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NASA Infrared Telescope Facility

Dome Drive Servo Specifications

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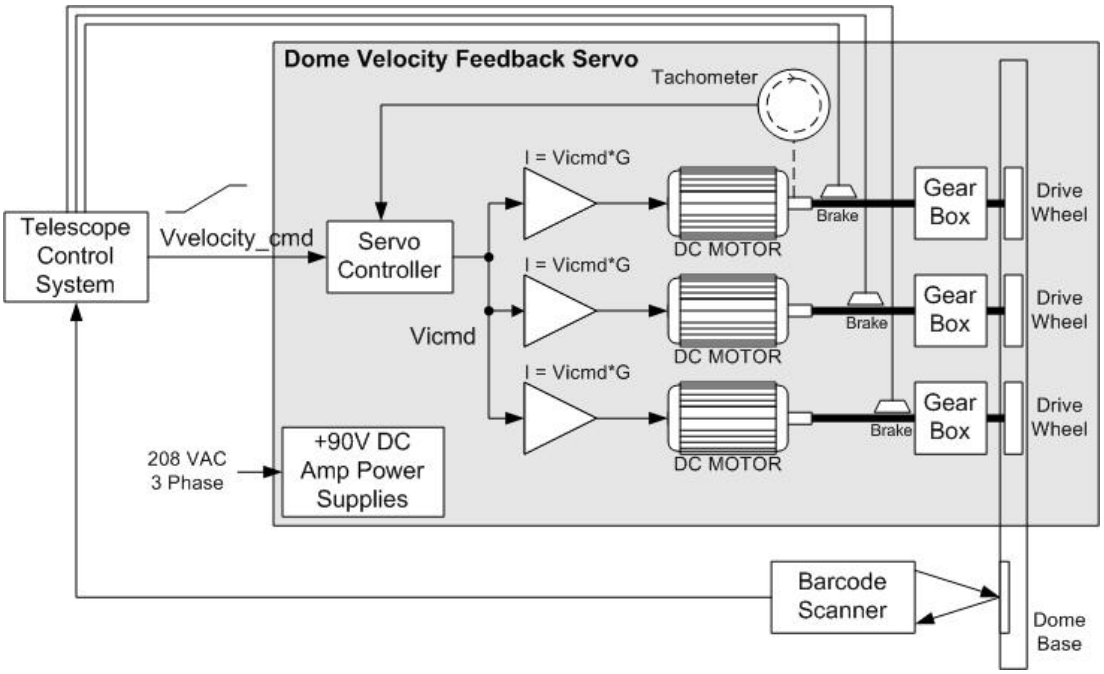
1.0 Introduction

The NASA IRTF dome drive electronics have been in use for over 30 years. While this system has been fairly reliable over this time period, it has recently experienced a much higher frequency of stalls. The issues may be mechanical, electrical, or both. Everything in the system is original and is suspect.

The goal of this document is to provide enough information to design a velocity feedback servo system to drive the dome. The TCS and barcode reader are not part of the system being specified. It is outside of this velocity loop and provides the actual velocity command to the velocity feedback servo.

2.0 Present System

The complete system consists of a servo with tachometer feedback, 3 amplifiers, 3 brushed DC motors, and DC power supplies. The telescope control system (TCS) provides a velocity command to the servo and receives dome position feedback from a barcode reader and barcodes pasted onto the dome base. The servo in turn provides an identical current command to all 3 amplifiers as required to reach the commanded velocity. The velocity feedback servo being specified is contained within the shaded box.



3.0 Servo Requirements

3.1 Power Supply

The electronics and servo shall be powered from facility power, which is 3phase 208VAC or single phase, 120 VAC. DC power supplies may be used, however, the supply power must come from the 208VAC 3 phase or 120VAC single phase.

3.2 Velocity

The minimum rotational velocity shall be 2 deg/s. Presently, the IRTF dome rotates at a nominal rotational velocity of 2 deg/s.

3.3 Acceleration

The minimum acceleration shall be 0.1666 deg/s2. Presently, the rotational acceleration of the dome is typically 0.1666 deg/s2. This equates to the dome reaching 2 deg/s in 12 seconds from a stop.

3.4 Servo Command Input

The servo shall accept a velocity input. The input shall be an analog voltage scaled up to a maximum of +/-10V or the input shall be a command over digital communications (e.g. Ethernet).

3.5 Enable/Disable

The amplifier must have an enable/disable command. This can be either a discrete digital input or a command over digital communications. In addition, a discrete command originating from the TCS Safety Board must be also be able to disable the amplifiers independent of any other controls, software, etc. That is, it must be a discrete signal directly from the TCS Safety Board to the servo.

3.6 Overcurrent Protection

The dome servo shall limit the current to the motors to prevent damage. It shall be adjustable by an analog or digital command.

3.7 Brakes

Electronically actuated brakes shall be provided for each motor assembly. It may be integrated within the motor or as part of the motor and gearbox assembly.

3.8 Telemetry

3.8.1 Motor Currents

All motor currents shall be available to the TCS. The currents shall be scaled analog +/- 10V signals or digital communications output (e.g. Ethernet).

3.8.2 Faults

All servo fault information shall be provided to the TCS. The signals shall be discrete digital I/O or data provided over digital communications (e.g. Ethernet).

4.0 Design Preferences

This section lists design preferences and other potentially useful information, *not* requirements. It is intended to provide information that may make the system easier to install.

4.1 Number of Motors

Presently there are 3 motor mounts, with 3 motors and 3 gear boxes. If 3 motors are used in the new design, much of the wiring and mounts would be in place

4.2 Motor Type

DC brushed motors are presently used with 2 wires for power. If DC motors are used, this wiring (2 wires) is in place. However, brushed DC motors may not be preferred for a new design.

4.3 Dome Velocity & Acceleration

The specs are not intended to complicate the design of the servo system. Present, normal operation moves the dome at a rotational velocity of 2 deg/s and accelerates it at about 0.1666 deg/s2. This equates to the dome reaching 2 deg/s in 12 seconds from a stop. If it is safe for the dome to move faster that would be preferred. Something around 3 deg/s would probably be ideal, but this shouldn't complicate the design. Likewise, faster acceleration would be nice, but should not drive the design.

4.4 Brakes

Present brakes use 120VAC to actuate them. This would be preferable, but DC actuated brakes could be used. There are 2 wires that go to each motor for brakes.

4.5 Velocity Feedback Transducer

A tachometer with 2 wires is presently used for each motor. So there are two wires available for feedback.