NHP Technical NEWS

Motor Control · Power Distribution · Automation & Communication · Control & Switching · Safety & Protection · Power Quality · Hazardous Location · Sensing & Detection · Monitoring & Display · Enclosures & Termination

Quarterly Technical Newsletter of Australasia's leading supplier of low-voltage motor control and switchgear

ISSUE 42 - September 2004

Please circulate to

____
____
____
____
____
____
____

Keeping in contact

written by William Mairs - Technical Manager, NHP Electrical Engineering Products Pty. Ltd.

Operation of electrical contacts at very low power levels can create an open circuit condition or dry contact when the switch should be closed. This problem is very significant when the contact system is used to switch low power inputs as found with PLCs. A contact system can vary from never conducting to say failing only to close once in a thousand operations. In most applications even an occasional failure is unacceptable. To prevent the problem contact systems must be chosen to suit the application.

PLC inputs are often switched by conventional contact systems. Minimum switching capabilities must be considered.

The problems

1.0 Dust

Dust or other particles on the contact surface can cause problems even for switches operating at 240 V. Contamination can be caused by packaging materials, debris produced during the installation process and wearing of the plastic materials in the switch. For low power applications even minute amounts of dust can cause a problem. Part of the problem is that the typical convex shape of the contacts provide a homogeneous electric field increasing the breakdown voltage.

1.2 Surface film

Oxidation of the contact material and degradation of the surfaces from such sources as outgassing of lubricants and plastics used in the switch construction can cause open circuits.

IP 67 rated relay with 10 mW minimum switching

In this Issue…

1.3 Porous coatings

Gold flashed contacts have a very thin layer of gold and can allow the base metal to corrode through voids in the gold. The contact surface can be degraded through this action as the corrosion products can easily reach the contact surface.

1.4 Atmosphere

Industrial plants often have pollutants in the atmosphere that are detrimental to the contact material. The resulting effect is to increase the contact resistance. With some pollutants the corrosion products of silver contacts are highly resistive.

1.5 Wear

Repeated operation can cause wear and smoothing of the contact surfaces. For an electroplated contact surface the coating material can be completely worn through. At low power however mechanical operation ratings of many millions are common.

The solutions

2.0 Hermetically sealed

Magnetically operated reed relays have contacts sealed in a glass envelope providing complete protection. Some conventional relays also offer a completely sealed case. A sealed arrangement is normally best if air borne pollutants are present.

2.1 Gold

Gold contacts provide the best resistance to corrosion and generally make the best material for low power switching applications. The gold is normally applied by electroplating and if too thin, voids are likely, allowing corrosion of the base material to effect the contact performance. Select from only reputable manufacturers.

2.2 Bifurcated

Providing a bifurcated or dual contact arrangement can greatly increase the reliability of a contact system. With two contacts operating together the two must fail at the same time for a problem to arise. Actual testing to compare different contact configurations for reliability has produced the relative performances shown in *Figure 1*. The table takes the typical bridge contact as the reference arrangement and compares the performance of the others to it. While this type of table can only be taken as a guide it does indicate that the bifurcated arrangement can provide significant improvement in the reliability of the contact performance at low power levels. The "H" configuration allows failure of one contact on each side of the bridge (see *Figure 2*).

Contact forms

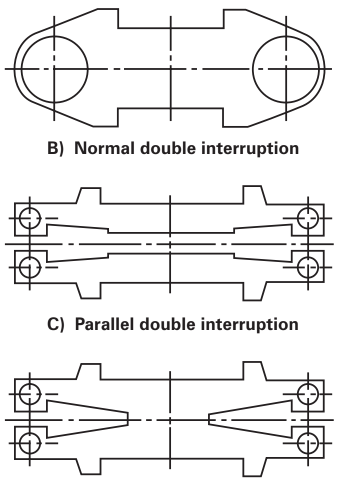


Figure 2. "H" contact provides the best reliability

Contact Security/Fault Frequency					
	A	B	C	D	E
Circuit function					
Type of interruption	Single interruption	Double interruption	Parallel double interruption	(H) contact bridge	Parallel single interruption

Figure 1. Contact security Error frequency: A=50%; B=100% (highest); C=17%; D=6%; E=5% (lowest). With regard to contact security and switching capacity, bifurcated (H) contacts represent the best approach.

2.3 Wiping

A slight wiping action when the contacts close can help remove small amounts of surface contamination. The flexing of the moving contact arm in a relay can provide the required action.

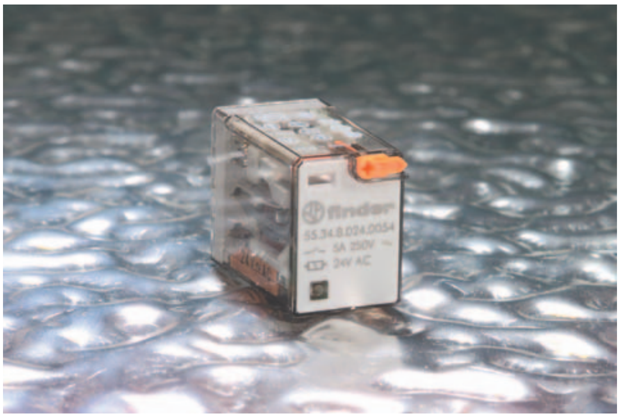
2.4 Pressure

The higher the pressure at the contact surface the more reliably the make. As pressure is the force divided by the area of contact even in what seem to be delicate contacts the pressure can be quite high.

3.0 Check the ratings

Many switches and relays are offered with gold contacts specifically designed for low power applications. If these are used at the ratings for the standard version the gold surface will be quickly lost. Some auxiliary contacts are designed to handle the very low power levels required for PLC inputs as well as the higher levels required for normal signal and control functions. This type of dual function contact will typically have the contacts dust sealed and special design considerations such as bifurcated contacts.

For contacts designed to carry high currents the ratings are based on maximums, voltage and current. For very low power applications the ratings are based on the minimum voltage and current. The minimum current or wetting current is the minimum current required for the contact to be self-cleaning. Some relays are rated by the minimum power rating. To determine the minimum current, divide the power rating by the system voltage. If the current to be switched does not exceed the rating of the desired switch, a resistor can sometimes be added to load the circuit and provide the required current.



Typical control relay providing slight wiping action on contacts.

Care should also be taken if contacts are arranged in series, E-Stop strings are a prime example. Some contacts may never switch any current as another contact in the circuit always opens first. Contacts that rely on breaking current to clean the surface may not perform well in this situation. Arrangements providing contact security via a mechanical scrapping action and/or by using bifurcated designs will provide much better reliability.

4.0 Design checking

Intermittent faults are usually the hardest to resolve in any circuit. Testing and checking for switch reliability is very important at low power levels. If possible the arrangement should be cycled exhaustively to check for switch reliability. Unfortunately some failures will only appear after some time in service and therefore the switch selection is very important. The switch must be of a rating and design to suit the application and preferably a model with a known service history in a similar application.

5.0 Field failures

If repeated failures are experienced in an installation positive action must be taken. It is no use just replacing the switch with the same type if it proving to be unreliable. A suggested check list is,

A. Check the selection. Is the switch rated for the application.

B. Is the switch being affected by atmospheric pollutants. Can it be segregated by placing in a sealed cabinet or other means.

C. If the switched currents are very low can a loading resistor be applied.

D. Is the switch failing to perform to its claimed ratings. If so consider replacement with another type or brand.

If you would like previous copies of Technical News, please complete the following form and **fax to NHP on (03) 9429 1075** marked to the attention of the **Marketing Department.**

Name: ....

Title: ....

Company: ....

Address: ....

....

Telephone: (   )... Fax: (   ).......................................

Other issues currently available. Please tick those you would like to receive.

- ☐ 1. First edition (Latched and delayed contactors)
- ☐ 2. Non-standard contactor applications (Parallel and series connections of contacts varying frequencies)
- ☐ 3. Contactor failure (Reasons for the failure)
- ☐ 4. Soft start for generator loads (Advantages of electronic soft starters)
- ☐ 5. Set the protection (MCCB breakers and application)
- ☐ 6. Contactor operating speed (Difference between AC and DC systems)
- ☐ 7. Quick guide to fault levels (Calculating the approximate fault levels)
- ☐ 8. IP ratings what do they mean? (IP Ratings, use and meaning)
- ☐ 9. Utilisation categories (Electrical life of switches)
- ☐ 10. AC variable frequency drives and breaking (Regenerative energy)
- ☐ 11.Don't forget the motor protection (Motor protection devices and application)
- ☐ 12. Electrical life of contactors (How and why contactors are tested)
- ☐ 13. Liquid resistance starter developments (For large slipring motors)
- ☐ 14. Taking the 'hiss' out of DC switching (DC switching principles)
- ☐ 15. Start in the correct gear (Application of different motor starters)
- ☐ 16. Application guide to lamp selection (Industrial pushbutton controls)
- ☐ 17. Electrical surges can be expensive (Electrical surges)
- ☐ 18. Putting the PLC in control (advantages of the PLC)
- ☐ 19. The thinking contactor (The development of the contactor)
- ☐ 20. Some don't like it hot (Temperature rise in electrical switchgear)
- ☐ 21. Pollution of the airwaves (Unwanted signals and their effects on motor protection devices)
- ☐ 22. What's different about safety (Safety devices and their application)
- ☐ 23. Talk about torque (Motors and torque)
- ☐ 24. Power factor what is it? (Power factor and correction equipment)
- ☐ 25. Terminations, good or bad? (Terminals)
- ☐ 26. RCDs are saving lives (Earth leakage protection; RCDs)
- ☐ 27. The quality switchboard (Switchgear and protection devices for Switchboards)
- ☐ 28. How does electrical equipment rate (Understanding ratings of electrical equipment)
- ☐ 29. EMC - what's all the noise about (Understanding EMC)
- ☐ 30. Controlling high short circuit currents with current limiting circuit breakers (Short circuit co-ordination KT 7)
- ☐ 31. Another step in electrical safety (Changes to electrical safety)
- ☐ 32. Keep your cables cool (New requirements on cable protection)
- ☐ 33. A leak to earth can be electric (RCDs)
- ☐ 34. Keep Cool (Derating)
- ☐ 35. Improving star-delta protection. (Overload and short circuit protection)
- ☐ 36. Does your CT measure up? (Selecting the correct current transformer)
- ☐ 37. Is your copper flexible? (Flexible busbars)
- ☐ 38. Where did the 10 volts go? (world uniform voltages)
- ☐ 39. Motor protection and wiring rules (overload protection)
- ☐ 40. Confused about which RCD you should be choosing?
- ☐ 41. Circuit breakers working together

Editorial content: - Please address all enquiries to:
The Editor - 'NHP Technical News' PO Box 199, Richmond, Victoria, 3121.

NHP Electrical Engineering Products Pty Ltd A.B.N. 84 004 304 812
www.nhp.com.au
AUSTRALIA
VICTORIA
MELBOURNE
43-67 River Street
Richmond VIC 3121
Phone (03) 9429 2999
Fax (03) 9429 1075
NEW SOUTH WALES
SYDNEY
30-34 Day Street North,
Silverwater NSW 2128
Phone (02) 9748 3444
Fax (02) 9648 4353
NEWCASTLE
575 Maitland Road
Mayfield West NSW 2304
Phone (02) 4960 2220
Fax (02) 4960 2203
QUEENSLAND
BRISBANE
25 Turbo Drive
Coorparoo QLD 4151
Phone (07) 3891 6008
Fax (07) 3891 6139
TOWNSVILLE
62 Leyland Street
Garbutt QLD 4814
Phone (07) 4779 0700
Fax (07) 4775 1457
ROCKHAMPTON
14 Robison Street
Rockhampton North QLD 4701
Phone (07) 4927 2277
Fax (07) 4922 2947
TOOWOOMBA
Cnr Carroll St & Struan Crt
Toowoomba QLD 4350
Phone (07) 4634 4799
Fax (07) 4633 1796
CAIRNS
Unit 2, 1 Bramp Close
Portsmith QLD 4870
Phone (07) 4035 6888
Fax (07) 4035 6999
SOUTH AUSTRALIA
ADELAIDE
36-38 Croydon Road
Keswick SA 5035
Phone (08) 8297 9055
Fax (08) 8371 0962
WESTERN AUSTRALIA
PERTH
38 Belmont Ave
Rivervale WA 6103
Phone (08) 9277 1777
Fax (08) 9277 1700
NORTHERN TERRITORY
DARWIN
3 Steele Street
Winnellie NT 0820
Phone (08) 8947 2666
Fax (08) 8947 2049
TASMANIA
HOBART
2/65 Albert Road
Moonah Tasmania 7009
Phone (03) 6228 9575
Fax (03) 6228 9757
NEW ZEALAND
NHP Electrical Engineering Products (NZ) Limited
7 Lockhart Place
Mt Wellington Auckland NZ
Phone 64 9 276 1967
Fax 64 9 276 1992
476 St Asaph Street
Linwood Christchurch NZ
Phone 64 3 389 7604
Fax 64 3 389 7605

Version 7