3200 | 23400 |
| 42 | 1600 | 11300 | 4300 | 25200 |
| 43 | 2500 | 14700 | 5000 | 26000 |
| 44 | 4000 | 19000 | 10000 | 41000 |

*Plus or minus 10% at 25°C

## SPST-NO 12 Volt-Amperes At 0.25 Amp.

**CLASS 101M MINIATURE OPEN STYLE**

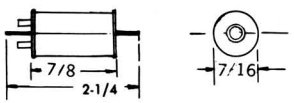

**SPST-NO (1 FORM A) DRY REED RELAY**

### SPECIFICATIONS

**CLASS 101 SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive
**Nominal Coil Power:** 600 mw
**Operate Time:** 1 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 0.5 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 0.7 pf average
**Typical Life at Rated Load:** 5 million operations —longer at reduced loads

### DIMENSIONS




**SPST-NO (1 Form A)**

### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W101X-1 | — | 6V | 100 | |
| W101X-2 | — | 12V | 250 | 600 |
| W101X-3 | — | 24V | 500 | mw |
| W101X-4 | 9 | — | 2500 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

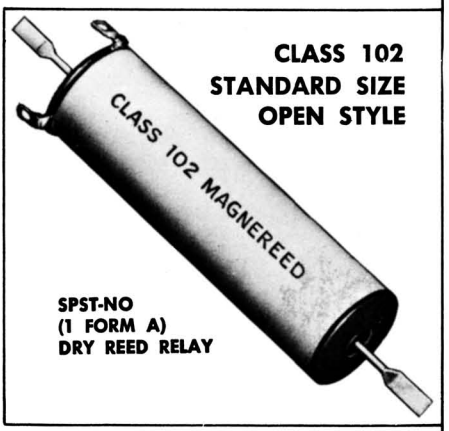
# OPEN STYLE DRY REED RELAYS

## SPST-NO 15 Volt-Amperes At 1 Amp.

### SPECIFICATIONS

**CLASS 102 SPST-NO**

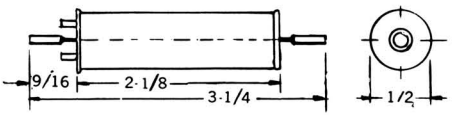
**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 3 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 1 ms average
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 0.9 pf average
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads




### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W102X-1 | 32 | — | 100 | |
| W102X-2 | — | 6V | 200 | 300 |
| W102X-3 | — | 12V | 500 | mw |
| W102X-4 | — | 24V | 2000 | |
| W102X-5 | 4.6 | — | 5000 | |

### DIMENSIONS




SPST-NO (1 Form A)

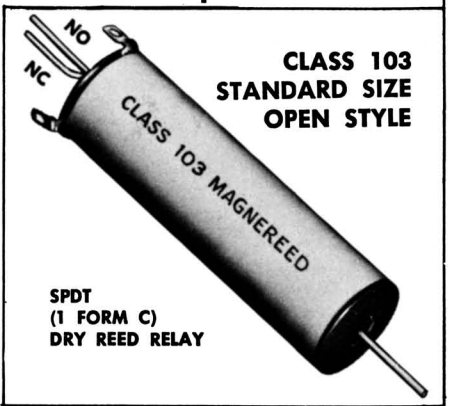
*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

## SPDT 10 Volt-Amperes At 0.5 Amp.

### SPECIFICATIONS

**CLASS 103 SPDT**

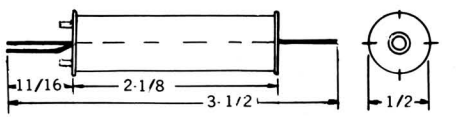
**Contact Combination:** SPDT (1 Form C)
**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 2 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** 4 ms average on release (normally closed contacts)
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 3.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads




### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W103X-8 | 32 | — | 100 | |
| W103X-9 | — | 6V | 200 | 300 |
| W103X-10 | — | 12V | 500 | mw |
| W103X-11 | — | 24V | 2000 | |
| W103X-12 | 4.6 | — | 5000 | |

### DIMENSIONS

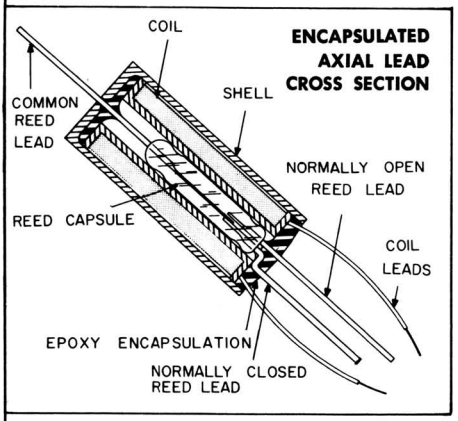



SPDT (1 Form C)

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED AXIAL LEAD DRY REED RELAYS

## Construction Data and Special Ordering



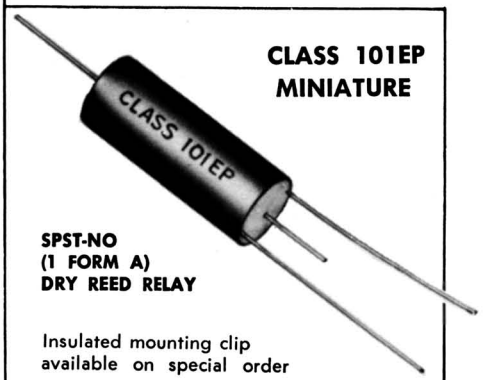

**STANDARD COIL CHARACTERISTICS**

| AWG Wire Size | 101EP and 104EP *Ohms | 101EP and 104EP Turns | AWG Wire Size | 105EP *Ohms | 105EP Turns |
|---|---|---|---|---|---|
| 27 | 1.0 | 270 | 36 | 4 | 225 |
| 28 | 1.5 | 320 | 37 | 6 | 270 |
| 29 | 2.5 | 410 | 38 | 9 | 320 |
| 30 | 4.0 | 500 | 39 | 14 | 400 |
| 31 | 7.0 | 600 | 40 | 25 | 530 |
| 32 | 10 | 800 | 41 | 35 | 650 |
| 33 | 15 | 1000 | 42 | 55 | 780 |
| 34 | 25 | 1300 | 43 | 90 | 1000 |
| 35 | 45 | 1700 | 44 | 140 | 1300 |
| 36 | 65 | 2000 | 45 | 225 | 1650 |
| 37 | 100 | 2700 | 46 | 350 | 2000 |
| 38 | 160 | 3300 | 47 | 550 | 2500 |
| 39 | 225 | 3800 | 48 | 860 | 3100 |
| 40 | 450 | 5700 | 49 | 1300 | 3700 |
| 41 | 625 | 6500 | — | — | — |
| 42 | 800 | 6800 | — | — | — |
| 43 | 1000 | 7200 | — | — | — |
| 44 | 2500 | 13000 | — | — | — |

*Resistance values ±10%, measured at 25° C.

1. **Reed Capsule Contacts** are hermetically sealed with inert gas inside glass capsule to completely protect them from harmful moisture, dust, contamination or tampering.
2. **Reed Leads** (common, normally open and normally closed) are gold plated or tinned for ease in soldering.
3. **Coil** is precision wound on specially designed molded bobbin having excellent dielectric qualities.
4. **Shell** of molded epoxy affords mechanical protection for complete relay assembly.
5. **Epoxy** encapsulation completely seals reed and coil assembly from adverse environmental conditions. In addition reed leads are rigidly positioned so stresses placed upon external leads are not transmitted to glass reed capsule.
6. **Coil Leads** are flexible and insulated from protection from shorts. Ends of leads are tinned for ease of soldering.

## SPST-NO 12 Volt-Amperes At 0.25 Amp.

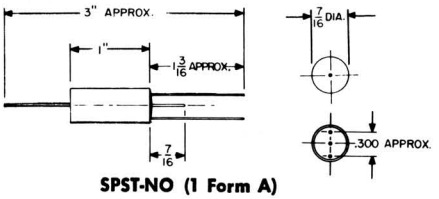



**CLASS 101EP MINIATURE**

**SPST-NO (1 FORM A) DRY REED RELAY**

Insulated mounting clip available on special order

### DIMENSIONS




**SPST-NO (1 Form A)**

### SPECIFICATIONS

**CLASS 101EP SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 12 Volt-Ampere maximum at 0.25 amp. max. or 100 VAC max., resistive
**Nominal Coil Power:** 600 mw
**Operate Time:** 1 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 0.5 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 0.5 pf average
**Typical Life at Rated Load:** 5 million operations—longer on reduced loads

### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W101EPX-5 | — | 6VDC | 65 | 600 mw |
| W101EPX-6 | — | 12VDC | 225 | |
| W101EPX-7 | — | 24VDC | 1000 | |
| W101EPX-8 | 8 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

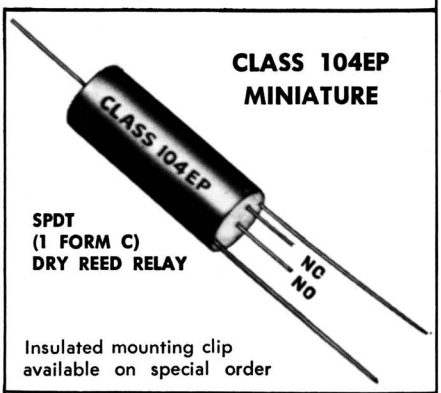
# ENCAPSULATED AXIAL LEAD DRY REED RELAYS

## SPDT 3 Volt-Amperes At 0.25 Amp.

### SPECIFICATIONS

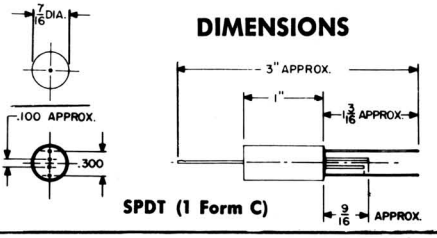
**CLASS 104EP SPDT**

**Contact Combination:** SPDT (1 Form C)
**Contact Load Rating:** 3 Volt-Ampere maximum at 0.25 amp. max. or 28 VAC max., resistive
**Nominal Coil Power:** 600 mw
**Operate Time:** 1 ms average
**Release Time:** 1 ms average
**Contact Bounce:** Normally open contacts less than 0.5 ms average. Normally closed contacts 2 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 1.5 pf average
**Typical Life at Rated Load:** 10 million operations—longer on reduced loads




### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W104EPX-2 | — | 6VDC | 65 | 600 mw |
| W104EPX-3 | — | 12VDC | 225 | |
| W104EPX-4 | — | 24VDC | 1000 | |
| W104EPX-5 | 8 | — | 5000 | |



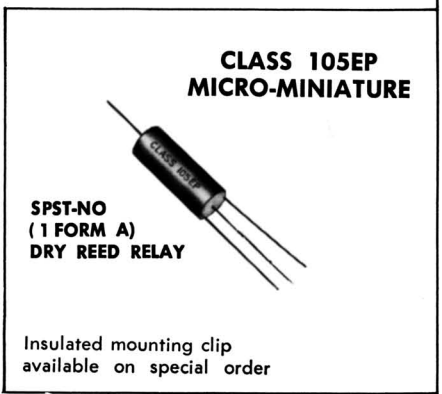

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

## SPST-NO 0.1 Volt-Amperes At .01 Amp.

### SPECIFICATIONS

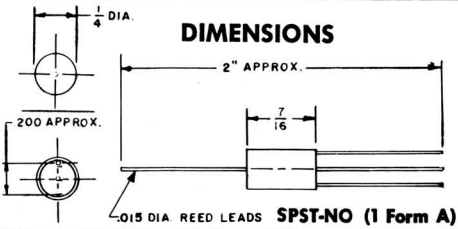
**CLASS 105EP SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 0.1 Volt-Ampere maximum at .01 amp. max. or 12 VAC maximum, resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 0.25 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** 0.5 ms average
**Dielectric Strength Between Contacts:** 200 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 200 milliohms average
**Capacitance Across Contacts:** 0.5 pf average
**Typical Life at Rated Load:** 10 million operations—longer on reduced loads



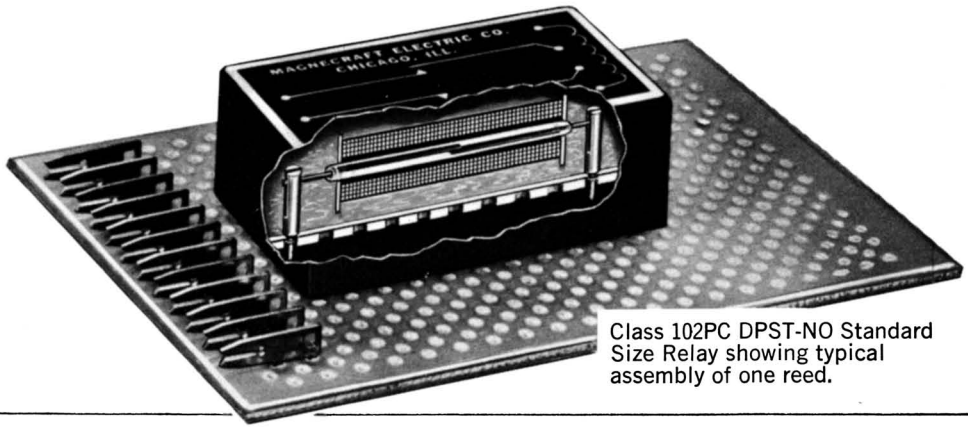

### IN STOCK FOR IMMEDIATE DELIVERY

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W105EPX-1 | — | 6VDC | 90 | 300 mw |
| W105EPX-2 | — | 12VDC | 350 | |
| W105EPX-3 | — | 24VDC | 1300 | |




*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED PRINTED CIRCUIT DRY REED RELAYS




Class 102PC DPST-NO Standard Size Relay showing typical assembly of one reed.

1. Reed contact leads are soldered stress-free to rugged terminal posts.
2. Terminal posts extend through the terminal board as printed circuit pins.
3. The complete assembly is encapsulated, which provides:
   - **a.** Mechanical protection for the glass capsule, contact leads and coil.
   - **b.** Full protection against tampering and contaminating atmosphere.
   - **c.** Rigid positioning of terminal supports and printed circuit pins; stresses on circuit pins cannot transmit to the reed contact leads and affect relay adjustment.
4. Construction of miniature encapsulated printed circuit reed relay is similar to the standard size.

**STANDARD COIL DATA FOR PC SERIES RELAYS**

| AWG Wire Size | 104PC SPDT | | 101PC SPST-NO<br>131PC SPST-NO | | 102PC SPST-NO<br>103PC SPDT | | 101PC DPST-NO<br>104PC DPDT<br>131PC DPST-NO | | 102PC DPST-NO<br>103PC DPDT | |
|---|---|---|---|---|---|---|---|---|---|---|
| | *Ohms | Turns | *Ohms | Turns | *Ohms | Turns | *Ohms | Turns | *Ohms | Turns |
| 27 | 0.5 | 140 | 1.0 | 270 | 2.3 | 460 | 1.0 | 185 | 6 | 800 |
| 28 | 0.8 | 190 | 1.5 | 320 | 3.5 | 560 | 2.0 | 240 | 10 | 1030 |
| 29 | 1.3 | 225 | 2.5 | 410 | 5.5 | 710 | 3.0 | 300 | 16 | 1300 |
| 30 | 1.9 | 300 | 4.0 | 500 | 9.0 | 870 | 4.0 | 370 | 25 | 1640 |
| 31 | 3.0 | 370 | 7.0 | 600 | 13 | 1060 | 7.0 | 500 | 40 | 2100 |
| 32 | 5.0 | 450 | 10 | 800 | 23 | 1400 | 11 | 600 | 50 | 2040 |
| 33 | 7.0 | 575 | 15 | 1000 | 30 | 1750 | 17 | 760 | 90 | 3100 |
| 34 | 12 | 700 | 25 | 1300 | 50 | 2000 | 27 | 970 | 150 | 3900 |
| 35 | 20 | 950 | 40 | 1700 | 90 | 2800 | 40 | 1150 | 200 | 4400 |
| 36 | 30 | 1170 | 65 | 2000 | 100 | 2600 | 70 | 1520 | 400 | 6560 |
| 37 | 45 | 1400 | 100 | 2700 | 200 | 4000 | 100 | 1860 | 625 | 8200 |
| 38 | 55 | 1560 | 160 | 3300 | 340 | 5620 | 150 | 2150 | 800 | 8000 |
| 39 | 100 | 2000 | 250 | 4100 | 400 | 5300 | 290 | 3170 | 1750 | 13300 |
| 40 | 225 | 3000 | 450 | 5700 | 1000 | 9600 | 475 | 4130 | 2900 | 17300 |
| 41 | 300 | 3750 | 625 | 6500 | 1500 | 12000 | 650 | 4700 | 4500 | 21000 |
| 42 | 500 | 4400 | 1000 | 8000 | 2400 | 14500 | 1100 | 6050 | 5000 | 21200 |
| 43 | 750 | 5800 | 1700 | 10600 | 3700 | 17700 | 1800 | 7780 | 10000 | 32500 |
| 44 | 1000 | 6000 | 2500 | 13000 | 5000 | 20500 | 2800 | 10100 | 15000 | 41600 |

***Resistance values ±10%, measured at 25° C.**

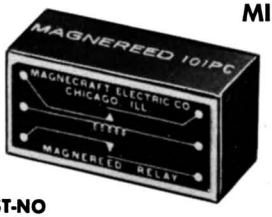
# ENCAPSULATED PRINTED CIRCUIT DRY REED RELAYS

## SPST-NO & DPST-NO 12 Volt-Amperes At 0.25 Amp.

**CLASS 101PC**
**MINIATURE**


**SPST-NO**
**(1 FORM A)**
**DRY REED RELAY**

**CLASS 101PC**
**MINIATURE**




**DPST-NO**
**(2 FORM A)**
**DRY REED RELAY**

### SPECIFICATIONS

**CLASS 101PC SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** 600 mw

**Operate Time:** 1 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 0.5 ms average

**Dielectric Strength Between Contacts:** 250 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 150 milliohms average

**Capacitance Across Contacts:** 0.8 pf average

**Typical Life at Rated Load:** 5 million operations—longer at reduced loads

### SPECIFICATIONS

**CLASS 101PC DPST-NO**

**Contact Combination:** DPST-NO (2 Form A)

**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** 900 mw

**Operate Time:** 1 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 0.5 ms average

**Dielectric Strength Between Contacts:** 250 VAC, RMS

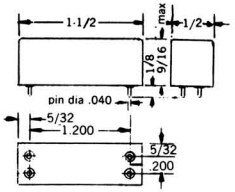
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 150 milliohms average

**Capacitance Across Contacts:** 1.0 pf average

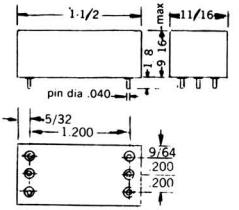
**Typical Life at Rated Load:** 5 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC




**Top View**
**SPST-NO (1 Form A)**

### DIMENSIONS AND SCHEMATIC




**Top View**
**DPST-NO (2 Form A)**

### IN STOCK FOR IMMEDIATE DELIVERY

**101PC SPST-NO**

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W101PCX-5 | — | 6V | 65 | |
| W101PCX-6 | — | 12V | 250 | 600 |
| W101PCX-7 | — | 24V | 1000 | mw |
| W101PCX-8 | 8 | — | 5000 | |

### IN STOCK FOR IMMEDIATE DELIVERY

**101PC DPST-NO**

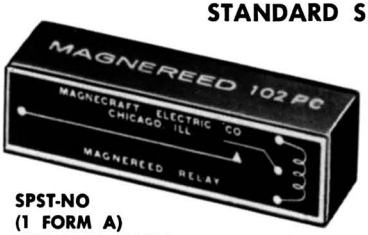
| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W101PCX-9 | — | 6V | 40 | |
| W101PCX-10 | — | 12V | 150 | 900 |
| W101PCX-11 | — | 24V | 650 | mw |
| W101PCX-12 | 8 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED PRINTED CIRCUIT DRY REED RELAYS

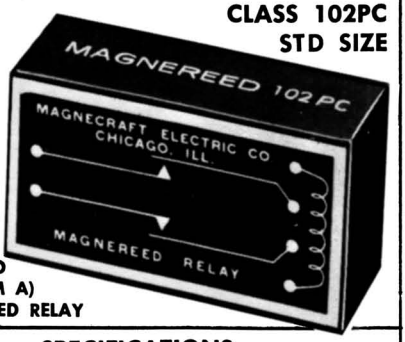
## SPST-NO & DPST-NO 15 Volt-Amperes At 1 Amp.

### CLASS 102PC STANDARD SIZE




SPST-NO
(1 FORM A)
DRY REED RELAY

### CLASS 102PC STD SIZE




DPST-NO
(2 FORM A)
DRY REED RELAY

### SPECIFICATIONS

**CLASS 102PC SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 400 mw

**Operate Time:** 3 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 1 ms average

**Dielectric Strength Between Contacts:** 500 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 1.0 pf average

**Typical Life at Rated Load:** 20 million operations—longer at reduced load

### SPECIFICATIONS

**CLASS 102PC DPST-NO**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 700 mw

**Operate Time:** 3 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 1 ms average

**Dielectric Strength Between Contacts:** 500 VAC, RMS

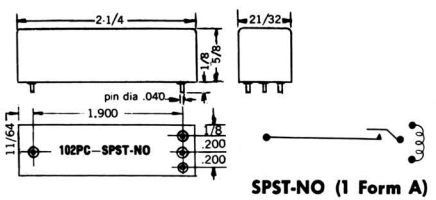
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 1.2 pf average

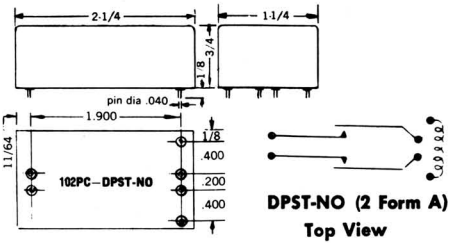
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC




SPST-NO (1 Form A)
Top View

### DIMENSIONS AND SCHEMATIC




DPST-NO (2 Form A)
Top View

### IN STOCK FOR IMMEDIATE DELIVERY

**102PC SPST-NO**

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W102PCX-1 | — | 6VDC | 100 | |
| W102PCX-2 | — | 12VDC | 400 | 400 |
| W102PCX-3 | — | 24VDC | 1500 | mw |
| W102PCX-4 | 6.5 | — | 5000 | |

### IN STOCK FOR IMMEDIATE DELIVERY

**102PC DPST-NO**

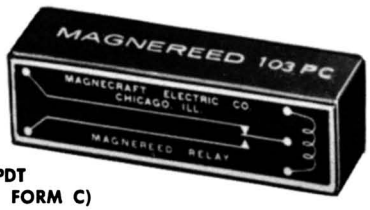
| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W102PCX-5 | — | 6VDC | 50 | |
| W102PCX-6 | — | 12VDC | 200 | 700 |
| W102PCX-7 | — | 24VDC | 800 | mw |
| W102PCX-8 | 9 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED PRINTED CIRCUIT DRY REED RELAYS

## SPDT & DPDT 10 Volt-Amperes At 0.5 Amp.

**CLASS 103PC**
**STANDARD SIZE**




**SPDT**
**(1 FORM C)**
**DRY REED RELAY**

### SPECIFICATIONS

**CLASS 103PC SPDT**

**Contact Combination:** SPDT (1 Form C)

**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 400 mw

**Operate Time:** 2 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** 4 ms average on release (normally closed contacts)

**Dielectric Strength Between Contacts:** 500 VAC, RMS

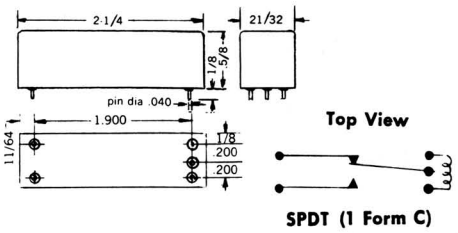
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 3.0 pf average

**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC

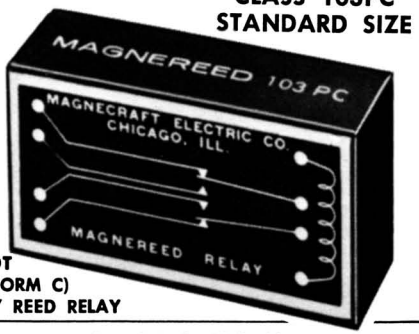



### IN STOCK FOR IMMEDIATE DELIVERY

**103PC SPDT**

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W103PCX-1 | — | 6V | 100 | |
| W103PCX-2 | — | 12V | 400 | 400 |
| W103PCX-3 | — | 24V | 1500 | mw |
| W103PCX-4 | 6.5 | — | 5000 | |

**CLASS 103PC**
**STANDARD SIZE**




**DPDT**
**(2 FORM C)**
**DRY REED RELAY**

### SPECIFICATIONS

**CLASS 103PC DPDT**

**Contact Combination:** DPDT (2 Form C)

**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 700 mw

**Operate Time:** 2 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** 4 ms average on release (normally closed contacts)

**Dielectric Strength Between Contacts:** 500 VAC, RMS

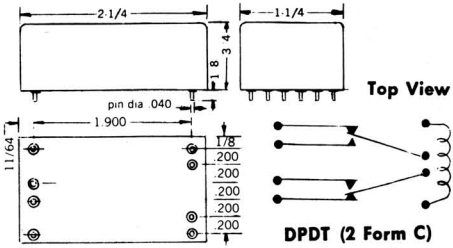
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 3.5 pf average

**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC




### IN STOCK FOR IMMEDIATE DELIVERY

**103PC DPDT**

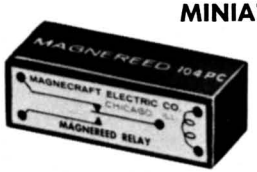
| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W103PCX-5 | — | 6V | 50 | |
| W103PCX-6 | — | 12V | 200 | 700 |
| W103PCX-7 | — | 24V | 800 | mw |
| W103PCX-8 | 9 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED PRINTED CIRCUIT DRY REED RELAYS

## SPDT & DPDT 3 Volt-Amperes At 0.25 Amp.

**CLASS 104PC MINIATURE**




**SPDT**
**(1 FORM C)**
**DRY REED RELAY**

### SPECIFICATIONS

**CLASS 104PC SPDT**

**Contact Combination:** SPDT (1 Form C)

**Contact Load Rating:** 3 Volt-Amperes maximum at 0.25 amp. max. or 28 VAC max., resistive

**Nominal Coil Power:** 600 mw

**Operate Time:** 1 ms average

**Release Time:** 1 ms average

**Contact Bounce:** Normally open contacts less than 0.5 ms average. Normally closed contacts 2 ms average

**Dielectric Strength Between Contacts:** 250 VAC, RMS

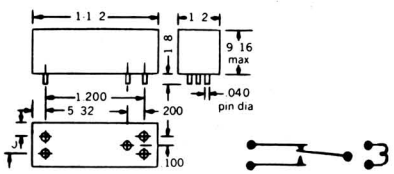
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 150 milliohms average

**Capacitance Across Contacts:** 1.5 pf average

**Typical Life at Rated Load:** 10 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC



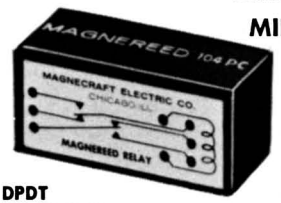

**Top View**
**SPDT (1 Form C)**

### IN STOCK FOR IMMEDIATE DELIVERY

**104PC SPDT**

| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W104PCX-7 | — | 6V | 65 | |
| W104PCX-8 | — | 12V | 225 | 600 |
| W104PCX-9 | — | 24V | 1000 | mw |
| W104PCX-10 | 8 | — | 5000 | |

**CLASS 104PC MINIATURE**




**DPDT**
**(2 FORM C)**
**DRY REED RELAY**

### SPECIFICATIONS

**CLASS 104PC DPDT**

**Contact Combination:** DPDT (2 Form C)

**Contact Load Rating:** 3 Volt-Amperes maximum at 0.25 amp. max. or 28 VAC max., resistive

**Nominal Coil Power:** 900 mw

**Operate Time:** 1 ms average

**Release Time:** 1 ms average

**Contact Bounce:** Normally open contacts less than 0.5 ms average. Normally closed contacts 2 ms average

**Dielectric Strength Between Contacts:** 250 VAC, RMS

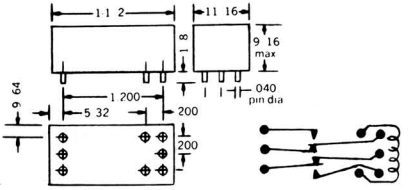
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 150 milliohms average

**Capacitance Across Contacts:** 2.0 pf average

**Typical Life at Rated Load:** 10 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC




**Top View**
**DPDT (2 Form C)**

### IN STOCK FOR IMMEDIATE DELIVERY

**104PC DPDT**

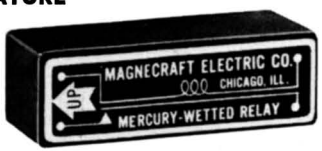
| Stock Part No. | COIL ††MA | COIL †VDC | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W104PCX-3 | — | 6V | 40 | |
| W104PCX-4 | — | 12V | 150 | 900 |
| W104PCX-5 | — | 24V | 650 | mw |
| W104PCX-6 | 8 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# ENCAPSULATED PRINTED CIRCUIT MERCURY WETTED RELAYS

## SPST-NO & DPST-NO 28 Volt-Amperes At 1 Amp.

### CLASS 131PC MINIATURE




SPST-NO (1 FORM A) MERCURY WETTED CONTACT RELAY

### SPECIFICATIONS

**CLASS 131PC SPST-NO**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 28 Volt-Amperes maximum at 1 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** 600 mw

**Operate Time:** 1 ms average

**Release Time:** 1 ms average

**Contact Bounce:** None

**Dielectric Strength Between Contacts:** 500 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

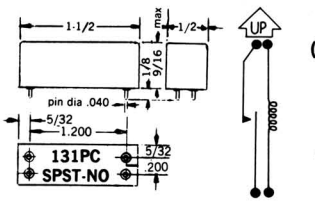
**Contact Resistance:** 50 milliohms average

**Capacitance Across Contacts:** 1.0 pf average

**Operating Position:** Upright, not more than 30° from vertical

**Typical Life at Rated Load:** 100 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATIC




SPST-NO (1 Form A)

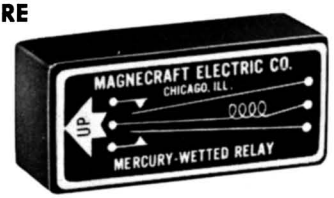
Top View

### IN STOCK FOR IMMEDIATE DELIVERY

**131PC SPST-NO**

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W131PCX-8 | — | 6V | 65 | |
| W131PCX-9 | — | 12V | 250 | 600 |
| W131PCX-10 | — | 24V | 1000 | mw |
| W131PCX-11 | 8 | — | 5000 | |

### CLASS 131PC MINIATURE




DPST-NO (2 FORM A) MERCURY WETTED CONTACT RELAY

### SPECIFICATIONS

**CLASS 131PC DPST-NO**

**Contact Combination:** DPST-NO (2 Form A)

**Contact Load Rating:** 28 Volt-Amperes maximum at 1 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** 900 mw

**Operate Time:** 1 ms average

**Release Time:** 1 ms average

**Contact Bounce:** None

**Dielectric Strength Between Contacts:** 500 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

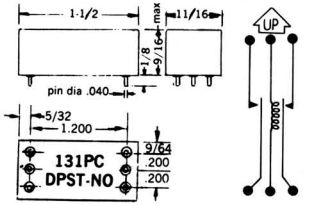
**Contact Resistance:** 50 milliohms average

**Capacitance Across Contacts:** 1.2 pf average

**Operating Position:** Upright, not more than 30° from vertical

**Typical Life at Rated Load:** 100 million operations—longer at reduced load

### DIMENSIONS AND SCHEMATIC




DPST-NO (2 Form A)

Top View

### IN STOCK FOR IMMEDIATE DELIVERY

**131PC DPST-NO**

| Stock Part No. | COIL ††MA | COIL †Volts | COIL *Ohms | Nom. Pwr. |
|---|---|---|---|---|
| W131PCX-12 | — | 6V | 40 | |
| W131PCX-13 | — | 12V | 150 | 900 |
| W131PCX-14 | — | 24V | 650 | mw |
| W131PCX-15 | 8 | — | 5000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

# Reed Relays Designed for Standard Printed Circuit Boards

**Views illustrating application and comparative sizes of printed circuit relays.**

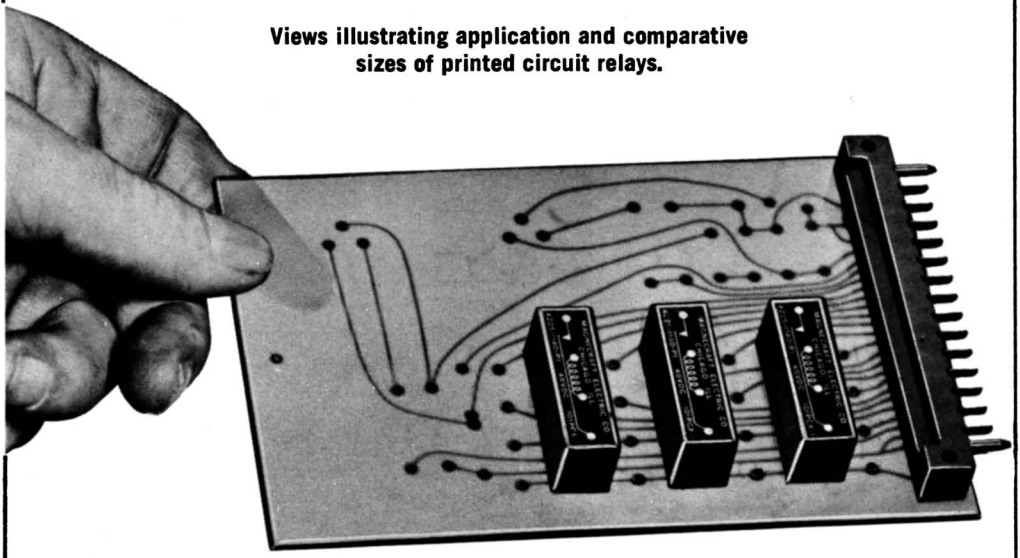
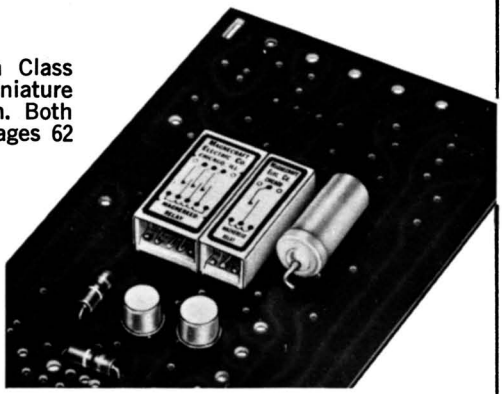


Fig. 1 Printed circuit board with 3 Class 101PC encapsulated miniature reed relays described on preceding page 43.

Fig. 2 Printed circuit board with Class 101MPC SPST-NO and 3PST-NO miniature MPC reed relay packages in position. Both packages are listed on following pages 62 and 63.



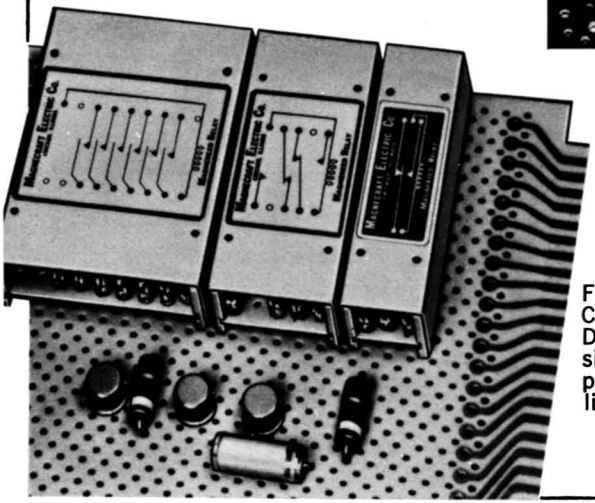


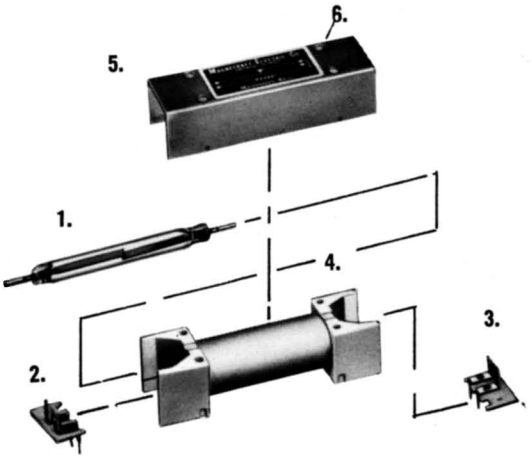
Fig. 3 Printed circuit board with Class 102MPC 6PST-NO, 103MPC DPDT and 103MPC SPDT standard size MPC reed relay packages in position. These three packages are listed on following pages.

## Mercury Wetted and Dry Reed MPC Class Relays

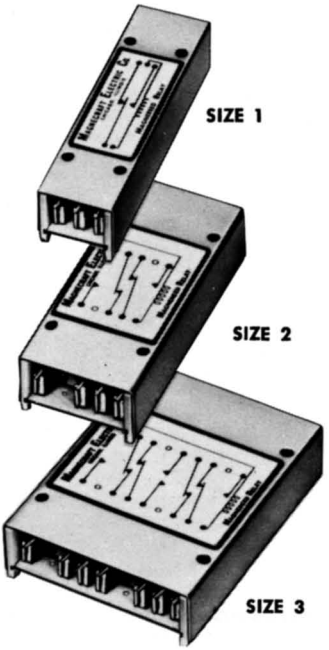
### UNI-PACKS OR MULTI-PACKS FLEXIBILITY FOR EVERY PC PROBLEM!

The versatile MPC concept (Modular Printed Circuit reed relay concept) provides individual package designs that permit almost unlimited combining of basic reed switches to obtain any contact configuration (shown in detail on following pages.) It is a concept that makes available in a single reed-coil package, highly reliable SPST and SPDT mercury wetted and dry reeds, power reed, magnetic latching reeds and high voltage reeds. It includes standard designs that are immediately available from stock, or on special orders, and prompt delivery of custom built units.

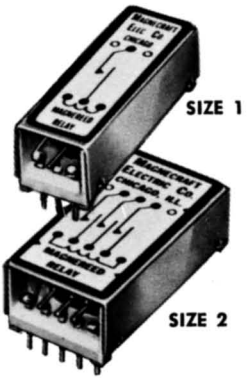
In addition, the MPC concept offers fast operating time, long and reliable life expectancies, contact ratings fully consistent with printed circuit applications, and mechanical construction that meets the highest standards of shock and vibration resistance.




1. **Switch Mechanism.** Hermetically sealed within a glass capsule filled with inert gas. The contacts are completely protected from contamination and tampering.
2. **Reed Support Terminal Pin.** One-piece unit is rigidly riveted to the terminal boards soldered stress-free to the switch-leads. Switch adjustments and performance cannot be affected by external stresses. Wire pin extenders available on special order.
3. **Terminal Boards.** Rugged epoxy construction. Mortised into nylon base for maximum rigidity.
4. **Nylon Bobbin and Mounting Base.** Integrally molded to provide maximum electrical insulation and mechanical protection for the switch capsule, coil leads and terminal boards.
5. **Snap-On Steel Cover.** Provides full protection and magnetic shielding to relay assembly. No magnetic interaction between adjacent relays.
6. **Mounting Holes.** Four holes provide for panel mounting, etc.




STANDARD SERIES

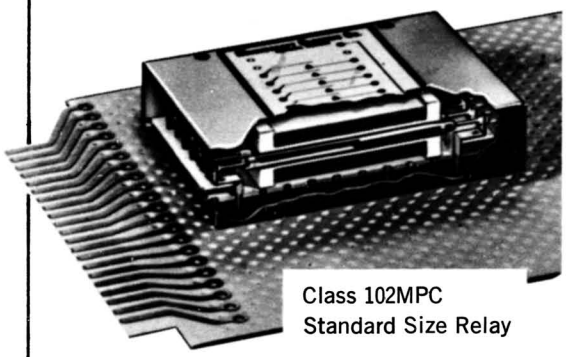



MINIATURE SERIES

MICRO-MINIATURE SERIES

# MODULAR PACKAGE PRINTED CIRCUIT REED RELAYS

1. Reed Relay contacts are hermetically sealed with inert gas in glass capsule: completely protected from contamination and tampering.
2. Contact leads are soldered (or welded) stress-free to rigidly positioned terminal supports.

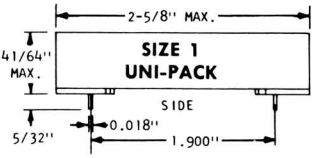


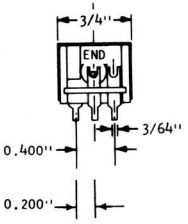
Class 102MPC
Standard Size Relay

3. The combination circuit board pins and terminal supports are securely fastened to terminal board; stresses on circuit board pins cannot transmit to contact leads and affect relay adjustment.
4. Integrally molded Nylon bobbin and mounting base combine electrical insulation and mechanical protection for the glass capsule.
5. Snap-on steel cover adds mechanical protection and magnetic shielding.

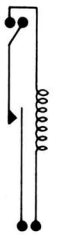
## 3 Standard Series MPC Case Styles

### DIMENSIONS AND SCHEMATICS



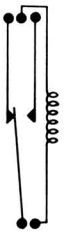




102MPC



Schematics show top view of relays

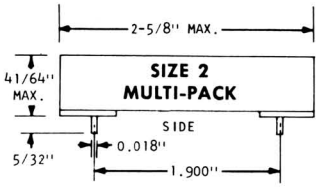
103MPC

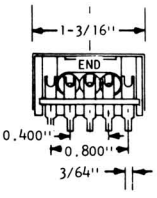


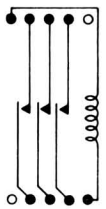
**SPST-NO (1 Form A) Dry & Mercury**

**SPDT (1 Form C) Dry & Mercury**

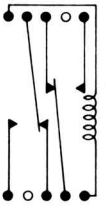
### DIMENSIONS AND SCHEMATICS



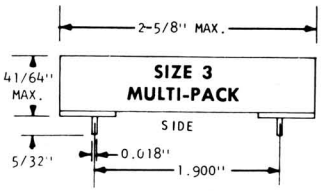



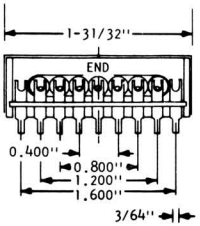
**3PST-NO (3 Form A) Dry Reed**

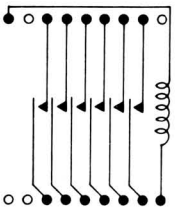


**DPDT (2 Form C) Dry Reed**

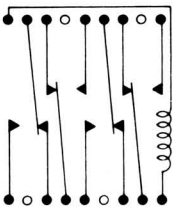
### DIMENSIONS AND SCHEMATICS



**6PST-NO (6 Form A) Dry Reed**



**4PDT (4 Form C) Dry Reed**

# MODULAR PACKAGE PRINTED CIRCUIT REED RELAYS

### Standard Stock Combinations

Your choice of switching combination from Magnecraft's vast store of MPC Reed Relays featured on this and following pages! They are the most widely used contact combinations to which we have assigned stock part numbers and stocked for immediate off-the-shelf delivery.

### Readily Available on Special Order

Variations from the stock-relays are readily available on special order to meet specific requirements not met by stock units. These variations may be ordered by specifying the part number of the stock relay most closely approximating the characteristics needed and by indicating the variations desired. Variations in combinations of forms are also available: Such as, combining Forms A, B and C; or standard reeds with power reeds or high voltage reeds; or, in some cases, combining dry reeds with mercury-wetted reeds. See page 32 for special order information.

**CONTACT ARRANGEMENTS COMMONLY AVAILABLE ON SPECIAL ORDER**

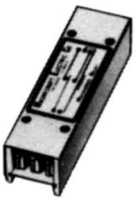
| SIZE | DRY REEDS | MERCURY-WETTED |
|---|---|---|
| 1 | Form B | 1 Form D |
| 2 | Form A up to 3A, Form C up to 2C and Form 1A1C | Form A up to 3A |
| 3 | Form A up to 7A, Form C up to 4C, Form 1A3C, Form 2A2C and Form 4A1C | Form A up to 7A |

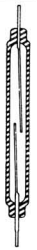
**STANDARD COIL DATA**

| AWG WIRE SIZE | SIZE 1 SPST-NO & SPDT | | SIZE 2 to 3PST-NO or DPDT | | SIZE 3 to 7PST-NO or 4PDT | |
|---|---|---|---|---|---|---|
| | *OHMS | TURNS | *OHMS | TURNS | *OHMS | TURNS |
| 27 | 3 | 530 | 5 | 530 | 8 | 490 |
| 28 | 5 | 700 | 8 | 670 | 12 | 620 |
| 29 | 7 | 750 | 12 | 820 | 20 | 740 |
| 30 | 10 | 1000 | 20 | 1040 | 25 | 775 |
| 31 | 19 | 1300 | 32 | 1300 | 45 | 1200 |
| 32 | 30 | 1750 | 50 | 1700 | 70 | 1450 |
| 33 | 45 | 2000 | 70 | 2000 | 100 | 1800 |
| 34 | 70 | 2450 | 110 | 2500 | 175 | 2300 |
| 35 | 100 | 3000 | 175 | 3300 | 300 | 3000 |
| 36 | 175 | 3900 | 300 | 4000 | 375 | 4000 |
| 37 | 250 | 4500 | 450 | 5230 | 700 | 4600 |
| 38 | 450 | 6400 | 750 | 6500 | 1100 | 5700 |
| 39 | 700 | 7300 | 1200 | 8300 | 1500 | 5500 |
| 40 | 1000 | 9000 | 2000 | 10900 | 3400 | 10000 |
| 41 | 1900 | 13300 | 3000 | 12800 | 4800 | 12000 |
| 42 | 3000 | 16100 | 4400 | 14700 | 7800 | 15000 |
| 43 | 4000 | 18500 | 7200 | 18400 | 12000 | 18900 |
| 44 | 7000 | 24600 | 11000 | 24000 | 19000 | 24500 |

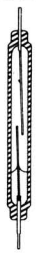
*Resistance values ±10%, measured at 25° C.

**STANDARD SIZE 1**

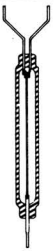




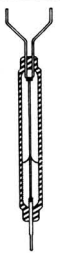
**SPST-NO (1 Form A)**
**Dry Reed**



**SPST-NO (1 Form A)**
**Mercury Reed**

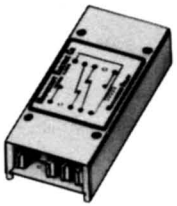


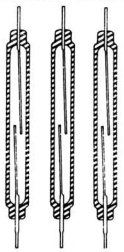
**SPDT (1 Form C)**
**Dry Reed**



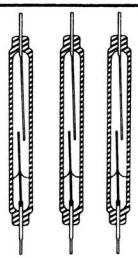
**SPDT (1 Form C)**
**Mercury Reed**

**STANDARD SIZE 2**

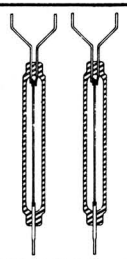




**3PST-NO (3 Form A)**
**Dry Reed**

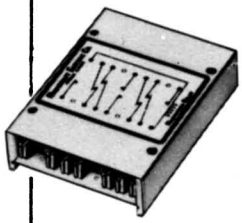


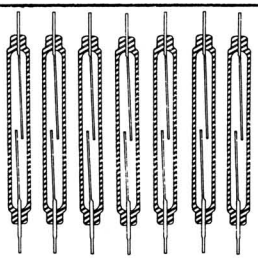
**3PST-NO (3 Form A)**
**Mercury Reed**



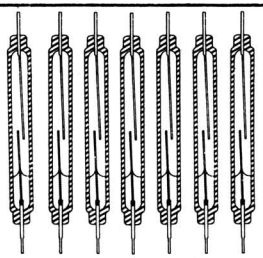
**DPDT (2 Form C)**
**Dry Reed**

**STANDARD SIZE 3**

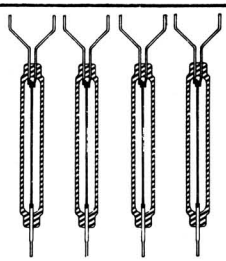




**7PST-NO (7 Form A)**
**Dry Reed**



**7PST-NO (7 Form A)**
**Mercury Reed**

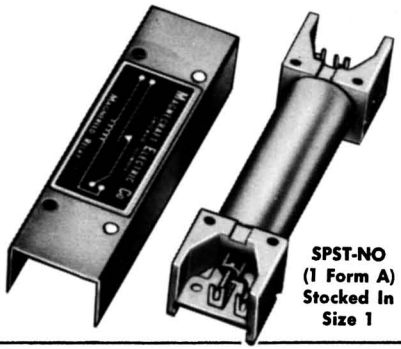


**4PDT (4 Form C)**
**Dry Reed**

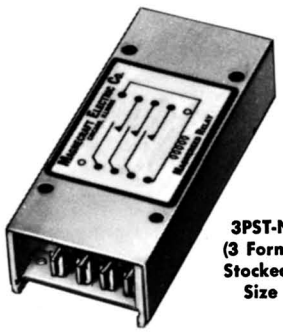
Variations other than those listed are also available under special headings.

# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 102MPC Dry Reed 15 Volt-Amperes At 1 Amp.



SPST-NO
(1 Form A)
Stocked In
Size 1



3PST-NO
(3 Form A)
Stocked In
Size 2

## SPECIFICATIONS

**CLASS 102MPC**

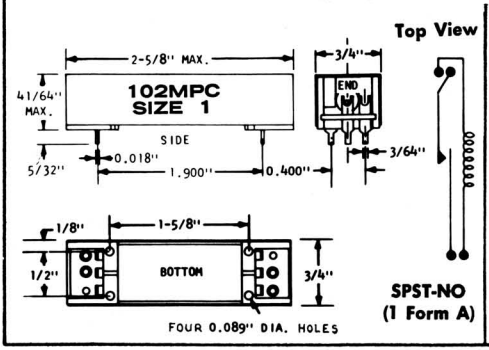
**Contact Combinations:** Size 1: SPST-NO (1 Form A), Size 2: 3PST-NO (3 Form A), Size 3: 6PST-NO (6 Form A). Available from stock
**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** Size 1: 500 mw, Size 2: 750 mw, Size 3: 1.5 watts
**Operate Time:** 3 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 1.0 ms average
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** Size 1: 1.0 pf average, Sizes 2 & 3: 1.2 pf average
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads

## IN STOCK FOR IMMEDIATE DELIVERY

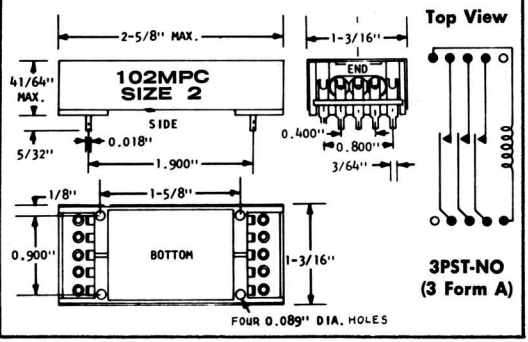
| STOCK PART NO. | CONTACTS | TYPE | SIZE | ††MA | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|---|---|
| W102MPCX-5 | SPST-NO | Dry | 1 | 140 | — | 30 |
| W102MPCX-6 | SPST-NO | Dry | 1 | — | 6 | 70 |
| W102MPCX-7 | SPST-NO | Dry | 1 | — | 12 | 250 |
| W102MPCX-8 | SPST-NO | Dry | 1 | — | 24 | 1000 |
| W102MPCX-9 | SPST-NO | Dry | 1 | — | 48 | 4000 |
| W102MPCX-10 | SPST-NO | Dry | 1 | 9 | — | 7000 |
| W102MPCX-48 | 3PST-NO | Dry | 2 | — | 6 | 50 |
| W102MPCX-49 | 3PST-NO | Dry | 2 | — | 12 | 175 |
| W102MPCX-50 | 3PST-NO | Dry | 2 | — | 24 | 750 |
| W102MPCX-51 | 3PST-NO | Dry | 2 | — | 48 | 3000 |
| W102MPCX-52 | 6PST-NO | Dry | 3 | — | 6 | 25 |
| W102MPCX-53 | 6PST-NO | Dry | 3 | — | 12 | 100 |
| W102MPCX-54 | 6PST-NO | Dry | 3 | — | 24 | 375 |
| W102MPCX-55 | 6PST-NO | Dry | 3 | — | 48 | 1500 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

## DIMENSIONS AND SCHEMATICS



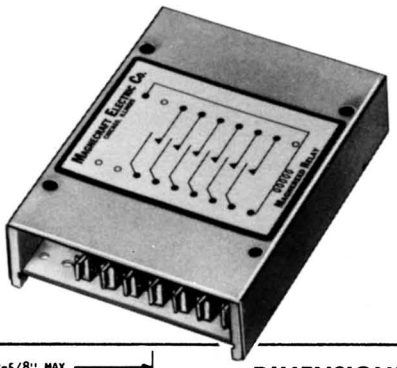

SPST-NO
(1 Form A)




3PST-NO
(3 Form A)

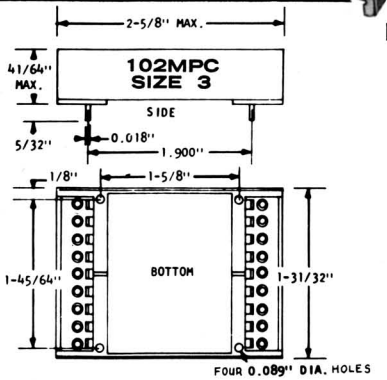
# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

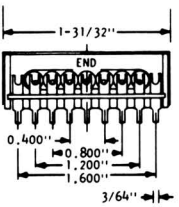
## Class 102MPC Dry Reed 15 Volt-Amperes At 1 Amp.



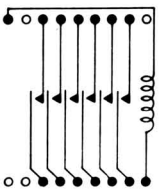
6PST-NO
(6 Form A)
Stocked In
Size 3

## DIMENSIONS AND SCHEMATIC




Top View



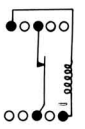
6PST-NO
(6 Form A)

## SPECIAL ORDER DATA

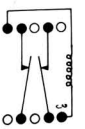
Readily available on special order are variations of contact combinations made from our Class 102MPC stock units. Custom-built to the highest standards, making these special order variations have become a regular service for our customers here at Magnecraft. When ordering, specify Class 102MPC stock relay and indicate the specific variations desired. Contact arrangements most commonly available in Class 102MPC are SPST-NC (1 Form B) in Size 2, DPST-NC (2 Form B) and DPST-NO (2 Form A) in Size 2, and 7PST-NO (7 Form A) in Size 3 packaging. See chart below for specific data. Also available are various combinations of Form A and Form B contacts in a single package.

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 102MPCX-64 | | 2 | 6 | 50 |
| 102MPCX-65 | DPST-NC | 2 | 12 | 175 |
| 102MPCX-66 | (2 Form B) | 2 | 24 | 150 |
| 102MPCX-67 | | 2 | 48 | 3000 |
| 102MPCX-76 | | 2 | 6 | 50 |
| 102MPCX-77 | SPST-NC | 2 | 12 | 175 |
| 102MPCX-78 | (1 Form B) | 2 | 24 | 750 |
| 102MPCX-79 | | 2 | 48 | 3000 |
| 102MPCX-80 | | 2 | 6 | 50 |
| 102MPCX-81 | DPST-NO | 2 | 12 | 175 |
| 102MPCX-82 | (2 Form A) | 2 | 24 | 750 |
| 102MPCX-83 | | 2 | 48 | 3000 |
| 102MPCX-84 | | 3 | 6 | 25 |
| 102MPCX-85 | 7PST-NO | 3 | 12 | 100 |
| 102MPCX-86 | (7 Form A) | 3 | 24 | 375 |
| 102MPCX-87 | | 3 | 48 | 1500 |

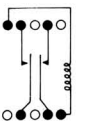
*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.



SPST-NC
(1 Form B)

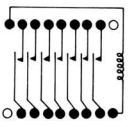


DPST-NC
(2 Form B)



DPST-NO
(2 Form A)

Top View

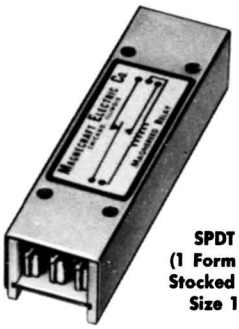


7PST-NO
(7 Form A)

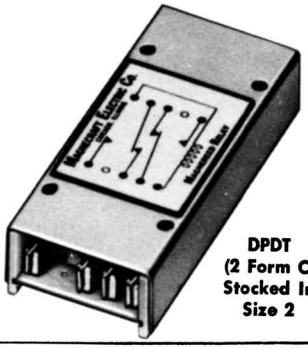
Top View

# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 103MPC Dry Reed 10 Volt-Amperes At 0.5 Amp.



SPDT
(1 Form C)
Stocked In
Size 1



DPDT
(2 Form C)
Stocked In
Size 2

## SPECIFICATIONS

**CLASS 103MPC**

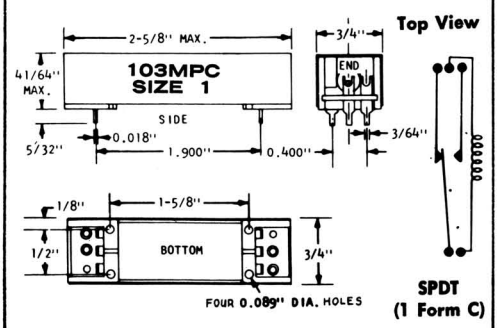
**Contact Combinations:** Size 1: SPDT (1 Form C), Size 2: DPDT (2 Form C), Size 3: 4PDT (4 Form C). Available from stock
**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** Size 1: 500 mw, Size 2: 750 mw, Size 3: 1.5 watts
**Operate Time:** 2 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** 4 ms average on release. Normally closed contacts
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** Size 1: 3.0 pf average, Sizes 2 & 3: 3.5 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

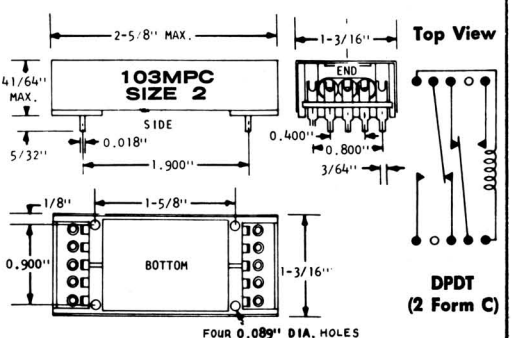
## IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NO. | CONTACTS | TYPE | SIZE | ††MA | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|---|---|
| W103MPCX-1 | SPDT | Dry | 1 | 140 | — | 30 |
| W103MPCX-2 | SPDT | Dry | 1 | — | 6 | 60 |
| W103MPCX-3 | SPDT | Dry | 1 | — | 12 | 250 |
| W103MPCX-4 | SPDT | Dry | 1 | — | 24 | 1000 |
| W103MPCX-5 | SPDT | Dry | 1 | — | 48 | 4000 |
| W103MPCX-6 | SPDT | Dry | 1 | 9 | — | 7000 |
| W103MPCX-30 | DPDT | Dry | 2 | — | 6 | 50 |
| W103MPCX-31 | DPDT | Dry | 2 | — | 12 | 175 |
| W103MPCX-32 | DPDT | Dry | 2 | — | 24 | 750 |
| W103MPCX-33 | DPDT | Dry | 2 | — | 48 | 3000 |
| W103MPCX-34 | 4PDT | Dry | 3 | — | 6 | 25 |
| W103MPCX-35 | 4PDT | Dry | 3 | — | 12 | 100 |
| W103MPCX-36 | 4PDT | Dry | 3 | — | 24 | 375 |
| W103MPCX-37 | 4PDT | Dry | 3 | — | 48 | 1500 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

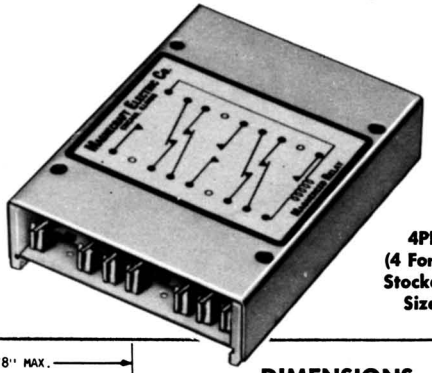
## DIMENSIONS AND SCHEMATICS



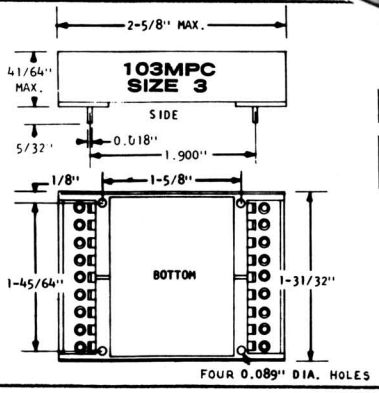
# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

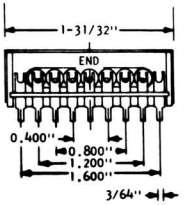
## Class 103MPC Dry Reed 10 Volt-Amperes At 0.5 Amp.



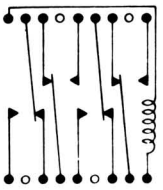
4PDT
(4 Form C)
Stocked In
Size 3

## DIMENSIONS AND SCHEMATIC




Top View



4PDT
(4 Form C)

## SPECIAL ORDER DATA

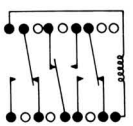
Readily available on special order are variations of contact combinations made from our Class 103MPC stock units. Custom-built to the highest standards, making these special order variations have become a regular service for our customers here at Magnecraft. When ordering, specify Class 103MPC stock relay and indicate the specific variations desired. Contact arrangement most commonly available in Class 103MPC is 3PDT (3 Form C) in Size 3 packaging. See chart below for specific data. Also available are various combinations of Forms A, B, and C contacts in a single package. Refer to page 32 for information on special orders.

## PROMPTLY SHIPPED ON SPECIAL ORDER

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 103MPCX-48 | 3PDT (3 Form C) | 3 | 6 | 25 |
| 103MPCX-49 | | 3 | 12 | 100 |
| 103MPCX-50 | | 3 | 24 | 375 |
| 103MPCX-51 | | 3 | 48 | 1500 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

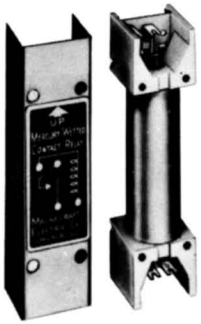
Top View



3PDT
(3 Form C)

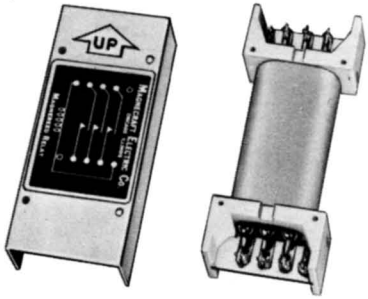
# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 132MPC Mercury-Wetted Reed 50 Volt-Amperes At 3 Amps.



SPST-NO
(1 Form A)
Stocked In
Size 1

3PST-NO
(3 Form A)
and
DPST-NO
(2 Form A)
Available In
Size 2




### SPECIFICATIONS

**CLASS 132MPC**

**Contact Combination:** SPST-NO (1 Form A). Available from stock
**Contact Load Rating:** 50 Volt-Amperes maximum at 3.0 amps. max. or 400 V max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 2 ms average
**Release Time:** 2 ms average
**Contact Bounce:** None
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 50 milliohms average
**Capacitance Across Contacts:** 1.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced load
**Operating Position:** Upright. Not more than 30° from vertical

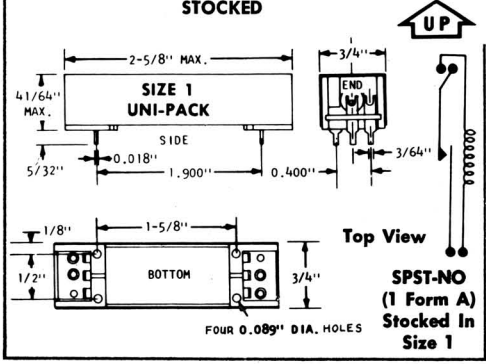
### IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NO. | CONTACTS | TYPE | SIZE | ††MA | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|---|---|
| W132MPCX-1 | SPST-NO | Hg | 1 | 140 | — | 30 |
| W132MPCX-2 | SPST-NO | Hg | 1 | — | 6 | 70 |
| W132MPCX-3 | SPST-NO | Hg | 1 | — | 12 | 250 |
| W132MPCX-4 | SPST-NO | Hg | 1 | — | 24 | 1000 |
| W132MPCX-5 | SPST-NO | Hg | 1 | — | 48 | 4000 |
| W132MPCX-6 | SPST-NO | Hg | 1 | 9 | — | 7000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

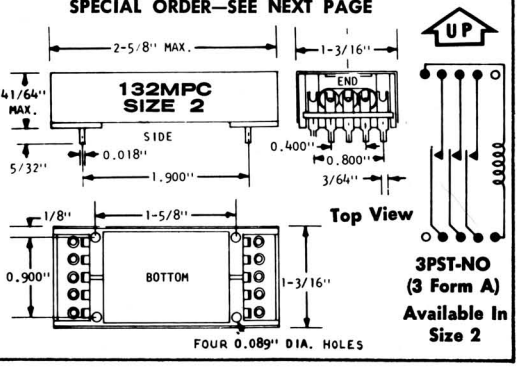
### DIMENSIONS AND SCHEMATICS

STOCKED




SPST-NO
(1 Form A)
Stocked In
Size 1

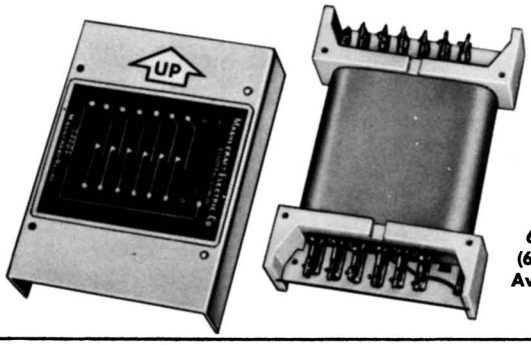
SPECIAL ORDER—SEE NEXT PAGE




3PST-NO
(3 Form A)
Available In
Size 2

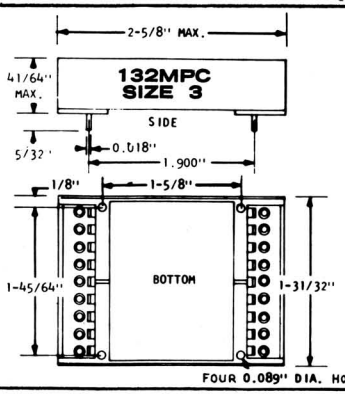
# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

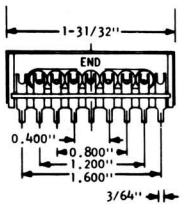
## Class 132MPC Mercury-Wetted Reed 50 Volt-Amperes At 3 Amps.

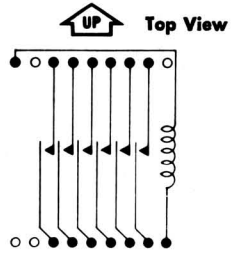



6PST-NO
(6 Form A)
Available In
Size 3

## DIMENSIONS AND SCHEMATICS



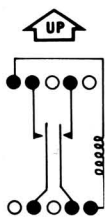




6PST-NO
(6 Form A)

## SPECIAL ORDER DATA

Readily available on special order are variations of contact combinations made from our Class 132MPC stock units. Custom-built to the highest standards, making these special order variations have become a regular service for our customers here at Magnecraft. When ordering, specify Class 132MPC stock relay and indicate the specific variations desired. Contact arrangements most commonly available in Class 132MPC are DPST-NO (2 Form A) and 3PST-NO (3 Form A) in Size 2, and 6PST-NO (6 Form A) in Size 3 packaging. See chart below for specific data and page 32 for required specifications when making a special order.

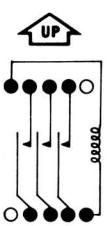
## PROMPTLY SHIPPED ON SPECIAL ORDER




DPST-NO
(2 Form A)

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 132MPCX-9 | | 2 | 6 | 50 |
| 132MPCX-10 | 3PST-NO | 2 | 12 | 175 |
| 132MPCX-11 | (3 Form A) | 2 | 24 | 750 |
| 132MPCX-12 | | 2 | 48 | 3000 |
| 132MPCX-13 | | 3 | 6 | 25 |
| 132MPCX-14 | 6PST-NO | 3 | 12 | 100 |
| 132MPCX-15 | (6 Form A) | 3 | 24 | 375 |
| 132MPCX-16 | | 3 | 48 | 1500 |
| 132MPCX-18 | | 2 | 6 | 50 |
| 132MPCX-19 | DPST-NO | 2 | 12 | 175 |
| 132MPCX-20 | (2 Form A) | 2 | 24 | 750 |
| 132MPCX-21 | | 2 | 48 | 3000 |

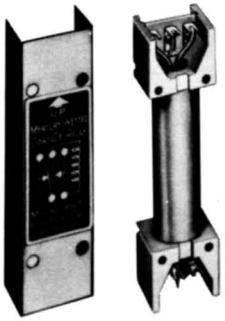
*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.




3PST-NO
(3 Form A)

# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 133MPC Mercury-Wetted Reed 50 Volt-Amperes At 2 Amps.



SPDT
(1 Form C)
Stocked In
Size 1

### SPECIFICATIONS

**CLASS 133MPC**

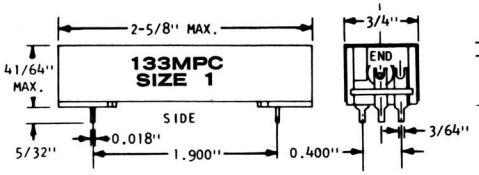
**Contact Combination:** SPDT (1 Form C). Available from stock
**Contact Load Rating:** 50 Volt-Amperes maximum at 2.0 amps. max. or 400 V max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 2 ms average
**Release Time:** 2 ms average
**Contact Bounce:** None
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 50 milliohms average
**Capacitance Across Contacts:** 3.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads
**Operating Position:** Upright. Not more than 30° from vertical. Magnetically biased. Observe coil polarity

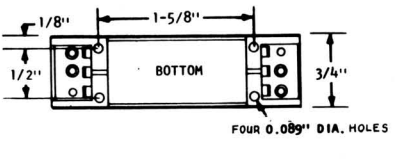
### IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NO. | CONTACTS | TYPE | SIZE | ††MA | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|---|---|
| W133MPCX-1 | SPDT | Hg | 1 | 140 | — | 30 |
| W133MPCX-2 | SPDT | Hg | 1 | — | 6 | 70 |
| W133MPCX-3 | SPDT | Hg | 1 | — | 12 | 250 |
| W133MPCX-4 | SPDT | Hg | 1 | — | 24 | 1000 |
| W133MPCX-5 | SPDT | Hg | 1 | — | 48 | 4000 |
| W133MPCX-6 | SPDT | Hg | 1 | 9 | — | 7000 |

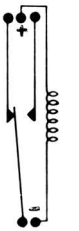
*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

### DIMENSIONS AND SCHEMATIC



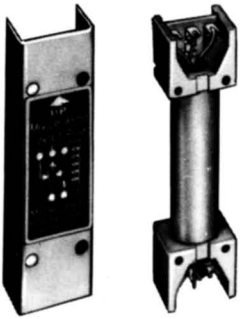

Top View UP



SPDT
(1 Form C)

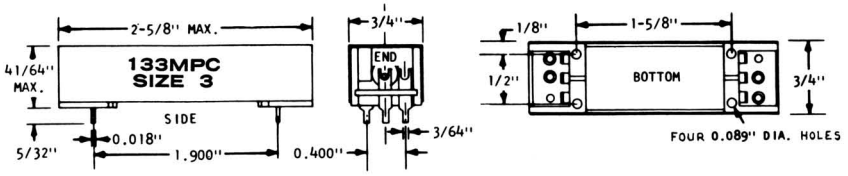
# STANDARD SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 133MPC Mercury-Wetted Reed 50 Volt-Amperes At 2 Amps.



**SPDT M-B**
**(1 Form D Make before break)**
**Available in Size 1**

### DIMENSIONS AND SCHEMATICS




**SPDT M-B**
**(1 Form D Make before break)**

### SPECIAL ORDER DATA

Readily available on special order is this Form D variation made from our Class 133MPC stock units. Custom-built to the highest standards, making these special order variations have become a regular service for our customers here at Magnecraft. When ordering, specify Class 133MPC stock relay and indicate the specific variations desired. Contact arrangement most commonly available in Class 133MPC is SPDT M-B (1 Form D make before break) in Size 1 packaging. See chart below for specific data and page 30 for information on special orders.

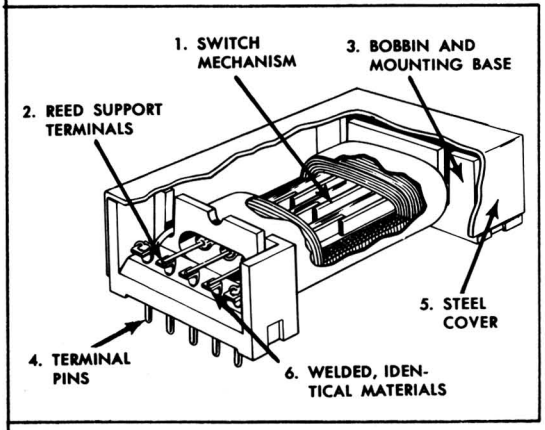
### PROMPTLY SHIPPED ON SPECIAL ORDER

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 133MPCX-30 | SPDT M-B (1 Form D) (Make before break) | 1 | 6 | 70 |
| 133MPCX-31 | | 1 | 12 | 250 |
| 133MPCX-32 | | 1 | 24 | 1000 |
| 133MPCX-33 | | 1 | 48 | 4000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

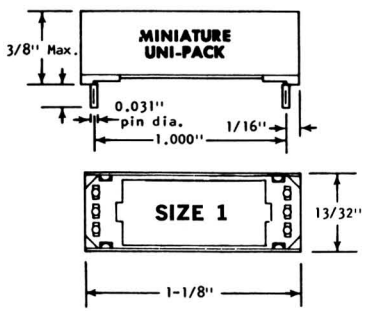
1. **Switch Mechanism.** Hermetically sealed within a glass capsule filled with an inert gas, contacts and reeds are completely protected from contamination and tampering.
2. **Reed Support Terminals.** Rigidly anchored to the molded bobbin and welded stress-free to the switch leads. External stresses cannot be transmitted to the switch mechanism.
3. **Bobbin and Mounting Base.** The integral nylon molding provides maximum electrical insulation and mechanical protection to the relay's components.



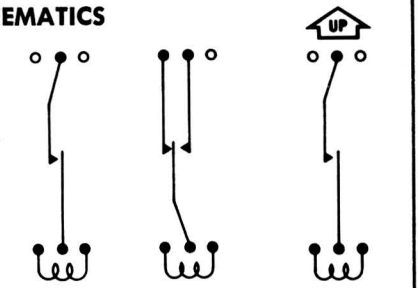

4. **Terminal Pins.** Spaced for 0.1 inch grid centers for easy, rapid assembly to printed circuit boards.
5. **Steel Cover.** Provides full mechanical protection and magnetic shielding to the relay.
6. **Welded Identical Materials.** Welding provides highest connection strength with lowest electrical resistance; identical materials provide lowest thermal noise.

## 2 Miniature Series MPC Case Styles

### DIMENSIONS AND SCHEMATICS

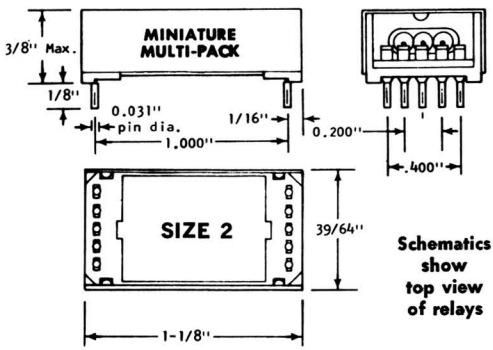



Schematics show top view of relays

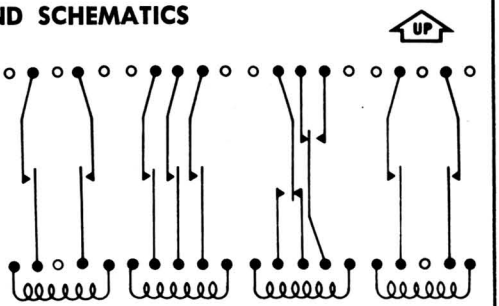



SPST-NO (1 Form A) Dry Reed | SPDT (1 Form C) Dry Reed | SPST-NO (1 Form A) Mercury Reed

### DIMENSIONS AND SCHEMATICS




Schematics show top view of relays




DPST-NO (2 Form A) Dry Reed | 3PST-NO (3 Form A) Dry Reed | DPDT (2 Form C) Dry Reed | DPST-NO (2 Form A) Mercury Reed

# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

### Standard Stock Combinations

The introduction of Magnecraft's Miniature MPC family of dry reed relays has made available to circuit design engineers literally hundreds of variations in contact configurations and coil characteristics. Many of the most widely used contact combinations in the Miniature MPC Reed Relays are now stocked by Magnecraft for fast, off-the-shelf delivery. These are illustrated and described in detail on the following pages. However, these are not the only combinations available.

### Readily Available on Special Order

Special variations on stock Miniature MPC Reed Relays are readily available on special order to meet specific application requirements. These special orders can be made by specifying the part number of the stock relays that most closely matches the desired characteristics, and by specifying the variations required. Variations in combinations of forms are also available: Such as, combining Form A, B, and C, or combining dry reeds with mercury-wetted reeds.

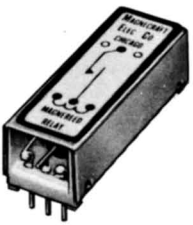
### STANDARD COIL DATA

| AWG WIRE SIZE | SIZE 1 SPST-NO & SPDT | | SIZE 2 to 3PST-NO or DPDT | |
|---|---|---|---|---|
| | *OHMS | TURNS | *OHMS | TURNS |
| 27 | .7 | 200 | 1.5 | 200 |
| 28 | 1.0 | 250 | 2.0 | 250 |
| 29 | 2.0 | 320 | 3.0 | 300 |
| 30 | 3.0 | 400 | 4.0 | 380 |
| 31 | 4.5 | 490 | 5.5 | 400 |
| 32 | 6.5 | 600 | 10 | 600 |
| 33 | 10 | 700 | 15 | 750 |
| 34 | 20 | 1000 | 25 | 900 |
| 35 | 30 | 1270 | 40 | 1250 |
| 36 | 45 | 1500 | 50 | 1200 |
| 37 | 70 | 2000 | 90 | 1850 |
| 38 | 100 | 2400 | 150 | 2300 |
| 39 | 200 | 3200 | 220 | 2600 |
| 40 | 300 | 4150 | 450 | 4100 |
| 41 | 450 | 5000 | 650 | 4800 |
| 42 | 700 | 6200 | 850 | 5200 |
| 43 | 1100 | 7500 | 1600 | 7500 |
| 44 | 1750 | 10000 | 2400 | 10000 |
| 45 | 2100 | 13000 | 3300 | 10500 |
| 46 | 4300 | 15500 | — | — |

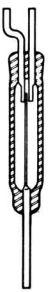
*Resistance values ±10%, measured at 25° C.

## Design Flexibility From 2 Miniature Package Sizes

**MINIATURE SIZE 1**



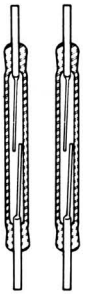
**SPST-NO**
**(1 Form A)**
**Dry Reed**



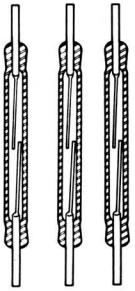
**SPDT**
**(1 Form C)**
**Dry Reed**

**SPST-NO**
**(1 Form A)**
**Mercury Reed**

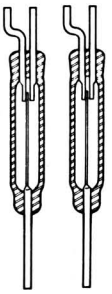
**MINIATURE SIZE 2**



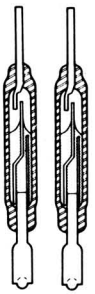
**DPST-NO**
**(2 Form A)**
**Dry Reed**



**3PST-NO**
**(3 Form A)**
**Dry Reed**



**DPDT**
**(2 Form C)**
**Dry Reed**



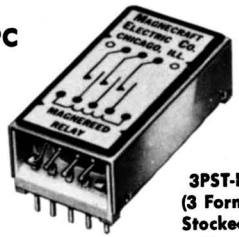
**DPST-NO**
**(2 Form A)**
**Mercury Reed**

Variations other than those listed are also available under special headings.

# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 101MPC Dry Reed 12 Volt-Amperes At 0.25 Amp.

**CLASS 101MPC MINIATURE**



**SPST-NO (1 Form A) Stocked In Size 1**

**3PST-NO (3 Form A) Stocked In Size 2**

## SPECIFICATIONS

**CLASS 101MPC**

**Contact Combinations:** Size 1: SPST-NO (1 Form A), Size 2: 3PST-NO (3 Form A). Available from stock

**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** Size 1: 500 mw, Size 2: 700 mw

**Operate Time:** 1 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 0.5 ms average

**Dielectric Strength Between Contacts:** 250 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS

**Contact Resistance:** 150 milliohms average

**Capacitance Across Contacts:** Size 1: 0.8 pf average, Size 2: 1.0 pf average

**Typical Life at Rated Load:** 5 million operations—longer at reduced loads

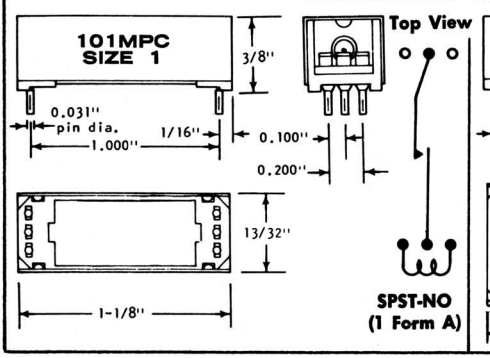
## IN STOCK FOR IMMEDIATE DELIVERY

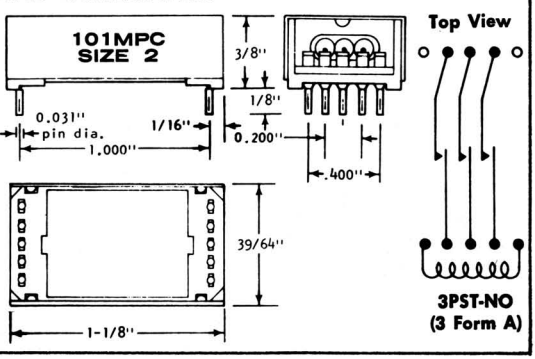
| STOCK PART NO. | CONTACTS | SIZE | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|
| W101MPCX-1 | SPST-NO | 1 | 6 | 70 |
| W101MPCX-2 | SPST-NO | 1 | 12 | 300 |
| W101MPCX-3 | SPST-NO | 1 | 24 | 1100 |
| W101MPCX-4 | SPST-NO | 1 | 48 | 4300 |
| W101MPCX-5 | 3PST-NO | 2 | 6 | 50 |
| W101MPCX-6 | 3PST-NO | 2 | 12 | 220 |
| W101MPCX-7 | 3PST-NO | 2 | 24 | 850 |
| W101MPCX-8 | 3PST-NO | 2 | 48 | 3300 |

*Resistance values ±10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

## DIMENSIONS AND SCHEMATICS



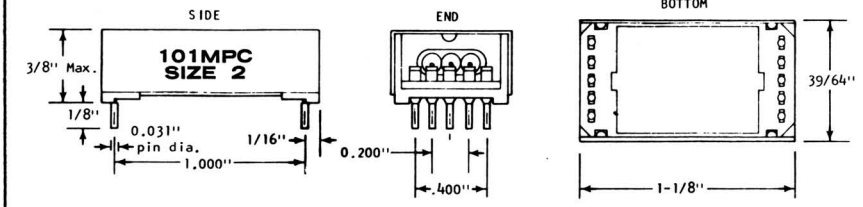
# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

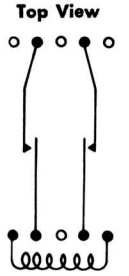
## Class 101MPC Dry Reed 12 Volt-Amperes At 0.25 Amp.


**MINIATURE**

**SPST-NC (1 Form B) and DPST-NC (2 Form B) and DPST-NO (2 Form A) Available In Size 2**

## DIMENSIONS AND SCHEMATICS



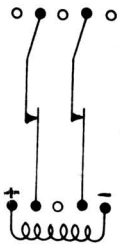




**DPST-NO (2 Form A)**

## SPECIAL ORDER DATA

Readily available on special order are variations of contact combinations made from our Class 101MPC stock units. Custom-built to the highest standards, making these special order variations have become a regular service for our customers here at Magnecraft. When ordering, specify Class 101MPC stock relay and indicate the specific variations desired. Contact arrangements most commonly available in Class 101MPC are SPST-NC (1 Form B), DPST-NC (2 Form B) and DPST-NO (2 Form A) in Size 2 packaging. See chart below for specific data. Also available are various combinations of Form A and Form B contacts in a single package. Under certain circumstances dry reed and mercury-wetted reed combinations can be packaged together. See page 32 for information on special orders.

## PROMPTLY SHIPPED ON SPECIAL ORDER

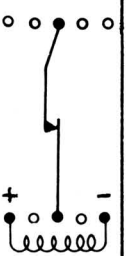



**DPST-NC (2 Form B)**

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 101MPCX-12 | SPST-NC (1 Form B) | 2 | 6 | 50 |
| 101MPCX-13 | | 2 | 12 | 220 |
| 101MPCX-14 | | 2 | 24 | 850 |
| 101MPCX-15 | | 2 | 48 | 3300 |
| 101MPCX-16 | DPST-NC (2 Form B) | 2 | 6 | 50 |
| 101MPCX-17 | | 2 | 12 | 220 |
| 101MPCX-18 | | 2 | 24 | 850 |
| 101MPCX-19 | | 2 | 48 | 3300 |
| 101MPCX-20 | DPST-NO (2 Form A) | 2 | 6 | 50 |
| 101MPCX-21 | | 2 | 12 | 220 |
| 101MPCX-22 | | 2 | 24 | 850 |
| 101MPCX-23 | | 2 | 48 | 3300 |

*Resistance values ±10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.



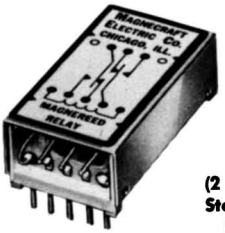

**SPST-NC (1 Form B)**

# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 104MPC Dry Reed 3 Volt-Amperes At 0.25 Amp.

**CLASS 104MPC**
**MINIATURE**

**SPDT**
**(1 Form C)**
**Stocked In**
**Size 1**



**DPDT**
**(2 Form C)**
**Stocked In**
**Size 2**

### SPECIFICATIONS

**CLASS 104MPC**

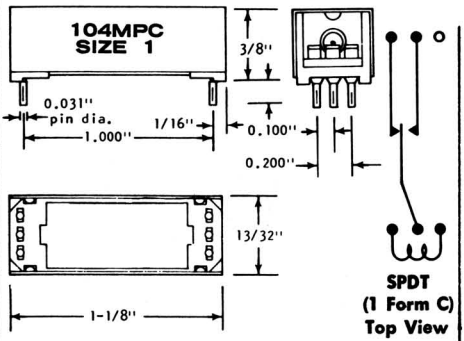
**Contact Combinations:** Size 1: SPDT (1 Form C), Size 2: DPDT (2 Form C). Available from stock
**Contact Load Rating:** 3 Volt-Amperes maximum at 0.25 amp. max. or 28 V max., resistive
**Nominal Coil Power:** Size 1: 500 mw, Size 2: 700 mw
**Operate Time:** 1 ms average
**Release Time:** 1 ms average
**Contact Bounce:** Less than 0.5 ms average. Normally open contacts
Less than 2.0 ms average. Normally closed contacts
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** Size 1: 1.5 pf average, Size 2: 2.0 pf average
**Typical Life at Rated Load:** 10 million operations—longer at reduced loads

### IN STOCK FOR IMMEDIATE DELIVERY

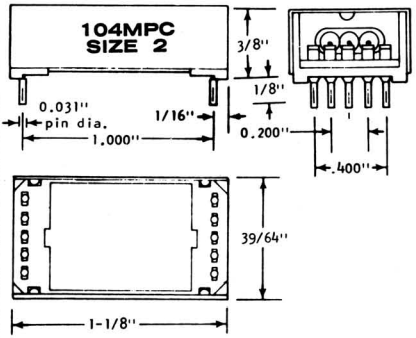
| STOCK PART NO. | CONTACTS | SIZE | COIL DATA †VDC | COIL DATA *OHMS |
|---|---|---|---|---|
| W104MPCX-1 | SPDT | 1 | 6 | 70 |
| W104MPCX-2 | SPDT | 1 | 12 | 300 |
| W104MPCX-3 | SPDT | 1 | 24 | 1100 |
| W104MPCX-4 | SPDT | 1 | 48 | 4300 |
| W104MPCX-5 | DPDT | 2 | 6 | 50 |
| W104MPCX-6 | DPDT | 2 | 12 | 220 |
| W104MPCX-7 | DPDT | 2 | 24 | 850 |
| W104MPCX-8 | DPDT | 2 | 48 | 3300 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

### DIMENSIONS AND SCHEMATICS



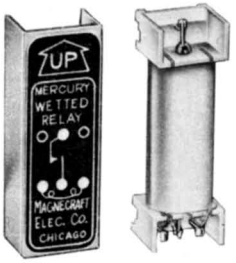

**SPDT**
**(1 Form C)**
**Top View**




**DPDT**
**(2 Form C)**
**Top View**

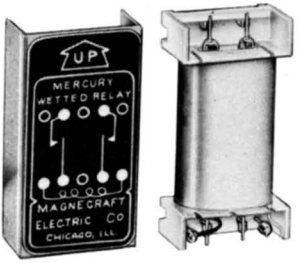
# MINIATURE SIZE MODULAR PRINTED CIRCUIT REED RELAYS

## Class 131MPC Mercury-Wetted Reed 28 Volt-Amperes At 1 Amp.




**MINIATURE**

**SPST-NO (1 Form A) Available In Size 1**




**MINIATURE**

**DPST-NO Available In (2 Form A) Available In Size 2**

## SPECIFICATIONS

**CLASS 131MPC**

**Contact Combinations:** Size 1: SPST-NO (1 Form A), Size 2: DPST-NO (2 Form A). Available through special order

**Contact Load Rating:** 28 Volt-Amperes maximum at 1.0 amp. max. or 100 VAC max., resistive

**Nominal Coil Power:** Size 1: 500 mw, Size 2: 700 mw

**Operate Time:** 1 ms average

**Release Time:** 1 ms average

**Contact Bounce:** None

**Dielectric Strength Between Contacts:** 500 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS

**Contact Resistance:** 50 milliohms average

**Capacitance Across Contacts:** 1.2 pf average

**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

**Operating Position:** Upright. Not more than 30° from vertical

## SPECIAL ORDER DATA

As certain types of special order relays become popular among circuit design engineers, Magnecraft has found it helpful to have readily available these often-ordered special relays. The popular Class 131MPC Mercury-Wetted Reed Relays is just such a "variation". For this reason we have gathered on this page the characteristic data, specifications and dimensions on these relays. When ordering, merely give the catalog numbers of the relays desired and they will be promptly shipped at the earliest opportunity.

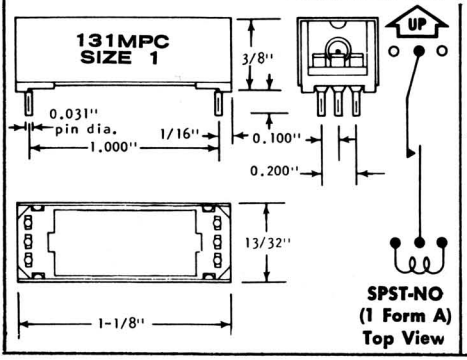
## PROMPTLY SHIPPED ON SPECIAL ORDER

| CATALOG NUMBER | CONTACTS | SIZE | COIL †VDC | COIL *OHMS |
|---|---|---|---|---|
| 131MPCX-2 | SPST-NO (1 Form A) | 1 | 6 | 70 |
| 131MPCX-3 | | 1 | 12 | 300 |
| 131MPCX-4 | | 1 | 24 | 1100 |
| 131MPCX-5 | | 1 | 48 | 4300 |
| 131MPCX-6 | DPST-NO (2 Form A) | 2 | 6 | 50 |
| 131MPCX-7 | | 2 | 12 | 220 |
| 131MPCX-8 | | 2 | 24 | 850 |
| 131MPCX-9 | | 2 | 48 | 3300 |

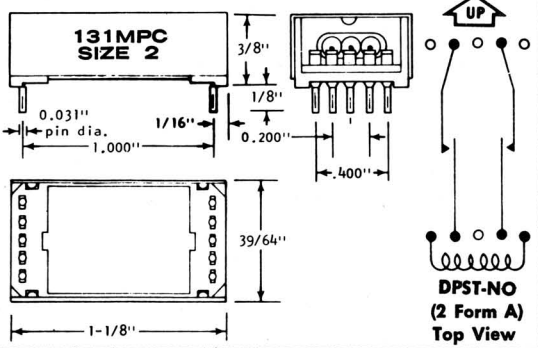
*Resistance values ±10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

## DIMENSIONS AND SCHEMATICS



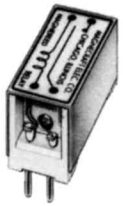

SPST-NO (1 Form A) Top View




DPST-NO (2 Form A) Top View

# MICRO MINIATURE PRINTED CIRCUIT REED RELAY

## 105MPC 100 Millivolt-Amperes At 10 Milliamps



**CLASS 105MPC**

**SPST-NO (1 Form A)**
**Only 5/8 inch total length**

**MPC, high reliability printed circuit construction described on page 60**

The low profile, terminal pin design of the 105MPC micro-miniature reed relay is the smallest member of the versatile family of Magnecraft's Modular Packaged Reed Relays. It is the ultimate in compactness with a total case length of only 5/8 inch and a height of only 11/32 inch . . . no larger than commonly used capacitors and resistors. See specification data below for further information.

### SPECIFICATIONS

**CLASS 105MPC**

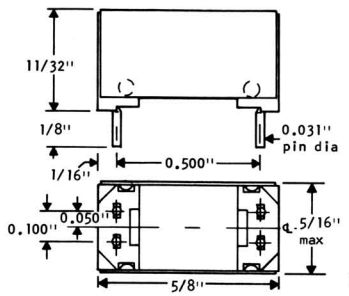
**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 100 Millivolt-Amperes maximum at 10 milliamps max. or 12 V maximum, resistive
**Nominal Coil Power:** 300 mw
**Operate Time:** 0.25 ms average
**Release Time:** 0.50 ms average
**Contact Bounce:** 0.50 ms average
**Dielectric Strength Between Contacts:** 200 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
**Contact Resistance:** 200 milliohms average
**Capacitance Across Contacts:** 0.4 pf average
**Typical Life at Rated Load:** 10 million operations—longer at reduced load

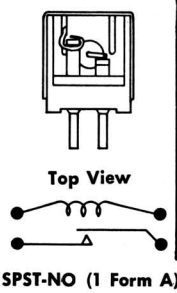
### IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NUMBER | COIL †VDC | COIL *OHMS | NOMINAL POWER |
|---|---|---|---|
| W105MPCX-1 | 6 | 120 | 300 mw |
| W105MPCX-2 | 12 | 500 | |
| W105MPCX-3 | 24 | 2000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

### DIMENSIONS AND SCHEMATIC




### STANDARD COIL DATA

| AWG WIRE SIZE | *OHMS | TURNS | AWG WIRE SIZE | *OHMS | TURNS |
|---|---|---|---|---|---|
| 36 | 12 | 550 | 43 | 300 | 2750 |
| 37 | 18 | 770 | 44 | 500 | 3700 |
| 38 | 30 | 875 | 45 | 800 | 4650 |
| 39 | 50 | 1100 | 46 | 1200 | 5600 |
| 40 | 80 | 1450 | 47 | 2000 | 7150 |
| 41 | 120 | 1780 | 48 | 3000 | 8500 |
| 42 | 200 | 2200 | 49 | 4700 | 10800 |

*Resistance values ±10%, measured at 25° C.

# MODULAR PACKAGED PRINTED CIRCUIT LATCHING RELAYS

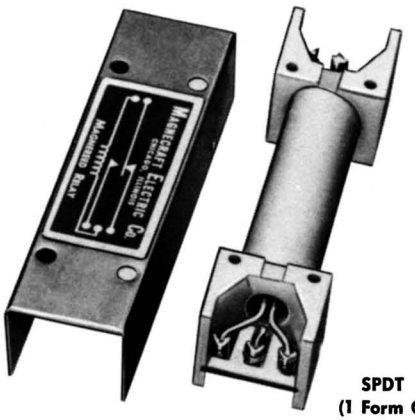
## Class 103LMPC Magnetic Latching 10 Volt-Amperes at 0.2 Amp.

Ideal for memory applications, the 103LMPC Magnetic Latching Dry Reed Relay requires no coil current to hold either of two latching positions. With single wound coils, switching is achieved by reversing coil current polarity, and with double wound coil having separate polarized windings, switching is achieved by use of two separate inputs.

### IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NO. | ††MA | DC COIL DATA †VOLTS | DC COIL DATA *OHMS |
|---|---|---|---|
| **Single Wound Coils** | | | |
| W103LMPCX-3 | 40 | — | 70 |
| W103LMPCX-4 | — | 6 | 250 |
| W103LMPCX-5 | — | 12 | 1000 |
| W103LMPCX-6 | — | 24 | 4000 |
| W103LMPCX-7 | 4 | — | 7000 |
| **Double Wound Coils** | | | |
| W103LMPCX-8 | 80 | — | 30/30 |
| W103LMPCX-9 | — | 6 | 120/120 |
| W103LMPCX-10 | — | 12 | 460/460 |
| W103LMPCX-11 | — | 24 | 1800/1800 |
| W103LMPCX-12 | 8 | — | 3000/3000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.




SPDT
(1 Form C)

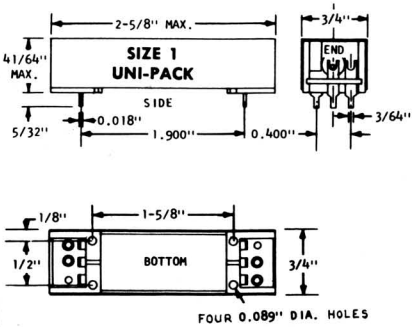
**Low Profile Standard Size Magnetic Latching (Bi-Stable) MPC Reed Relay!**

## SPECIFICATIONS

**CLASS 103LMPC**

**Contact Combination:** SPDT (1 Form C) Break-before-make, bi-stable (armature contact remains in the last operated position until coil polarity is reversed.)
**Contact Load Rating:** 10 Volt-Amperes at 0.2 amp. maximum or 200 VDC max., resistive
**Nominal Coil Power:** 150 mw
**Operate Time:** 2 ms average
**Contact Bounce:** 2 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 4.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

## DIMENSIONS

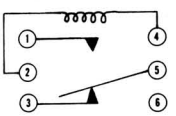



## 103LMPC Description of Electrical Operation

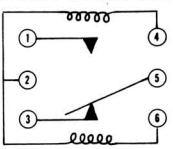
**When nominal voltage is applied across pins 2 and 4 (pin 2 positive with respect to pin 4), contacts 3 and 5 open and contacts 1 and 5 close. When nominal voltage is applied across pins 2 and 4 (pin 4 positive with respect to pin 2), contacts 1 and 5 open and contacts 3 and 5 close.**

**When nominal voltage is applied across pins 2 and 4 (pin 2 positive with respect to pin 4), contacts 3 and 5 open and contacts 1 and 5 close. When nominal voltage is applied across pins 2 and 6 (pin 2 positive with respect to pin 6) contacts 1 and 5 open and contacts 3 and 5 close.**

**Single Wound Coil**




**Double Wound Coil**

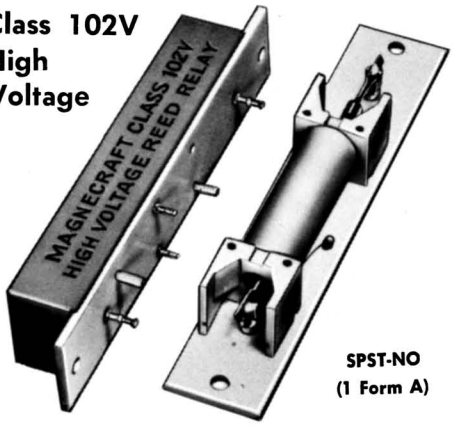



**Note: Upon removal of voltage contacts remain in the last operated position.**

# HIGH VOLTAGE REED RELAYS

## High Voltage Reed Relay for 5000 V Switching

**Class 102V High Voltage**




**SPST-NO (1 Form A)**

The Class 102V High Voltage Reed Relay, made with contacts of special materials, permits switching voltages as high as 5000 volts at 50 volt-amperes maximum with the inherent reliability of reed relay operation. Reed switch leads are not bent and used as terminals but are soldered to rigid terminal supports...external stresses cannot be transmitted to the switch members. The molded nylon coil, bobbin and epoxy resin terminal boards provide maximum dielectric constants for continued high voltage insulation.

The unusually compact package features an internally insulated metal cover to effectively shield the relay from stray magnetic fields and electrostatically shield the surrounding medium from possible RF generation due to contact arcing.

### IN STOCK FOR IMMEDIATE DELIVERY

| CATALOG NUMBER | MA | DC COIL DATA †VOLTS | DC COIL DATA *OHMS |
|---|---|---|---|
| W102VX-9 | 140 | — | 30 |
| W102VX-10 | — | 6 | 70 |
| W102VX-11 | — | 12 | 250 |
| W102VX-12 | — | 24 | 1000 |
| W102VX-13 | — | 48 | 4000 |
| W102VX-14 | 9 | — | 7000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

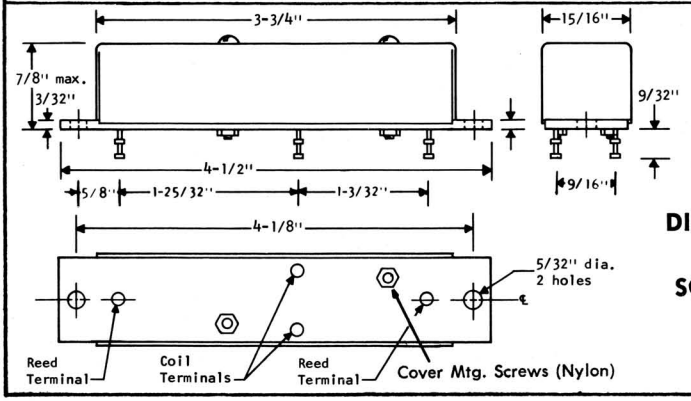
### STANDARD COIL DATA

| AWG WIRE SIZE | *OHMS | TURNS | AWG WIRE SIZE | *OHMS | TURNS |
|---|---|---|---|---|---|
| 27 | 8 | 530 | 36 | 175 | 3900 |
| 28 | 5 | 700 | 37 | 250 | 4500 |
| 29 | 7 | 750 | 38 | 450 | 6400 |
| 30 | 10 | 1000 | 39 | 700 | 7300 |
| 31 | 19 | 1300 | 40 | 1000 | 9000 |
| 32 | 30 | 1750 | 41 | 1900 | 13300 |
| 33 | 45 | 2000 | 42 | 3000 | 16100 |
| 34 | 70 | 2450 | 43 | 4000 | 18500 |
| 35 | 100 | 3000 | 44 | 7000 | 24600 |

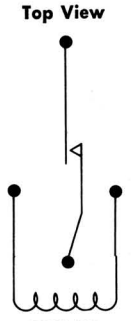
### SPECIFICATIONS

**CLASS 102V**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 50 Volt-Amperes at 3 amps. maximum or 5000 VDC max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 3.0 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** 0.5 ms average
**Dielectric Strength Between Contacts:** 5000 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 1.0 pf average
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads

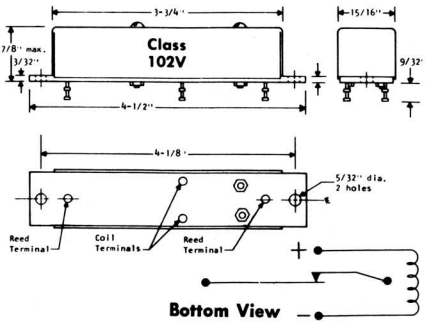



**DIMENSIONS AND SCHEMATIC**



## Class 102V Form B 5000V High Voltage Reed Relay


SPST-NC
(1 Form B)




Bottom View

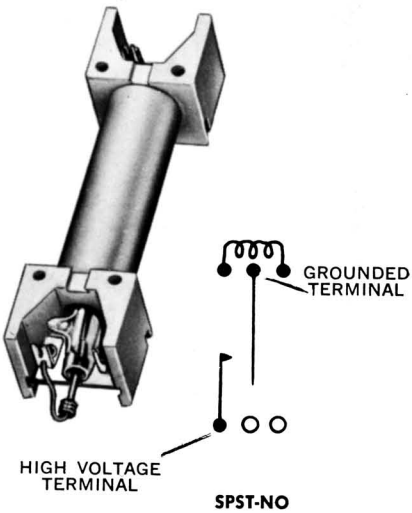
This relay is similar in design to the 102V SPST-NO Form A High Voltage Relay shown on the preceding page and will meet all of the specifications indicated, except for the DC coil power required and DC coil resistance. By the use of a biasing magnet a normally closed contact is obtained. It should be noted that these are polarity sensitive and voltage of the indicated polarity must be applied to the proper coil terminals for operation. These relays are designed to pull in at 85%, or less, of the nominal voltage at 25° C. Due to the use of the biasing permanent magnet it is not recommend that these units be operated on more than 25% higher than the nominal voltage to obtain maximum reliability and proper contact switching.

**PROMPTLY SHIPPED ON SPECIAL ORDER**

| CATALOG NUMBER | COIL | | NOMINAL POWER |
|---|---|---|---|
| | †VOLTS | *OHMS | |
| 102VX-24 | 6 | 150 | 225 mw |
| 102VX-25 | 12 | 625 | |
| 102VX-26 | 24 | 2900 | |
| 102VX-27 | 48 | 10000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

## Class 102VMPC 5000V High Voltage P.C. Reed Relay




SPST-NO
(1 Form A)

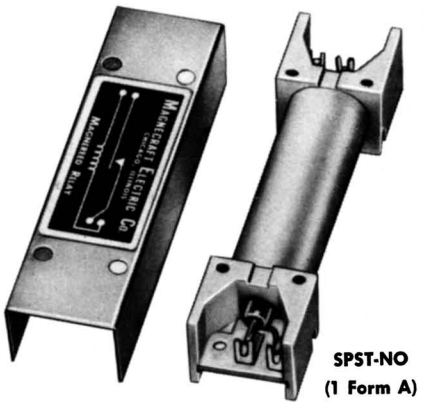
Dozens of variations of stock Class 102V High Voltage Reed Relays are available on special order to meet specific design requirements. These variations may be ordered by specifying the catalog number of the stock unit most similar to that required and specifying the desired variation. The 102VMPC Special High Voltage Dry Reed Relay is an example of such a variation. A uniquely compact relay for high voltage switching on printed circuit mounting, it is fast becoming one of the most popular high voltage units on the market.

**PROMPTLY SHIPPED ON SPECIAL ORDER**

| CATALOG NUMBER | COIL | | NOMINAL POWER |
|---|---|---|---|
| | †VOLTS | *OHMS | |
| 102VMPCX-15 | 6 | 70 | 500 mw |
| 102VMPCX-16 | 12 | 250 | |
| 102VMPCX-17 | 24 | 1000 | |
| 102VMPCX-18 | 48 | 4000 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

## Class 102RMPC Power Reed 100 Volt-Amperes At 3 Amps.




SPST-NO
(1 Form A)

**Switches Higher Currents with Reed Relay Reliability**

A low profile printed circuit relay developed especially to switch higher currents with reed relay reliability. The 102RMPC Reed Relay provides the printed circuit design engineer with a reed relay capable of switching up to 100 watts at 3 amps within an average of 1 milliseconds. Constructed to the same high standards as the other MPC relays featured on these pages, the 102RMPC can be combined, on special order, with another 102RMPC or standard size dry and mercury-wetted reed relays. Stocked in four standard coil voltages, it is also available in sizes 2 and 3 for multiple contact packaging.

### SPECIFICATIONS

**CLASS 102RMPC**

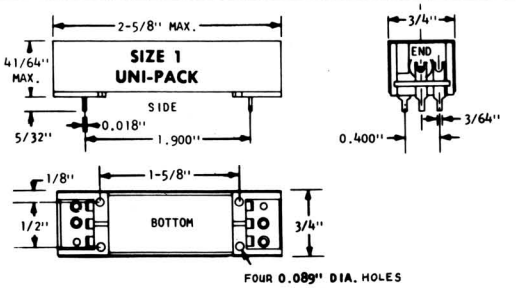
**Contact Combination:** SPST-NO (1 Form A) in stock. Multiple pole relays available on special order.
**Contact Load Rating:** 100 Volt-Amperes at 3 amps. maximum or 250 volts max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 1 ms average
**Release Time:** 1 ms average
**Contact Bounce:** 0.5 ms average
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 1.5 pf average
**Typical Life at 1 Amp. 115 VAC:** 200,000 operations—longer at reduced loads

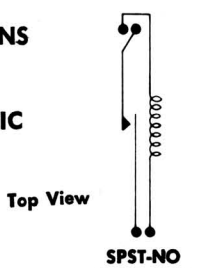
### IN STOCK FOR IMMEDIATE DELIVERY

| STOCK PART NO. | DC COIL DATA | |
|---|---|---|
| | †VOLTS | *OHMS |
| W102RMPCX-1 | 6 | 70 |
| W102RMPCX-2 | 12 | 250 |
| W102RMPCX-3 | 24 | 1000 |
| W102RMPCX-4 | 48 | 4000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

### DIMENSIONS AND SCHEMATIC



Top View

SPST-NO
(1 Form A)

# MERCURY WETTED PRINTED CIRCUIT CONTACT RELAY

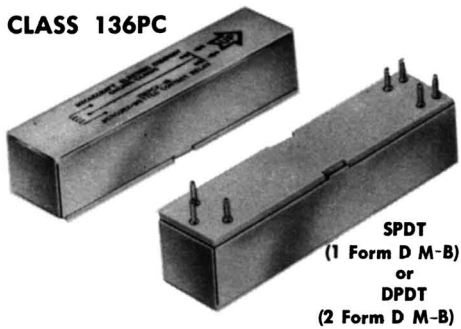
## Class 136PC 250 Volt-Amperes At 5.0 Amps

Ideally suited for computer, counting and applications requiring a high degree of stability of characteristics over extended life. Features printed circuit terminals on the popular 0.1" grid spacing with the low profile required for printed circuit card mounting. The hermetically sealed mercury wetted contacts completely avoid contact corrosion and wear. The contacts are bounce-free and contact resistance varies less than 10% over a life of one billion operations at full rated load. Contacts of this relay must be protected by a series resistor-capacitor network connected across each loaded contact. The recommended values of R and C can be calculated from the following equations:

$$C = \frac{I^2}{10} \text{ microfarads}$$

$$R = \frac{E}{10\,I\,(1 + \frac{50}{E})} \text{ ohms}$$

**CLASS 136PC**



**SPDT**
**(1 Form D M-B)**
**or**
**DPDT**
**(2 Form D M-B)**

## SPECIFICATIONS

**CLASS 136PC**

**Contact Combination:** SPDT (1 Form D make-before-break) with normally open contacts in parallel and normally closed contacts in parallel; or DPDT (2 Form D make-before-break) having a common swinger using separate stationary contacts.

**Contact Load Rating:** 250 Volt-Amperes maximum at 5 amps max. or 500V max., resistive with normally open contacts in parallel and normally closed contacts in parallel. For any single contact in the switch the current immediately prior to opening must not exceed 2.5 amps.

**Nominal Coil Power:** 1.0 watt

**Operate Time:** 4.0 ms average

**Release Time:** 3 ms average

**Contact Bounce:** none

**Dielectric Strength Between Contacts:** 750 VAC, RMS

**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 50 milliohms average

**Capacitance Across Contacts:** 5.0 pf average

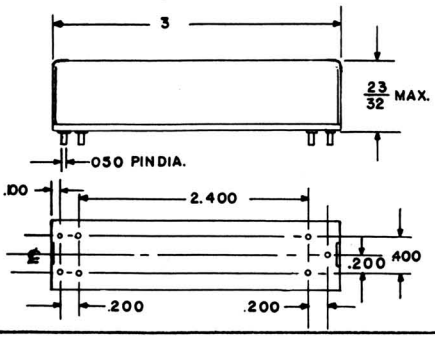
**Operating Position:** Upright. Not more than 30° from vertical

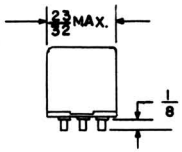
**Typical Life at Rated Load:** 1 billion operations

**PROMPT DELIVERY ON SPECIAL ORDER**

| CATALOG NUMBER | COIL †VDC | COIL *OHMS | NOMINAL POWER |
|---|---|---|---|
| 136PCX-4 | 6 | 35 | 1.0 watt |
| 136PCX-5 | 12 | 150 | |
| 136PCX-6 | 24 | 600 | |
| 136PCX-7 | 48 | 2150 | |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.



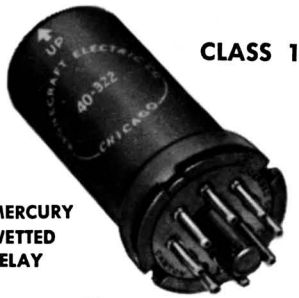




**DIMENSIONS AND SCHEMATICS**


**Wiring diagram viewed from pin end**

# PLUG-IN TYPE MERCURY WETTED CONTACT RELAY

## SPDT & DPDT 250 Volt-Amperes At 5 Amp.



CLASS 136CP

MERCURY WETTED RELAY

Rugged, Potted Construction

### CLASS 136CP MERCURY WETTED CONTACT PLUG-IN RELAY

The Class 136CP Mercury Wetted Contact Plug-In assembly is ideally suited for computer, counting and other applications where a high degree of characteristic stability over extended life is required. The hermetically sealed, mercury wetted contacts completely prevent contact erosion and wear. The contacting surfaces are renewed after each operation by capillary action of the mercury film. The capsule contains an atmosphere of high pressure hydrogen for switching up to 500 volts. Coils are wound to turns and resistance as required on special bobbins for long life and maximum dielectric characteristics. The unit is potted in special electrical potting compound for maximum protection from adverse environmental conditions. The entire assembly is shielded by a steel cover and may be grounded to a plug-pin.

### SPECIFICATIONS

**CLASS 136CP SPDT (M-B) & DPDT (M-B)**

**Contact Combinations:** SPDT (1 Form D) make-before-break with normally open contacts in parallel and normally closed contacts in parallel. Or, DPDT (2 Form D) having a common swinger using separate stationary contacts

**Contact Load Rating:** 250 Volt-Amperes maximum at 500 V max. 5 amps maximum for SPDT, 2.5 amps maximum for DPDT. 500 VAC max. resistive. (See page 71 for arc suppression).

**Nominal Coil Power:** 1 watt

**Operate Time:** 5 ms average at nominal voltage

**Release Time:** 3.2 ms average

**Contact Bounce:** None

**Dielectric Strength Between Contacts:** 1000 VAC, RMS

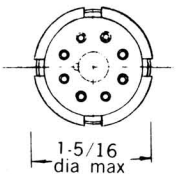
**Dielectric Strength Between Contacts and Coil:** 1000 VAC, RMS

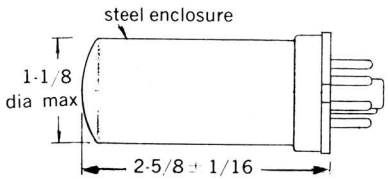
**Contact Resistance:** 25 milliohms average

**Typical Life at Rated Load:** 1 billion operations

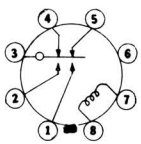
### DIMENSIONS

8- or 11-pin octal style plug




### SCHEMATIC




**Single-wound coil shown. Available with one pin grounded to case or with special wiring as requested.**

| Catalog Number | COIL | | Must Operate MADC | Must Operate VDC | Max. VDC | Nominal VDC |
|---|---|---|---|---|---|---|
| | *Ohms | Turns | | | | |
| 136CPX-1 | 40 | 2800 | 67.7 | 3.0 | 8.9 | 6 |
| 136CPX-2 | 130 | 4900 | 38.8 | 5.6 | 16.1 | 12 |
| 136CPX-3 | 500 | 9450 | 20.1 | 11.1 | 31.6 | 16 |
| 136CPX-4 | 700 | 9500 | 20.0 | 15.4 | 37.4 | 24 |
| 136CPX-5 | 2500 | 18800 | 10.1 | 27.8 | 70.7 | 36 |
| 136CPX-6 | 4000 | 23400 | 8.1 | 35.6 | 89.5 | 48 |
| 136CPX-7 | 7000 | 31700 | 6.0 | 46.2 | 118.0 | 64 |
| 136CPX-8 | 11000 | 38000 | 5.0 | 60.5 | 148.0 | 115 |

*Plus or minus 10% at 25°C.

# PLUG-IN TYPE REED RELAYS

## DPDT & 3PDT 10 Volt-Amperes At 0.5 Amp.

### CLASS 103CP PLUG-IN REED RELAY

The Class 103CP Plug-In assembly is available with contact forms up to a maximum of 3PDT (3 Form C). The switch capsules are true Form C contacts requiring no biasing magnet or special coil polarity. The reed and coil assembly is enclosed in an opaque plastic cover and wired to a standard octal type plug, either 8-pin or 11-pin as required. The unit is potted in a special electrical insulating potting compound for complete mechanical protection of the reed switches and wiring.

### SPECIFICATIONS

**CLASS 103CP**

**Contact Combination:** Up to 3PDT (3 Form C), break before make

**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. or 250 VAC max., resistive

**Nominal Coil Power:** 500 mw for DPDT

**Nominal Coil Power:** 900 mw for 3PDT

**Operate Time:** 2 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** 4 ms average on release (normally closed contact)

**Dielectric Strength Between Contacts:** 500 VAC, RMS

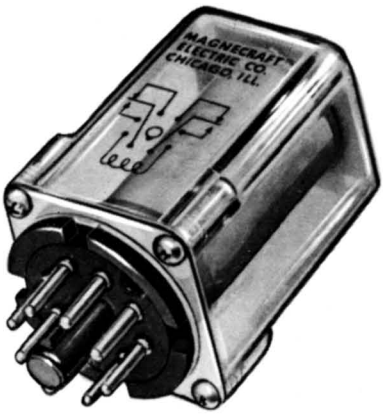
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 4.0 pf average

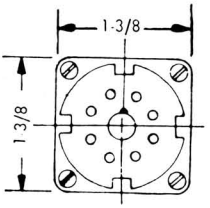
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads

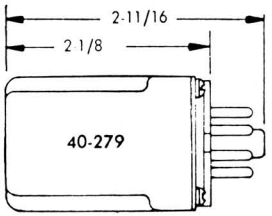
### CLASS 103CP DRY REED RELAY

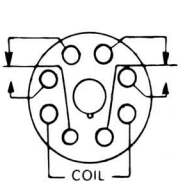



**Plug-In Mounted In Plastic Cover**

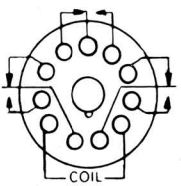
### DIMENSIONS AND SCHEMATICS




**DPDT WD-2 8 Pin**




**3PDT WD-3 11 Pin**

### IN STOCK FOR IMMEDIATE DELIVERY

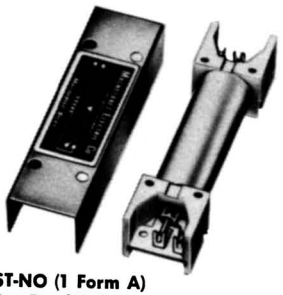
| 103CP DPDT & 3PDT | | | | |
|---|---|---|---|---|
| Stock Part No. | Contacts | COIL ††MA | COIL †Volts | COIL *Ohms |
| W103CPX-7 | | — | 6 VDC | 75 |
| W103CPX-8 | DPDT | — | 12 VDC | 300 |
| W103CPX-9 | WD-2 | — | 24 VDC | 1000 |
| W103CPX-10 | | 8 | — | 5000 |
| W103CPX-11 | | — | 6 VDC | 40 |
| W103CPX-12 | 3PDT | — | 12 VDC | 150 |
| W103CPX-13 | WD-3 | — | 24 VDC | 650 |
| W103CPX-14 | | 10 | — | 5000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.
††Current operated relays pull in at specified value or less.

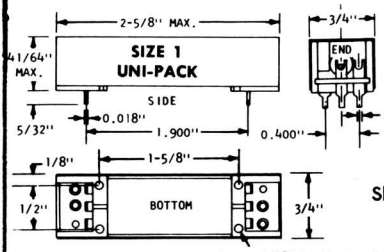
# ELECTRO-STATICALLY SHIELDED REED RELAYS

Essentially all of the many reed relay configurations shown in this handbook can be obtained with electro-static shielding. This shielding consists of a non-magnetic, metallic shield which surrounds the switch capsule and is fastened to an appropriate grounding pin or terminal. On the relays illustrated on these pages this shield is placed between the reed switch and the coil winding. On other multiple contact relays shielding can also be placed between the individual switch elements.

## Class 102MPC Standard Size 15 Volt-Amperes At 1 Amp.



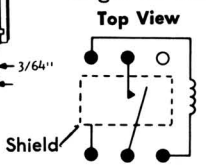
**SPST-NO (1 Form A)**
**Dry Reed Relay**




### SPECIFICATIONS

**CLASS 102MPC**

**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 3.0 ms average
**Release Time:** 0.5 average
**Contact Bounce:** Less than 1.0 ms average
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 1.0 pf average
**Typical Life at Rated Load:** 20 million operations—longer at reduced loads



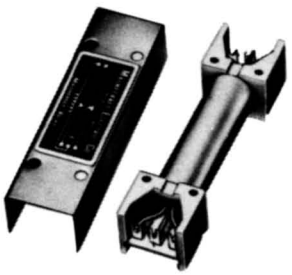

**SPST-NO**
**(1 Form A)**

### AVAILABLE ON SPECIAL ORDER

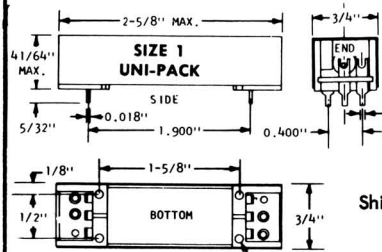
| Catalog Number | COIL †VDC | COIL *Ohms |
|---|---|---|
| 102MPCX-102 | 12 | 250 |
| 102MPCX-103 | 24 | 1000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

## Class 103MPC Standard Size 10 Volt-Amperes At 0.5 Amp.



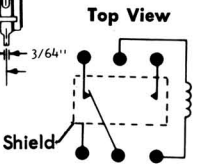
**SPDT (1 Form C)**
**Dry Reed Relay**




### SPECIFICATIONS

**CLASS 103MPC**

**Contact Combination:** SPDT (1 Form C)
**Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 2.0 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** 4.0 ms average on release. Normally closed contacts
**Dielectric Strength Between Contacts:** 500 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
**Contact Resistance:** 100 milliohms average
**Capacitance Across Contacts:** 2.0 pf average
**Typical Life at Rated Load:** 25 million operations—longer at reduced loads




**SPDT**
**(1 Form C)**

### AVAILABLE ON SPECIAL ORDER

| Catalog Number | COIL †VDC | COIL *Ohms |
|---|---|---|
| 103MPCX-58 | 12 | 250 |
| 103MPCX-59 | 24 | 1000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

# ELECTRO-STATICALLY SHIELDED REED RELAYS

The electro-static shield assists in reducing stray pick up of RF noise by the contacts of the relay and will prevent the generated noise, which could be associated with arcing of the reed switch contacts, from affecting other elements closely adjacent to the relay in the circuit.

Illustrated on these two pages are examples of typical reed relay packages furnished with electro-static shielding.

## Class 101MPC Miniature 12 Volt-Amperes At 0.25 Amp.

### SPECIFICATIONS

**CLASS 101MPC**

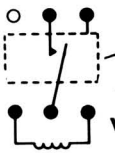
**Contact Combination:** SPST-NO (1 Form A)
**Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 1.0 ms average
**Release Time:** 0.5 ms average
**Contact Bounce:** Less than 0.5 ms average
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 0.8 pf average
**Typical Life at Rated Load:** 5 million operations—longer at reduced loads

**SPST-NO (1 Form A)**
**Dry Reed Relay**

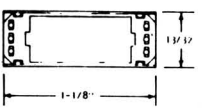

### AVAILABLE ON SPECIAL ORDER

| Catalog Number | COIL | |
|---|---|---|
| | †VDC | *Ohms |
| 101MPCX-34 | 12 | 300 |
| 101MPCX-35 | 24 | 1100 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.




**SPST-NO (1 Form A)**



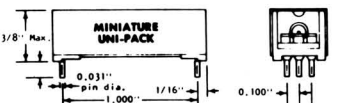

## Class 104MPC Miniature 3 Volt-Amperes At 0.25 Amp.

### SPECIFICATIONS

**CLASS 104MPC**

**Contact Combination:** SPDT (1 Form C)
**Contact Load Rating:** 3 Volt-Amperes maximum at 0.25 amp. max. or 28 V max., resistive
**Nominal Coil Power:** 500 mw
**Operate Time:** 1.0 ms average
**Release Time:** 1.0 ms average
**Contact Bounce:** Less than 0.5 ms average normally open contacts
Less than 2.0 ms average normally closed contacts
**Dielectric Strength Between Contacts:** 250 VAC, RMS
**Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
**Contact Resistance:** 150 milliohms average
**Capacitance Across Contacts:** 1.5 pf average
**Typical Life at Rated Load:** 10 million operations—longer at reduced loads

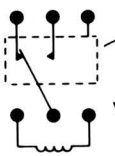
**SPDT (1 Form C)**
**Dry Reed Relay**



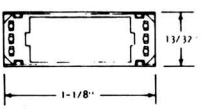

### AVAILABLE ON SPECIAL ORDER

| Catalog Number | COIL | |
|---|---|---|
| | †VDC | *Ohms |
| 104MPCX-13 | 12 | 300 |
| 104MPCX-14 | 24 | 11000 |

*Resistance values ±10%, measured at 25° C.
†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.




**SPDT (1 Form C)**



# SENSITIVE REED RELAYS

Most of the various reed relay configurations shown in this Handbook can be obtained with greater sensitivity than standard units. Illustrated below are some typical reed relay packages which have special reed switches for maximum sensitivity with minimum de-rating of the contacts. These units represent the minimum practical sensitivity of the given mechanical design without sacrificing reliability. They are designed to pull-in at 85%, or less, of the nominal voltage, but it is recommended that they be operated on the nominal voltage in order to obtain the maximum life for the indicated ratings.

## MINIATURE CLASS 101 SENSITIVE

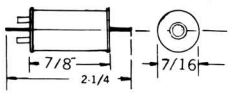
**SPST-NO**
**(1 Form A)**
**Dry Reed Relay**


### SPECIFICATIONS

**CLASS 101 SENSITIVE**

- **Contact Combination:** SPST-NO (1 Form A)
- **Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive
- **Nominal Coil Power:** 50 mw
- **Operate Time:** 1.0 ms average
- **Release Time:** 0.5 ms average
- **Contact Bounce:** Less than 0.5 ms average
- **Dielectric Strength Between Contacts:** 150 VAC, RMS
- **Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
- **Contact Resistance:** 150 milliohms average
- **Capacitance Across Contacts:** 0.9 pf average
- **Typical Life at Rated Load:** 5 million operations—longer at reduced loads

### DIMENSIONS




### AVAILABLE FOR PROMPT DELIVERY

| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 101X-44 | 6 | 700 | 50 |
| 101X-45 | 12 | 3000 | mw |
| 101X-46 | 24 | 11000 | |

## MINIATURE CLASS 101MPC SENSITIVE

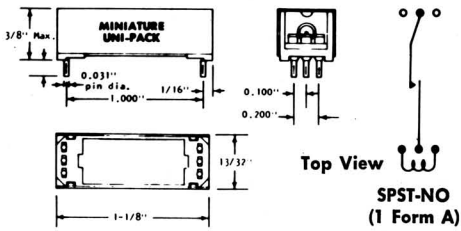
**SPST-NO**
**(1 Form A)**
**Dry Reed Relay**

### SPECIFICATIONS

**CLASS 101MPC SENSITIVE, SIZE 1**

- **Contact Combination:** SPST-NO (1 Form A)
- **Contact Load Rating:** 12 Volt-Amperes maximum at 0.25 amp. max. or 100 VAC max., resistive
- **Nominal Coil Power:** 75 mw
- **Operate Time:** 1.0 ms average
- **Release Time:** 0.5 ms average
- **Contact Bounce:** Less than 0.5 ms average
- **Dielectric Strength Between Contacts:** 150 VAC, RMS
- **Dielectric Strength Between Contacts and Coil:** 500 VAC, RMS
- **Contact Resistance:** 150 milliohms average
- **Capacitance Across Contacts:** 1.0 ms average
- **Typical Life at Rated Load:** 5 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATICS




### AVAILABLE FOR PROMPT DELIVERY

| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 101MPCX-24 | 6 | 450 | 75 |
| 101MPCX-25 | 12 | 2100 | mw |
| 101MPCX-26 | 24 | 7500 | |

*Resistance values ± 10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

# SENSITIVE REED RELAYS

Most of the various reed relay configurations shown in this Handbook can be obtained with greater sensitivity than standard units. Illustrated below are some typical reed relay packages which have special reed switches for maximum sensitivity with minimum de-rating of the contacts. These units represent the minimum practical sensitivity of the given mechanical design without sacrificing reliability. They are designed to pull-in at 85%, or less, of the nominal voltage, but it is recommended that they be operated on the nominal voltage in order to obtain the maximum life for the indicated ratings.

## STANDARD SIZE CLASS 102 SENSITIVE


**SPST-NO**
**(1 Form A)**
**Dry Reed Relay**

### SPECIFICATIONS

**CLASS 102 SENSITIVE**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 80 mw

**Operate Time:** 3.0 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 1.0 ms average

**Dielectric Strength Between Contacts:** 350 VAC, RMS

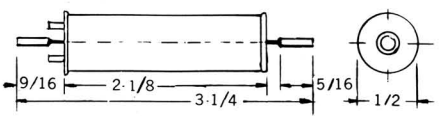
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 1.2 pf average

**Typical Life at Rated Load:** 20 million operations—longer at reduced loads

### DIMENSIONS

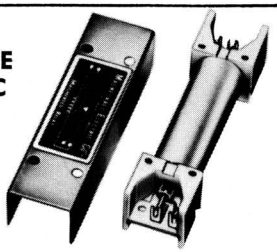



### AVAILABLE FOR PROMPT DELIVERY

| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 102X-66 | 6 | 450 | 80 mw |
| 102X-67 | 12 | 2000 | |
| 102X-68 | 24 | 7000 | |
| 102X-69 | 48 | 29000 | |

## STANDARD SIZE CLASS 102MPC SENSITIVE

**SPST-NO**
**(1 Form A)**
**Dry Reed Relay**



### SPECIFICATIONS

**CLASS 102MPC SENSITIVE**

**Contact Combination:** SPST-NO (1 Form A)

**Contact Load Rating:** 15 Volt-Amperes maximum at 1 amp. max. or 250 VAC max., resistive

**Nominal Coil Power:** 140 mw

**Operate Time:** 3.0 ms average

**Release Time:** 0.5 ms average

**Contact Bounce:** Less than 1.0 ms average

**Dielectric Strength Between Contacts:** 350 VAC, RMS

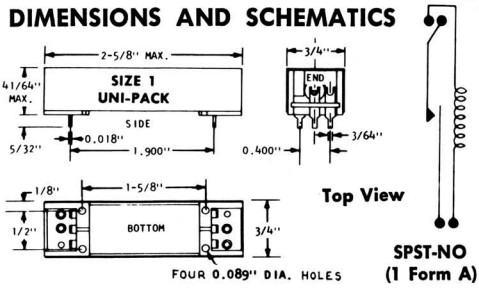
**Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS

**Contact Resistance:** 100 milliohms average

**Capacitance Across Contacts:** 1.3 pf average

**Typical Life at Rated Load:** 2.0 million operations—longer at reduced loads

### DIMENSIONS AND SCHEMATICS




### AVAILABLE FOR PROMPT DELIVERY

| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 102MPCX-91 | 6 | 250 | 140 mw |
| 102MPCX-92 | 12 | 1000 | |
| 102MPCX-93 | 24 | 4000 | |
| 102MPCX-94 | 48 | 17000 | |

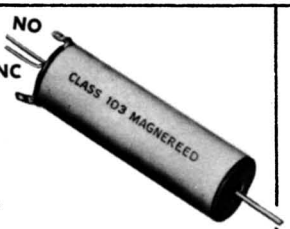
*Resistance values ± 10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

# SENSITIVE REED RELAYS

Most of the various reed relay configurations shown in this Handbook can be obtained with greater sensitivity than standard units. Illustrated below are some typical reed relay packages which have special reed switches for maximum sensitivity with minimum de-rating of the contacts. These units represent the minimum practical sensitivity of the given mechanical design without sacrificing reliability. They are designed to pull-in at 85%, or less, of the nominal voltage, but it is recommended that they be operated on the nominal voltage in order to obtain the maximum life for the indicated ratings.

## STANDARD SIZE CLASS 103 SENSITIVE



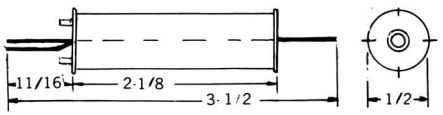

**SPDT**
**(1 Form C)**
**Dry Reed Relay**

## SPECIFICATIONS

**CLASS 103 SENSITIVE**

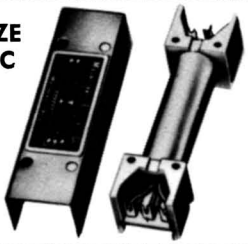
- **Contact Combination:** SPDT (1 Form C)
- **Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive
- **Nominal Coil Power:** 125 mw
- **Operate Time:** 2.0 ms average
- **Release Time:** 0.5 ms average
- **Contact Bounce:** 4.0 ms average on release (normally closed contacts)
- **Dielectric Strength Between Contacts:** 350 VAC, RMS
- **Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
- **Contact Resistance:** 100 milliohms average
- **Capacitance Across Contacts:** 3.5 pf average
- **Typical Life at Rated Load:** 25 million operations—longer at reduced loads

## DIMENSIONS




**SPDT**
**(1 Form C)**

## STANDARD SIZE CLASS 103MPC SENSITIVE



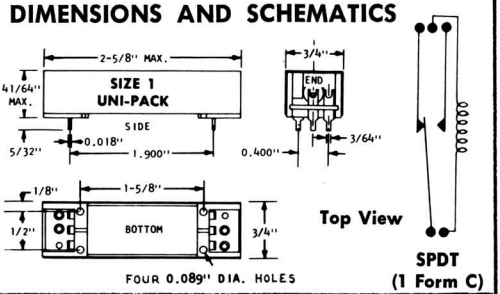
**SPDT**
**(1 Form C)**
**Dry Reed Relay**

## SPECIFICATIONS

**CLASS 103MPC SENSITIVE**

- **Contact Combination:** SPDT (1 Form C)
- **Contact Load Rating:** 10 Volt-Amperes maximum at 0.5 amp. max. or 250 VAC max., resistive
- **Nominal Coil Power:** 250 mw
- **Operate Time:** 2.0 ms average
- **Release Time:** 0.5 ms average
- **Contact Bounce:** 4.0 ms average on release (normally closed contacts)
- **Dielectric Strength Between Contacts:** 350 VAC, RMS
- **Dielectric Strength Between Contacts and Coil:** 750 VAC, RMS
- **Contact Resistance:** 100 milliohms average
- **Capacitance Across Contacts:** 3.5 pf average
- **Typical Life at Rated Load:** 25 million operations—longer at reduced loads

## DIMENSIONS AND SCHEMATICS




## AVAILABLE FOR PROMPT DELIVERY

| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 103X-35 | 6 | 300 | |
| 103X-36 | 12 | 1200 | 125 |
| 103X-37 | 24 | 4300 | mw |
| 103X-38 | 48 | 18000 | |

## AVAILABLE FOR PROMPT DELIVERY

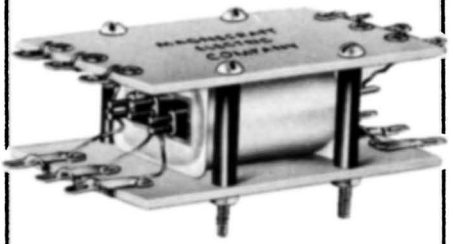
| Catalog Number | COIL †Volts | COIL *Ohms | Nominal Power |
|---|---|---|---|
| 103MPCX-52 | 6 | 150 | |
| 103MPCX-53 | 12 | 600 | 250 |
| 103MPCX-54 | 24 | 2400 | mw |
| 103MPCX-55 | 48 | 19000 | |

*Resistance values ± 10%, measured at 25° C.

†Voltage operated relays pull in at 85%, or less, of nominal voltage at 25° C.

# CUSTOM BUILT REED RELAYS

In the preceding pages, many different types of Magnecraft dry reed, mercury wetted reed and mercury wetted contact relays have been described. In addition to the various types shown, Magnecraft has produced many other types of relays for specific customer's requirements. Some of these have been simply minor modifications of standard relays while others have been extremely specialized. Illustrated below are three typical examples of custom built relays produced by Magnecraft Electric Company.



**Multipole Dry Reed Relay With Solder Lug Terminals**

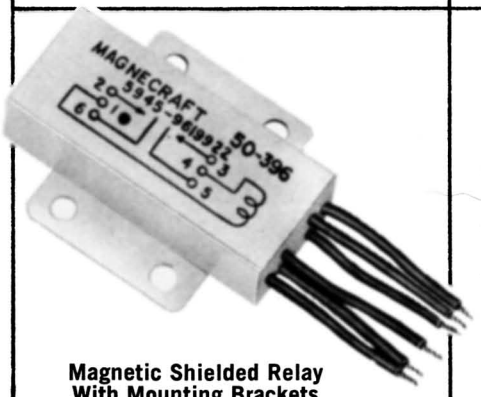
### Multipole Dry Reed Relay With Solder Lug Terminals

The relay as shown here was specifically designed to allow the customer to have sturdy solder lug terminals for wiring and yet minimize major tooling costs. The particular design shown consists of three SPDT switches pre-wired to two parallel terminal boards having solder lug terminals. The reed switches used in this assembly wire are similar to the type used in the Class 103 shown on page 39.


**Standard Size Axial Lead Relay**

### Standard Size Axial Lead Relay

This relay makes use of the standard size SPST normally open switch capsule as used on the Class 102 relay shown on page 39. This relay was designed to provide a unit having flexible lead wires of a specific length, terminated at one end of a cylindrical package. The entire unit was epoxy encapsulated for maximum protection from adverse environmental conditions.




**Magnetic Shielded Relay With Mounting Brackets**

### Magnetic Shielded Relay With Mounting Brackets

This relay was designed to meet the requirements for a DPST normally open contact relay having flexible lead wires, appropriate brackets for flat mounting, and effective magnetic shielding. The reed switches used were similar to those of the Class 101 shown on page 38 and the enclosure was fabricated from a special alloy to yield maximum possible magnetic shielding. The entire unit was epoxy encapsulated for mechanical protection.

# RELAY APPLICATION FORM

Check List of information for ordering Relays and for requesting Application Recommendations. Fill in applicable data.

Company _____ Date _____

Address _____

Individual _____ Title _____

Company Part No. _____ Company Ref. No. _____

Type of: Magnecraft Class Relay : or Type of other make _____

Contact Combination _____ Contact load volts _____ Contact load amps. _____

Type of Contact Load: (Resistive, inductive, etc.) _____

Required Life _____

Nominal Coil voltage or current _____ Pull-in voltage or current _____

Drop-out voltage or current (if applicable) _____ DC Ohms Resist. _____

Ambient Temperature _____ Duty : Continuous ☐ Cycle: Intermittent ☐

Operate Time _____ Release Time _____

TERMINALS Plug-in ☐ Solder ☐ Printed Circuit ☐ Taper Tab. ☐ Other ☐

ENCLOSURE Hermetically Sealed Enc. No. _____ Dust Cover Enc. No. _____

Type and maximum dimensions of enclosure if not standard _____

Applicable MIL. SPECS. _____

Quantity Required _____

Special Features _____

Send to MAGNECRAFT ELECTRIC CO.,
5575 North Lynch Avenue, Chicago, Ill. 60630

Figure 11.

**MAGNECRAFT ELECTRIC COMPANY**

5575 North Lynch Avenue • Chicago, Illinois 60630
Phone (312)282-5500 TWX: 910-221-5221

60-381