# **Reed Relays Product Catalog**



The Leaders in Reed Relays

Instrument Grade Reed Switches

Outstanding Technical Support

SoftCenter® Technology

**Innovative Product Range** 

Custom Designs

High Density| High Voltage| Coaxial/RF/High Speed Digital| Portable Instrumentation| Low Thermal EMF| High Power

### pickeringrelay.com





Formerless Coil Winding on fully automatic machinery

Life Testing to billions of operations

## **Pickering Electronics - A Brief History**

Pickering Electronics are a British manufacturer of high quality Reed Relays predominantly used in Instrumentation and Test equipment. Pickering have been designing Reed Relays since 1968 and today, Pickering's Single-in-Line (SIL/SIP) range is by far the most developed in the relay industry, with relays 25 percent the size of many of their competitors. Pickering Relays are available in Surface Mount, Single-in-Line (SIL/SIP) and Dual-in-Line (DIL/DIP), with the option of dry or mercury wetted switches. These small relays are sold in high volumes to large ATE companies throughout the world.

In 1980 Pickering moved to a purpose-built factory of 2200m<sup>2</sup> (22000 ft<sup>2</sup>) in Clacton-on-Sea, Essex, where all manufacturing took place until 2007, when Pickering opened a Czech manufacturing facility located on a site of 12500 ft<sup>2</sup>. Pickering is a privately-owned company and currently employs approximately 150 people.

Pickering are certified to ISO 9001-2000 and audited by the British Standards Institution. Pickering prides itself on the quality of its products therefore continuous inspection during the manufacturing process is carried out, and Reed Relays are 100 percent tested for all operating parameters.

## **Pickering Interfaces - Technology Partner**

Pickering Interfaces is a sister company, who design and manufacture modular PXI/PCI/LXI switching systems for the Functional ATE market - **pickeringtest.com**. Pickering Interfaces are a large reed relay customer who work very closely with Pickering Electronics on leading edge reed relay designs, reliability testing, life testing, production engineering and QA issues. This close relationship greatly benefits both companies.

	Pages
Quick Reference Guide	2-4
Technical Guide	5-8
Notes	
Custom Relays	10
Single-in-Line (SIL/SIP) Reed Relays	
High Density Vertical	11-20
Plastic Package	21-30, 35-36
Metal Package	23-26, 31-34
Coaxial/RF/High Speed Digital	23-26, 35-38
High Voltage	39-48
Surface Mount/Surface Mount RF	49-50
High Switching Power	51-52
Low Coil Power/Low Thermal EMF.	53-58
Dual-in-Line (DIL/DIP) and Older Style R	eed Relays
Plastic Package DIL/DIP	59-62
Older Style	63-66
Glossary	67-70

## Contents

Please click in the following frames to navigate to the page required.

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## **Quick Reference Guide**



### **Quick Reference Guide**





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## **Quick Reference Guide**



## SoftCenter® Technology

Pickering Reed Relays are encapsulated using a soft inner material to cushion the reed switch capsule as shown below. The very hard compounds used by most other manufacturers can cause stresses that can potentially damage the reed switch and degrade contact resistance stability and life expectation. Pickering relay SoftCenter® construction stops this.





## Former-less Coil Winding

Contact life and more reliable contact resistance are further improved by our use of Former-less coil winding. Our Former-less coils are manufactured using a fully automated process that provides consistent output quality and repeatability. So what is Former-less Coil Winding and what advantages does it give you?

Looking at the above diagram you can see that former-less winding greatly increases the winding 'window', providing the following advantages:

- A much higher magnetic drive level and better magnetic coupling as the smaller diameter of the inner turns are more efficient (more turns per Ohm).
- The number of Ampere Turns (AT) is increased Reed switches are usually rated in sensitivity by an Ampere Turn number, for example, an AT rating of 15AT is twice as sensitive as one with a 30AT. Because the 30AT switch needs more magnetic drive there is much more 'restoring force', which is the ability to open when the coil drive is turned off. This in turn extends the working life of the reed switch many times.

## Magnetic Interaction

The switch contacts in a reed relay are operated by the magnetic field generated by the coil which is wound around the hermetically sealed switch capsule. When these relays are stacked close together, the field from adjacent relays will partially oppose the magnetic field from the relay alongside, reducing its sensitivity. This means that a higher coil voltage will be required to operate it. For very small relays, this increase could be as high as 40% which means that it may not be possible to operate the relay at its normal coil voltage. Look at the magnetic field illustrations below:



Our relays are fitted with a Mu-metal magnetic screen rather than one made of steel because of its high permeability and very low magnetic remanence. This screen concentrates the magnetic field, greatly improving the device's efficiency and reliability and allowing side by side stacking to maximize density.

The high packing densities that can be achieved when using our reed relays is illustrated below on a PXI High Density Reed Relay Matrix Module from our sister company Pickering Interfaces.



This module uses 360 Pickering Series 111P relays, plus 156 Pickering Series 117 relays. A total of 516 Reed Relays.

#### Magnetic screening is absolutely essential for reed relays mounted on a close pitch!

## **Temperature Effects**

Reed Relays are sometimes considered a mundane component by design engineers and often little thought is given to their operating parameters. One of these parameters is operating temperature and failure to consider its effects can lead to the possibility of the relay not operating at high temperatures.

The relay's reed switch is operated by a magnetic field generated by a coil which is wound around it using copper wire. Copper has a positive coefficient of resistance of approximately 0.4% per °C and its resistance will increase with temperature at this rate. As the resistance increases, the current and therefore the level of magnetic field will fall.

The industry standard 'Must Operate Voltage' sometimes called the 'Pull-In Voltage' is 75% of nominal and usually quoted at 25°C. For a 5V relay this would be equal to 3.75V, although in practice it will be lower than this figure. The first graph shows the actual distribution of Operate Voltages for a batch of 1000 Pickering relays. In the second graph you can see how this operate voltage figure will change with temperature.





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Remember that there will also be a voltage drop in the relay driver that needs to be taken into account. It can be clearly seen that at higher temperatures it is possible that the relay will not operate at its nominal coil drive voltage. For Reed Relays other than those manufactured by Pickering, magnetic interaction with adjacent relays will also need to be considered. This is explained under Magnetic Interaction.

Pickering are able to supply Reed Relays with an increased magnetic drive level to accommodate higher temperatures if requested and also have sensitive 3V coil versions in many ranges.

## Getting the best from your Pickering Reed Relays

If used correctly, a reed relay is a superbly reliable device. The switch contacts are hermetically sealed, so do not suffer from oxidization or contamination in the same way as an open electromechanical relay. In reality, relays are often considered slightly mundane and little thought is given to them which sometimes leaves them vulnerable. This guide will help you to maximise the reliability of your design.

## **Contact Abuse**

High current or high power inrushes are the most damaging and most frequent cause of contact damage. Reed Relays have specified maximum Current, Voltage and Power ratings. The Power figure is simply the product of the voltage across the open contacts before closure and the instantaneous current as they first make.

We at Pickering have lost count of the number of times that we have heard something like "I was only switching 5 volts at 50 milliamps onto this CMOS logic board" when the user has completely disregarded the current inrush into the liberal sprinkling of decoupling capacitors and several micro-Farads of reservoir capacitance on that board.

Do not rely on electronic current limiting of power supplies only, to protect relay contacts. Electronic current limiting takes a finite time to react and there are often decoupling capacitors on the output of a power supply. There is nothing better than resistive current limiting.

As well as inrushes due to charging capacitive loads, discharging capacitors can be an even greater issue as the current is often only limited by the resistance of the reed switch and PC tracks. Even capacitors charged to quite low voltages can cause current inrushes of tens of amps and although they may be for microseconds only, they can cause damage to small reed switches.



Typical current inrush when discharging a 0.1uF capacitor at 10 Volts through a Reed Switch and 0.1 Ohms resistor

As voltages increase for some applications, inrushes can become an even greater issue, for example when discharging cables after high voltage proof testing. The energy stored in a capacitance is equal to  $\frac{1}{2}$  CV<sup>2</sup> Joules so will increase with the square of voltage. Increasing from 10 volts to 1000 volts will increase the stored energy by 10,000 times.

If you have ever had a relay contact stick closed, only to free with a slight tap, or had a longer than expected release time, more than likely, it is caused by a micro-weld due to a current inrush.

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### 'Hot' versus 'Cold' switching

Reed Relays generally have a higher Carry Current rating than their 'hot' Switching Current rating. It is usually during 'hot' switching where contact damage occurs due to the resulting arc across the contacts as they open or close. A severe current overload will quickly melt the contact area causing the two surfaces to fuse together creating a hard weld as soon as the contact closes. Less severe current inrushes will cause a milder weld or gradually build up a 'pip' on one contact and erode a 'crater' on the other according to the direction of current flow. These can eventually lock together. Arcs can occur when contacts open, particularly when the load is inductive and Back EMFs from inductive loads should always be limited, usually by a simple diode in the case of DC loads or by a Snubber or Varistor in the case of AC loads.

One way to reduce or remove these issues is to 'Cold' switch. This is a common technique in Test Instrumentation, where the current or voltage stimulus is not applied to the switch until after the relay has been operated and contact bounce finished. In the same way, the stimulus is removed before the contact is opened. In this way there will be no arcing or switched current inrushes and the relay will achieve maximum life, often into billions of operations.



Evidence of contact weld due to high inrush current

When calculating the delay time between switching on the relay coil and applying the current to the switch, it is important to consider the effects of high ambient temperature if this is likely to be encountered. The maximum operate time and bounce figures given on the data sheets are at a 25°C ambient level. At higher temperatures, the resistance of the coil winding will increase at a rate of 0.4 % per °C, this being the coefficient of resistance of the copper coil wire. There will therefore be a corresponding fall in coil current and the level of the magnetic field that is generated



Bad contact weld due to switching very high current

to operate the reed switch. This lower drive level will increase the operate time slightly. The timing figures on Pickering data sheets are normally quite conservative so this is unlikely to be an issue up to the normal ambient specification of 85°C. However, if there is any additional self-heating within the relay due to a high carry current and the switch resistance (I2R Watts), it will be necessary to consider this and allow a little more time before turning on the current through the switch.

Please contact Pickering Application Engineers at techsales@pickeringrelay.com for further help if required.



# **Custom Reed Relays**

As well as the relays detailed in this catalog, Pickering also manufacture many thousands of special model relays, designed to meet our customer's particular requirements.

If you do not see what you require in our standard Series ranges, please contact our technical sales team (techsales@pickeringrelay.com) who will be happy to work with you and design a specific 'one of a kind' reed relay.

### **Features**

- Special pin configurations or pin lengths
- Special print with customers own number or logo
- Custom packaging
- Controlled capacitance
- Controlled thermal emf
- Operate voltage
- Coil resistance, especially low power options
- Specific contact resistance requirements, including stability
- Switch life under specific loads
- Pin forming
- Specific operate & release times
- Specific environmental requirements



• 2-Pole Mercury Wet relay with custom pinout, an equivalent to a competitor's discontinued part



• 2-Pole Mercury Wet Changeover relay where a common open time is required



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# Single-in-Line SIL/SIP Reed Relays

## Very high packing density

1 Form A stacks on 0.15 x 0.27 inches pitch

## Features

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3 or 5 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 117 is a range of Single-in-Line relays intended for very high density applications such as A.T.E. switching matrices or multiplexers.

They are available with either 1 or 2 Form A (energize to make) switches.

Single switch versions require a board area of only 0.15 inches x 0.27 inches. This is one quarter of the board area of the industry standard 0.2 x 0.8 inches Single-in-Line package. The very small size of these relays often makes it possible to increase the functionality of existing designs without increasing the size of printed circuit boards.

The Series 117 switch rating of 5 Watts, 0.5 A is adequate for most instrumentation applications. If a higher rating is required, the Series 116, which is rated at 10 Watts, 0.5 A should be considered. The relay footprint and pin configurations of the Series 116 are identical but the case height increases slightly to 0.49 inches (12.5 mm).

The relays feature an internal mu-metal magnetic screen. Mu-metal has the advantage of a high permeability and low magnetic remanence and eliminates problems that would otherwise occur due to magnetic interaction. Interaction is usually measured as a percentage increase in the voltage required to operate a relay when additional relays, stacked each side, are themselves operated. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required.

3 volt and 5 volt coils are available with an optional Back E.M.F suppression diode.





1 Form A 2 Form A Actual size

### Typical Pickering SoftCenter® Construction



## **High Density Vertical**

The reed switch in the Series 117 is suitable for low level or 'cold' switching. In accordance with Pickering convention, this switch is referred to as type number 2. There is no general purpose switch (type number 1) currently available in this series, but the type 2 is suitable for all applications if it is used within its specified ratings. This means that high inrush currents, particularly caused by capacitive loads must be avoided.

Series 117 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
2	А	5 W	0.5 A	0.5 A	170	250 x 10E6	0.5 ms	0.2 ms	All applications

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V

#### Coil data and type numbers

Device	Tura Number	Coil	Coil	Max. contact	Insulation (mining)	resistance mum)	Capacitano (see Note	e (typical) <sup>2,3</sup> below)
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 2	117-1-A-3/2D 117-1-A-5/2D	3 5	200 Ω 400 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.0 pF	0.14 pF
2 Form A (energize to make)	117-2-A-5/2D	5	250 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.0 pF	0.14 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 250 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Switch to coil capacitance

Due to the asymmetrical internal construction of the relay, the capacitance to the coil from one switch connection is approximately half the capacitance of the other switch connection, for the 1 Form A versions pin 3 is lower. In some applications this feature may be used to advantage for example, in a multiplexer where it is desirable to minimize the capacitance of the common connection to maximize bandwidth.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### **Example of Packing Density - Actual Size**

		_					
RELAY							
RELAY							
RELAY							
RELAY							
RELAY							
RELAY							
RELAY							
RELAY							

In this small area of only 2.16 x 1.2 inches (5.48 x 3.05 cm), it is possible to construct an 8 x 8 matrix - 64, 1 Form A relays.

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Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



View from below showing postion of round pins

**Note**<sup>4</sup>: Pin 3 is round with an outer diameter of 0.016 (0.4). **Note**<sup>5</sup>: Pins 4 and 5 are round with an outer diameter of 0.016 (0.4).



Note<sup>6</sup>: The spacing between pins 4 and 5 is greater than between other pins.

Note7: When an optional diode is fitted pin 1 is the positive connection.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Internal Mu-metal Magnetic Screen

The Series 117 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

pickeringrelay.com

# Single-in-Line SIL/SIP Reed Relays

10 Watts switching - Very high packing density

1 Form A stacks on 0.15 x 0.27 inches pitch

## **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 or 12 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 116 is a range of Single-in-Line relays intended for very high density applications such as A.T.E. switching matrices or multiplexers.

They have a switch rating of 10 Watts, 0.5 A and are pin compatible with the Pickering Series 117 which have a lower power rating of 5 Watts and a lower profile height of 0.38 inches (9.65 mm).

Switches have sputtered ruthenium contacts making them ideal for low level or "cold" switching applications.

1 or 2 pole, Form A (energize to make) versions are available.

The single pole version uses the same switch and coil assembly as the Pickering Series 112.

Single switch versions require a board area of only 0.15 inches x 0.27 inches. This is one quarter of the board area of the industry standard  $0.2 \times 0.8$  inches Single-in-Line package. The very small size of these relays often makes it possible to increase the functionality of existing designs without increasing the size of printed circuit boards.

The relays feature an internal mu-metal magnetic screen. Mu-metal has the advantage of a high permeability and low magnetic remanence and eliminates problems that would otherwise occur due to magnetic interaction. Interaction is usually measured as a percentage increase in the voltage required to operate a relay when additional relays, stacked each side, are themselves operated. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required.

3 volt, 5 volt or 12 volt coils are available. An internal Back E.M.F suppression diode is available as an option.







### Typical Pickering SoftCenter® Construction



## **High Density Vertical**

The reed switch in the Series 116 is suitable for low level or 'cold' switching. In accordance with Pickering convention, this switch is referred to as type number 2. There is no general purpose switch (type number 1) currently available in this series, but the type 2 is suitable for all applications if it is used within its specified ratings.

Series 116 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
2	А	10 W	0.5 A	0.5 A	200	250 x 10E6	0.5 ms	0.2 ms	All applications

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9.0 V	1.2 V

#### Coil data and type numbers

Device	Tune Number	Coil Coil		Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2,3</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 2	116-1-A-3/2D 116-1-A-5/2D 116-1-A-12/2D	3 5 12	250 Ω 500 Ω 750 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.1 pF	0.2 pF
2 Form A (energize to make)	116-2-A-5/2D	5	375 Ω 750 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.1 pF	0.2 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 250 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 107 ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Switch to coil capacitance

Due to the asymmetrical internal construction of the relay, the capacitance to the coil from one switch connection is approximately half the capacitance of the other switch connection, pin 3 is lower. In some applications this feature may be used to advantage for example, in a multiplexer where it is desirable to minimize the capacitance of the common connection to maximize bandwidth.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Example of Packing Density - Actual Size

| RELAY |
|-------|-------|-------|-------|-------|-------|-------|-------|
| RELAY |
| RELAY |
| RELAY |
| RELAY |
| RELAY |
| RELAY |
| RELAY |

In this small area of only 2.16 x 1.2 inches (5.48 x 3.05 cm), it is possible to construct an 8 x 8 matrix - 64, 1 Form A relays.

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ISO9001 Manufacture of Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



Note4: Pin 3 is round with an outer diameter of 0.0175 (0.44).

Note⁵: Pins 4 and 5 are round with an outer diameter of

0.0175 (0.44) 1 Form A



Note<sup>6</sup>: The spacing between pins 4 and 5 is greater than between other pins

Note7: When an optional diode is fitted pin 1 is the positive connection.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

#### Internal Mu-metal Magnetic Screen

The Series 116 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.

Order Code	116 - 1 - A - 5 / 2 D
Series ———	
Number of reeds	
Switch form	
Coil voltage	
Switch number (Only Type 2 a	vailable)
Diode if fitted (Omit if not requ	uired)

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# Single-in-Line SIL/SIP Reed Relays

10, 15 or 20 Watts switching - Very high packing density

1 Form A stacks on 0.15 x 0.27 inches pitch

## **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 or 12 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 115 is a range of Single-in-Line relays intended for very high density applications such as A.T.E. switching matrices or multiplexers.

They are pin compatible with the Pickering Series 116 and 117 but have a slightly higher profile.

The reed switch/coil assemblies used in this series are the same as used in the long established and well proven, Series 109 and 109P.

Two switch types are available. Both types have sputtered ruthenium contacts for long life and high reliability.

Switch type number 1 is better suited for general purpose applications. It has a layer of copper beneath the ruthenium to help dissipate the heat from the contact area. This gives an improved current inrush handling ability.

Switch type number 2 should be chosen for low level or 'cold' switching applications.

Single switch versions require a board area of only 0.15 inches x 0.27 inches. This is one quarter of the board area of the industry standard  $0.2 \times 0.8$  inches Single-in-Line package. The very small size of these relays often makes it possible to increase the functionality of existing designs without increasing the size of printed circuit boards.

The relays feature an internal mu-metal magnetic screen. Mu-metal has the advantage of a high permeability and low magnetic remanence and eliminates problems that would otherwise occur due to magnetic interaction. Relays of this size without magnetic screening would be totally unsuitable for applications where dense packing is required.

3 volt, 5 volt or 12 volt coils are available. An internal Back E.M.F suppression diode is available as an option.





#### Typical Pickering SoftCenter® Construction



## **High Density Vertical**

#### Series 115 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A	15 W (3 V & 2 Form A) 20 W (5 V Versions) 20 W (12 V Versions)	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpos
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9.0 V	1.2 V

#### Coil data and type numbers

Device	TANK	Coil	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2,3</sup> below)	
type	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	115-1-A-3/1D 115-1-A-5/1D 115-1-A-12/1D	3 5 12	250 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.9 pF	0.14 pF
1 Form A (energize to make) Low Level Switch No. 2	115-1-A-3/2D 115-1-A-5/2D 115-1-A-12/2D	3 5 12	250 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.9 pF	0.14 pF
2 Form A (energize to make) Low Level Switch No. 2	115-2-A-5/1D 115-2-A-5/2D	5 5	250 Ω 350 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.9 pF	0.14 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Switch to coil capacitance

Due to the asymmetrical internal construction of the relay, the capacitance to the coil from one switch connection is approximately half the capacitance of the other switch connection, pin 3 is lower. In some applications this feature may be used to advantage for example, in a multiplexer where it is desirable to minimize the capacitance of the common connection to maximize bandwidth.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### **Example of Packing Density - Actual Size**

| RELAY |
|-------|-------|-------|-------|-------|-------|-------|-------|
| RELAY |
| RELAY |
| RELAY |
| RELAY |
| RELAY |
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In this small area of only 2.16 x 1.2 inches (5.48 x 3.05 cm), it is possible to construct an 8 x 8 matrix - 64, 1 Form A relays.

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Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



Note<sup>4</sup>: Pin 3 is round with an outer diameter of 0.0175 (0.44). Note<sup>5</sup>: Pins 4 and 5 are round with an outer diameter of 0.0175 (0.44).



Note<sup>6</sup>: The spacing between pins 4 and 5 is greater than between other pins.

Note7: When an optional diode is fitted pin 1 is the positive connection.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Internal Mu-metal Magnetic Screen

The Series 115 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.

#### 

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.



# Single-in-Line SIL/SIP Reed Relays

10 Watts switching - Very high packing density

1 Form A stacks on 0.15 x 0.4 inches pitch

## Features

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Ideal for high density card based systems and Automatic Test Equipment
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 and 12 Volt coils with or without internal diode
- 5 Volt coils of 500 ohms may be driven directly from TTL logic
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 112 is a range of magnetically screened singlein-line reed relays that require a board area of only 0.15 inches (3.8mm.) by 0.4 inches (10mm.) while retaining the 10 Watts, 0.5 Amps rating associated with larger relays. This small footprint is achieved by mounting the reed switch diagonally within the package.

These relays require around one third the board area of the more usual 0.2 x 0.8 inch devices and the height of only 0.43 inches (11mm.) is suitable for high density card based systems such as VME, VXI, Compact PCI, and PXI. The high quality, sputtered ruthenium switch contacts also makes them ideal for Automatic Test Equipment.

The Series 112 is encapsulated in a plastic package using a very high resistivity resin to achieve an insulation resistance greater than 10<sup>12</sup> ohms. The relay has an internal mumetal screen which totally eliminates the risk of magnetic interaction problems. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required. Pickering Series 112 have a typical interaction figure of 5 percent.

3, 5 and 12 Volt coils are standard, with the option of an internal diode. 5 Volt coils have a resistance of 500 ohms and may be driven directly from TTL logic.





## Typical Pickering SoftCenter® Construction



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## **High Density Vertical**

#### Series 112 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
2	Α	10 W	0.5 A	0.5 A	200	250 x 10E6	0.5 ms	0.2 ms	General purpose

Switch number 2 is suitable for low level or "cold" switching applications. It is also a good general purpose "hot" switch as long as the maximum switching current specification is observed. There is no Switch number 1 available in this range at present.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Tupo Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V) resistan	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 2	112-1-A-3/2D 112-1-A-5/2D 112-1-A-12/2D	3 5 12	250 Ω 500 Ω 750 Ω	0.12 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 250 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Internal Mu-metal Magnetic Screen

The Series 112 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



#### 1 Form A Energize to make

Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematic.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

Order Code	112 -	1 -	A - 5	/ 2	D
Series					
Number of reeds					
Switch form			_		
Coil voltage					
Switch number (Only Type 2 avai	lable) —				
Diode if fitted (Omit if not require	d) ——				

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

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# **SIL/SIP Reed Relays**

## 20 Watts switching - Very high packing density

1 Form A stacks on 0.15 x 0.40 inches pitch

## **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 and 12 Volt coils with or without internal diode
- 5 Volt coils of 500 ohms may be driven directly from TTL logic
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 110 V-SIL (vertical single-in-line) is a range of magnetically screened single-in-line reed relays that stack on 0.15 inches by 0.4 inches pitch. The switches in this range are mounted vertically within the package, this allows the use of the same switch types as would normally be found in relays requiring a very much larger board area. Two types of Form A (energize to make) switches are available, a general purpose version and a type suitable for low level or "cold" switching applications.

These relays require around one third the board area of the more usual  $0.2 \times 0.8$  inch devices. These are your ideal choice for high density applications such as A.T.E. switching matrices or where very little board area is available. If a lower profile device is required, look at the Series 111 & 112.

The Series 110 is encapsulated in a plastic package using a very high resistivity resin. The relay has an internal mu-metal screen which totally eliminates the risk of magnetic interaction problems. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required. Pickering Series 110 have a typical interaction figure of 5 percent.

3, 5 and 12 Volt coils are standard, with the option of an internal diode. 5 Volt coils have a resistance of 500 ohms and may be driven directly from TTL logic.





## Typical Pickering SoftCenter® Construction



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## **High Density Vertical**

#### Series 110 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	20 W	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low leve

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Tune Number	Coil	Coil	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance		Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	110-1-A-5/1D 110-1-A-12/1D	5 12	500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	3 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	110-1-A-3/2D 110-1-A-5/2D 110-1-A-12/2D	3 5 12	250 Ω 500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	3 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Internal Mu-metal Magnetic Screen

The Series 110 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.

Graph showing the effects of different types of Screening



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#### Pin Configuration and Dimensional Data

Dimensions in Inches (Millimeters in brackets)



Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematic.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

Order Code 1	10 - 1 - A - 5 / 2 D
Series	
Number of reeds	
Switch form	
Coil voltage	
Switch number (See table adjacent)	
Diode if fitted (Omit if not required)	

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# Single-in-Line SIL/SIP Reed Relays

Up to 10 Watts switching - Very high packing density

Stacks on 0.15 x 0.5 inches pitch

## Features

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Form A versions have sputtered ruthenium contacts, ideal for Automatic Test Equipment
- Plastic package with internal mu-metal magnetic screen
- They take up very little area, conserving board space
- High insulation resistance greater than 10<sup>12</sup> ohms for Form A types and greater than 10<sup>10</sup> ohms for Form C types
- 3, 5 and 12 Volt coils are standard, with or without internal diode
- 1 Form A, 5 volt version has a coil resistance of 500 ohms drives directly from TTL logic
- 100% tested for dynamic contact resistance

The Pickering Series 113 is a range of magnetically screened single-in-line reed relays that require a board area of only 0.15 inches (3.8mm.) by 0.5 inches (12.7mm.) The Form A (energize to make) versions retain the 10 Watts, 0.5 Amps rating associated with larger relays. The changeover version has a 3 Watts rating.

These relays require less than half the board area of the more usual  $0.2 \times 0.8$  inch devices and have a height of only 0.26 inches (6.6mm.) for the 1 Form A and 1 Form C types and 0.35 inches (8.9 mm.) for the 2 Form A type.

The Series 113 is encapsulated in a plastic package using a very high resistivity resin to achieve an insulation resistance greater than 10<sup>12</sup> ohms for the Form A types. The relay has an internal mu-metal screen which totally eliminates the risk of magnetic interaction problems. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required. Pickering Series 113 have a typical interaction figure of 5 percent.

3, 5 and 12 Volt coils are standard, with the option of an internal diode. 1 Form A, 5 Volt coils have a resistance of 500 ohms and may be driven directly from TTL logic.





#### Switch Ratings - Dry switches

- 1 Form A (Energize to Make) relays.
  10 Watts at 200V
- 2 Form A (Energize to Make) relays.
  10 Watts at 200V
- 1 Form C (Change-over) relays.
  3 Watts at 30V

### Typical Pickering SoftCenter® Construction



## **Plastic Package SIL**

#### Series 113 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
2	А	10 W	0.5 A	0.5 A	200	250 x 10E6	0.5 ms	0.2 ms	General purpose
3	С	3 W	0.1 A	0.1 A	30	10E7	1.0 ms	0.2 ms	Low level

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Tura Number	Coil	Coil	Max. contact	Insulation (mini	resistance mum)	Capacitanc (see Note	e (typical) <sup>2</sup> below)
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 2	113-1-A-3/2D 113-1-A-5/2D 113-1-A-12/2D	3 5 12	250 Ω 500 Ω 650 Ω	0.12 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF
1 Form A (energize to make) Switch No. 2 (Special Pinout)	113SP-1-A-5/2D 113SP-1-A-12/2D	5 12	500 Ω 650 Ω	0.12 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF
2 Form A (energize to make) Switch No. 2	113-2-A-5/2D	5	150 Ω	0.12 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form C (change-over) Switch No. 3	113-1-C-5/3D	5	150 Ω	0.25 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 250 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

#### Internal Mu-metal Magnetic Screen

The Series 113 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.15 inches pitch.

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

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#### Special pin configuration for 1 Form A

The standard 1 FormA device has 4 pins on 0.1 inches (2.54mm) pitch (see drawing above). This configuration makes it pin compatible with the Pickering Series 110, 111 and 112. A special pin configuration is also available with a pinout compatible with that of the 2 FormA type (see drawing above). The switch terminals are pins 1&6, the coil is Pins 3&4 with pins 2&5 omitted, this version has the prefix 113SP. It is sometimes desirable to have a PCB that can be used for either 1 FormA or 2 FormA switching, this arrangement allows the use of a common board fitted with the appropriate relay.



Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics above.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

Order Code	113 - 1 - A - 5 / 2 D
Series	
Number of reeds	
Switch form	
Coil voltage	
Switch number (See table adja	icent)
Diode if fitted (Omit if not requ	ired)

Please ask us for a FREE evaluation sample.

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# **Pico-SIL/SIP Reed Relays**

## Including coaxial types for up to 1.5GHz

Stacks on 0.15 x 0.40 inches pitch giving very high packing density

## **Features**

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Mu-metal magnetic screening
- Two package styles Mu-metal package or Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3 or 5 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 111 is a range of magnetically screened singlein-line reed relays that stack on 0.15 inches by 0.4 inches pitch. They have an identical footprint to the Series 110 and 112 but the height is reduced to only 0.26 inches (6.6mm). The switch rating of 5 Watts is adequate for most instrumentation applications. If a higher power rating is required, please look at our Series 110 or 112 which have a higher power rating and an identical pin-out. The range also includes the type 111RF, a 50 ohms coaxial device suitable for use up to 1.5GHz.

These relays require around one third the board area of the more usual  $0.2 \times 0.8$  inch devices and are ideal for high density applications.

Two package styles are available:

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The type 111 is encapsulated in a mu-metal can. The coaxial version, type 111RF, is also available in this package style.

The type 111P is encapsulated in a plastic package and features an internal mu-metal screen. An internal diode is an option in both types.

Magnetic screening is essential to avoid magnetic interaction problems. Interaction is usually measured as a percentage increase in the voltage required to operate a relay when two additional relays, stacked one each side, are themselves operated. An unscreened device mounted on this pitch would have an interaction figure of around 40%. Relays of this size would therefore be totally unsuitable for applications where dense packing is required. Pickering Series 111 have an interaction figure of around 1 percent.





The plastic package features the same dimensions as the mu-metal version detailed above.

## Typical Pickering SoftCenter® Construction



## **Plastic Package SIL**

#### Series 111 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	5 W	0.5 A	0.5 A	170	250 x10E6	0.5 ms	0.2 ms	General purpose

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V

#### Coil data and type numbers

Device	Package	Tune Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Style	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A Switch No. 1	Mu-metal	111-1-A-3/1D 111-1-A-5/1D	3 5	200 Ω 500 Ω	0.15 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF
1 Form A Switch No. 1	Plastic with internal screen	111P-1-A-3/1D 111P-1-A-5/1D	3 5	200 Ω 400 Ω	0.15 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF
1 Form A Switch No. 1 (Coaxial)	Mu-metal	111RF-1-A-5/1D	5	180 Ω	0.15 Ω	10E12 Ω	10E12 Ω	1.5 pF	0.15 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 250 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

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24

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Reed Relays FM 29036

Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)

#### **Type 111**





#### Type 111P

Plastic package with internal mu-metal screen



#### Type 111RF

Mu-metal package



**Important:** Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Order Code

	TTT	- 1		A -	<b>5</b> /	1	υ
Sorios							
Series							
Number of reeds							
Switch form							
Coil voltage							
Switch number (Only Type 1 availa	able) -						
Diode if fitted (Omit if not required	) —		_			_	

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

Please ask us for a FREE evaluation sample.

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# **Micro-SIL<sup>®</sup> SIL/SIP Reed Relays**

Including coaxial types Up to 20 Watts switching - Very high packing density

## Features

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- 1 Form A and 2 Form A (energise to make)
- 1 Form B (energise to break)
- 1 Form C (changeover)
- 1 Form A Coaxial 50 Ohms impedance (energise to make)
- 1 Form A Coaxial 75 Ohms impedance (energise to make)
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 and 12 Volt coils with or without internal diode

The mu-metal packaged Series 109 and 109RF, and the plastic packaged Series 109P, are magnetically screened single-in-line reed relays that stack on 0.15 inches x 0.6 inches pitch. The adjacent column gives further details of the device types available.

These relays require little more than half the board area of the more usual 0.2 x 0.8 inch devices, this allows around 80 percent more relays onto your board. These are the ideal choice for high density applications such as A.T.E. switching matrices or where very little board area is available.

Mu-metal, due to its high permeability and low magnetic remanence is used to provide magnetic screening. This eliminates problems that would otherwise occur due to magnetic interaction. Interaction is usually measured as a percentage increase in the voltage required to operate a relay when two additional relays, stacked one each side, are themselves operated. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent. Relays of this size without magnetic screening would therefore be totally unsuitable for applications where dense packing is required. Pickering Series 109 and 109RF have a typical interaction figure of 1 percent. Series 109P and 109PH have a typical figure of 3 percent.

Two types of Form A (energize to make) switches are available, a general purpose switch (switch no.1) and a vacuum sputtered ruthenium switch (switch no.2) which is ideal for low level or "cold" switching applications. 5 volt coils normally have a resistance of 500 ohms and 12 volt coils are 1000 ohms. A sensitive single pole 5 volt device with a 1000 ohms coil is also available. Internal back E.M.F. clamping diodes are an option for all types. The small size of these relays often makes it possible to increase the functionality of existing designs without increasing the size of printed circuit boards.





## Device Types

#### Series 109 1 Form A, 2 Form A, 1 Form B, 1 Form C

Similar in construction to the Pickering Series 107 and Series 108. These patented devices are encapsulated in mu-metal cans using very high resistivity resins.

#### Series 109RF Coaxial 1 Form A

Coaxial relays in mu-metal cans. They are available with a characteristic impedance of either 50 or 75 ohms. For R.F. up to 2GHz, telecoms, video or high speed digital switching up to 500 Mbits/sec.

#### Series 109P 1 Form A

The electrical specification and dimensions are identical to the 1 Form A Series 109. They are encapsulated using the same resins within a plastic package which features an internal mumetal magnetic screen.

## Typical Pickering SoftCenter® Construction



## **Plastic Package SIL**

#### Series 109 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	15 W (5L Version) 20 W (Other)	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	A or B	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.1 A	0.1 A	30	10E7	0.75 ms	0.5 ms	Change over

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Operating voltages

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Package	Ture Number	Coil Coil		Max. contact	Insulation (minir	resistance num)	Capacitance (typical) (see Note <sup>2</sup> below)	
type	Style	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A General Purpose Switch No. 1	1	109-1-A-5/1D 109-1-A-5L/1D 109-1-A-12/1D	5 5 12	500 Ω 1000 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A Low Level Switch No. 2	1	109-1-A-3/2D 109-1-A-5/2D 109-1-A-5L/2D 109-1-A-12/2D	3 5 5 12	330 Ω 500 Ω 1000 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form B Low Level Switch No. 2	2	109-1-B-5/2D	5	750 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	5	109-1-C-3/3D 109-1-C-5/3D	3 5	100 Ω 150 Ω	0.25 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A Switch No. 2	3	109-2-A-5/2D 109-2-A-12/2D	5 12	375 Ω 750 Ω	0.14 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
50 Ω Coaxial Switch No. 1	4	109RF50-1-A-5/1D 109RF50-1-A-12/1D	5 12	375 Ω 600 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
50 Ω Coaxial Switch No. 2	4	109RF50-1-A-3/2D 109RF50-1-A-5/2D 109RF50-1-A-12/2D	3 5 12	200 Ω 375 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
75 Ω Coaxial Switch No. 1	4	109RF75-1-A-5/1D 109RF75-1-A-12/1D	5 12	375 Ω 600 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
75 Ω Coaxial Switch No. 2	4	109RF75-1-A-5/2D 109RF75-1-A-12/2D	5 12	375 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A Switch No. 1	6	109P-1-A-5/1D 109P-1-A-5L/1D 109P-1-A-12/1D	5 5 12	500 Ω 1000 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A Switch No. 2	6	109P-1-A-3/2D 109P-1-A-5/2D 109P-1-A-5L/2D	3 5 5	250 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85  $^\circ\text{C}.$ 

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details. Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

Pickering Electronics Limited Stephenson Road Clacton-on-Sea CO15 4NL England email: sales@pickeringrelay.com Tel. (UK) 01255 428141 (International) +44 1255 428141 Fax. (UK) 01255 475058 (International) +44 1255 475058



ISO9001 Manufacture of Reed Relays FM 29036

#### Pin Configuration and Dimensional Data

Dimensions in Inches (Millimeters in brackets)



**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

Order Code 109 RF 50 - 1 - A - 5 L / 2 D
Series
RF (Omit if RF not required)
RF Impedance 50Ω or 75Ω (Omit if not RF)
Number of reeds
Switch form
Coil voltage
'L' - Special 1000Ω, 5V coil
(Form A Types only. Not RF - Omit 'L' if not required)
Switch number (1, 2 or 3 See table adjacent)
Diode if fitted (Omit if not required)

#### Alternative pin configurations

Alternative pin configurations are available, for example, 1 FormA relays with pins on 0.1 inches (2.54mm) pitch to enable insertion into standard SIL sockets. Please contact our technical sales office for further information.

Please ask us for a FREE evaluation sample.

# Single-in-Line SIL/SIP Reed Relays

1 Form A (energise to make), 20 Watts at 200V 1 Form C (change-over), 3 Watts at 200V

## **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Internal mu-metal magnetic screen
- Insulation resistance greater than 10<sup>12</sup> Ω for Form A devices
- Dry switches available in both 1 Form A and 1 Form C configurations
- 3, 5 and 12 Volt coils with or without internal diode
- 5 Volt coils are 500 ohms and may be driven directly from TTL logic
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 106 is a range of Single-In-Line reed relays intended for stacking on 0.2 inches pitch. Their small size, superb contact resistance stability and ultra high insulation resistance, make these relays an ideal choice for Automatic Test Equipment. They have an internal mu-metal screen to eliminate problems that would otherwise be experienced due to magnetic interaction. While the screening is not quite as efficient as the complete mu-metal can of the Series 107, 108 or 109, it is more than adequate for most applications (see explanation below).

If even greater packing density is required, smaller devices are available in other Pickering SIL ranges.

#### Magnetic Interaction - An explanation

Magnetic interaction between relays is normally expressed as a percentage increase in the voltage required to operate the relay, due to the extraneous fields from adjacent relay coils.

An unscreened SIL relay of this size would have an interaction figure of around 30 percent, i.e. the voltage required to operate it will increase by this amount when relays alongside are operated also. It may prove impossible to use such a relay at its nominal coil voltage in high density applications.

A Pickering Series 106 reed relay has an interaction figure of approximately 5 percent.





#### Switch Ratings

- 1 Form A (Energize to Make) relays. Up to 1 Amp switching at 20 Watts
- 1 Form C (Change-over) relays.
  3 Watts at 200 Volts

## Typical Pickering SoftCenter® Construction



## **Plastic Package SIL**

#### Series 106 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	20 W	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	0.5 ms	Change over

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Tura Number	Coil	Coil	Max. contact	Insulation (mining)	resistance mum)	istance Capacitance (typical m) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	106-1-A-5/1D 106-1-A-12/1D	5 12	500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	106-1-A-3/2D 106-1-A-5/2D 106-1-A-12/2D	3 5 12	500 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	106-1-C-5/3D 106-1-C-12/3D	5 12	500 Ω 1000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

#### Internal Mu-metal Magnetic Screen

The Series 106 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.2 inches pitch.



#### Pin Configuration and Dimensional Data

Dimensions in Inches (Millimeters in brackets)









Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

#### Mercury Relays



With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### **Order Code**



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# Single-in-Line SIL/SIP Reed Relays

Up to 20 Watts switching for Dry Reed Relays Up to 50 Watts switching for Mercury Reed Relays

## Features

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Encapsulated in a Plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations -1 Form A, 1 Form B, 2 Form A, 1 Form C
- Two pole relay requires the same board area as the single pole type
- Dry and mercury wetted switches are available with the same pin configuration and footprint. (see "A useful tip" below)
- Insulation resistance greater than 10<sup>12</sup> Ω for dry Form A devices
- 3, 5, 12 and 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 105 is a range of Single-in Line reed relays, available with a wide variety of switching configurations and switch types, including mercury wetted versions. They feature internal mu-metal magnetic screens which allow high packing density without the risk of magnetic interaction problems.

The Pickering Series 100, 101, 103, 106, 107 and 108 all have the same pin locations as the Series 105. If a reduced coil power is desired, please consider our Series 100 and 101 which may be driven directly from CMOS logic. If a higher packing density is required, smaller devices are available in other Pickering SIL ranges.

In addition to the relays shown on this brochure, many other special types are manufactured to meet customers specific requirements. Please contact our technical sales department for further information or samples.

#### A useful tip

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If there is a chance that you might want to use mercury wetted relays instead of dry relays at a later date, for example to increase switch ratings, lay out the PCB initially as though for the mercury wetted type with pin 1 uppermost. This allows uprating later without PCB changes. The mercury versions in the Series 105 have identical pin configurations to the dry types.





#### Switch Ratings - Dry switches

- Single or Double pole Form A (Energize to Make) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form B (Energize to Break) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form C (Change-over) relays. 0.25 Amps switching at 3 Watts

#### Switch Ratings - Mercury Wetted Switches

- Single or Double pole Form A (Energize to Make) relays. 2 Amp switching at 50 Watts
- Single pole, Non Position Sensitive, Form A (Energize to Make) relays. 2 Amp switching at 50 Watts

### Typical Pickering SoftCenter® Construction



## **Plastic Package SIL**

#### Series 105 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	15 W (5 V Versions) 20 W (12 & 24 V)	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	0.5 ms	Change over
4	А	10 W	0.5 A	1.2 A	400	10E7	0.75 ms	0.5 ms	500V stand-off

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Dry Relay - Coil data and type numbers

Device	Tables	Coil	Coil	Max. contact	Insulation (minit	ulation resistance (minimum)		e (typical) <sup>2</sup> below)
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	105-1-A-5/1D 105-1-A-12/1D 105-1-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	105-1-A-3/2D 105-1-A-5/2D 105-1-A-12/2D 105-1-A-24/2D	3 5 12 24	500 Ω 500 Ω 1000 Ω 3000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) High Voltage Switch No. 4	105-1-A-5/4D 105-1-A-12/4D 105-1-A-24/4D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.15 pF
1 Form C (change-over) Switch No. 3	105-1-C-5/3D 105-1-C-12/3D 105-1-C-24/3D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	105-1-B-5/1D 105-1-B-12/1D 105-1-B-24/1D	5 12 24	1000 Ω 3000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
2 Form A (energize to make) General Purpose Switch No. 1	105-2-A-5/1D 105-2-A-12/1D 105-2-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Low Level Switch No. 2	105-2-A-5/2D 105-2-A-12/2D 105-2-A-24/2D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Mercury Reed: Series 105 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	А	50 W	2 A	3 A	500	10E8	1.5 ms	1.0 ms	Standard Mercury
8	А	50 W	2 A	2 A	350	10E8	1.5 ms	1.0 ms	Position Insensitive

#### Mercury Relay: Coil data and type numbers

Device	Tune Number	Coil	Coil	Max. contact	Insulation (minit	resistance mum)	Capacitanc (see Note	e (typical) <sup>2</sup> below)
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	105-1-A-5/6D 105-1-A-12/6D 105-1-A-24/6D	5 12 24	140 Ω 500 Ω 1500 Ω	0.075 Ω	10E12 Ω	10E11 Ω	4 pF	0.1 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	105-1-A-5/8D 105-1-A-12/8D 105-1-A-24/8D	5 12 24	140 Ω 500 Ω 1500 Ω	0.100 Ω	10E12 Ω	10E11 Ω	4 pF	0.1 pF
2 Form A (energize to make) Switch No. 6	105-2-A-5/6D 105-2-A-12/6D 105-2-A-24/6D	5 12 24	100 Ω 375 Ω 1000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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ISO9001 Manufacture of Reed Relays FM 29036





**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### **Mercury Relays**



With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### Internal Mu-metal Magnetic Screen

The Series 105 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking.

.

#### **Order Code**

1	UD	- 1	-	A	- ၁	1	2	υ
	1	- I		1			1	1
Series								
Number of reeds								
Switch form								
Coil voltage								
Switch number (See table adjacent)								
Diode if fitted (Omit if not required)								

#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# **Micro-SIL<sup>®</sup> SIL/SIP Reed Relays**

20 Watts at 200V - 1 Form A and 2 Form A (energise to make) 3 Watts at 200V - 1 Form C (change-over)

## **Features**

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Encapsulated in mu-metal can
- Insulation resistance greater than 10<sup>12</sup> Ω for Form A devices
- Dry switches available in 1 Form A, 2 Form A and 1 Form C configurations. 2 Form A types require the same board area as 1 Form A
- 3, 5 and 12 Volt coils with or without internal diode
- 5 Volt coils are 500 ohms and may be driven directly from TTL logic
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 108 is a range of magnetically screened single-in-line reed relays that stack on 0.15 inches (3.8mm) pitch, resulting in a 25 percent saving in board space over 0.2 inch (5.08mm) wide relays. This means that it is possible to pack 33 percent more relays into the same board area.

Their small size, superb contact resistance stability and ultra high insulation resistance, greater than 10<sup>12</sup> ohms for Form A devices, make these relays a popular choice for high quality instrumentation.

The device is encapsulated in a mu-metal can using a very high resistivity resin. Mu-metal is used rather than steel because of both its very high permeability and its low magnetic remanence. This construction totally eliminates the risk of magnetic interaction problems. Magnetic interaction is usually measured as a percentage increase in the voltage required to operate a relay when two additional relays, stacked one each side, are themselves operated. An unscreened device mounted on this pitch would have an interaction figure of around 40 percent, it would therefore be totally unsuitable for applications where relays are to be packed densely. Pickering Series 108 have a typical interaction figure of only 1 percent.

Dry switches are available in 1 or 2 Form A (energize to make) and 1 Form C (change-over) configurations. 3, 5 and 12 Volt coils are available, 5 Volt coils have a resistance of 500 Ohms and may therefore be driven directly from TTL logic.





#### Switch Ratings - Dry switches

- Single or Double pole Form A (Energize to Make) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form C (Change-over) relays. 0.25 Amps switching at 3 Watts

### Typical Pickering SoftCenter® Construction



pickering

## **Metal Package SIL**

#### Series 108 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	15 W (5 V Versions) 20 W (12 V Versions)	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	0.5 ms	Change ove

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device type	Tune Number	Coil	Coil	Max. contact	Insulation (mini	resistance mum)	Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	108-1-A-5/1D 108-1-A-12/1D	5 12	500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.15 pF
1 Form A (energize to make) Low Level Switch No. 2	108-1-A-3/2D 108-1-A-5/2D 108-1-A-12/2D	3 5 12	330 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.15 pF
1 Form C (change-over) Switch No. 3	108-1-C-5/3D 108-1-C-12/3D	5 12	500 Ω 1000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) General Purpose Switch No. 1	108-2-A-5/1D 108-2-A-12/1D	5 12	375 Ω 1000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make)	108-2-A-5/2D	5 12	375 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See	See

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately  $40 \times 0.4 = 16\%$  to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

#### Graph showing the effects of different types of Screening



Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



**Important:** Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# Mini-SIL<sup>®</sup> SIL/SIP Reed Relays

## Up to 20 Watts switching

Stacking on 0.2 inches pitch

## **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Encapsulated in patented mu-metal can
- Insulation resistance greater than 10<sup>12</sup> Ω for Form A devices
- Dry and mercury wetted switches available
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A, 1 Form C, and 2 Form C, see adjacent column
- For R.F. or high speed digital applications, 50 ohms coaxial devices are available in the same package style, see Series 102M
- 3, 5, 12 or 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 107 Mini-SIL range of reed relays are intended for stacking on 0.2 inches (5.08mm) pitch. Their small size, superb contact resistance stability and ultra high insulation resistance, make these relays an ideal choice for high quality instrumentation.

The mu-metal case ensures virtually total magnetic screening, see explanation below.

Both dry and mercury wetted switches are available in a wide range of configurations, see adjacent column.

If even greater packing density is required, smaller devices are available in other Pickering SIL ranges (except for two pole changeover types).

#### Magnetic Interaction - An explanation

Magnetic interaction between relays is normally expressed as a percentage increase in the voltage required to operate the relay, due to the extraneous fields from adjacent relay coils.

An unscreened SIL relay of this size would have an interaction figure of around 30 percent, i.e. the voltage required to operate it will increase by this amount when relays alongside are operated also. It may prove impossible to use such a relay at its nominal coil voltage in high density applications.

A Pickering Series 107 reed relay has an interaction figure of approximately 1 percent.





#### Switch Ratings - Dry switches

- Single or Double pole Form A (Energize to Make) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form B (Energize to Break) relays. Up to 1 Amp switching at 20 Watts
- Single or Double pole Form C (Change-over) relays. 0.25 Amps switching at 3 Watts

#### **Switch Ratings - Mercury Wetted Switches**

- Single or Double pole Form A (Energize to Make) relays. 2 Amp switching at 50 Watts
- Single pole, Non Position Sensitive, Form A (Energize to Make) relays. 2 Amp switching at 50 Watts

## Typical Pickering SoftCenter® Construction



## **Metal Package SIL**

#### Series 107 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	15 W (5 V Versions) 20 W (12 & 24 V)	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	0.5 ms	Change over
4	А	10 W	0.5 A	1.2 A	400	10E7	0.75 ms	0.25 ms	500V stand-off

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Coil data and type numbers

Device	Tura Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	107-1-A-5/1D 107-1-A-12/1D 107-1-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.2 pF
1 Form A (energize to make) Low Level Switch No. 2	107-1-A-3/2D 107-1-A-5/2D 107-1-A-12/2D 107-1-A-24/2D	3 5 12 24	500 Ω 500 Ω 1000 Ω 3000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.2 pF
1 Form A (energize to make) High Voltage Switch No. 4	107-1-A-5/4D 107-1-A-12/4D 107-1-A-24/4D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.2 pF
1 Form C (change-over) Switch No. 3	107-1-C-5/3D 107-1-C-12/3D 107-1-C-24/3D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	107-1-B-5/1D 107-1-B-12/1D 107-1-B-24/1D	5 12 24	1000 Ω 3000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.2 pF
2 Form A (energize to make) General Purpose Switch No. 1	107-2-A-5/1D 107-2-A-12/1D 107-2-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Low Level Switch No. 2	107-2-A-5/2D 107-2-A-12/2D 107-2-A-24/2D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form C (change-over) Switch No. 3	107-2-C-3/3D 107-2-C-5/3D 107-2-C-12/3D 107-2-C-24/3D	3 5 12 24	200 Ω 375 Ω 1000 Ω 2700 Ω	0.22 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Mercury Reed: Series 107 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	А	50 W	2 A	3 A	500	10E8	2.0 ms	1.25 ms	Standard Mercury
8	А	50 W	2 A	2 A	350	10E8	2.0 ms	1.25 ms	Position Insensitive

#### Mercury Relay: Coil data and type numbers

Device type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	107-1-A-5/6D 107-1-A-12/6D 107-1-A-24/6D	5 12 24	140 Ω 500 Ω 1500 Ω	0.075 Ω	10E12 Ω	10E11 Ω	5 pF	0.1 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	107-1-A-5/8D 107-1-A-12/8D 107-1-A-24/8D	5 12 24	140 Ω 500 Ω 1500 Ω	0.100 Ω	10E12 Ω	10E11 Ω	5 pF	0.1 pF
2 Form A (energize to make) Switch No. 6	107-2-A-5/6D 107-2-A-12/6D 107-2-A-24/6D	5 12 24	100 Ω 375 Ω 1000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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ISO9001 Manufacture of Reed Relays FM 29036

Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

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#### Mercury Relays

With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### Order Code



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.
# Low Capacitance SIL/SIP Reed Relays

# Up to 15 Watts switching

Stacking on 0.2 inches pitch

# **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Inter-terminal capacitances are a fraction of that for standard SIL relays
- Pin compatible with standard 0.2 inch SIL relays
- Optional internal mu-metal magnetic screen
- Optional internal coaxial electrostatic screen
- Insulation resistance greater than 10<sup>12</sup> Ω
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 103 is a range of Single-in-Line reed relays intended for such applications as wide bandwidth A.T.E. switching matrices, attenuator switching or any other applications where exceptionally low levels of inter-terminal capacitances are required, for example, when carrying fast rise time pulses. A version with an internal co-axial electrostatic screen is available which is ideal for applications where capacitively coupled noise from switch to coil connections is undesirable. The co-axial device has a characteristic impedance of 50 ohms and is also suitable for RF applications, HF performance is similar to the Series 102M.

The range consists of two basic types, the first achieves ultra low capacitance levels of typically 0.1pf from each switch connection to the coil and typically 0.08pf across the open switch contacts, by virtue of an internal coaxial electrostatic screen or guard connection. Where it is not possible to drive a guard, the second type has inherently low capacitance figures of typically 0.4pf from each switch connection to the coil and typically 0.1pf across the open switch contacts. These figures for the unguarded version are around one quarter of those for standard SIL devices. An internal mu-metal magnetic screen is an option in both of these types.

The Series 103 may be stacked on 0.2 inches pitch and is pin compatible with all other 0.2 inch SIL relays. They are encapsulated in a plastic package using a very high resistivity resins.

Two types of Form A (energize to make) switches are available, a general purpose switch (switch no.1) and a vacuum sputtered ruthenium switch (switch no.2) which is ideal for very low level or "cold" switching applications.





# Switch Ratings

- 1 Form A (energize to make), 15 watts at 1 Amp
- 1 Form A (co-axial), up to 15 watts at 1 Amp.
  50 ohms characteristic impedance makes this device suitable for RF applications also

# **Optional magnetic screening**

In high density applications when more than one relay may be operated at any time, for example, ATE switching matrices, it is usually necessary to use a relay that includes internal mu-metal magnetic screening to reduce the effects of extraneous fields from adjacent devices. The addition of this screen however does have the effect of slightly increasing the capacitance figures of the relay, as illustrated in the tables over.

# Typical Pickering SoftCenter® Construction



# **Coaxial/RF/High Speed Digital**

#### Dry Reed Series 103 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	15 W	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12V	9 V	1.2 V

### Dry Relays - Data and type numbers

Config	Switch		Tune Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
Conng	Form	Туре	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
No Magnetic screen or Guard screen	A A	1 2	103-1-A-5/1D 103-1-A-5/2D	5 5	150 Ω 150 Ω	0.15 Ω 0.12 Ω	10E12 Ω	10E12 Ω	0.4 pF	0.13 pF 0.10 pF
Magnetic screen only	A A	1 2	103M-1-A-5/1D 103M-1-A-5/2D	5 5	150 Ω 150 Ω	0.15 Ω 0.12 Ω	10E12 Ω	10E12 Ω	0.45 pF	0.13 pF 0.20 pF
Guard screen only	A A A A	2 1 2 1 2	103G-1-A-3/2D 103G-1-A-5/1D 103G-1-A-5/2D 103G-1-A-12/1D 103G-1-A-12/2D	3 5 5 12 12	300 Ω 500 Ω 500 Ω 1000 Ω 1000 Ω	0.12 Ω 0.15 Ω 0.12 Ω 0.15 Ω 0.15 Ω	10E12 Ω	10E12 Ω	0.1 pF	0.08 pF 0.10 pF 0.08 pF 0.10 pF 0.08 pF
Guard screen and Magnetic screen	A A A A	2 1 2 1 2	103GM-1-A-3/2D 103GM-1-A-5/1D 103GM-1-A-5/2D 103GM-1-A-12/1D 103GM-1-A-12/2D	3 5 12 12	300 Ω 500 Ω 500 Ω 1000 Ω 1000 Ω	0.12 Ω 0.15 Ω 0.12 Ω 0.15 Ω 0.15 Ω	10E12 Ω	10E12 Ω	0.2 pF	0.08 pF 0.10 pF 0.08 pF 0.10 pF 0.08 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level Please contact sales@pickeringrelay.com for assistance.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

### Simplified equivalent circuits

It is convenient to consider the internal capacitances as a delta network as in the circuit diagram alongside. C1 is the capacitance between one end of the switch and the coil, C2 is the capacitance between the other end of the switch and the coil. These two figures will be approximately equal. C3 is the capacitance across the open switch. When measuring the values of any one of these capacitances, it is necessary to "guard" the unused relay connections to avoid the parallel effects of the other capacitances, connection details when performing these measurements on a capacitance bridge are shown below. Relays with an internal electrostatic screen have the screen terminals guarded in all cases.



ISO9001 Manufacture of Reed Relays FM 29036

# Pin Configuration and Dimensional Data



### 1 Form A (Co-axial)

5

Important: Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics

7

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Internal Mu-metal Magnetic Screen

The Series 103 relays are fitted with an optional internal mu-metal magnetic screen which permits side-by-side stacking on 0.2 inches pitch.

#### Order Code

	103 G M	-1-	A - 5	/ 2 L	
Series					
Guard (omit if not required)					
Mag. screen (omit if not requi	red)				
Number of reeds					
Switch form					
Coil voltage					
Switch number (See table adj	acent)				
Diode if fitted (Omit if not reg	uired) ——				J

#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

# Subminiature Coaxial SIL/SIP Reed Relays for RF and High Speed Digital

Up to 20 Watts switching

# Features

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Form A (energize to make) or Form B (energize to break) configurations
- Up to 20 Watts switching capability
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3, 5 and 12 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 102 is a range of subminiature coaxial reed relays for high frequency applications up to 3 GHz, performance characteristics will be found on reverse of this sheet. Two package types are available, both displaying outstanding RF performance in terms of low insertion loss, good isolation and excellent VSWR characteristics in 50 ohms systems. These relays have good coil drive levels making them ideal for portable applications or where space is at a premium. If an even smaller RF relay is required, look at the Series 109RF or 111 RF.

### 102M (Mu-metal) Package.

This device, constructed in the popular Single-In-Line format, features a mu-metal case allowing dense packaging without magnetic interaction problems. It has six pins for conventional PCB mounting. With careful printed circuit board layout this configuration will perform well up to 1.5GHz, it is easy to use and will meet most requirements.

### 102F (Flatpack) package.

The 102F package dispenses with the leadframe connections to the switch and screen. These terminations are instead brought out axially from the ends of the device where they are soldered directly to the stripline. This technique allows very accurate matching to the 50 ohms line and gives an excellent VSWR right up to 3 GHz.

### Mounting method:

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A small rectangular hole is punched into the printed circuit board or notched into the board edge to accommodate the package. The switch leads are then soldered directly to the 50 ohms stripline, the tin plated copper foil from the screen is soldered directly to the ground plane on the reverse side of the P.C.B. The coil connections are soldered directly to their tracks in the same way.







# Switch Ratings

- 1 Form A coaxial (energize to make), 10 watts at 200V - Switch No.1
- 1 Form A coaxial (energize to make), 20 watts at 200V Switch No.2
- 1 Form B coaxial (energize to break), 10 watts at 200V - Switch No.1
- 1 Form B coaxial (energize to break), 20 watts at 200V Switch No.2

# Typical Pickering SoftCenter® Construction



# **Coaxial/RF/High Speed Digital**

#### Series 102 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time
1	A or B	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms
2	А	20 W	1 A	1.2 A	200	10E9	0.5 ms	0.2 ms

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

### 102M (mu-metal) Data and type numbers

Device	Ture Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance resistance Switch (initial) to coil		Across switch	Closed switch to coil	Across open switch	
1 Form A (energize to make) General Purpose Switch No. 1 (10 Watts)	102M-1-A-3/1D 102M-1-A-5/1D 102M-1-A-12/1D	3 5 12	300 Ω 500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2 (20 Watts)	102M-1-A-5/2D 102M-1-A-12/2D	5 12	375 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF
1 Form B (energize to break) General Purpose Switch No. 1 (10 Watts)	102M-1-B-5/1D 102M-1-B-12/1D	5 12	1000 Ω 1500 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF
1 Form B (energize to break) General Purpose Switch No. 2 (20 Watts)	102M-1-B-5/2D 102M-1-B-12/2D	5 12	500 Ω 1500 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

## 102F (flatpack) Data and type numbers

Device	Tune Number	Coil	Coil	Max. contact	Insulation (mining)	resistance num)	Capacitance (typical) (see Note <sup>2</sup> below)		
type	Type Number	er (V) resistance resistance Switch (initial) to coil		Across switch	Closed switch to coil	Across open switch			
1 Form A (energize to make) General Purpose Switch No. 1 (10 Watts)	102F-1-A-3/1D 102F-1-A-5/1D 102F-1-A-12/1D	3 5 12	300 Ω 500 Ω 1000 Ω	0.10 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF	
1 Form A (energize to make) Low Level Switch No. 2 (20 Watts)	102F-1-A-5/2D 102F-1-A-12/2D	5 12	375 Ω 1000 Ω	0.10 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	0.1 pF	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

# Pin Configuration and Dimensional Data

Dimensions in Inches (Millimeters in brackets)

#### 102M Package





Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

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0.30

ISO9001 Manufacture of Reed Relays FM 29036

102F Package

0.53max (13.5)

0.5 (12.7)

0.2

Suggested PCB cut-out 0.55 (14) x 0.35 (8.9)

0.2 (5.06) dia switch

0.2

oil

# **Typical Performance Characteristics**





Isolation



3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

### Also available - Low capacitance reed relays

If your high frequency application does not require coaxial relays, Pickering also manufacture devices featuring very low levels of capacitance between the switch and coil, see our Series 103. These are especially useful for such applications as the switching of ranges and attenuators in computer controlled instrumentation. Contact our sales office for further details.

#### Order Code



### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

Please ask us for a FREE evaluation sample.

# **High Voltage**

# **Pickering Series 119**

# High Voltage Micro-SIL Single-in-Line SIL/SIP Reed Relays

Up to 3kV Stand-off

# Features

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Small size
- Internal mu-metal magnetic screen
- One or two switches in a single package
- 1 Form A or 2 Form A (energize to make) or 1 Form B (energize to break) configurations
- 3, 5 and 12 Volt coils are standard, with or without internal diode
- 100% tested for dynamic contact resistance
- Ideal for Cable Testers, Mixed signal testers or other applications where High Voltage capability is required.

The Pickering Series 119 is a new range of very small Single-in-Line Reed Relays intended for voltages very much higher than standard small SIL relays. The vacuumed, sputtered ruthenium reed switches have a superb low level performance also, which makes them an ideal choice where a wide range of signals are involved.

The range is based on the long established Series 109P style of plastic package with an internal mu-metal magnetic screen which allows high packing density and are made using Pickering's **SoftCenter**® construction.

Six versions are available, all with either 3, 5 or 12 volt operating coils. The 1 Form A, 1kV version has a package and pin configuration compatible with the standard 109P type, i.e. 4 pins on 0.15 inches (3.8mm) pitch. The other types have package lengths and pin configurations appropriate for their voltage ratings and the user will need to arrange suitable clearance distances around the parts.

Form A types can be mounted side by side, but a 1cm space should be left between the Form B type and other relays, as the magnetic field from the internal biasing magnet could slightly affect the sensitivity of the relay alongside.





# Switch Ratings - Dry switches

- 1 Form A (energize to make) Stand-off 1kV, switching up to 1kV. Stand-off 2kV, switching up to 1kV. Stand-off 3kV, switching up to 1kV.
- 1 Form B (energize to break) Stand-off 1kV, switching up to 1kV. Stand-off 2kV, switching up to 1kV.
- 2 Form A (energize to make) Stand-off 1kV, switching up to 1kV.

# Typical Pickering SoftCenter® Construction



# **High Voltage**

## Series 119 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts (see Note <sup>1</sup> )	Max. stand-off volts	Life expectancy ops typical (see Note <sup>2</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	10 W	0.7 A	1.25 A	1000	1000	10E8	0.5 ms	0.2 ms	High voltage
2	A or B	10 W	0.7 A	1.25 A	1000	2000	10E8	0.5 ms	0.2 ms	High voltage
3	А	10 W	0.7 A	1.25 A	1000	3000	10E8	0.5 ms	0.2 ms	High voltage

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V

#### Coil data and type numbers

Device	Tune Number	Coil	Coil	Max. contact	Insulation (minir	resistance num)	Capacitance (typical) (see Note <sup>3</sup> below)		
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch	
1 Form A (energize to make) Switch No. 1 (1kV)	119-1-A-3/1D 119-1-A-5/1D 119-1-A-12/1D	3 5 12	100 Ω 250 Ω 750 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF	
1 Form A (energize to make) Switch No. 2 (2kV)	119-1-A-3/2D 119-1-A-5/2D 119-1-A-12/2D	3 5 12	75 Ω 200 Ω 500 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF	
1 Form A (energize to make) Switch No. 3 (3kV)	119-1-A-3/3D 119-1-A-5/3D 119-1-A-12/3D	3 5 12	50 Ω 125 Ω 400 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.0 pF	0.1 pF	
2 Form A (energize to make) Switch No. 1 (1kV)	119-2-A-3/1D 119-2-A-5/1D 119-2-A-12/1D	3 5 12	50 Ω 100 Ω 400 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF	
1 Form B (energize to break) Switch No. 1 (1kV)	119-1-B-3/1D 119-1-B-5/1D 119-1-B-12/1D	3 5 12	50 Ω 100 Ω 400 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF	
1 Form B (energize to break) Switch No. 2 (2kV)	119-1-B-3/2D 119-1-B-5/2D 119-1-B-12/2D	3 5 12	50 Ω 100 Ω 400 Ω	0.17 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Environmental specification

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Switching Voltage

This high voltage rating is for RESISTIVE loads only. At these high voltages, even stray capacitance can generate very high current pulses, which can damage the contact plating causing welding of the reed switch. If there is capacitance in circuit, provision should be made to limit the surge, to within the current and power ratings of the relay.

#### Note<sup>2</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 107 ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>3</sup> Capacitance across open switch

This is measured with all other component leads connected to the guard terminal of the measuring bridge.

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

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Reed Relays FM 29036





Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics

Note4: A 1cm space should be left between Form B types and other relays, as the magnetic field from the internal biasing magnet could slightly affect the sensitivity of the relay alongside.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

119 \_ 1 \_ A \_ 5 / 1 D

email: sales@pickeringrelay.com

#### Order Code

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	 -	 v	• •	
Series				
Number of reeds				
Switch form		 J		
Coil voltage	 	 		
Switch number (See table adjacent)	 	 		
Diode if fitted (Omit if not required)	 	 		

Please ask us for a FREE evaluation sample.

pickeringrelay.com

# **High Voltage SIL/SIP Reed Relays**

# Up to 3 kilovolts Stand-off

Stacking on 0.25 inches pitch

# **Features**

- Small size
- Internal mu-metal magnetic screen
- One or two switches in a single package
- Form A (energise to make) or Form B (energise to break) configurations
- Dry and mercury wetted switches available
- 3, 12 and 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 104 is a range of Single-In-Line reed relays intended for voltages that are beyond the capabilities of conventional SIL reed relays.

They are ideal for such applications as transformer or cable testing or any other automatic test equipment where high voltages are involved.

Where mains voltages are switched, for example to control and isolate S.C.R. or triac gates, they are an ideal choice.

One or two Form A (energize to make) or one Form B (energize to break) configurations are available.

The range features an internal mu-metal screen to eliminate problems that would otherwise be experienced due to magnetic interaction when they are closely stacked.

Three types of dry switches are available, capable of standing-off 1, 1.5 or 3kV d.c. The 3kV version has an increased clearance between the switch and coil pins to accommodate the higher voltage. Even higher voltage ratings are available to special order, please contact our sales office for further information.

Mercury wetted devices are also available for applications where bounce free switching is required. These are rated at 1500 volts d.c. stand-off, 500 volts d.c. switching at up to 50 watts.





# Switch Ratings - Dry switches

- 1 or 2 Form A (energize to make) 1000 Volts d.c. stand-off 500 Volts d.c. switching at 10 Watts
- 1 or 2 Form A (energize to make) 1500 Volts d.c. stand-off 1000 Volts d.c. switching at 10 Watts
- 1 Form A (energize to make) 3000 Volts d.c. stand-off 1000 Volts d.c. switching at 25 Watts
- 1 Form B (energize to break) 1000 Volts d.c. stand-off 500 Volts d.c. switching at 10 Watts
- 1 Form B (energize to break) 1500 Volts d.c. stand-off 1000 Volts d.c. switching at 10 Watts

# Switch Ratings - Mercury switches

 1 or 2 Form A (energize to make) 1500 Volts d.c. stand-off 500 Volts d.c. switching at 50 Watts

# **High Voltage**

## Series 104 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max. stand-off volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time
1	A or B	10 W	0.50 A	1.0 A	500	1000	10E8	1.0 ms	0.3 ms
2	A or B	10 W	0.50 A	1.0 A	1000	1500	10E8	1.0 ms	0.3 ms
3	А	25 W	1.00 A	1.5 A	1000	3000	10E8	1.0 ms	0.3 ms

#### Coil data and type numbers

Device	Tune Number	Coil	Coil resistance	Max. contact resistance (initial)	Insulation (mining)	resistance num)	Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1 (1kV)	104-1-A-5/1D 104-1-A-12/1D 104-1-A-24/1D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Switch No. 2 (1.5kV)	104-1-A-5/2D 104-1-A-12/2D 104-1-A-24/2D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Switch No. 3 (3.0kV)	104-1-A-5/3D 104-1-A-12/3D 104-1-A-24/3D	5 12 24	220 Ω 500 Ω 3000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form B (energize to break) Switch No. 1 (1kV)	104-1-B-5/1D 104-1-B-12/1D 104-1-B-24/1D	5 12 24	750 Ω 2000 Ω 3000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form B (energize to break) Switch No. 2 (1.5kV)	104-1-B-5/2D 104-1-B-12/2D 104-1-B-24/2D	5 12 24	750 Ω 2000 Ω 3000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
2 Form A (energize to make) Switch No. 1 (1kV)	104-2-A-5/1D 104-2-A-12/1D 104-2-A-24/1D	5 12 24	250 Ω 750 Ω 2000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Switch No. 2 (1.5kV)	104-2-A-5/2D 104-2-A-12/2D 104-2-A-24/2D	5 12 24	250 Ω 750 Ω 2000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Mercury Reed: Series 104 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max. stand-off volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time
6	А	50 W	2.00 A	3.00 A	500	1500	10E8	1.5 ms	1.0 ms

### Mercury Relay: Coil data and type numbers

Device	Tune Number	Coil	Coil resistance	Max. contact resistance (initial)	Insulation (minit	resistance mum)	Capacitance (typical) (see Note <sup>2</sup> below)		
type	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch	
1 Form A (energize to make) Switch No. 6 (1.5kV)	104-1-A-5/6D 104-1-A-12/6D 104-1-A-24/6D	5 12 24	100 Ω 500 Ω 1500 Ω	0.12 Ω	10E12 Ω	10E11 Ω	3 pF	0.1 pF	
2 Form A (energize to make) Switch No. 6 (1.5KV)	104-2-A-5/6D 104-2-A-12/6D 104-2-A-24/6D	5 12 24	50 Ω 275 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

#### Mercury Relays

∎ 🖁 Mercury relays should be mounted vertically with pin 1 uppermost. Pin 1 is marked with a bar on the top face of the relay.

#### Internal Mu-metal Magnetic Screen

The Series 104 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking.

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ISO9001 Manufacture of Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

#### Order Code



#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

pickeringrelay.com

# **Pickering Series 67, 68**

# High Voltage Dry Reed Relays for up to 10kV

# **Features**

- SoftCenter<sup>®</sup> construction
- Option of PCB or flying lead switch connections
- Small size
- Up to 10 kV stand-off, 7.5 kV switching
- Long life
- Fully encapsulated

Series 67 - PCB connections to switch and coil

Series 68 - PCB connections to coil and flying leads to the switch which keeps the high voltage away from the PCB

The Series 67 and 68 ranges of high voltage reed relays have similar specifications to the established Series 60/65 and 62/63 but are constructed using a leadframe in a Single-in-Line format and feature former-less coils which enables a smaller package than is usual for this type of device.

The unusual package style allows some interesting stacking possibilities (see adjacent photo) when used to construct high density multiplexers or matrices. The parts feature an internal mu-metal magnetic screen.

They are available for up to 10kV stand-off, 7.5kV switching at 50 Watts maximum. The tungsten plated contacts ensure a long and reliable life.

5, 12, and 24 volt coils are available as standard. Other voltages can be supplied to special order as can variations in the lead length of the Series 68 type.





# **Switch Ratings**

- **1 Form A (energize to make)** Switch Number 1, 5kV stand-off. 3.5kV switching at up to 50 Watts
- 1 Form A (energize to make) Switch Number 2, 10kV stand-off. 7.5kV switching at up to 50 Watts



Our Series 67 relays mounted on a 3U PXI 12-Way High Voltage Multiplexer Module, illustrates interesting stacking possibilities.

# **High Voltage**

# Series 67, 68 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max stand-off voltage	Life expectancy ops typical (see Note <sup>2</sup> below)	Operate time inc bounce (max)	Release time
1	А	50 W	3 A	3 A	3500 (Note1)	5000	10E7	3 ms	2 ms
2	А	50 W	3 A	3 A	7500 (Note1)	10000	10E7	3 ms	2 ms

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

#### Series 67 Coil data and type numbers

Device type	Tune Number	Coil	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>3</sup> below)	
	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1	67-1-A-5/1D 67-1-A-12/1D 67-1-A-24/1D	5 12 24	40 Ω 150 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2	67-1-A-5/2D 67-1-A-12/2D 67-1-A-24/2D	5 12 24	40 Ω 150 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Series 68 Coil data and type numbers

Device type	Tune Number	Coil	Coil resistance	Max. contact resistance (initial)	Insulation (mining)	resistance num)	Capacitance (typical) (see Note <sup>3</sup> below)	
	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1	68-1-A-5/1D 68-1-A-12/1D 68-1-A-24/1D	5 12 24	40 Ω 150 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2	68-1-A-5/2D 68-1-A-12/2D	5 12 24	40 Ω 150 Ω 600 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G Shock: Maximum 50 G

#### Note<sup>1</sup> Switching Voltage

This high voltage rating is for RESISTIVE loads only. At these high voltages, circuit capacitance can generate very high current pulses which can damage the contact plating. If there is capacitance in circuit, provision should be made to limit the surge to within the current and power ratings of the relay. The product of open circuit switch voltage and instantaneous current at the point of switch-on should not exceed the 50 Watts power rating of the contact. Exceeding this level will reduce the operational life of the relay.

#### Note<sup>2</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 10 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>6</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>3</sup> Capacitance across open switch

This is measured with the coil connected to the guard terminal of the measuring bridge.

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Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)

Series 67



# Series 68



**Important:** Where the optional internal diode is fitted, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Order Code

Order Gode	67	- 1	-	A -	5	/ 2	D
Series							
Number of reeds							
Switch form							
Coil voltage							
Switch number (See table adjacent)							
Diode if fitted (Omit if not required)							

# Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

# Please ask us for a FREE evaluation sample.

pickeringrelay.com

# **Pickering Series 60, 65**

# High Voltage Dry Reed Relays for up to 15kV

# Features

- SoftCenter<sup>®</sup> construction
- Up to 15 kV stand-off
- Up to 12.5 kV switching
- Small size
- Easy mounting
- Long life
- Fully encapsulated

Series 60 - Chassis mounting with solder connections on the top face

# Series 65 - Printed circuit mounting

The Series 60 and 65 ranges of high voltage reed relays have been manufactured for many years and remain popular due to their small size and ease of use.

They are available for up to 15kV stand-off, 12.5kV switching at 50 Watts maximum. Tungsten plated contacts ensure a long and reliable life.

Both Form A (energize to make) and Form B (energize to break) configurations are available and it is usually possible to achieve a Form C (change-over) function by using a Form A and a Form B type together.

Form B types are magnetically biased and should not be mounted directly onto ferrous metal chassis or less than 1.5 inches (38mm) away from other relays as the coil operating voltage characteristics will be altered due to magnetic interaction. The coils of Form B relays are polarity sensitive, the positive connection is identified by a red spot.

Form A types can be mounted on ferrous chassis but a space of 1 inch (25mm) should be allowed between adjacent relays. 5, 12, and 24 volt coils are available as standard other voltages can be supplied to special order, please contact our sales office.

If similar relays with "push-on" connectors are preferred, please look at our Series 62 and Series 63.





Series 60





# **Switch Ratings**

- 1 Form A (energize to make) Switch Number 1 5kV stand-off. 3.5kV switching at up to 50 Watts
- 1 Form A (energize to make) Switch Number 2 10kV stand-off. 7.5kV switching at up to 50 Watts
- 1 Form A (energize to make) Switch Number 3 15kV stand-off. 12.5kV switching at up to 50 Watts
- 1 Form B (energize to break) Switch Number 1 5kV stand-off. 3.5kV switching at up to 50 Watts
- 1 Form B (energize to break) Switch Number 2 10kV stand-off. 7.5kV switching at up to 50 Watts

# **High Voltage**

#### Series 60, 65 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max. stand-off volts	Life expectancy ops typical (see Note <sup>2</sup> below)	Operate time inc bounce (max)	Release time
1	A or B	50 W	3 A (Note1)	3 A	3500	5000	10E7	3 ms	2 ms
2	A or B	50 W	3 A (Note1)	3 A	7500	10000	10E7	3 ms	2 ms
3	А	50 W	3 A (Note1)	3 A.	12500	15000	10E7	3 ms	2 ms

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

#### Series 60 Coil data and type numbers

Device	Type Number	Coil (V)	Coil	Max. contact resistance (initial)	Insulation (mining)	resistance num)	Capacitance (typical) (see Note <sup>3</sup> below)	
type			resistance		Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1 (5kV Stand-Off)	60-1-A-5/1 60-1-A-12/1 60-1-A-24/1	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2 (10kV Stand-Off)	60-1-A-5/2 60-1-A-12/2 60-1-A-24/2	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 3 (15kV Stand-Off)	60-1-A-5/3 60-1-A-12/3 60-1-A-24/3	5 12 24	20 Ω 50 Ω 200 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 1 (5kV Stand-Off)	60-1-B-5/1 60-1-B-12/1 60-1-B-24/1	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 2 (10kV Stand-Off)	60-1-B-5/2 60-1-B-12/2 60-1-B-24/2	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

#### Series 65 Coil data and type numbers

Device	Tura Number	Coil	Coil	Max. contact	Insulation (mining)	resistance num)	Capacitance (typical) (see Note <sup>3</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1 (5kV Stand-Off)	65-1-A-5/1 65-1-A-12/1 65-1-A-24/1	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2 (10kV Stand-Off)	65-1-A-5/2 65-1-A-12/2 65-1-A-24/2	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 1 (5kV Stand-Off)	65-1-B-5/1 65-1-B-12/1 65-1-B-24/1	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 2 (10kV Stand-Off)	65-1-B-5/2 65-1-B-12/2 65-1-B-24/2	5 12 24	35 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Important - Current Rating

This is the maximum current rating at 50 Watts. If, for example, you wish to switch 5000 volts, the maximum current will be 10mA. Multiply your instantaneous switching current by the voltage to be switched, to ensure that you do not exceed this 50 Watts rating. Capacitive inrush currents can sometimes be high due to the voltages involved, if possible insert a series resistance into the circuit to limit this. Contact our Technical Department for assistance if required.

#### Note<sup>2</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 10 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>6</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

Pickering Electronics Limited Stephenson Road Clacton-on-Sea CO15 4NL England email: sales@pickeringrelay.com Tel. (UK) 01255 428141 (International) +44 1255 428141 Fax. (UK) 01255 475058 (International) +44 1255 475058



Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)

### Series 60 Chassis mounting



### Series 65 PCB mounting



**Important:** For all Form B types, the correct coil polarity must be observed. The positive connection is shown by the red spot on the package.

#### 3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

# Order Code



### Other Pickering HV reed relays

If similar relays with push on connections are preferred, please look at our Series 62 and 63. If your requirement is for voltages up to 3kV, please look at our Series 104 Single-in-Line relays.

#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

pickeringrelay.com

· email: sales@pickeringrelay.com

# **Pickering Series 62, 63**

# High Voltage Dry Reed Relays for up to 15kV

# **Features**

- SoftCenter<sup>®</sup> construction
- Up to 15 kV stand-off
- Up to 12.5 kV switching
- Small size
- Easy mounting
- Long life
- Fully encapsulated
- Series 62 Chassis mounting with push-on connections on the top face
- Series 63 Printed circuit mounting with push-on high voltage connections on the top face

The Series 62 and 63 ranges of high voltage reed relays feature push-on terminals and are supplied complete with the appropriate connectors and insulating boots.

They are available for up to 15kV stand-off, 12.5kV switching at 50 Watts maximum. Tungsten plated contacts ensure a long and reliable life.

Both Form A (energize to make) and Form B (energize to break) configurations are available and it is usually possible to achieve a Form C (change-over) function by using a Form A and a Form B type together.

These relays feature an internal mu-metal magnetic screen which permits the Form A (energize to make) versions to be mounted side by side. Special versions can be manufactured with an electrostatic screen and/or earth connection to the magnetic screen. This can often be useful where EMC problems are encountered, please contact our technical sales office.

Form B types are magnetically biased and should not be mounted directly onto ferrous metal chassis or less than 1 inch (25mm) away from other relays as the coil operating voltage characteristics will be altered due to magnetic interaction. The coils of Form B relays are polarity sensitive, the positive connection is identified by a red spot.

5, 12, and 24 volt coils are available as standard other voltages can be supplied to special order.





Series 63



# Switch Ratings

- 1 Form A (energize to make) Switch Number 1, 5kV stand-off. 3.5kV switching at up to 50 Watts
- 1 Form A (energize to make) Switch Number 2, 10kV stand-off. 7.5kV switching at up to 50 Watts
- 1 Form A (energize to make) Switch Number 3, 15kV stand-off. 12.5kV switching at up to 50 Watts
- 1 Form B (energize to break) Switch Number 1, 5kV stand-off. 3.5kV switching at up to 50 Watts
- 1 Form B (energize to break) Switch Number 2, 10kV stand-off. 7.5kV switching at up to 50 Watts



# **High Voltage**

#### Series 62, 63 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max. stand-off volts	Life expectancy ops typical (see Note <sup>2</sup> below)	Operate time inc bounce (max)	Release time
1	A or B	50 W	3 A (Note1)	3 A	3500	5000	10E7	3 ms	2 ms
2	A or B	50 W	3 A (Note1)	3 A	7500	10000	10E7	3 ms	2 ms
3	А	50 W	3 A (Note1)	3 A.	12500	15000	10E7	3 ms	2 ms

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	24 V

#### Series 62 Coil data and type numbers

Device	Type Number	Coil (V)	Coil	Max. contact	Insulation (mining)	resistance mum)	Capacitance (typical) (see Note <sup>3</sup> below)	
type			resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1 (5kV Stand-Off)	62-1-A-5/1 62-1-A-12/1 62-1-A-24/1	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2 (10kV Stand-Off)	62-1-A-5/2 62-1-A-12/2 62-1-A-24/2	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 1 (5kV Stand-Off)	62-1-B-5/1 62-1-B-12/1 62-1-B-24/1	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 2 (10kV Stand-Off)	62-1-B-5/2 62-1-B-12/2 62-1-B-24/2	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

#### Series 63 Coil data and type numbers

Device	Tune Number	Coil (V)	Coil	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>3</sup> below)	
type	Type Number		resistance		Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1 (5kV Stand-Off)	63-1-A-5/1 63-1-A-12/1 63-1-A-24/1	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 2 (10kV Stand-Off)	63-1-A-5/2 63-1-A-12/2 63-1-A-24/2	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form A (energize to make) Switch No. 3 (15kV Stand-Off)	63-1-A-5/3 63-1-A-12/3 63-1-A-24/3	5 12 24	25 Ω 75 Ω 350 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 1 (5kV Stand-Off)	63-1-B-5/1 63-1-B-12/1 63-1-B-24/1	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF
1 Form B (energize to break) Switch No. 2 (10kV Stand-Off)	63-1-B-5/2 63-1-B-12/2 63-1-B-24/2	5 12 24	50 Ω 150 Ω 500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3 pF	0.15 pF

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Important - Current Rating

This is the maximum current rating at 50 Watts. If, for example, you wish to switch 5000 volts, the maximum current will be 10mA. Multiply your instantaneous switching current by the voltage to be switched, to ensure that you do not exceed this 50 Watts rating. Capacitive inrush currents can sometimes be high due to the voltages involved, if possible insert a series resistance into the circuit to limit this. Contact our Technical Department for assistance if required.

#### Note<sup>2</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 10 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>6</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

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Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)

#### Series 62 Chassis mounting



### Series 63 PCB mounting

Sw. No.1 - 5kV Sw. No.2 - 10kV



**Important:** For all Form B types, the correct coil polarity must be observed. The positive connection is shown by the red spot on the package.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

60 4

A E / 0

#### Order Code

	02 - 1	- A-	57	~
			1	
Series				
Number of reeds				
Switch form				
Coil voltage				
Switch number (See table adia	cent)			

#### Other Pickering HV reed relays

If similar relays with PCB pins for both switch and coil connections are preferred, please look at our Series 65. If your requirement is for voltages up to 3kV, please look at our Series 104 Single-in-Line relays.

#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

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email: sales@pickeringrelay.com

# **Surface Mount Reed Relays**

Including coaxial types for up to 5GHz

# **Features**

- SoftCenter® construction
- Highest quality instrumentation grade switches
- Encapsulated in plastic package with internal mu-metal screen for side-by-side mounting without magnetic interaction
- Insulation resistance greater than 10<sup>12</sup> ohms for Form A devices
- Dry and mercury wetted switches available
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A and 1 Form C
- For R.F. or high speed digital applications, 50 or 75 ohms coaxial devices are available in the same small package
- 3, 5, and 12 volt coils are standard, with or without internal diode
- 100% tested for dynamic contact resistance

The Series 200 is a complete range of surface mount reed relays. Both dry and mercury wetted switches are available in a wide range of configurations including coaxial types for RF up to 5GHz, or high speed digital switching with a step response time of less than 30ps. Please contact our technical department for supplementary RF data.

The special high temperature plastic package will withstand the temperatures associated with Infra-red or vapor phase reflow soldering processes. A flexible inner encapsulant protects the sensitive glass/metal reed switch seals - this is a very big advantage over the more usual hard moulded package.

# Switch Ratings - Dry switches

- 1 Form A (energize to make), 10 watts at 200V
- 1 Form A (energize to make), 15 watts at 200V
- 1 Form A (energize to make), 10 watts at 500V
- Coaxial 50Ω (energize to make), 10 watts at 200V
- Coaxial 75Ω (energize to make), 10 watts at 200V
- 1 Form B (energize to break), 10 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 watts at 200V



# Switch Ratings - Mercury Wetted Switches

- 1 Form A (energize to make), 50 watts at 500V
- 1 Form A (Position insensitive), 50 watts at 500V

# **Surface Mount**

#### Dry Reed - Series 200 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	15 W	1.0 A	1.2 A	200	10E9	0.5 ms	0.2 ms	General purpose
2	A or B	10 W	0.5 A	1.2 A	200	10E9	0.5 ms	0.2 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	0.5 ms	Change-over
4	А	10 W	0.5 A	1.2 A	500	10E8	0.5 ms	0.2 ms	High voltage

#### Dry Relay - Coil data and type numbers

D. I.	Durlau		0.1	0.1	Max.	Insulation (mining)	resistance mum)	Capacitance (typical) (see Note <sup>2</sup> below)	
type	Number	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1	1	200-1-A-5/1D 200-1-A-12/1D	5 12	500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Switch No. 2	1	200-1-A-3/2D 200-1-A-5/2D 200-1-A-12/2D	3 5 12	250 Ω 500 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A 50 Ω coaxial Switch No. 2	2	200RF50-1-A-5/2D	5	250 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A 75 Ω coaxial Switch No. 2	2	200RF75-1-A-5/2D	5	250 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) HV Switch No. 4	5	200-1-A-5/4D 200-1-A-12/4D	5 12	500 Ω 1000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	6	200-1-C-5/3D 200-1-C-12/3D	5 12	500 Ω 1000 Ω	0.20 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) Switch No. 2	4	200-1-B-5/2D 200-1-B-12/2D	5 12	750 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
2 Form A (energize to make) Switch No. 2	3	200-2-A-5/2D 200-2-A-12/2D	5 12	400 Ω 1000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Mercury Reed: Series 200 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	A	50 W	2 A	3 A	500	10E8	2.0 ms	1.25 ms	Standard Mercury
8	А	50 W	2 A	3 A	500	10E8	2.0 ms	1.25 ms	Position insensitive

### Mercury Relay: Coil data and type numbers

Device	Tune Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	200-1-A-5/6D 200-1-A-12/6D	5 12	140 Ω 500 Ω	0.075 Ω	10E12 Ω	10E10 Ω	4 pF	0.1 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	200-1-A-5/8D 200-1-A-12/8D	5 12	140 Ω 500 Ω	0.100 Ω	10E12 Ω	10E10 Ω	4 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

This is measured with all other component leads connected to the guard terminal of the measuring bridge.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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ISO9001 Manufacture of Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



Note<sup>3</sup>: When an optional diode is fitted the orientation spot end of the relay forms the positive connection.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### **Mercury Relays**

With the exception of the position insensitive type, mercury relays should be mounted vertically in the direction of the arrow.

#### **Order Code**



### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

### Please ask us for a FREE evaluation sample.



# **High Power**

# Pickering Series 114 High Power Dry SIL/SIP Reed Relays

# 40 Watts switching

# **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Small size
- Internal mu-metal magnetic screen
- One or two switches in a single package
- Form A (energise to make) or Form B (energise to break) configurations
- 3, 5, 12 and 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 114 is a range of Single-In-Line reed relays intended for power levels that are beyond the capabilities of conventional dry SIL reed relays.

The more usual dry relays are rated at 0.5 amps at 10 Watts. The Series 114 have a rating of 1 amp switching at up to 40 watts and will carry 2 amps. In many cases, this higher rating will allow them to be used as an alternative to mercury wetted reed relays.

Unusually for high power relays, they feature sputtered ruthenium contacts instead of the more common electroplated rhodium or tungsten types. This makes them suitable for low level or "dry" switching also.

They are able to switch a.c. mains voltages so are suitable for interfacing to larger electromechanical relays or contactors. It is important however, to suppress back EMFs from inductive loads. This is achievable by using an RC snubber, varistor or similar voltage limiting device.

1 or 2 Form A (energize to make) or 1 Form B (energize to break) configurations are available.

The range features an internal mu-metal screen to minimize problems that would otherwise be experienced due to magnetic interaction when they are closely stacked.

Form A versions may be stacked side-by-side.

Due to the fact that the Form B types feature an internal biasing magnet, a gap of 0.4 inches minimum should be left between adjacent relays.





# Switch Ratings - Dry switches

- 1 Form A (Energize to Make) relays.
  200 Volts dc or 240 Volts ac rms switching at up to 40 Watts. 500 Volts dc or ac peak stand-off.
- 2 Form A (Energize to Make) relays.
  200 Volts dc or 240 Volts ac rms switching at up to 40 Watts. 500 Volts dc or ac peak stand-off
- 1 Form C (Energise to Break) relays.
  200 Volts dc or 240 Volts ac rms switching at up to 40 Watts. 500 Volts dc or ac peak stand-off

# Typical Pickering SoftCenter<sup>®</sup> Construction



pickering

# **High Power**

#### Series 114 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Max. stand-off volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	40 W	1.0 A	2.0 A	200 V DC 240 V AC RMS	500	10E8	1.0 ms	0.5 ms	General purpose

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

#### Coil data and type numbers

Device type	Type Number	Coil (V)	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
			resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	114-1-A-3/1D 114-1-A-5/1D 114-1-A-12/1D 114-1-A-24/1D	3 5 12 24	75 Ω 250 Ω 750 Ω 2000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.0 pF	0.1 pF
2 Form A (energize to make) General Purpose Switch No. 1	114-2-A-5/1D 114-2-A-12/1D 114-2-A-24/1D	5 12 24	150 Ω 350 Ω 1000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	114-1-B-5/1D 114-1-B-12/1D 114-1-B-24/1D	5 12 24	350 Ω 1000 Ω 2200 Ω	0.20 Ω	10E12 Ω	10E12 Ω	2.0 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 100 x 10<sup>6</sup> ops. At the maximum load (resistive), typical life is 10 x 10<sup>6</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

#### Internal Mu-metal Magnetic Screen

The Series 114 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.25 inches pitch for Form A devices.

#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

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Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



0.125 (3.175) 0.02 (0.51)

(Energize to make)



P



Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

Note4: Due to the presence of an internal biasing magnet, Form B relays have a higher level of magnetic interaction than Form A types. A space of 0.4 inches minimum should therefore be left between adjacent parts.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

Order Code	114 - 1 - A - 5 / 1 D
Series —	
Number of reeds	
Switch form	
Coil voltage	
Switch number (Only Type 1 ava	ilable)
Diode if fitted (Omit if not require	ed)

Please ask us for a FREE evaluation sample.

# High Coil Resistance Single-in-Line SIL/SIP Reed Relays

Up to 15 Watts switching - Very high packing density

# Features

- SoftCenter<sup>®</sup> construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Sputtered ruthenium switches rated at 10 Watts, 0.5 A or 15 Watts, 1.0 A
- Plastic package with internal mu-metal magnetic screen
- They take up the minimum of board area, conserving board space
- Insulation resistance greater than 10<sup>12</sup> Ω
- 3 or 5 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 118 is a range of very sensitive reed relays that are ideal for portable electronic instruments or other applications where low power consumption and a very small footprint is important. They have 5 volt coils with a resistance up to 2200  $\Omega$  and the option of an internal diode.

Two switch types are available. Switch type number 1 is better suited for general purpose applications. Switch type 2 is better suited to low level or 'cold' switching.

Both types feature high quality, instrumentation grade switch contacts and require a board area of only  $0.2 \times 0.33$  inches (5.1 x 8.4 mm).

These relays feature internal mu-metal magnetic screens. Mu-metal has the advantage of a high permeability and low magnetic remanence and eliminates problems that would otherwise occur due to magnetic interaction. Relays of this size without magnetic screening would be totally unsuitable for applications where dense packing is required.

Initially, single pole versions only are available in this range but double pole versions will follow in the future.





# Typical Pickering SoftCenter® Construction



# Low Power/Low Thermal EMF

# Series 118 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	А	15 W	1.0 A	1.2 A	200	10E9	0.6 ms	0.35 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	0.6 ms	0.35 ms	Low level

#### Operating voltages

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
3 V	2.25 V	0.3 V
5 V	3 75 V	0.5 V

#### Coil data and type numbers

Device	Tune Number	Coil	Coil resistance	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2,3</sup> below)	
type	Type Number	(V)		resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 1	118-1-A-5/1D	5	1500 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3.0 pF	0.14 pF
1 Form A (energize to make) Switch No. 2	118-1-A-3/2D 118-1-A-5/2D	3 5	1000 Ω 2200 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3.0 pF	0.14 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Environmental specification

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Switch to coil capacitance

Due to the asymmetrical internal construction of the relay, the capacitance to the coil from one switch connection is approximately half the capacitance of the other switch connection, pin 3 is lower. In some applications this feature may be used to advantage for example, in a multiplexer where it is desirable to minimize the capacitance of the common connection to maximize bandwidth.

#### Note<sup>3</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

# Pin Configuration and Dimensional Data







Note4: When an optional diode is fitted pin 1 is the positive connection.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Internal Mu-metal Magnetic Screen

The Series 118 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.2 inches pitch.

Order Code



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

## Please ask us for a FREE evaluation sample.

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Reed Relays FM 29036

# Pickering Series 101 CMOS Drive SIL/SIP Reed Relays

# Direct drive from 74HC or HCT

Stacking on 0.3 inches pitch

# **Features**

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Board space may be saved by eliminating the need for drivers
- Direct drive from 74HC logic
- Encapsulated in plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A, 1 Form C
- Two pole relay requires the same board area as the single pole type
- Dry and mercury wetted switches are available with the same pin configuration and footprint
- Insulation resistance greater than 10<sup>12</sup> Ω for dry Form A devices
- 3, 5 12 or 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Series 101 have very high coil resistances. 5 Volt dry versions may be driven directly from 74HC or 74HCT logic without the need for additional drivers.

74HC logic will drive up to 4mA at 5 Volts, therefore a coil resistance of 1600 ohms is desirable to avoid running the IC at its maximum rating; 1600 ohms is the coil resistance of the single pole dry Series 101. They may be stacked on 0.3 inches pitch (7.6mm) and as they have an internal mu-metal magnetic screen, there is no risk of magnetic interaction problems.

Both dry and mercury wetted switches are available in a range of configurations and coil voltages. The switches in the 2 Form A version are vertically stacked so the relay requires the same board area as the 1 Form A type.

A special 1 Form A, 5 Volt version is available with an even higher coil resistance of 3000 ohms. This is particularly suited to applications such as battery powered portable equipment as it requires a coil current of only 1.7 mA. This part, the 101-1-A-5/17 or 17D has the advantage of a lower level of thermal EMF of 3 microvolts or less.

Other special parts are also available that may be operated from 3 Volt logic.





# Switch Ratings - Dry switches

- Single or Double pole Form A (Energize to Make) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form B (Energize to Break) relays. Up to 1 Amp switching at 20 Watts
- Single pole Form C (Change-over) relays. 0.25 Amps switching at 3 Watts

# **Switch Ratings - Mercury Wetted Switches**

- Single or Double pole Form A (Energize to Make) relays. 2 Amp switching at 50 Watts
- Single pole, Non Position Sensitive, Form A (Energize to Make) relays. 2 Amp switching at 50 Watts

# Typical Pickering SoftCenter® Construction



# Low Power/Low Thermal EMF

#### Series 101 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	15 W (5 V Versions) 20 W (12 & 24 V)	1.0 A	1.2 A	200	10E9	1.0 ms	0.75 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	1.0 ms	0.75 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.25 ms	1.0 ms	Change over
4	А	10 W	0.5 A	1.2 A	400	10E8	1.0 ms	0.75 ms	500V stand-of

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Coil data and type numbers

Device		Coil	Coil	Max. contact	Insulation (mining)	resistance num)	Capacitanc (see Note	e (typical) <sup>2</sup> below)
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	101-1-A-5/1D 101-1-A-12/1D 101-1-A-24/1D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	101-1-A-3/2D 101-1-A-5/2D 101-1-A-12/2D 101-1-A-24/2D	3 5 12 24	1600 Ω 1600 Ω 6000 Ω 6000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) High Voltage Switch No. 4	101-1-A-5/4D 101-1-A-12/4D 101-1-A-24/4D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	101-1-C-5/3D 101-1-C-12/3D 101-1-C-24/3D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	101-1-B-5/1D 101-1-B-12/1D 101-1-B-24/1D	5 12 24	3000 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
2 Form A (energize to make) General Purpose Switch No. 1	101-2-A-5/1D 101-2-A-12/1D 101-2-A-24/1D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Low Level Switch No. 2	101-2-A-5/2D 101-2-A-12/2D 101-2-A-24/2D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form A (energize to make) Special Extra Sensitive Version Low Level Switch No. 2	101-1-A-5/17D	5	3000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Mercury Reed: Series 101 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	А	50 W	2 A	3 A	500	10E8	1.75 ms	1.75 ms	Standard Mercury
8	А	50 W	2 A	3 A	500	10E8	1.75 ms	1.75 ms	Position Insensitive

#### Mercury Relay: Coil data and type numbers

Device	Ture Number	Coil	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)			Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	101-1-A-5/6D 101-1-A-12/6D 101-1-A-24/6D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.075 Ω	10E12 Ω	10E11 Ω	4.5 pF	0.08 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	101-1-A-5/8D 101-1-A-12/8D 101-1-A-24/8D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	4.5 pF	0.08 pF
2 Form A (energize to make) Switch No. 6	101-2-A-5/6D 101-2-A-12/6D 101-2-A-24/6D	5 12 24	150 Ω 650 Ω 2000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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ISO9001 Manufacture of Reed Relays FM 29036

Pin Configuration and Dimensional Data

Dimensions in Inches (Millimeters in brackets)



1 Form B (Energize to break)



2 Form A (Energize to make)



Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Mercury Relays

10 (2.54) 0.10 (2.54)

∎₽

With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### Internal Mu-metal Magnetic Screen

The Series 101 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.3 inches pitch.

101 - 1 - A - 5 / 2 D

#### Order Code

	1	1	1	
Series				
Number of reeds				
Switch form			]	
Coil voltage				
Switch number (See table adjacent)				
Diode if fitted (Omit if not required)				

#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.



# Low Thermal EMF SIL/SIP Reed Relays

**Direct drive from CMOS** 

# Features

- SoftCenter® construction (see adjacent diagram)
- Highest quality instrumentation grade switches
- Thermal EMF about 1 microvolt or less
- Low power consumption, ideal for portable equipment
- Encapsulated in a plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A, 1 Form C
- Two pole relay requires the same board area as the single pole type
- Dry and mercury wetted switches are available with the same pin configuration and footprint
- Insulation resistance greater than 10<sup>12</sup> Ω for dry Form A devices
- 3, 5, 12 or 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 100 is a complete range of Single-in- Line (SIL) reed relays primarily intended for direct drive from 4000B CMOS or NMOS logic or similar low current sources. The mercury wetted relays in the range may be driven directly from TTL logic.

They are also useful for applications where conservation of current is important, for example, battery powered equipment.

The extremely low level of thermal EMF, about 1 microvolt or less, of the dry versions make them ideally suited to applications such as data acquisition or thermocouple switching.

An internal mu-metal magnetic screen is fitted to avoid the effects of magnetic interaction between relays.

If you do not require quite such high coil resistances or if a slightly smaller device is desired, please look also at our Series 101 which may be driven directly by 74HC or 74HCT logic.

Other special parts are also available that may be operated from 3 Volt logic, please contact our Sales Office for further information.





# Switch Ratings - Dry switches

- 1 Form A (energize to make), 10 watts at 200V
- 1 Form A (energize to make), 10 watts at 500V
- 1 Form B (energize to break), 10 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 watts at 200V

Switch Ratings - Mercury Wetted Switches

- 1 Form A (energize to make), 50 watts at 500V
  - 1 Form A (Position insensitive), 50 watts at 500V
- 2 Form A (energize to make), 50 watts at 500V

# Typical Pickering SoftCenter® Construction

TYPICAL PICKERING CONSTRUCTION -No mu-metal magnetic screen High magnetic Encapsulation Soft inner encapsulation interaction Shell material Very hard with adjacent relays Interna to protect mu-meta moulding materia magnetic screen reed switch Bobbinles Reed switch self supporting coil to maximise magnetic drive Coil winding Coil supporting bobbin, encapsulatior material wastes space and reduces magnetic drive



# Low Power/Low Thermal EMF

#### Series 100 switch ratings - The contact ratings for each switch type are shown below:

			-						
Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	10 W	0.5 A	1.2 A	200	10E9	1.0 ms	1.0 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E9	1.0 ms	1.0 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.0 ms	1.0 ms	Change over
4	А	10 W	0.5 A	1.2 A	500	10E8	1.75 ms	1.75 ms	1000V stand-off

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Coil data and type numbers

Device	Tune Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Humber	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	100-1-A-5/1D 100-1-A-12/1D 100-1-A-24/1D	5 12 24	3300 Ω 6800 Ω 6800 Ω	0.15 Ω	10E12 Ω	10E12 Ω	3.5 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	100-1-A-3/2D 100-1-A-5/2D 100-1-A-12/2D 100-1-A-24/2D	3 5 12 24	2000 Ω 3300 Ω 6800 Ω 6800 Ω	0.12 Ω	10E12 Ω	10E12 Ω	3.5 pF	0.1 pF
1 Form A (energize to make) High Voltage Switch No. 4	100-1-A-5/4D 100-1-A-12/4D 100-1-A-24/4D	5 12 24	2200 Ω 6800 Ω 6800 Ω	0.15 Ω	10E12 Ω	10E12 Ω	3.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	100-1-C-5/3D 100-1-C-12/3D 100-1-C-24/3D	5 12 24	3300 Ω 6800 Ω 6800 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	100-1-B-5/1D 100-1-B-12/1D 100-1-B-24/1D	5 12 24	2700 Ω 6000 Ω 6000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) General Purpose Switch No. 1	100-2-A-5/1D 100-2-A-12/1D 100-2-A-24/1D	5 12 24	2700 Ω 6000 Ω 6000 Ω	0.20 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Low Level Switch No. 2	100-2-A-5/2D 100-2-A-12/2D 100-2-A-24/2D	5 12 24	2700 Ω 6000 Ω 6000 Ω	0.18 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

## Mercury Reed: Series 100 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	А	50 W	2 A	3 A	500	10E8	2.0 ms	2.0 ms	Standard Mercury
8	A	50 W	2 A	3 A	500	10E8	2.0 ms	2.0 ms	Position Insensitive

#### Mercury Relay: Coil data and type numbers

Device type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	100-1-A-5/6D 100-1-A-12/6D 100-1-A-24/6D	5 12 24	500 Ω 2000 Ω 3300 Ω	0.100 Ω	10E12 Ω	10E11 Ω	5 pF	0.3 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	100-1-A-5/8D 100-1-A-12/8D 100-1-A-24/8D	5 12 24	370 Ω 1000 Ω 3300 Ω	0.120 Ω	10E12 Ω	10E11 Ω	5 pF	0.3 pF
2 Form A (energize to make) Switch No. 6	100-2-A-5/6D 100-2-A-12/6D 100-2-A-24/6D	5 12 24	370 Ω 1000 Ω 3300 Ω	0.150 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>9</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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ISO9001 Manufacture of Reed Relays FM 29036

#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site

#### Mercury Relays

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With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### Internal Mu-metal Magnetic Screen

The Series 100 relays are fitted with an internal mu-metal magnetic screen which permits side-by-side stacking on 0.4 inches pitch.

#### **Order Code**



### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

Please ask us for a FREE evaluation sample.

# **CMOS Drive DIL/DIP Reed Relays**

Direct drive from 74HC or HCT

# **Features**

- SoftCenter<sup>®</sup> construction
- Pin compatible with standard DIL relays
- Board space may be saved by eliminating drivers
- Encapsulated in a plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A, 1 Form C
- Dry and mercury wetted switches are available with the same pin configuration and footprint (see "A useful tip" below)
- 5, 12 and 24 Volt coils with or without internal diode
- 100% tested for dynamic contact resistance for guaranteed performance

The Pickering Series 98 is a range of Dual-In-Line relays, electrically equivalent to the Series 101 CMOS drive, Single-In-Line types, but pin compatible with standard DIL relays. The range features very high coil resistances, the 5 volt dry devices may be driven directly from 74HC or 74HCT logic without the need for additional drivers. Naturally, high resistance 12 and 24 volt coils are also available in this series.

74HC logic will drive up to 4mA at 5 volts which means that a nominal coil resistance of 1600 ohms is required to avoid running the IC at its maximum rating; 1600 ohms is the coil resistance of the single pole dry Series 98. A special model with an even higher coil resistance of 3000 ohms is also available, our type number 98-1-A-5/17D (the D suffix indicates an internal diode).

It is often possible to replace TTL ICs with their equivalent CMOS ones and replace standard DIL relays with Pickering Series 98, to obtain the benefits of CMOS without any circuit or PCB redesign.

The range like its SIL equivalent has an internal mu-metal screen to enable high packing density with negligible interaction between adjacent devices.

# A useful tip

pickering

If there is a chance that you might want to use mercury wetted relays instead of dry relays at a later date, for example to increase switch ratings, lay out the PCB initially as though for the mercury wetted type with pins 1 and 14 uppermost. This allows uprating later without PCB changes. The mercury versions in the Series 98 have identical pin configurations to the dry types.





# Switch Ratings - Dry switches

- 1 Form A (energize to make), 10 or 15 watts at 200V
- 1 Form A (energize to make), 10 watts at 300V
- 1 Form B (energize to break), 15 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 or 15 watts at 200V

# **Switch Ratings - Mercury Wetted switches**

- 1 Form A (energize to make), 50 watts at 500V
- 1 Form A (Position insensitive), 50 watts at 500V
- 2 Form A (energize to make), 50 watts at 500V

# **Plastic Package DIL**

#### Dry Reed - Series 98 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time inc bounce (max)	Release time	Special features
1	A or B	15 W	1.0 A	1.2 A	200	10E8	1.0 ms	0.75 ms	General purpose
2	А	10 W	0.5 A	1.2 A	200	10E8	1.0 ms	0.75 ms	Low level
3	С	3 W	0.25 A	1.2 A	200	10E7	1.25 ms	1.0 ms	Change over
4	А	10 W	0.5 A	1.2 A	300	10E8	1.0 ms	0.75 ms	500V stand-off

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### Dry Relay - Coil data and type numbers

Device	Tuno Number	Coil	Coil	Max. contact	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
type	Type Number	(V)	resistance	resistance (initial)	Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) General Purpose Switch No. 1	98-1-A-5/1D 98-1-A-12/1D 98-1-A-24/1D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) Low Level Switch No. 2	98-1-A-5/2D 98-1-A-12/2D 98-1-A-24/2D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form A (energize to make) High Voltage Switch No. 4	98-1-A-5/4D 98-1-A-12/4D 98-1-A-24/4D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
1 Form C (change-over) Switch No. 3	98-1-C-5/3D 98-1-C-12/3D 98-1-C-24/3D	5 12 24	1600 Ω 6000 Ω 6000 Ω	0.20 Ω	10E12 Ω	10E10 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form B (energize to break) General Purpose Switch No. 1	98-1-B-5/1D 98-1-B-12/1D 98-1-B-24/1D	5 12 24	3000 Ω 6000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF
2 Form A (energize to make) General Purpose Switch No. 1	98-2-A-5/1D 98-2-A-12/1D 98-2-A-24/1D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.17 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
2 Form A (energize to make) Low Level Switch No. 2	98-2-A-5/2D 98-2-A-12/2D 98-2-A-24/2D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.15 Ω	10E12 Ω	10E12 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>
1 Form A (energize to make) Special Extra Sensitive Version Low Level Switch No. 2	98-1-A-5/17D	5	3000 Ω	0.12 Ω	10E12 Ω	10E12 Ω	2.5 pF	0.1 pF

When an internal diode is required, the suffix D is added to the part number as shown in the table.

Mercury Reed: Series 98 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Operate time (max)	Release time	Special features
6	А	50 W	2 A	3 A	500	10E8	1.75 ms	1.75 ms	Standard Mercury
8	А	50 W	2 A	3 A	500	10E8	1.75 ms	1.75 ms	Position Insensitive

### Mercury Relay: Coil data and type numbers

Device type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)	Insulation resistance (minimum)		Capacitance (typical) (see Note <sup>2</sup> below)	
					Switch to coil	Across switch	Closed switch to coil	Across open switch
1 Form A (energize to make) Switch No. 6	98-1-A-5/6D 98-1-A-12/6D 98-1-A-24/6D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.075 Ω	10E12 Ω	10E11 Ω	4.5 pF	0.08 pF
1 Form A (energize to make) Position Insensitive Switch No. 8	98-1-A-5/8D 98-1-A-12/8D 98-1-A-24/8D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	4.5 pF	0.08 pF
2 Form A (energize to make) Switch No. 6	98-2-A-5/6D 98-2-A-12/6D 98-2-A-24/6D	5 12 24	150 Ω 650 Ω 2000 Ω	0.100 Ω	10E12 Ω	10E11 Ω	See Note <sup>3</sup>	See Note <sup>3</sup>

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1 Ω, switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

#### Note<sup>2</sup> Capacitance across open switch

The capacitance across the open switch was measured with other connections guarded.

#### Note<sup>3</sup> Capacitance values

The value will depend upon on the mode of connection/guarding of unused terminals. Please contact technical sales for details.

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#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)





Schematics are shown from UNDERNEATH the relay.



(Energize to break)

Important: Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### Mercury Relays

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(Changeover)

With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### Order Code



Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

### Please ask us for a FREE evaluation sample.

# **Dual-in-Line DIL/DIP Reed Relays**

Up to 10 Watts switching for dry reed

# **Features**

- Encapsulated in a plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations 1 Form A, 1 Form B, 2 Form A, 1 Form C
- Dry and mercury wetted switches are available with the same pin configuration and footprint (see "A useful tip" below)
- 5, 12 and 24 Volt coils with or without internal diode

The Series 97 is a range of reed relays with pins in the popular Dual-in-Line format.

Being encapsulated in a plastic package using a very high resistivity epoxy resin gives the device several advantages over the more usual moulded construction. The reed switches are not subjected to the high temperatures and pressures of the transfer moulding process with the inherent risk of damage to the sensitive glass to metal seals. The construction incorporates a mu-metal wrap around the operating coil to eliminate magnetic interaction problems. Higher drive levels are achieved, allowing a full range of switching configurations including 1 or 2 Form A (energize to make), Form C (change-over) and Form B (energize to break) in both dry and mercury wetted types.

If higher coil resistance levels are required, please look at our Series 98 DIL relays which may be driven directly from 74HC or 74HCT CMOS logic.

# A useful tip

If there is a chance that you might want to use mercury wetted relays instead of dry relays at a later date, for example to increase switch ratings, lay out the PCB initially as though for the mercury wetted type with pins 1 and 14 uppermost. This allows uprating later without PCB changes. The mercury versions in the Series 97 have identical pin configurations to the dry types.





## Switch Ratings - Dry switches

- 1 Form A (energize to make), 10 watts at 200V
- 1 Form A (energize to make), 10 watts at 300V
- 1 Form B (energize to break), 10 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 watts at 200V

### Switch Ratings - Mercury Wetted switches

• 1 Form A (energize to make), 50 watts at 500V

# **Plastic Package DIL**

#### Dry Reed - Series 97 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special features
1	A or B	10 W	0.5 A	1.2 A	200	10E8	General purpose
3	С	3 W	0.25 A	1.2 A	200	10E7	Change over
4	А	10 W	0.5 A	1.2 A	300	10E8	500V stand-off

Switch no.2 is particularly good for switching low currents and/or voltages. It is the ideal switch for A.T.E. systems where cold switching techniques are often used. Where higher power levels are involved, switch no.1 is more suitable.

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

# Dry Relay - Coil data and type numbers

Device type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A (energize to make)	97-1-A-5/1D	5	500 Ω	0.15 Ω
General Purpose	97-1-A-12/1D	12	1000 Ω	
Switch No. 1	97-1-A-24/1D	24	3000 Ω	
1 Form A (energize to make) High Voltage Switch No. 4	97-1-A-5/4D 97-1-A-12/4D 97-1-A-24/4D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω
1 Form C (change-over) Switch No. 3	97-1-C-5/3D 97-1-C-12/3D 97-1-C-24/3D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.20 Ω
1 Form B (energize to break)	97-1-B-5/1D	5	1000 Ω	0.15 Ω
General Purpose	97-1-B-12/1D	12	3000 Ω	
Switch No. 1	97-1-B-24/1D	24	3000 Ω	
2 Form A (energize to make)	97-2-A-5/1D	5	500 Ω	0.17 Ω
General Purpose	97-2-A-12/1D	12	1000 Ω	
Switch No. 1	97-2-A-24/1D	24	3000 Ω	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Mercury Reed: Series 97 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special features
6	A	50 W	2 A	3 A	500	10E8	Standard Mercury

#### Mercury Relay: Coil data and type numbers

Device type	Type Number	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A (energize to make) Switch No. 6	97-1-A-5/6D 97-1-A-12/6D 97-1-A-24/6D	5 12 24	140 Ω 500 Ω 1500 Ω	0.075 Ω

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

#### Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately  $40 \times 0.4 = 16\%$  to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

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#### Pin Configuration and Dimensional Data Dimensions in Inches (Millimeters in brackets)



Schematics are shown from UNDERNEATH the relay.





1 Form A (Energize to make)

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**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

### **Mercury Relays**

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With the exception of the position insensitive type, mercury relays should be mounted vertically with pin 1 uppermost.

#### **Order Code**



#### Help

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If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

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# Pickering Series 86, 87

# **High Sensitivity Reed Relays**

Dry and mercury wetted

# **Features**

- Encapsulated in a plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations
- Dry and mercury wetted switches are available with the same pin configuration and footprint (see "A useful tip" below)
- 5, 12 or 24 Volt coils with or without internal diode

These ranges of reed relays are essentially the same as the dry Series 80 and 85 and the mercury wetted Series 88 and 89 but with coil resistances between 2 and 3 times higher. This feature is particularly useful when using large numbers of relays, to reduce overall current requirements and heating effects, or when the available coil drive power is restricted, for example, in battery operated equipment.

Many special resistances are available, and relays can be designed to customers specific requirements.

These Pickering reed relays fit straight onto P.C. boards with pins on 0.1 inch grid. They are completely protected, being encapsulated with plastic covers. All relays are fitted with internal magnetic screens to avoid stray magnetic interaction between adjacent relays.

The Series 86 and 87 are electrically identical ranges but offer alternative pin configurations. These are shown overleaf.

# A useful tip

If there is a chance that you might want to use mercury wetted relays instead of dry relays at a later date, for example to increase switch ratings, lay out the PCB initially as though for the mercury wetted type. This allows uprating later without PCB changes.





### Switch Ratings - Dry Switches

- 1 Form A (energize to make), 10 watts at 200V
- 1 Form B (energize to break), 10 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 watts at 200V

### Switch Ratings - Mercury Wetted Switches

• 1 Form A (energize to make), 50 watts at 500V

# **Older Style**

# Series 86, 87 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special features
1	A or B	10 W	0.5 A	1.2 A	200	10E8	General purpose
7	С	3 W	0.25 A	1.2 A	200	10E7	Change over

#### **Operating voltages**

Coil voltage - nominal	Must operate voltage - maximum at 25°C	Must release voltage - minimum at 25°C
5 V	3.75 V	0.5 V
12 V	9 V	1.2 V
24 V	18 V	2.4 V

### Series 86, 87 Coil data and type numbers

Device type	Type Number Series 80	Type Number Series 85	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A (energize to make) General Purpose Switch No. 1	86-1-A-5/1D 86-1-A-12/1D 86-1-A-24/1D	87-1-A-5/1D 87-1-A-12/1D 87-1-A-24/1D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.15 Ω
1 Form B (energize to make) General Purpose Switch No. 1	86-1-B-5/1D 86-1-B-12/1D 86-1-B-24/1D	87-1-B-5/1D 87-1-B-12/1D 87-1-B-24/1D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.15 Ω
1 Form C (change-over) Switch No. 7	86-1-C-5/7D 86-1-C-12/7D 86-1-C-24/7D	87-1-C-5/7D 87-1-C-12/7D 87-1-C-24/7D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.20 Ω
2 Form A (energize to make) General Purpose Switch No. 1	86-2-A-5/1D 86-2-A-12/1D 86-2-A-24/1D	87-2-A-5/1D 87-2-A-12/1D 87-2-A-24/1D	5 12 24	1000 Ω 3000 Ω 6000 Ω	0.15 Ω

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Mercury Reed: Series 86, 87 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special features
8	А	50 W	2 A	3 A	500	10E8	Standard Mercury

#### Mercury Relay: Series 86, 87 Coil data and type numbers

Device type	Type Number Series 88	Type Number Series 89	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A	86-1-A-5/8D	87-1-A-5/8D	5	350 Ω	0.07 Ω
(energize to make)	86-1-A-12/8D	87-1-A-12/8D	12	1000 Ω	
Switch No. 8	86-1-A-24/8D	87-1-A-24/8D	24	3000 Ω	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### **Environmental specification**

Standard operating temperature range: -20 to +85 °C.

Note: The upper temperature limit can be extended to +125 °C if the coil drive voltage is increased to accommodate the resistance/temperature coefficient of the copper coil winding. This is approximately 0.4% per °C. This means that at 125 °C the coil drive voltage will need to be increased by approximately 40 x 0.4 =16% to maintain the required magnetic drive level. Please contact sales@pickeringrelay.com for assistance if necessary.

Vibration: Maximum 20 G

Shock: Maximum 50 G

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

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ISO9001 Manufacture of Reed Relays FM 29036

### **Dimensional Data**

Dimensions in Inches (Millimeters in brackets)



### **Pin Configurations**

Schematics are shown from UNDERNEATH the relay.



**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### **Mercury Wetted Versions**

Mercury wetted relays should be mounted vertically in the direction of the arrow printed on the package.

#### **Order Code**



#### Help

If you need any technical advice or other help, for example, any special tests that you would like carried out, please do not hesitate to contact our Technical Sales Department. We will always be pleased to discuss Pickering relays with you. email: techsales@pickeringrelay.com

#### Please ask us for a FREE evaluation sample.

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# Pickering Series 80, 85, 88, 89

# **General Purpose Reed Relays**

Dry and Mercury wetted

# Features

- Encapsulated in a plastic package with internal mu-metal magnetic screen
- Wide range of switch configurations
- Dry and mercury wetted switches are available with the same pin configuration and footprint (see "A useful tip" below)
- 5, 12 or 24 Volt coils with or without internal diode

These ranges of reed relays are available with both dry and mercury wetted switches. They are available with 5, 12 and 24 volts coils, a particularly useful feature of the 5 volt dry devices is their ability to be driven directly from TTL, the coil requiring only 10mA of drive current. All units have an internal magnetic screen and can be supplied with built-in diode if required.

Standard coil voltages are 5, 12 and 24 volts. All relays are fitted with internal magnetic screen to avoid stray magnetic interaction between adjacent relays. Many special coil resistances are available, and relays can be designed to customers specific requirements. These Pickering relays fit straight onto P.C. boards with pins on the popular 0.1 inch grid. They are completely protected, being encapsulated in plastic cases. With these series you get the choice of three different dry reed switches and two mercury wetted switches in a range of configurations to cover all switching problems. See "Switch Ratings" in adjacent column.

The Series 80 and 85 are electrically similar ranges but with alternative pin configurations; these are shown overleaf. Their mercury wetted equivalents are prefixed 88 and 89 respectively.

# A useful tip

If there is a chance that you might want to use mercury wetted relays instead of dry relays at a later date, for example to increase switch ratings, lay out the PCB initially as though for the mercury wetted type. This allows uprating later without PCB changes. The mercury Series 88 and 89 have identical pin configurations to the dry Series 80 and 85.





### Switch Ratings - Dry Switches

- 1 Form A (energize to make), 10 watts at 200V
- 1 Form A (energize to make), 10 watts at 500V
- 1 Form B (energize to break), 10 watts at 200V
- 1 Form C (change-over), 3 watts at 200V
- 2 Form A (energize to make), 10 watts at 200V
- 2 Form C (change-over), 3 watts at 200V
- 3 Form A (energize to make), 10 watts at 200V

### Switch Ratings - Mercury Wetted Switches

- 1 Form A (energize to make), 50 watts at 500V
- 1 Form B (energize to break), 50 watts at 500V
- 2 Form A (energize to make), 50 watts at 500V

# **Older Style**

#### Series 80, 85 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special features
1	A or B	10 W	0.5 A	1.2 A	200	10E8	General purpose
5	А	10 W	0.5 A	1.2 A	500	10E8	1000V stand-off
7	С	3 W	0.25 A	1.2 A	200	10E7	Change over

#### Series 80, 85 Coil data and type numbers

Device type	Type Number Series 80	Type Number Series 85	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A (energize to make) General Purpose Switch No. 1	80-1-A-5/1D 80-1-A-12/1D 80-1-A-24/1D	85-1-A-5/1D 85-1-A-12/1D 85-1-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω
1 Form A (energize to make) HV Switch No. 5 Note: Special Pin Configuration	80-1-A-5/5D 80-1-A-12/5D 80-1-A-24/5D	Not Available	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω
1 Form B (energize to make) General Purpose Switch No. 1	80-1-B-5/1D 80-1-B-12/1D 80-1-B-24/1D	85-1-B-5/1D 85-1-B-12/1D 85-1-B-24/1D	5 12 24	1000 Ω 3000 Ω 3000 Ω	0.15 Ω
1 Form C (change-over) Switch No. 7	80-1-C-5/7D 80-1-C-12/7D 80-1-C-24/7D	85-1-C-5/7D 85-1-C-12/7D 85-1-C-24/7D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.20 Ω
2 Form A (energize to make) General Purpose Switch No. 1	80-2-A-5/1D 80-2-A-12/1D 80-2-A-24/1D	85-2-A-5/1D 85-2-A-12/1D 85-2-A-24/1D	5 12 24	500 Ω 1000 Ω 3000 Ω	0.15 Ω
2 Form C (change-over) Switch No. 7	80-2-C-5/7D 80-2-C-12/7D 80-2-C-24/7D	85-2-C-5/7D 85-2-C-12/7D 85-2-C-24/7D	5 12 24	375 Ω 1000 Ω 3000 Ω	0.20 Ω
3 Form A (energize to make) General Purpose Switch No. 1	80-3-A-5/1D 80-3-A-12/1D 80-3-A-24/1D	Not Available	5	375 Ω 1000 Ω 3000 Ω	0.15 Ω

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Mercury Reed: Series 88, 89 switch ratings - The contact ratings for each switch type are shown below:

Switch No	Switch form	Power rating	Max. switch current	Max. carry current	Max. switching volts	Life expectancy ops typical (see Note <sup>1</sup> below)	Special Features
1	А	50 W	2 A	3 A	500	10E8	Standard Mercury

### Mercury Relay: Series 88, 89 Coil data and type numbers

Device type	Type Number Series 88	Type Number Series 89	Coil (V)	Coil resistance	Max. contact resistance (initial)
1 Form A	88-1-A-5/1D	89-1-A-5/1D	5	140 Ω	0.07 Ω
(energize to make)	88-1-A-12/1D	89-1-A-12/1D	12	750 Ω	
Switch No. 1	88-1-A-24/1D	89-1-A-24/1D	24	2000 Ω	
1 Form B	88-1-B-5/1D	89-1-B-5/1D	5	90 Ω	0.07 Ω
(energize to break)	88-1-B-12/1D	89-1-B-12/1D	12	430 Ω	
Switch No. 1	88-1-B-24/1D	89-1-B-24/1D	24	1750 Ω	
2 Form A	88-2-A-5/1D	89-2-A-5/1D	5	90 Ω	0.05 Ω
(energize to make)	88-2-A-12/1D	89-2-A-12/1D	12	430 Ω	
Switch No. 1	88-2-A-24/1D	89-2-A-24/1D	24	1750 Ω	

When an internal diode is required, the suffix D is added to the part number as shown in the table.

#### Note<sup>1</sup> Life expectancy

The life of a reed relay depends upon the switch load and end of life criteria. For example, for an 'end of life' contact resistance specification of 1  $\Omega$ , switching low loads (10 V at 10 mA resistive) or when 'cold' switching, typical life is approx 1 x 10<sup>8</sup> ops. At the maximum load (resistive), typical life is 1 x 10<sup>7</sup> ops. In the event of abusive conditions, e.g. high currents due to capacitive inrushes, this figure reduces considerably. Pickering will be pleased to perform life testing with any particular load condition.

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Reed Relays FM 29036

### **Dimensional Data**



### **Pin Configurations**

Schematics are shown from UNDERNEATH the relay.



**Important:** Where the optional internal diode is fitted or for all Form B types, the correct coil polarity must be observed, as shown by the + symbol on the schematics.

#### 3D Models: Interactive models of the complete range of Pickering relay products can be downloaded from the web site.

#### **Mercury Relays**

Mercury wetted relays should be mounted vertically in the direction of the arrow printed on the package.

#### **Order Code**



#### Help

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#### Please ask us for a FREE evaluation sample.



# **Pickering Relays**

# **Glossary of Terms**

# • ACTUATE TIME:

The time between the application of the coil voltage and the operation of the relay contact. Some manufacturers include bounce while others exclude it so caution is needed with this term. Pickering prefer to specify **OPERATE TIME** and **BOUNCE TIME**. See these terms.

### • AMPERE-TURNS:

A convenient measure of magnetic field level. Reed switch sensitivity is usually measured in Ampere-Turns (AT). The magnetic drive from the relay operating coil can be calculated in AT, simply the product of the number of wire turns on the coil and the current flowing through it.

# • BIAS MAGNET:

A permanent magnet which is added to a relay. Most commonly this technique is used to create a Form B (energize to break) relay. The magnet operates the reed switch and the field from the coil cancels the field from the magnet causing the switch to open when energized. The technique is also sometimes used to create a bi-stable or latching relay.

### BOUNCE TIME:

Contact Bounce is the intermittent opening of switch contacts occurring after the initial closure of the contacts due to mechanical rebound.

### BREAKDOWN VOLTAGE:

The breakdown voltage is the maximum level that can be applied to the open switch contact before breakdown occurs. The level is primarily determined by the size of the contact gap and the type of inert gas used within the reed switch capsule. High voltage reed switches are normally in a vacuum. (See also **STAND-OFF VOLTAGE**).

## • CARRY CURRENT:

The maximum continuous current that can be carried by the switch contact after it has operated and contact bounce has ceased. This figure is usually higher than the switching current. There are other factors that determine this figure but the main one is the heating effect of the current and switch resistance (I<sup>2</sup>R).

#### • COAXIAL SHIELD:

Usually in the form of a copper tube around the reed switch with a connection at each end of the device. Most commonly used to create a relay intended for high frequency or high speed digital applications with a 50 Ohms characteristic impedance.

#### • COIL:

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An assembly consisting of many turns of wire which surrounds the reed switch. The magnetic field generated by the current flowing through this coil causes the operation of the reed switch.

### COIL POWER:

The power in Watts, required to operate the relay. This is the product of the current drawn and the coil voltage. Some sensitive Pickering relays have power levels of less than 10 mW.

### • COIL RESISTANCE:

The nominal coil resistance of the relay operating coil and is usually specified at 25 Degrees Centigrade. The coil resistance will increase with temperature at a rate of approximately 0.4% per degree C, this being the coefficient of resistance of the copper coil winding. With increasing temperature and increasing coil resistance, the level of magnetic field generated by the coil will become lower as the current falls but this can sometimes be accommodated by increasing the coil voltage. This is the main factor that determines the upper temperature specification of the relay.

## • COIL VOLTAGE:

The normal DC operating voltage of the relay coil.

### • COLD SWITCHING:

The technique of applying the current through the switch contacts after the switch has operated and all bounce has ceased. The switch current is then removed before the switch is opened. If possible cold switching is preferred as there will be no switching current surges or arcing. This will maximize contact life.

# • CONTACT RATING:

A Reed Relay has a specification for the voltage, current and power that can be switched. The power rating is the product of the voltage across the open contact immediately before the contact is closed and the initial current switched when the contact first makes.

## • CONTACT RESISTANCE:

The DC resistance of the closed contacts measured at the device terminals. Measurement is made after all contact bounce has ceased and the switch is in a stable state. The term is in reality a misnomer, as only a portion of this figure is due to the resistance of the switch contact point itself. The major part of this figure will be the nickel-iron switch connection leads and the lead-frame on which the relay is constructed. Only the resistance at the contact point will increase with life, the rest will be constant.

## • CONTACT:

The switch contact is the area of the ferro-magnetic reed switch blades that come together to complete the electrical circuit when the coil is operated. This contact area is usually plated, galvanically or by vacuum deposition, with a suitable material, usually rhodium or ruthenium. In the case of very high voltage switches, it is usually tungsten due to its high melting temperature and resistance to welding due to arcing.

# • DUTY CYCLE:

The ratio of energized to de-energized time.

### • ELECTROSTATIC SHIELD:

A wrap of material, usually copper, between the switch and the operating coil. This is usually connected to one pin and to an earth connection to minimize the capacitive coupling of noise between the coil and the signal on the switch contacts.

### • FORM A:

Normally Open, Energize to Make switch configuration. A relay with a single switch would be known as a 1 Form A type or sometimes, Single Pole Single Throw (SPST). A relay with two switches would be a 2 Form A type or Double Pole Single throw (DPST).

### • FORM B:

Normally Closed, Energize to Break switch configuration. A relay with a single switch would be known as a 1 Form B type or sometimes, Single Pole Single Throw Normally Closed (SPST Normally Closed).

### • Form C:

Change-over configuration. Each switch has three connections, a Common (or Wiper), a Normally Open (NO) and a Normally Closed (NC). When the relay is energized, the common connection will move from the NC contact to the NO contact with a break before make action. A single switch relay is known as a 1 Form C type or Single Pole Double Throw (SPDT) and a two switch version is a 2 Form C or Double Pole Double Throw (DPDT).

### • Form D:

Change-over configuration. This is unusual for a reed relay but is more common with electromechanical relays. It is like the Form C above but with a make before beak action.

### • FORMER-LESS COIL:

A construction method used extensively by Pickering, where the more usual coil supporting bobbin is eliminated and a self-supporting coil is used. The extra room that this makes available within the relay allows either a smaller package, a higher coil resistance or the use of less sensitive reed switches with inherently higher operating and restoring forces. These are all major advantages of this construction method.

### • HERMETIC SEAL:

With respect to Reed Relays, this usually refers to the glass to metal seal of the Reed Switch capsule itself. The capsule contains either an inert gas, usually nitrogen or in the case of high voltage reeds, a vacuum. The integrity of this seal is of paramount importance.



# • HOT SWITCHING:

An arrangement where the voltage to be switched is present at the open contact before the coil is energized and the resultant current is actually switched by the contact as it closes.

### • INRUSH CURRENT:

The current initially switched when the load is first connected to the source. A high inrush current can sometimes flow through the relay contact when switching a non-linear load. Current surges into capacitive loads can be very damaging and high inrush currents should be avoided.

## • INSULATION RESISTANCE:

The DC resistance between two specified points. In reed relays this figure is normally specified for both the resistance across the open switch and for the resistance between the switch and the coil connections. The figure is usually very high, in the region of 10E12 Ohms (1 TOhm) or higher. This figure is normally measured at 25 Degrees Centigrade and may fall slightly at higher temperatures.

## • LIFE EXPECTANCY:

The average number of cycles that a relay will achieve under specified load conditions before the contacts fail due to sticking or excessive contact resistance. Usually expressed as Mean Cycles Before Failure (MCBF) rather than as Mean Time Before Failure (MTBF). Life depends on many factors, the type and level of load, current, voltage, power and the end of life criteria if contact resistance is critical.

## • MAGNETIC INTERACTION:

The effect of a relay being influenced by the magnetic field from an adjacent, energized relay. The magnetic field from unscreened relays can partially cancel those from adjacent relays, severely changing their operate sensitivity beyond their normal specification limits. A magnetic screen will reduce or eliminate this issue.

## • MAGNETIC SCREEN:

A ferromagnetic shield, either inside or on the exterior of a relay to reduce the magnetic coupling to adjacent parts. Pickering magnetic screens are mu-metal rather than steel. Mu-metal is preferable due to its high permeability and low magnetic remanence and will eliminate issues due to magnetic interaction between relays.

## MERCURY WETTED RELAY:

A form of reed relay in which the reed contacts are wetted by a film of mercury obtained by capillary action from a mercury pool within the reed switch capsule. This techniques removes all contact bounce and generally gives a higher power rating. Traditional mercury wetted relays have to be mounted close to vertical so that the mercury drains correctly but versions with a slightly different construction and a reduced mercury content are available that can be used in any position. Mercury relays are not favoured today due to the restrictions of the RoHS Directive.

# • MUST OPERATE VOLTAGE:

The specification for the DC voltage applied to the coil at which the relay must have operated. The industry standard for this figure is 75% of its nominal coil voltage at 25 Degrees Centigrade, that is for example, 3.75 Volts for a 5 Volt relay and 9 Volts for a 12 Volt relay. In reality, there will be a good margin on this figure and it will accommodate temperature effects on the coil resistance up to 85 Degrees Centigrade. Relay driver voltage drops should always be considered in the design process.

### • MUST RELEASE VOLTAGE:

The specification for the DC voltage applied to the coil above which the relay must have reverted to its un-operated state. The industry standard for this figure is 10% of its nominal coil voltage at 25 Degrees Centigrade.

## • OPERATE TIME:

The time value measured from the energization of the coil to the first contact closure (Form-A) or the contact opening (Form-B). When considering operate delay times, contact bounce must also be considered. Pickering will normally specify Operate Time Including Bounce as this is the important figure. (See also **ACTUATE TIME** and **BOUNCE TIME**).

# • OPERATE VOLTAGE:

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The actual measured coil voltage at which a contact changes from its un-energized condition to its operated state. This voltage will change with temperature as the coil resistance changes. (See **COIL RESISTANCE** for explanation).

## • RELEASE VOLTAGE:

The actual measured coil voltage at which the contact returns to its de-energized state after the coil drive voltage is removed.

## SoftCenter<sup>®</sup>:

A registered Trademark belonging to Pickering Electronics describing the construction using a soft inner encapsulation material to protect the delicate glass/metal seal of the reed switch capsule.

## • STAND-OFF VOLTAGE:

The stand-off voltage is the maximum voltage specification for the open switch contact and should not be exceeded. This level is primarily determined by the size of the contact gap and the type of inert gas used within the reed switch capsule. High voltages reed switches are normally in a vacuum. (See also **BREAKDOWN VOLTAGE**).

## • SWITCHING CURRENT:

The maximum current that can be hot-switched by a relay. The constraints of the rated contact power and voltage should be considered also. (See **CONTACT RATING**).

## • SWITCHING VOLTAGE:

The maximum voltage that can be hot-switched by a relay. The constraints of the rated contact power and current should be considered also. (See **CONTACT RATING**).



# **BASIC CIRCUIT SCHEMATICS**
## **Global Operations**



Pickering operates globally with manufacturing facilities in the UK and Czech Republic, along with additional representation in countries throughout the Americas, Europe, Asia and Australasia. To contact an official Pickering agent please visit: **pickeringrelay.com/agents** 

## **Support Literature**

The **Reed RelayMate** book from Pickering is an educational book providing an overview of how reed relays work, how they are constructed and how to interpret their specifications and make best use of them in their applications.

The Reed Relay Finder is a single sheet reference to our entire range of high quality reed relays.

For your **free Reed RelayMate** and/or **Reed Relay Finder** please visit: **pickeringrelay.com** Support literature is available to download as a pdf or you can request a hard copy.









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