

Operation Readiness Clearance (ORC)
of
SpinQuest (E1039) Target lifter ADC System

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1 The block diagram of the complete target lifter system

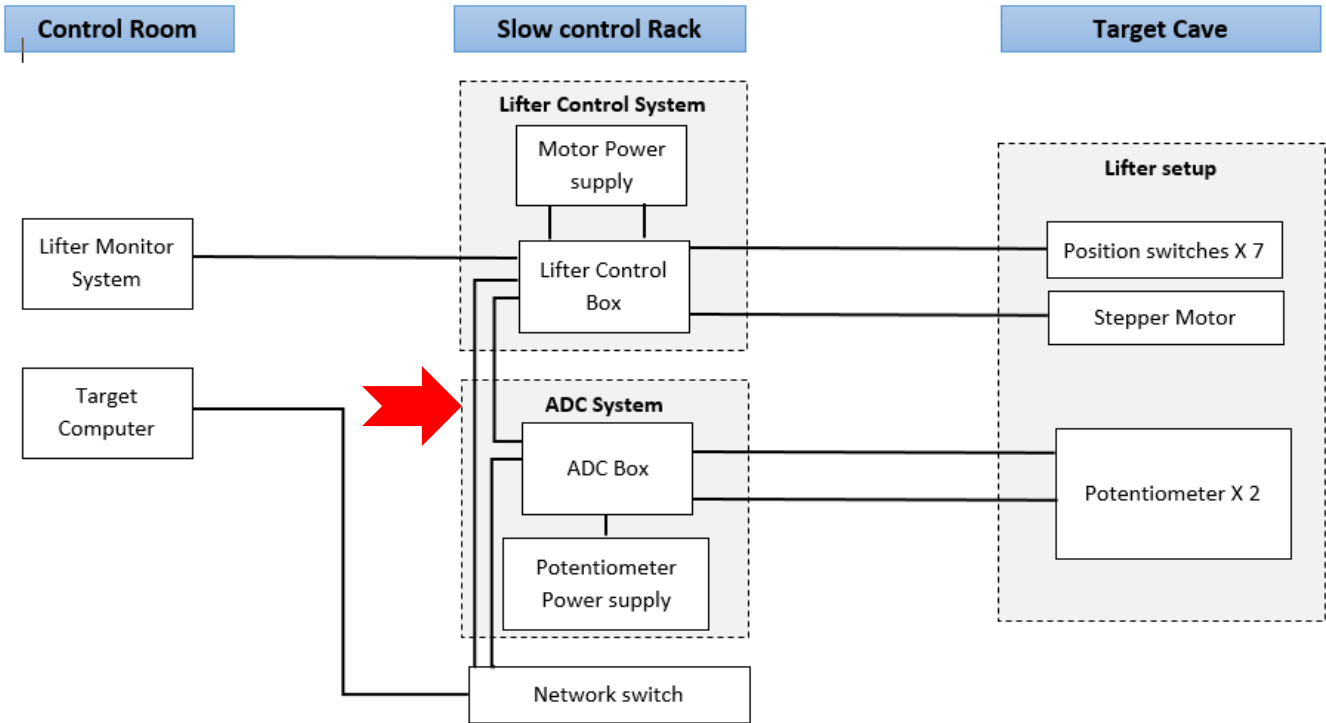


Figure 1 : The block diagram of the target lifter system

This ORC document discusses the ADC system on the slow control rack

2 ADC system

The ADC system consists of Analog to digital converter, Potentiometer power supply, and Isolation amplifier. The setup is planned to place on the slow control rack.

3 The tasks of the ADC system

- Supply -10V to +10 V voltage to the string potentiometers of the lifter
- Read the voltages of the two string potentiometers
- Connect one of the potentiometer output with the “Lifter Monitor system” through an isolation amplifier.
- Provide an electrical shielding for the ADC

4 The components of the system

Table 1 : The components of the lifter control system

Qty	Item	Model
1	Analog to digital converter (ADC)	Labjack U6 Pro
1	Power Supply	E3646A, KEYSIGHT TECHNOLOGIES
1	Isolation Amplifier	ISO 124

ADC and the Isolation amplifier are placed in a metallic box in a slow control rack. This metallic enclosure is named as ADC box

5 The ADC box

The front panel of the ADC box has following indicators and connections

- USB connection for the ADC
- 10V and 12 V LED indicators



Figure 2: Front face of the ADC box

The back panel of the ADC box consists following connections

- 4 pin circular connectors X 2 for the two string potentiometers
- 4 pin circular connector for potentiometer power supply
- 4 pin circular connector for the isolated potentiometer output



Figure 3 : Back panel of the box

Following figure shows the arrangement of the components inside the box

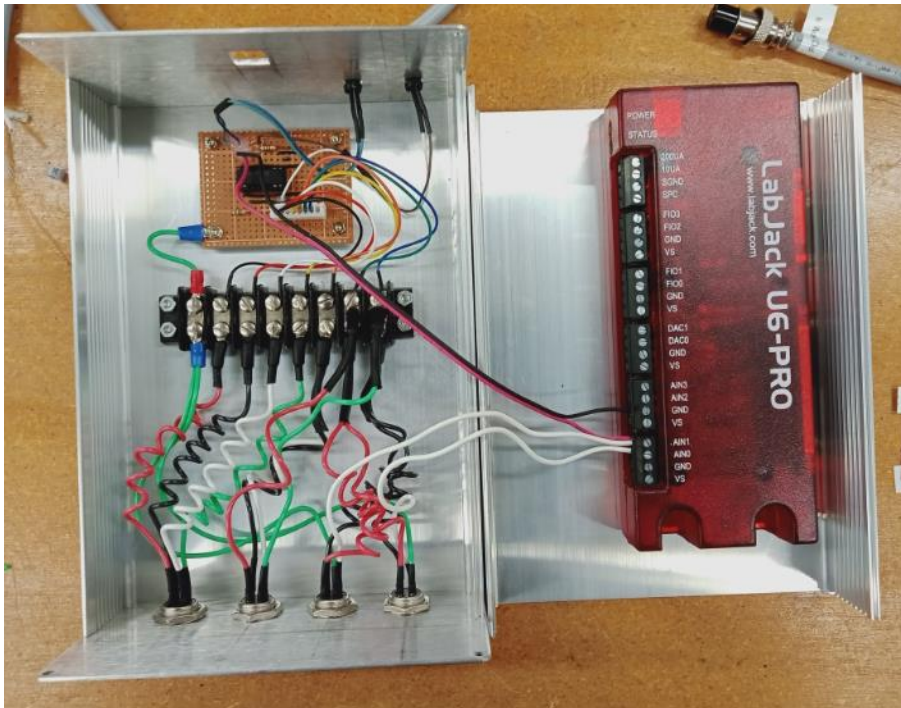


Figure 4 : components inside the box

6 The placement of the system in the slow control rack



Figure 5 : Placement of the control box on the slow control rack

7 Wiring diagram of the system

All the connecting wires are 18 AWG.

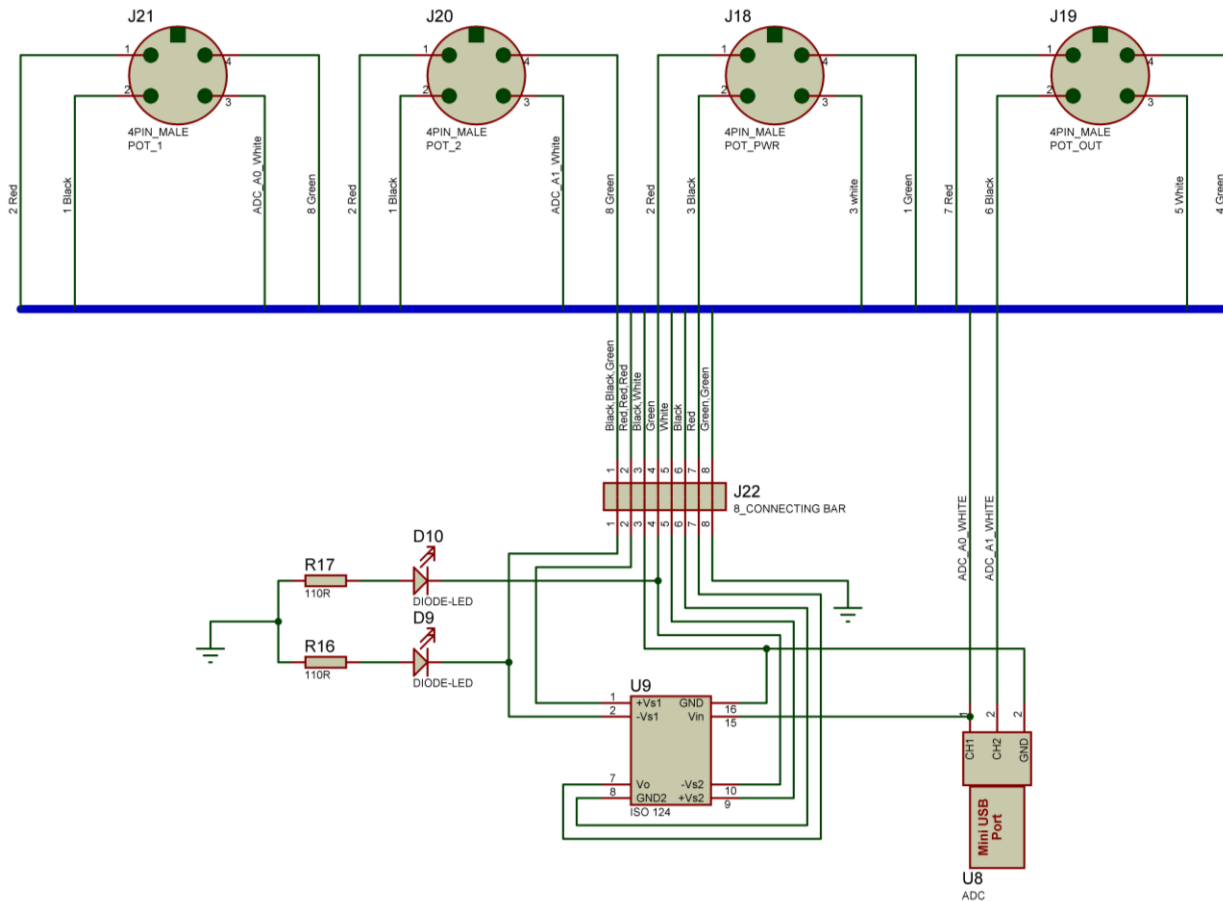


Figure 6 : The wiring diagram of the ADC box

The mini USB port of the ADC (U8)

- provides the supply voltage to the ADC
- connected to the target network to access the ADC data

8 Specifications

8.1 Analog to Digital converter



Figure 7 : 4 channel relay module

Table 2 : Specifications of the relay module

Parameter	Conditions	Min	Typical	Max	Units
General					
USB Cable Length				5	meters
Supply Voltage (1)		4.75	5	5.25	volts
Supply Current (2)			100		mA
Operating Temperature		-40		85	°C
Clock Error	~ 25 °C			±30	ppm
	-10 to 60 °C			±50	ppm
	-40 to 85 °C			±100	ppm
Typ. Command Execution Time (3)	USB High-High	0.6			ms
	USB Other	4			ms
Vs Outputs					
Typical Voltage (4)	Self-Powered	4.75	5	5.25	volts
	Bus-Powered	4.8	5	5.25	
Maximum Current (4)	Self-Powered		400		mA
	Bus-Powered		0		mA
Vm+ /Vm- Outputs					
Typical Voltage	No-load		±13		volts
	@ 2.5 mA		±12		volts
Maximum Current			2.5		mA
10UA & 200UA Current Outputs					
Absolute Accuracy (5)	~ 25 °C		±0.1	±0.2	%
Temperature Coefficient	See Section 2.5				ppm/°C
Maximum Voltage			VS - 2.0		volts

8.2 Potentiometer power supply



Figure 8 : Potentiometer powersupply

Table 3 : Specificatopn of the power supply

Model number	E3640A	E3641A	E3642A	E3643A	E3644A	E3645A
Maximum power	30 W		50 W		80 W	
# of outputs	1	1	1	1	1	1
DC output rating (@ 0 °C to 40 °C)	0 to 8 V/3 A or 0 to 20 V/1.5 A	0 to 35 V/0.8 A or 0 to 60 V/0.5 A	0 to 8 V/5 A or to 20 V/2.5 A	0 to 35 V/1.4 A or 0 to 60 V/0.8 A	0 to 8 V/8 A or 0 to 20 V/4 A	0 to 35 V/2.2 A or 0 to 60 V/1.3 A
Net weight	5.3 kg	5.2 kg	6.3 kg	6.2 kg	6.6 kg	6.7 kg
Dimensions (without bumper)	212.6 mm W x 88.5 mm H x 348.3 mm D					

Model number	E3646A	E3647A	E3648A	E3649A
Maximum power	60 W		100 W	
# of outputs	2	2	2	2
DC output rating (@ 0 °C to 40 °C)	Two 0 to 8 V/3 A or 0 to 20 V/1.5 A	Two 0 to 35 V/0.8 A or 0 to 60 V/0.5 A	Two 0 to 8 V/5 A or 0 to 20 V/2.5 A	Two 0 to 35 V/1.4 A or 0 to 60 V/0.8 A
Net weight	8.2 kg	8.0 kg	9.2 kg	9.1 kg
Dimensions (without bumper)	212.8 mm W x 133.0 mm H x 348.3 mm D			

Load and line regulation ± (% of output + offset)	
Voltage	< 0.01% + 3 mV
Current	< 0.01% + 250 µA

Ripple and noise (20 Hz to 20 MHz)	
Normal mode voltage	< 5 mVpp/0.5 mVrms for 8 V/20 V models < 8 mVpp/1 mVrms for 35 V/60 V models
Normal mode current	< 4 mArms
Common mode current	< 1.5 µArms
Accuracy ¹ 12 months (@ 25 °C ± 5 °C), ± (% output + offset)	

8.3 Isolation amplifier

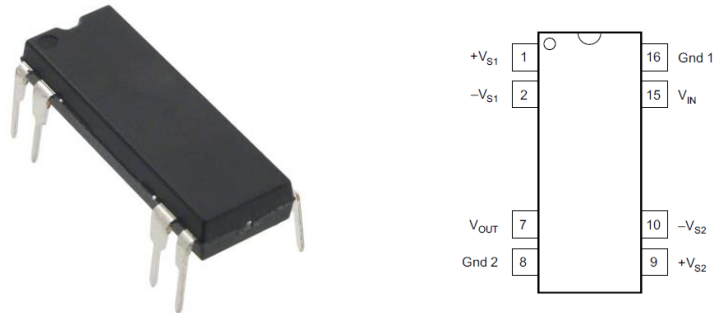


Figure 9 : Isolation Amplifier



Table 4 : Specifications of the Isolation amplifier

ISO124

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6 Specifications

6.1 Absolute Maximum Ratings

over operating free-air temperature range (unless otherwise noted) ⁽¹⁾

	MIN	MAX	UNIT
Supply voltage		±18	V
Analog input voltage, V_{IN}		100	V
Continuous isolation voltage		1500	V _{rms}
Junction temperature		125	°C
Output short to common		Continuous	
Storage temperature, T_{stg}	-40	125	°C

(1) Stresses beyond those listed under *Absolute Maximum Ratings* may cause permanent damage to the device. These are stress ratings only, which do not imply functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions*. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

6.2 ESD Ratings

		VALUE	UNIT
$V_{(ESD)}$	Electrostatic discharge	Human body model (HBM), per ANSI/ESDA/JEDEC JS-001 ⁽¹⁾	±1000
		Charged-device model (CDM), per JEDEC specification JESD22-C101 ⁽²⁾	±500

(1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.

(2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

6.3 Recommended Operating Conditions

over operating free-air temperature range (unless otherwise noted)

	MIN	NOM	MAX	UNIT
V_{S1}	High-side analog supply voltage ($\pm V_{S1}$ to GND1)		±18	V
V_{S2}	Low-side analog supply voltage ($\pm V_{S2}$ to GND2)		±18	V
V_{IN}	Analog input voltage		±10	V
T_A	Operating temperature		85	°C

END

1. The DC power input was labeled according to the recommendations of the ORC review committee.

