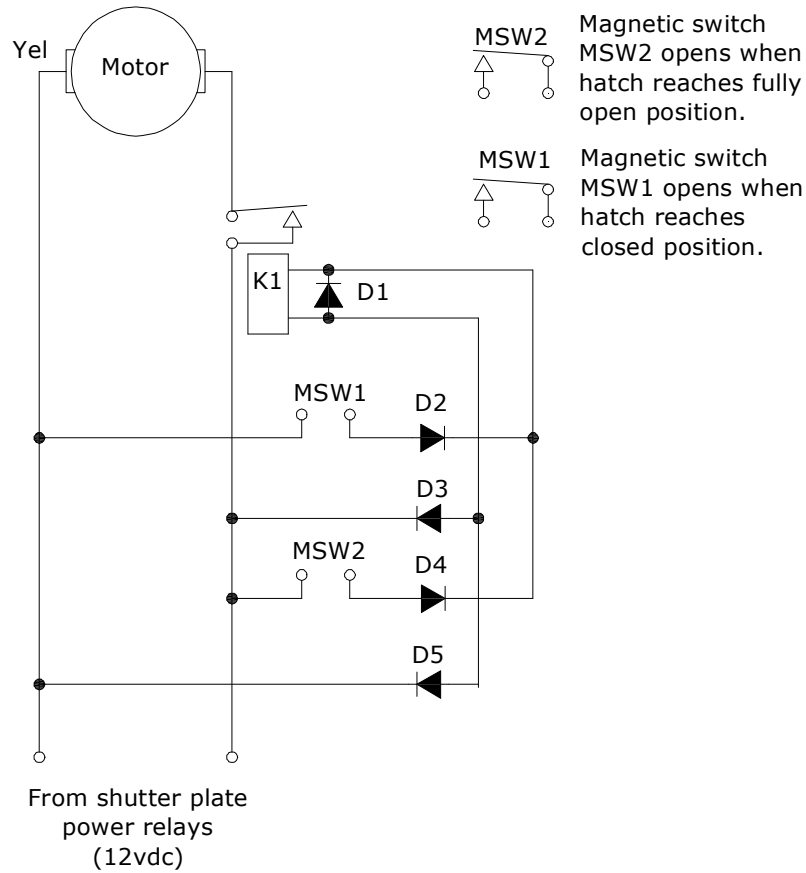


Shutter Control Relay schematic for use with Technical Innovations Shutter Motor / System

Design courtesy of Dennis Hohman, Stone Edge Observatory, November 26, 2007

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Note: When Yellow lead of shutter motor is positive, shutter moves to closed position.

Designator	Description	Radio Shack Part Number
D1	1N914 High Speed Diode	276-1122
D2, D3, D4, D5	1N4003, 1A, 200PRV Diode	276-1102
K1	12 VDC SPST 30 A Relay	275-226
MSW1, MSW2	Magnetic Switch 8601	55016279

Operation

The Lesve Dome Shutter control supplies 12 VDC for a fixed period time to the shutter motor to either open or close. Reversing the polarity of the voltage reverses the direction of motor rotation and determines whether the shutter opens or closes. The user sets a time value in the driver control panel that sets the length of time the shutter motor will run and is normally set slightly longer than the time it actually takes to open the shutter. The extra time guarantees that the shutter fully opens or closes. It is assumed that it takes an equal amount of time to close the shutter but in practice, closing is a bit quicker since gravity aids the process. Because the exact amount of time it takes to open or close can vary due to temperature, the amount of lubrication or extra weight loading caused by ice or snow, another and more precise means of stopping the motor before the shutter runs up against the stops is necessary to prevent damage to the shutter lift system.

This is where the shutter relay and magnetic switch system comes into play. The magnetic switches sense the position of the shutter and control a voltage applied to a relay that turns the motor off at the desired open and closed positions. Magnetic switches cannot handle the large amount of current used by the motor so they are used to control a lower current relay that in turns has contacts that can handle motor current. Diodes are used in my design to sense the voltage polarity change that occurs between the open and close operation and activate the relay at the proper time.

Let's say we want to open the shutter and the Lesve controller sends the correct polarity voltage. Referring to the above schematic and assuming the shutter is closed. Magnetic switch MSW2 will be closed and MSW1 will be open. The polarity of the voltage will be positive on the right motor lead and negative on the left or yellow lead. Power will flow through diode D4 to the coil of K1 closing the contacts and turning the motor on and then flow to the negative lead through diode D5. Diodes D2 and D3 cannot conduct because they are reverse biased by the polarity used for opening the shutter. When the shutter reaches the top, magnetic switch MSW2 opens and K1 deactivates turning the motor off. There is very little coast in this system and movement stops very quickly. MSW1 will now be closed. The motor cannot turn on again until the polarity of the voltage reverses which will initiate the closing of the shutter. When this happens, the left or yellow motor lead becomes positive and the right lead negative. Power now flows through MSW1, D2 and through the K1 turning on the motor. Current returns to the negative lead through D3. Diodes D4 and D5 cannot conduct with this polarity voltage. When the shutter reaches the closed position MSW1 opens turning K1 and the motor off thus stopping the shutter. MSW2 will be closed so the motor cannot run again until the correct voltage polarity is present to start a shutter open action.