

DRY5 Series DRY5Q Series G-Series G-DRY5 SM/M Types

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2.0 Dry Contact Overview

DRY CONTACTS or mechanical contacts have been in existence almost as long as man-made electricity. In simple terms, a DRY CONTACT consists of two metallic contacts which are caused to contact (close) or open under control, whether manual or otherwise. In more recent years, engineers have discovered that certain metals and alloys are better suited to switching small and large currents. This is, as with any science, an ongoing process.

2.1 Definition of Contact FORMS

Industrial organizations, such as NARM, USASI and many others have agreed on a standard for contact types. The symbols among the various industries vary slightly, but they all mean the same. For clarity, the three most common symbols are shown in Figure A.

FORM A — (N.O.) Normally Open — with no control applied, manual or otherwise, the contacts are open.

FORM B — (N.C.) Normally Closed — with no control applied, manual or otherwise, the contacts are closed.

FORM C — (Single Pole Double Throw — SPDT) — a contact consisting of a Common contact (C), a Normally Open (N.O.) and a Normally Closed (N.C.) contact in a break-before-make arrangement.

FORM D — Same as FORM C, except in a make-before-break arrangement.

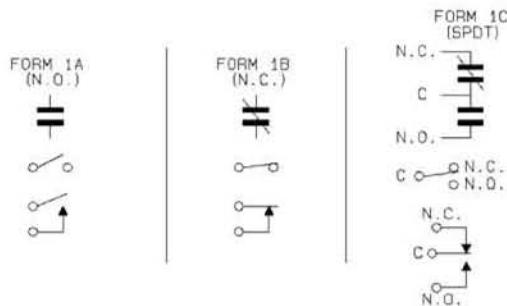


Figure A — FORM 1A, 1B and 1C Contacts

2.2 Extending Contact Service with Suppression Devices

Switching purely resistive loads is very straight-forward, but in many applications, loads under contact control are reactive or inductive. In such cases special considerations must be given to extend contact life, reduce harmful interference and prevent equipment damage.

2.2.1 AC Switching Considerations

When controlling inductively reactive loads, such as motors, relays, valves, contactors, etc., it is advisable to suppress the "inductive-kick" or back EMF directly across the load using a device such as an MOV (Metal Oxide Varistor) as shown in Figure B. Such devices will limit the voltage spikes which occur when voltage is interrupted to the inductive load. Suppressing these voltage spikes will do the following:

1. Reduce the voltage which could cause a contact to arc momentarily, thus extending service life.
2. Reduce RFI and EMI which can damage solid state components in the system and possibly cause CPU "latch-up".

An alternative, which is usually NOT recommended is to connect an MOV across the switching contact. This will serve to extend service life to the contact, but will increase the EMI voltages induced in the power source and cause a small current to flow to the load when the contact is open due to the inherent capacitance of MOVs.

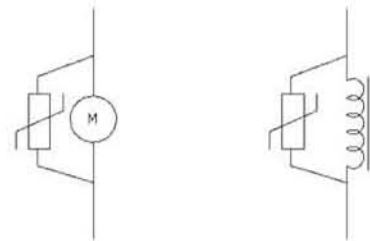


Figure B — MOV Suppression of Inductive Load

2.2.2 DC Switching Considerations

When switching DC inductive loads, it is highly advisable to connect a diode reverse biased across the coil. The diode will clamp the "inductive-kick" or back EMF which occurs when the voltage to the coil is interrupted.

2.3 DRY CONTACTS vs. SOLID STATE RELAYS

Conventional Solid State Relays (SSRs) are optically isolated Open Collector or Triac switches. In recent years, improvements have been made in the SSR technology. However, DRY CONTACTS are still the most versatile means of switching, because they inherently switch AC and DC signals and do not latch-up with high PF (power factor) reactive loads as SSRs can. Additionally, DRY CONTACTS do not leak current in the off-state like the phase-corrected SSRs do.

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Because there is not a direct comparison between SSRs and DRY CONTACTS Figure C lists the basic characteristics of both technologies in order to select the best solution for your application.

| DRY CONTACT | AC SSR | DC SSR |
|--|--|---|
| Advantages | Advantages | Advantages |
| Switches AC and/or DC Zero off-state Current Switches High pf loads Switches Audio Switches DATA and Analog FORM 1B - true N.C. Not Polarity Sensitive Low on-state resistance Isolation Input to Output | Zero-crossing Switching Isolation Input to Output Not Polarity Sensitive | Fast Switching Isolation Input to Output |
| Disadvantages | Disadvantages | Disadvantages |
| Contact Bounce | Off-State Leakage Current Switches AC Only (no DC) Produces Crossover Distortion High pf loads can cause latch-up No true FORM 1B contact Not suited for Audio Not suited for DATA or Analog | On-State resistance Switches DC Only (no AC) Has polarity Not suited for Audio Not suited for DATA or Analog No true FORM 1B contact |

Figure C — DRY CONTACTS vs. SSRs

2.4 Switching Considerations for Small and Large Currents

As mentioned in Section 2.0, specific metals are suited to specific switching applications. For example, gold plated contacts are capable of switching very small currents very reliably, such as low level audio. Analog current loops, and currents in the microamp range, but have a limited service life with large current switching. Silver and Silver Cadmium Oxide alloys are very well suited for large current switching, but are not reliable for switching small currents, because of oxidation which occurs on the contact surface. Therefore, specific contact types must be suited to the application.

For contacts which have been designed for small and large (or medium) currents, such as those of the DRY5 Series, G-Series G-DRY5 and DRY5Q Series, it is important to note that it is not recommended to use a contact to switch large currents and then use the same contact to switch small signals. This is true for any mechanical switch contact. The reason for this is that after a contact has been used for large currents, the contact surface may have become pitted or develop carbon deposits which will not affect the large current operation, but may affect the switching of smaller currents. Another factor to consider is that many contacts rated for small and large currents comprise a contact, such as gold plated silver. This makes the contact very versatile, but after the contact has been used for large currents, the gold plating may eventually be pierced and the silver will be exposed for switching which is not well suited for low current switching.

2.5 Observing the Volt-ampere (VA) Rating

On many contacts, such as Reed Relay contacts, three important ratings are given, none of which should be exceeded. For example, a contact rated at 200 Volts, 1 Amp, 20 VA is not intended to switch 1 Amp at 200 Volts. Each of the ratings given must be considered. A 1 Amp resistive load at 200 Volts is a 200 VA load, therefore the 20 VA rating has been exceeded. For resistive loads, the VA value is calculated:

$$\text{Voltage} \times \text{Current} = \text{VA}$$

where Voltage is in Volts and Current is in Amps.

For reactive loads, the calculations are more complex and go beyond the scope of this document. However, it is recommended to contact the manufacturer of your device load and have them supply the load's VA rating. (i.e. — Contactor, valve, motor, relay, etc.)

2.6 Configuring DRY Contacts for Power Down Defaults

Depending on the control application, a machine or process under control may require power-up and/or power-off default contact states. This is usually true for start-up, before a CPU has been initialized and if "loss of control" has been detected by the Watchdog Timer as a fail-safe precaution.

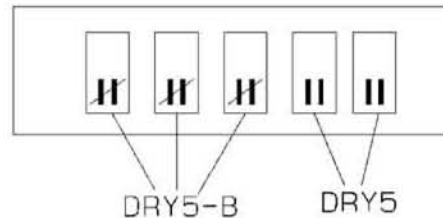


Figure D — FORM 1A and 1B Default Configuration

To configure the defaults, select the appropriate FORM A (N.O.) and FORM B (N.C.) DRY Output Modules for each output point. When power is lost to the I/O Rack, these selected outputs will be configured as open or closed. See Figure D.