

# **AMP002**

## **Strain Gauge Pre Amp**



Original Instructions

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## Chapter 1 Overview

This pre-amplification circuitry is designed to amplify resistance changes within a full Wheatstone bridge strain gauge, to produce a signal suitable for monitoring and interpretation by the Thorlabs strain gauge reader or other piezo electronics with feedback. This circuit can also be used in other custom applications.

The amplification circuitry uses a low power, general purpose instrumentation amplifier offering excellent accuracy suitable for strain gauge bridge amplification. Current-feedback input circuitry provides wide bandwidth even at high gain (200kHz at  $G = 100$ ). A single external resistor sets any gain from 1 to 10,000. The INA128 amplifier component provides an industry standard gain equation.

Under normal operating conditions the Thorlabs strain gauge reader anticipates a voltage range of  $>0\text{v}$  to 2V Pk-Pk for minimum and maximum strain.

**Note:** There is no phase monitoring to determine bridge polarity. The bridge should only be used for positive strain, where the bridge does not cross the balance point during operation.

## Chapter 2 Safety

### 2.1 Safety Information

For the continuing safety of the operators of this equipment, and the protection of the equipment itself, the operator should take note of the **Warnings**, **Cautions** and **Notes** throughout this handbook and, where visible, on the product itself.

The following safety symbols may be used throughout the handbook and on the equipment itself.

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**Warning: Risk of Electrical Shock**

Given when there is a risk of injury from electrical shock.



**Warning**

Given when there is a risk of injury to users.



**Caution**

Given when there is a risk of damage to the product.

**Note**

Clarification of an instruction or additional information.

## 1.2 Adjustments

1) To obtain the required voltage range the offset (VR2) and gain (VR1) potentiometers may need to be adjusted. See the circuit diagram opposite.

2) For some applications the default gain range may need changing beyond the limit of the adjustable gain. In this instance the value of R3 may need to be changed. The following equation can be used to help determine what gain resistance is needed.

$$G = 1 + \frac{50k\Omega}{R_G}$$

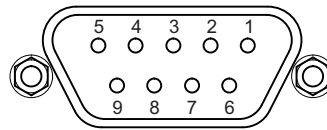
Where:

$$R_G = \frac{VR1 \times R3}{VR1 + R3}$$

### Note

In order to avoid saturating the Thorlabs strain gauge reader (or other piezo electronics feedback), under full strain conditions the output should not exceed 2V Pk-Pk.

## 1.3 D-Type Connections



- Pin1: Oscillator Input
- Pin2: +15v Input Supply
- Pin3: -15v Input Supply
- Pin4: 0v Supply
- Pin5: Amplifier Output
- Pin6: 0v Supply
- Pin7: ID Resistor Connection
- Pin8: N/C
- Pin9: N/C

### Note

The pin out of the D-Type connector is such that the amplifier can be connected directly to the Thorlabs range of closed loop controllers. If used with the BPC301 or BPC302 series controllers, the output is limited to 75 V. If the full 150 V drive is required the BPC303 controller or KPZ101 Piezo K-Cube together with the K-Cube strain gauge reader (KSG101) should be used. These controllers provide all the circuitry to convert the output of the preamplifier to a measure of displacement, allowing accurate position monitoring. In addition, the preamplifier can also be incorporated into other equipment.

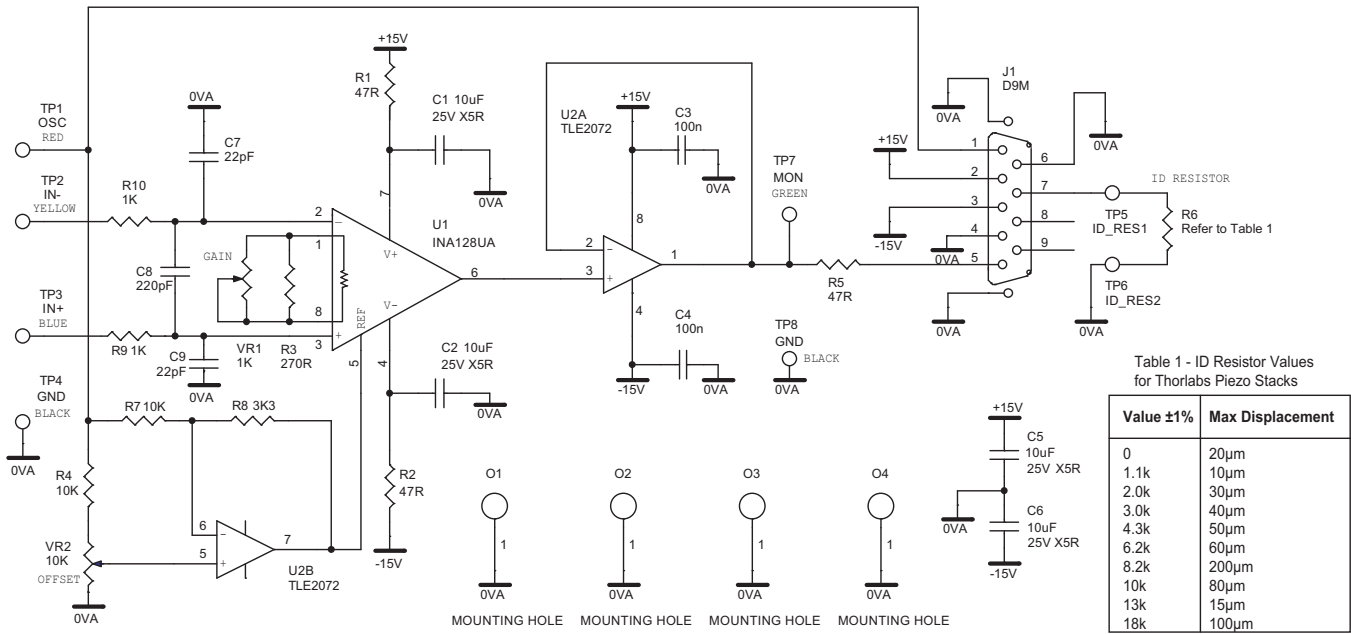


Table 1 - ID Resistor Values for Thorlabs Piezo Stacks

Value ±1%	Max Displacement
0	20µm
1.1k	10µm
2.0k	30µm
3.0k	40µm
4.3k	50µm
6.2k	60µm
8.2k	200µm
10k	80µm
13k	15µm
18k	100µm

Fig. 1.1 AMP002 Circuit Diagram

### 1.4 Strain Gauge Bridge Connections



**Caution**

When used with the BPC series controllers, connections to the bridge amplifier circuit are as detailed in Fig. 1.1 above. When used with the KSG101 K-Cube Reader, the TP2 and TP3 connections must be swapped as follows:

- TP1 (Red) Oscillator output to strain gauge bridge
- TP2 (Blue) Positive input for differential amplifier
- TP3 (Yellow) Negative input for differential amplifier
- TP4 (Black) Ground



**Caution**

For correct operation, the value of the ID resistor (R6) must be chosen to match the travel of the piezo stack being driven - see Table 1 in Fig. 1.1 above.

Use a standard 1% 0.25W resistor.

The Thorlabs piezo actuator with feedback (PZS001) is fitted with a full Wheatstone bridge strain gauge that can be monitored by this circuitry.

See Fig. 1.2 for connection details, where necessary:

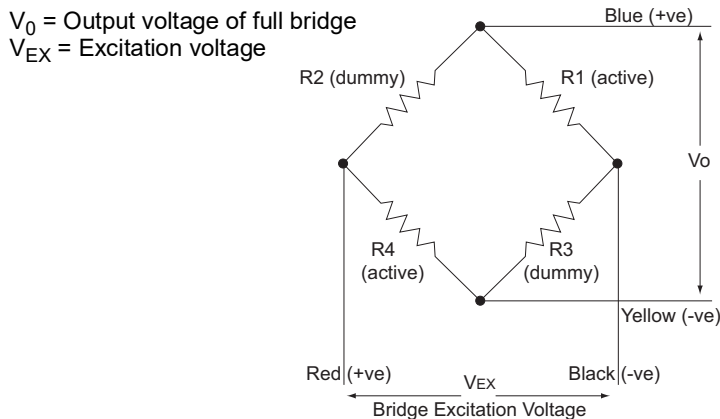


Fig. 1.2 Bridge Connections

## Chapter 2 Thorlabs Worldwide Contacts

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