

Operation Readiness Clearance (ORC) of SpinQuest (E1039) Target lifter system

Vibodha Bandara, Darshana Perera, Dustin Keller

1 Introduction

The main objective of the target lifter system is to position the target cups of the target stick aligning with the beamline. The movement of the actuator is produced by a stepper motor with a gear system. The motion of the stepper motor is controlled by a computer applet built on LabView. The real-time position of the actuator is determined using two string potentiometers and seven position switches. The voltages of the two potentiometers are captured by a 16-bit Analog to digital converter and the position switches are connected with the I/O pins of the motor controller. Figure 1 shows the target lifter system.

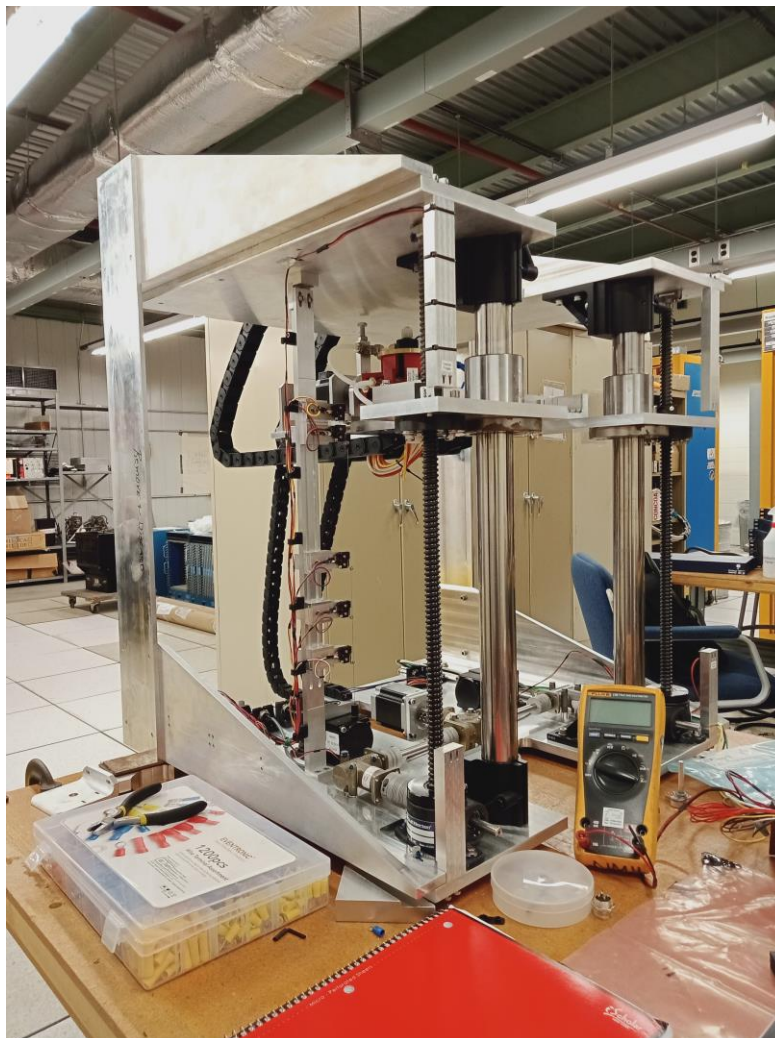


Figure 1: Target lifter system

2 The electrical components of the system

The electromechanical components of the lifter system operate with 24 V DC voltage. Following are the main components of the system.

- Stepper motor
- String potentiometer
- Position switches

The patch panel of the lifter setup contains the connecting sockets for the stepper motor, string potentiometers, and position switches. These connectors are connected with the lifter controlling system, placed in the slow control rack. ± 10 V voltage difference is applied across the potentiometers using a high precision power supply. The outputs of the potentiometers are connected to the 16-bit ADC which is also placed in the slow control rack.

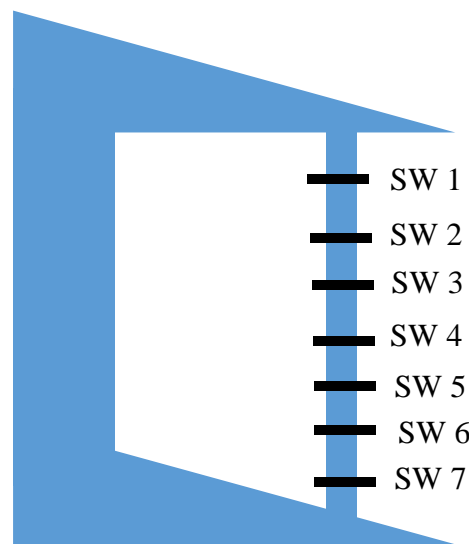


Figure 2: Labeling of the position switches

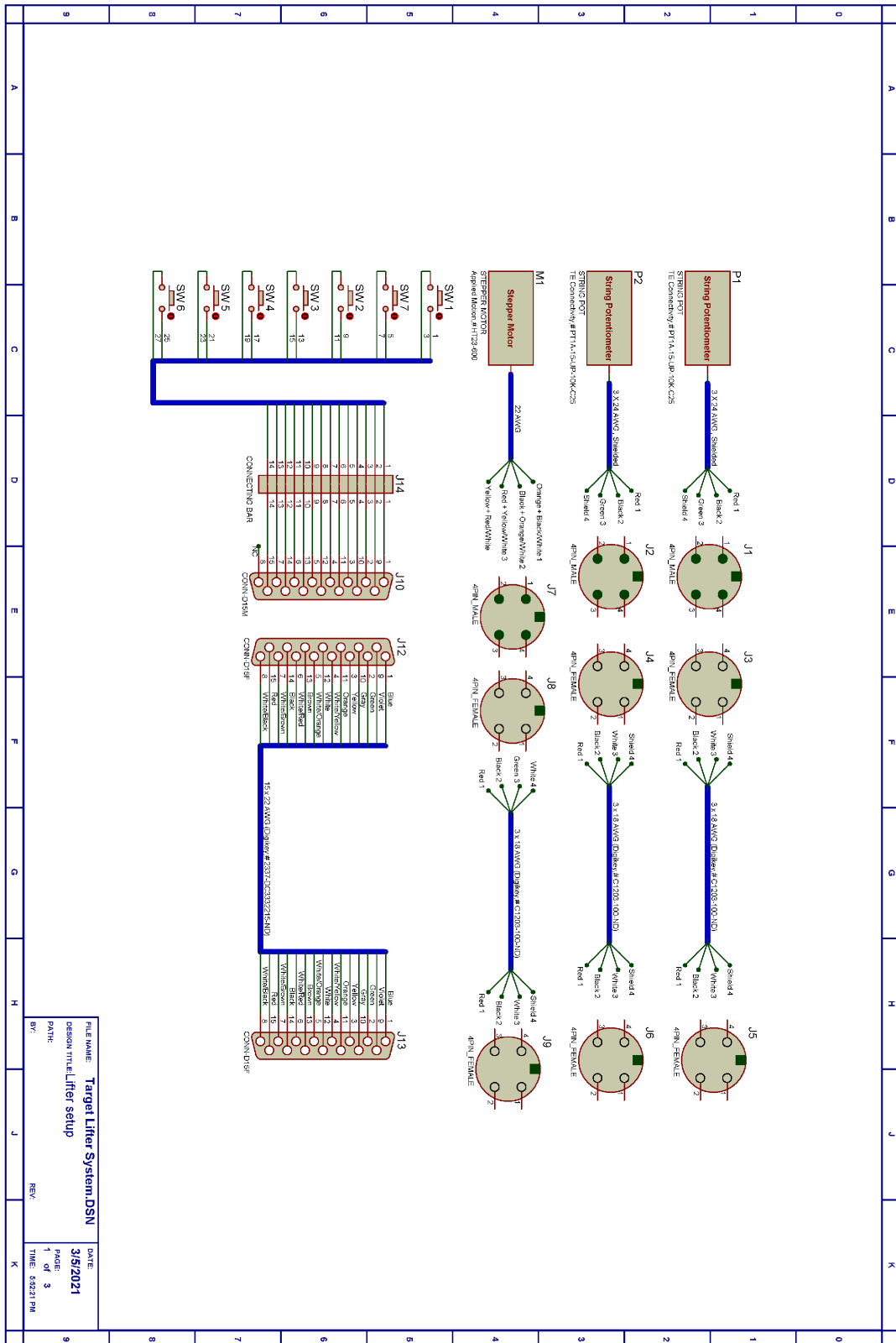


Figure 3: Detailed wiring diagram of the lifter setup.

3 Safety instructions

- Only qualified personnel should transport, assemble, install, operate, or maintain the system.
- Motor controller and motor power supply must be properly grounded.
- Do not unplug or connect any connection while the system under operation.
- Use recommended power supply and cables.
- Do not start the system without connecting the position switch connector.

4 Operating instruction

- Check the connectivity of all position switch connections.
- Properly connect the position switch cable with the motor controller.
- Properly connect the lead wires of the stepper motor with the controller.
- Connect a computer with the motor controller through the Ethernet interface.
- Power up the controller using recommended power supply.
- Configure the IP setting of the PC accordingly and start the connection with the controller using the LabView program.

5 Electrical Properties

5.1 Stepper motor



Figure 4: Stepper Motor

Manufacturer	Applied Motion Products, Inc.
Part Number	HT23-600
Number of lead wires	8
Lead wire configuration	Flying leads, No connector
Lead wire guage	22 AWG
Step angle	1.8 deg
Number of phases	2
Bipolar series current	1.41A/ phase
Bipolar Series Resistance:	4.5 Ohms/phase
Bipolar Series Inductance	15.6 mH/phase
Bipolar Parallel Current	2.83 A/phase
Bipolar Parallel Resistance	1.1 Ohms/phase

5.2 String Potentiometer



Figure 4: String Potentiometer

Manufacturer	TE Connectivity
Part Number	PT1A-15-UP-10K-C25
Input Resistance	10 k ohms
Power Rating	2 W
Maximum Voltage	30 V
Enclosure	NEMA 4, IP 65
Operating Temperature	-40° to 90°C
Vibration	up to 10 g to 2000 Hz maximum
