

“DESIGN OF HIGH VOLTAGE GAIN, VARIABLE OUTPUT DC-
DC CONVERTER FOR HI-REL APPLICATIONS”

SYNOPSIS

Submitted in partial fulfillment of the requirement of

B.Tech in ELECTRONICS AND COMMUNICATION ENGINEERING

By

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Project Synopsis

- **Title:** Design of high voltage gain, variable output dc-dc converter for Hi-Rel applications
- **Organization:** Space Applications Centre (SAC) – ISRO, Jodhpur Tekra, Ahmedabad
- **Project Duration:** 6 months (Jan – June 2023) (five days per week)

- **Abstract:**

Multiple systems onboard a satellite require a translator or rotational motion. This has traditionally been accomplished by mechanical motors and related mechanical systems. However, these mechanisms are bulky. In view of reducing the overall mass of such systems, satellites are largely shifting to a piezo-actuated approach. Examples of these systems are optical Fast steering mirrors. These actuators typically require large controllable bias voltages (150-200V) with low noise. Traditionally, in order to control this bias voltage, a fixed output converter is used in tandem with a linear regulator high voltage operational amplifier. This project focuses on developing a variable output DC-DC converter. This involves comparing various available topologies for dc-to-dc converters that fit into the system's requirements stated in table 1. Further, the most suitable controllable converter topology will be designed and developed into hardware. The hardware will then be tested on various conditions for high-reliability applications.

Parameter	Value
Nominal input voltage	12Vdc \pm 20%
Output voltage	10Vdc-150Vdc
Maximum output power	2W
Size	40mmX 60mm

Table 1

- **Methodology:**

- As per the system's requirement, shortlisting various available dc-dc converter configurations and controllers will be done.
- Appropriate calculations for parameters and component selection will be done accordingly.
- The designed converter will be simulated using MATLAB SIMULINK and the calculated values will be verified.
- Primarily, the converter will be tested by creating a temporary circuit on a breadboard.
- Control of the converter will be simulated and tested, and DC output (10Vdc-150Vdc) will be mapped with the control value.
- Appropriate ICs will be chosen, simulated, and tested in an open loop.
- A Printed Circuit Board will be designed to accommodate all the components and the converter will be tested in a closed loop.

- **Expected Outcome:**

A variable output dc-to-dc converter that fulfills the specified requirements of the system, which can be used for multiple systems and can sustain harsh conditions for high-reliability applications.

- **References:**

[1] N.C. Pisenti, A. Restelli, B.J. Reschovsky, D.S. Barker, and G.K. Campbell, "An ultra-low noise, high-voltage piezo driver," arXiv:1609.03607v2 [physics.ins-det] 11 Dec 2016