The Mauna Loa Solar Observatory
Automatic Dome Rotator System

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Foreword

Responding to a request for more accurate documentation, E. Yasukawa has written the following description for the newest system integrated into the Coronal Dynamics Project's experiment system, located at the Mauna Loa Solar Observatory (MLSO) on the island of Hawaii. This system differs from most others at the site in that it was designed and fabricated in Hilo, Hawaii, at the Cloud Physics Laboratory.

Written documentation along with the timely completion and integration of the dome rotator has set a new standard for the further development of the observing station, and equipment improvement in the future by the observing staff now seems likely and feasible. Readers of this description who require further information should contact E. Yasukawa at the High Altitude Observatory's support facility in Hilo, Hawaii.

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Introduction

A system to automatically rotate the slot on the ash dome at MLSO was developed with a minimum of design and construction effort, using widely available photoelectric control modules. The system operates reliably with minimal attention and is easily maintainable. The block-diagram schematic drawing for this system is shown in Fig. 1.
Description

The MLSO system uses two photoelectric control modules at the edge of the dome slot to detect shading by passing clouds and to rotate the slot as the instrument system tracks the sun. One module used is a Fisher Pierce Model 6690B SLS, a twist-lok-type photoelectric control module used to turn street-lights on at dusk and off at dawn. The controls had to be modified to have a narrow field of view and to switch on for the proper interval so as not to move the slot too far; for example, external adjustments of sensitivity were made so that the dome-sensing control activates when shaded by the dome and then deactivates soon after being illuminated, so that the trailing edge of the dome slot doesn’t occult the instrument. This modification was accomplished by blocking all of the module’s apertures except for a 3/16-in. hole in which a three-ion piece of 3/16-in. heat-shrink tube was modulated. The midsection of the tube was then progressively shrunk until the desired response was achieved by trial and error. Sensitivity varies from control to control. The progressive decreasing of tube diameter was achieved by lightly heating the tube around progressively smaller drill-bit shanks.

The second photoelectric control module is used to detect shading by clouds. Without it, if a large cloud moved into the field of view, the dome-sensing control would activate the rotator motor and not deactivate it until the cloud moved away. Cables could be ripped out before the observer is alerted to a potentially hazardous situation. The second control, then, is used to interrupt power to the motor during cloud passage. It also serves as a backup in case of dome-sensor control failure, deactivating by preventing the dome from rotating more than half the width of the slot. This control module is modified in the same way as the first sensor and should be made to activate faster than the dome sensor.
Each photoelectric control activates a relay mounted near the rotator motor. The dome sensor activates the coil of a relay wired normally-open to energize the motor when the sensor is shaded. The cloud sensor activates the coil of another relay wired normally-closed to interrupt power to the dome's relay contacts (and motor) when a cloud shades the sensor.

The change in declination (and thus the direction the dome needs to be rotated) at latitude 20 is handled by making the dome sensor movable. The twist-lok-receptacle mount is clamped to the spar at various locations determined to be optimal by the observers and revised periodically. Rotation direction is selected by switch; nonautomatic rotation direction is also selected by switch. The nonautomatic rotation mode is switch-selectable; the control is mounted on the west wall of the dome room. The cloud sensing control is mounted on the middle of the spar. This system was installed in the MLSO dome and put into operation in April 1982.
Figure 1