COTO CORPORATION

ULTRA-LOW THERMAL EMF REED RELAYS

FOR LOW-LEVEL DATA ACQUISITION SYSTEMS. SERIES 3400

Coto, the pioneer in low thermal EMF technology, announces the development of its series 3400, 3rd generation ultra-low thermal EMF reed relays. 3400 relays feature superior thermal EMF performance with <500 nanovolt thermals and 50 nanovolt stability. In addition, improved packaging and improved reed contact stability (the latter a result of Coto's Dynamic Testing) increase efficiency as well as performance, reliability and long life.

Series 3400 relays are designed especially as input devices for very low-level switching applications such as data acquisition systems, process controllers and monitors, data scanners, multiplexors and digital and analog multipoint recorders. Such systems often require as many as 1000 input relays which must switch signals to <1 microvolt resolution in an industrial environment. Since these applications also require ultra-high reliability, low, stable offset voltage, superior packaging and high control/signal isolation, 3400 is ideal for use in these systems.

- contacts especially conditioned for reliable low-level switching
- contact plating material eliminates "sticking" and unstable contact resistance
- choice of stable low thermal EMF ratings: <10μV, <5μV, <3μV, <1μV, <500nV
- fully encapsulated in a steel shell
- high insulation resistance – greater than 10^{12} ohms
- designed to meet industrial component standards
- 1500 VRMS control to signal isolation
- 100% dynamic testing and burn-in for ultra-high reliability
- less than 1.0 msec. switching speed typical

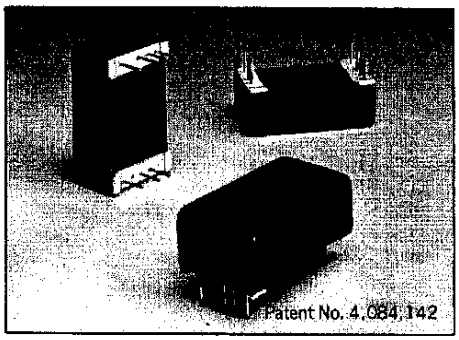
PACKAGING

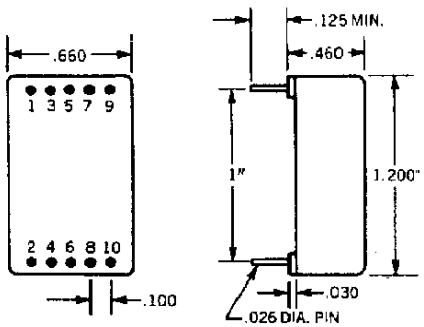
3400 relays are epoxy encapsulated in a steel shell which is coated in a bright red, chemically resistant and insulating epoxy. The reed switches are coated with a silicone rubber to provide stress-free encapsulation. Tinned electrolytic copper pins minimize thermal EMF junctions at PC board connections. All pins are epoxy sealed, to maintain integrity of insulation resistance. The coil and coil terminations are well isolated from the switches and shield which provide a minimum of 1500 VRMS isolation between control and signal circuits.

Careful attention to reed capsule cleanliness and packaging material selection assures insulation resistances of greater than 10^{12} ohms, even under elevated temperature and humidity conditions (95% RH, 40°C). All relays are both electrostatically and magnetically shielded, and unused terminals are omitted.

ENVIRONMENTAL RATINGS

Storage Temperature: −50 to +100 degrees C
Operating Temperature: −20 to +70 degrees C
Note: (The must-operate and must-release voltages and the coil resistance are specified at 25 degrees C. These values vary by approximately 0.4%/degrees C as the ambient temperature varies.)
Vibration: 20 G's to 2000hz
Shock: 50 G's





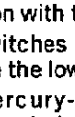
All dimensions are nominal
Pin 9 is the electrostatic shield pin.

TESTING AND RELIABILITY

All dry relays utilize premium quality, contamination-free reed switches. In order to assure the highest possible reliability, each switch and completed relay is subjected to an extensive series of cycling and dynamic testing.

In addition, each isolated pin is checked against every other pin for insulation resistance at the rated breakdown voltage. Finally, a thermal EMF test at the rated voltage is performed.

RELAY SPECIFICATIONS

CONTACT FORM	Model Number	Nominal Coil VDC	Coil Res. Ohms ±10%	Must Operate VDC	Pin Dia. Bottom View
2A DRY	3402-5	5	350	3.8	
	3402-12	12	2000	9.0	
3A DRY	3450-5	5	350	3.8	
	3450-12	12	2000	9.0	
3A DRY	3460-5	5	350	3.8	
	3460-12	12	2000	9.0	
2A HG WET	3432-5	5	105	3.8	
	3432-12	12	600	9.0	

NOTE: For Model 3460 the 3rd non-low thermal switch (9-10) is connected in common with the electrostatic shield at Pin 9.

Switches connected to pins 5-6 and 7-8 are the low thermal EMF switches.

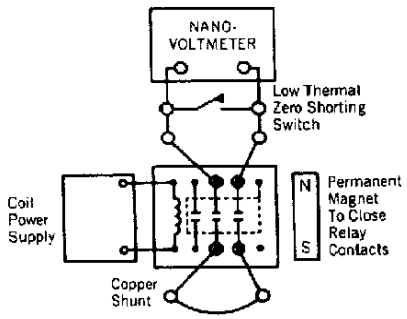
Mercury-wetted Relay 3432 must be mounted vertically, with the arrow pointing up and shield pin at the top.

THERMAL EMF

Ratings. The thermal EMF is specified differentially between the two low thermal EMF switches (pins 5-6 and 7-8). This measurement is made by shorting pins 6 and 8 with a copper shunt and connecting a nanovolt meter across pins 5 and 7.

The 3400 relays are available with maximum differential thermal EMF ratings of either <10μV, <5μV, <3μV, <1μV or <500nV. The ratings are determined by 100% testing and sorting according to the thermal EMF's measured after the coil has been energized for 5 minutes at its nominal voltage.

Thermal EMF Test Circuit



Effect Of Ambient Temperature. 3400 relays are exceptionally stable with ambient temperature changes. For the purpose of rating, the thermal EMF is measured at nominal 25 degrees C ambient. Slow temperature excursions from 0 degrees C to 50 degrees C should result in no more than a 1μV thermal EMF variation. External heat sources which create thermal gradients in the relay may cause larger variations and should be avoided.

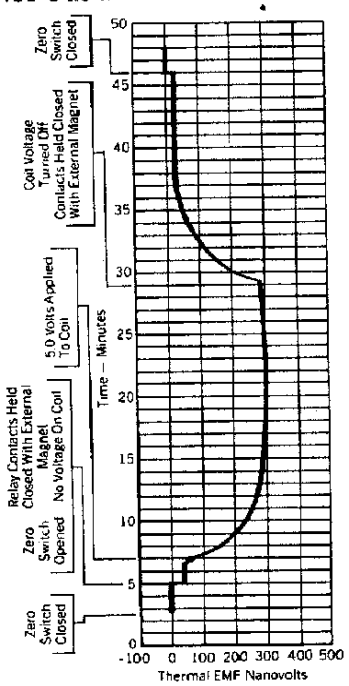
Coil Power And Duty Cycle. The thermal EMF of the 3400 relays is directly proportional to coil power or the square of the applied voltage. When the relays are operated in a scanning mode, the thermal EMF will be proportional to the coil duty cycle. Thus, a 1μV relay operated at 10% duty cycle will normally exhibit less than 200 nanovolt offset.

TESTING

Care must be exercised in testing the thermal EMF of the 3400 relays. Large errors in the thermal EMF readings may be introduced by an improperly designed test set-up. The connections to the copper switch pins should be made with 4 identical low mass connectors and lead wires.

Care should be taken to avoid all external thermal gradients. Pure copper wire and connections should be used throughout. Coto's engineering department will be pleased to assist in recommending thermal EMF test procedures.

Typical Recorder Trace of Thermal EMF of 3450-5 as a Function of Time



OPERATING PARAMETERS

PARAMETER		TEST CONDITIONS	VALUE	MERCURY WET VALUE
Max. Switch Voltage		DC/Peak AC	150 Volts	500 Volts
Max. Switch Current		DC/Peak AC Resistive	250 mA	1.0 Amp
Max. Carry Current			1.5 Amps	2.0 Amps
Max. Contact Rating		DC Resistive	5 Watts	50 Watts
Life Expectancy		At Signal Level	100×10^6 Cyc.	10^9 Cyc.
		At Rated Load	10×10^6 Cyc.	100×10^6 Cyc.
Static Contact Resistance (Initial)		0.050 Volt, 10 mA Contact Load	0.100 Ohms Max.	0.050 Ohms Max.
Dynamic Contact Resistance (Initial)		0.5 Volt, 50 mA Load 100 hz, 1.5 msec after coil energized	0.200 Ohms Max.	0.100 Ohms Max.
Insulation Resistance		Between all isolated pins @ 100 V, 25 deg. C, 40% relative humidity.	10^{10} Ohms min. 10^{12} Ohms Typ.	10^{10} Ohms min.
Open Contact Capacitance		Shield Floating	1.0 pf Typ.	1.0 pf Typ.
		Shield as Guard	0.4 pf Typ.	0.5 pf Typ.
Contact-to-Shield Capacitance		Contacts Open	1.5 pf Typ.	1.5 pf Typ
		Shield & Coil shorted together	1.5 pf Typ.	1.5 pf Typ.
Dielectric Strength (Minimum)	Between Contacts	DC/Peak AC Static Conditions	250 Volts	1000 Volts
	Contacts to Shield		500 Volts	1000 Volts
	Contacts and Shield to Coil	AC VRMS	1500 Volts	1500 Volts
Operating Time (Including Bounce)		At Nominal Voltage 30 hz Sq. wave	1.0 msec Typ.	2.0 msec Typ.
Release Time		Zener Diode Clamp Coil Suppression*	100μ sec Typ.	1.0 msec Typ.

*Consists of 20V Zener – diode and 1N 4002 diode in series connected in parallel to coil.

ORDERING INFORMATION

34 XX –XX–XX

Model No.

Coil Voltage

*Thermal

Contact Isolation (Ohms)
- 10^{10} – Suffix "0"
- 10^{12} – Suffix "1"

*<10μV – Suffix 1 Hg Wet
< 5μV – Suffix 9 Dry & Hg Wet
< 3μV – Suffix 8 Dry Only
< 1μV – Suffix 7 Dry Only
<500nV – Suffix 5 Dry Only

To order a COTO LOW THERMAL RELAY a part number can be assembled from the data sheet to describe the desired parameters as shown above.

Specifications subject to change without notice.