

Application Note

Multiplexing 8712 Picomotor™ Driver Output to Control Multiple Motors



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Introduction

The Model 8712 Picomotor Driver is designed to drive a single Picomotor. With external circuitry it is possible to use a single 8712 Picomotor Driver to drive more than one Picomotor but only one at a time. This Application Note describes the external circuitry necessary to use a single 8712 with multiple Picomotors.

CAUTION: This Application Note assumes that you are an experienced electronics engineer. If you are not, do not attempt to implement this solution.

CAUTION: Picomotors are driven by high voltages that can be dangerous. Do not attempt to implement this solution if you do not know how to safely handle high voltage circuitry.

Background -- Equivalent Circuits

The Picomotor itself acts electrically like a capacitor. The actual value of the capacitance varies from unit-to-unit and type-to-type. There also is a slight resistive component to its impedance presented during motion, but its impact is quite small relative to the capacitance.

The Model 8712 Picomotor Driver acts like a voltage source with low output impedance. The 8712's internal circuitry controls the shape of the voltage waveform applied to the Picomotor so that the current sourced (or sunk) by the 8712's output stage is limited.

Figure 1 shows an equivalent circuit for a Model 8712 connected to a Picomotor.

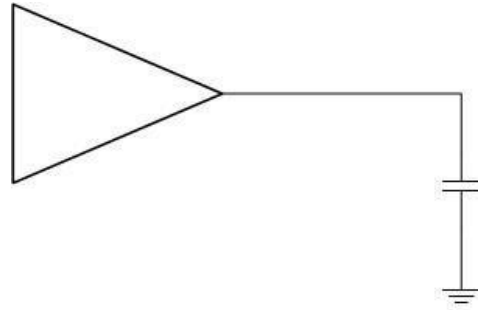


Figure 1 – Equivalent Circuit for a Model 8712 Connected to a Picomotor

Switching 8712 Output Issues

While you can use switches or relays between a Model 8712 driver and multiple Picomotors, you must be careful not to cause damage to the switching components and the 8712.

First of all, the voltage being switched can be up to 130V with and a sustained current of 1A. This means that the relays or switches must be able to withstand this voltage.

A bigger concern is that the capacitance of the Picomotor can result in a large current surge as a connection is made if the 8712 output voltage is not the same as the voltage stored on the Picomotor. This surge current can be large enough to damage the 8712, the relay, or even the Picomotor. Figure 2 shows how such a surge current could arise.

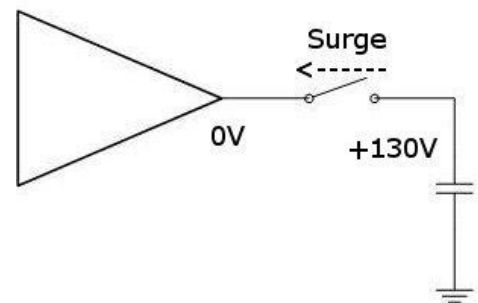


Figure 2 – Surge Current Resulting From Switching an 8712 Output

Another concern is that a Model 8712 is only able to drive a single Picomotor. Any switching circuitry must be break-before-make to eliminate the risk of multiple Picomotors being connected to the 8712.

Finally, the 8712 is an electronic device that can be damaged if it is exposed to ESD. Your switching circuitry must include provisions to dissipate any ESD that could be applied to any of the 8712's pins including the output ones.

Eliminating Surge Currents

The best way to prevent damaging surge currents is to only switch the 8712 output when the output is at 0V. This will prepare the Picomotor for future reconnection by removing any residual charge.

We recommend that you install “bleed” resistors in parallel with the Picomotors to ensure that they are fully discharged when they are not connected to the driver. These resistors should be about 1 Megohm in resistance and able to withstand 250 volts. This will ensure that any residual voltage will be discharged, should the relay controller fail to disconnect the picomotor when the voltage is zero.

The easiest way to bring the 8712 output to 0V is to drive the LIDLE signal LOW (0V) and wait for a minimum of 500 milliseconds. This will cause the 8712 to stop outputting pulses, to set its output to the inter-pulse voltage (which happens to be zero volts) and to shut down its internal high-voltage power supply. As this voltage collapses, the maximum possible 8712 output voltage will gradually go to zero and pull any remaining charge away from the attached Picomotor. With the recommended bleed resistors installed, the 8712 can safely be disconnected one second after the LIDLE

signal is driven low. Without the bleed resistors, you should wait at least 20 seconds after driving LIDLE LOW to ensure the high-voltage supply is sufficiently discharged to eliminate the risk of a current surge when the Picomotor is subsequently reconnected. At the same time, the driver output voltage will be near zero and, therefore, it can be safely connected to a previously-discharged Picomotor.

As long as you ensure that switching is only done with the 8712 output at 0 volts, any quantity of Picomotors can be multiplexed. Figure 3 shows a configuration consisting of four Picomotors.

As an aside, be aware that after connecting to the next Picomotor you will need to set LIDLE HIGH and then wait a minimum of 500 milliseconds before you can start moving the Picomotor. This time is required to allow the 8712's internal high voltage power supply to charge up to the +130V needed to drive the Picomotor.

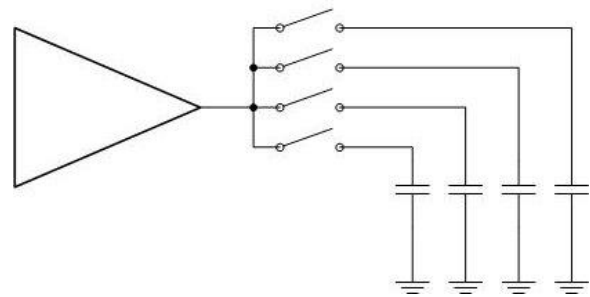


Figure 3 – Using a Single 8712 to Drive Four Picomotors

Summary

A single Model 8712 Picomotor Driver can be used to control multiple Picomotors as long as your external circuitry does the following:

1. Connections should only be changed when the 8712 is idle.
2. The switching circuitry should be break-before-make.
3. The switches or relays are able to withstand 130 VDC/1A levels and not present a safety hazard. (e.g., relay TE p/n IM03DGR)
4. Provides appropriate ESD protection.
5. “Bleed” resistors are connected in parallel with each Picomotor.