

Instruction Manual

TA-100

Transducer Amplifier



Read instructions carefully before operating this device.

- ❶ This device is not to be used for Human Life Support applications.
- ❷ To avoid possible electrical shock, do not operate this device if it is wet or has had liquids spilled onto it.
- ❸ Service or calibration procedures should only be performed by qualified personnel familiar with the electrical hazards of line-powered devices.



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STATEMENT OF WARRANTY

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Instruments manufactured by CWE, Incorporated are not authorized for use as critical components in human life support devices or systems. "Life support devices or systems", as used herein, are devices or systems whose failure to perform, whether through misuse, failure, or proper operation, can reasonably be expected to result in significant injury to the operator or subject persons.

This manual last updated on 1/24/23

1.0 INTRODUCTION

The TA-100 Transducer Amplifier is a compact, stand-alone amplifier for use with all DC-bridge type transducers. Compatible transducers include blood or air pressure, strain gauges, force transducers, and accelerometers. A built-in LCD display shows the current measurement as well as a fast-response bar graph for easy visualization of a rapidly changing signal. A serial port is also included, allowing remote data collection using any simple terminal software.

The TA-100 features a wide gain range and a sharp-cutoff high frequency (low-pass) filter. This filter includes a **MEAN** setting for producing a simple average of the signal.



Front panel view of TA-100 Transducer Amplifier

2.0 INPUT CONNECTION (rear panel)

Connect the transducer to the rear-panel **INPUT** jack. This is a 6-pin male connector (WK-6-32S) used by Grass Instruments and other manufacturers. The mating connector that should be on the end of your transducer cable is the WK-6-21C.

If your transducer does not have the required connector, an adapter cable is probably available. Please contact CWE, Inc, for information.

If you need to wire your own cable, the following table shown the proper pin connections:

WK-6-21C Pin No.	Function
1	+ Excitation
2	+ Signal
3	- Signal
4	- Excitation (ground)
5	not used
6	shield

Note: Excitation voltage is factory set to 5.00V

3.0 BALANCE KNOB

This 10-turn dial is used to null out any imbalance in the transducer being used. Normally, the transducer is set to a baseline condition (e.g. open to atmosphere), and **BALANCE** adjusted until a zero output is obtained.

The range of this control as provided by the factory is $\pm 100\text{mV}$. Additional balance ranges (10mV and 250mV) are available by setting an internal jumper on the circuit board.

4.0 GAIN SETTING

The TA-100 has a very wide amplification range (over three decades), allowing the user to exactly tailor the amplifier to the transducer being used as well as the output recording device (chart recorder, data acquisition system, etc.). Gain is set using the 12-step **GAIN** switch, and the multi-turn **ATTENUATOR** trimpot. The **ATTENUATOR** control permits precise gain settings that may be in between the stepwise settings of the **GAIN** switch.

In practice, most users will simply plug in their transducer, and empirically adjust the gain to get the desired output for a given input. The more mathematically inclined can calculate the gain needed for a given situation. The following example was used to determine the gain needed for measuring blood pressure using a standard transducer (V_{ext} is 5.00V):

Transducer parameters: $5\mu\text{V}/V_{\text{ext}}/\text{mmHg}$

(i.e. the transducer output is $5\mu\text{V}$ per volt of excitation per mmHg pressure)

Desired output voltage: $5\text{V}/300\text{mmHg}$

The raw transducer output is $300\text{mmHg} \times 5\mu\text{V} \times 5.00\text{V} = 0.0075\text{V}$

The gain required is: $5\text{V} / 0.0075\text{V} = 666$

To obtain this exact output, the gain switch is set to 1000X, and the attenuator control can be adjusted counterclockwise to reduce this to 666X.

5.0 LOW-PASS FILTER

The **FILTER** switch applies a 2-pole low-pass filter to the signal. This is useful for removing high-frequency noise coming from the transducer. The **MEAN** setting provides a 0.1Hz filter, which is used to produce an average of the signal being monitored.

6.0 LCD DISPLAY

The LCD display panel shows the actual output voltage being produced by the amplifier. The nominal range of this signal is $\pm 8.0\text{V}$.

The second line of the display shows a bar-graph corresponding to approximately $\pm 3.5\text{V}$. This display is useful for watching rapid changes in the signal.

7.0 OUTPUT (rear panel)

This BNC jack is used to connect the output signal from the TA-100 to an external monitoring or recording device. The usable range of the output signal is $\pm 8.0V$.

8.0 SERIAL OUTPUT (rear panel)

A serial output is produced each time the LCD display is updated (approximately every 200mS, or 50 times/second). This signal is in the following standard RS232 format: 9600,N,8,1.

The format is a simple ASCII string corresponding to the measurement shown on the front-panel display, followed by <cr> and <lf> characters (13,10). This format is easily accepted by any standard terminal program on a PC or Macintosh computer.

9.0 POWER SUPPLY (rear panel)

The TA-100 is supplied with a small, universal input power supply providing 5VDC. This power supply is suitable for use in any country.

WARNING! Use only the power supply provided with the instrument. Use of a different power source could result in permanent damage to the instrument!

TA-100 Setup Hints

Introduction:

To achieve the best Signal-to-Noise (S/N) performance, the user must consider the amplitude and frequency range of the input signal. The **GAIN** and **LO PASS FILTER** settings should thus be optimized to match the data acquisition system requirements.

Amplifier setup:

In general, we want to use the full output voltage range of the amplifier. This maximizes the S/N ratio, because the signal of interest will overwhelm any baseline noise of the amplifier. The following example will illustrate the process:

Blood Pressure Transducer example:

Almost all clinical-type BP transducers have the following signal size:

$$5\mu V / \text{mmHg} / V_{\text{excitation}}$$

Since the TA-100 has a $V_{\text{excitation}}$ of 5V, this means the transducer will output 25 μV for each mmHg of pressure.

Assuming you want a usable range of, say, 200mmHg, the signal from the BP transducer would be in the range 0 – 5000uV, or 5mV.

For many data-acquisition systems, the input range is around $\pm 5V$. Therefore, we need to boost the 5mV transducer signal to be, say, 2.5V which would allow room for growth, but would still use a good part of the data-acquisition input range.

To find out what TA-100 gain is needed, simply divide the input voltage by the required output voltage: $2.5V / 0.005V = 500X$.

These settings would maximize the S/N ratio by using close to the full range of the TA-100 amplifier, as well as a good part of the data-acquisition input a/d converter range.

You can see the actual output voltage of the amplifier by observing the front-panel LCD display.

Filtering:

To further enhance S/N performance, the **LO PASS FILTER** should be used to match the amplifier frequency response to the signal of interest. For BP measurements, a setting of 500Hz or even 100Hz will work well.

Summary:

For best performance, always adjust the **GAIN** to use most of the output voltage range of the amplifier, or to best match the input of the data-acquisition system.

10.0 ORDERING INFORMATION

Part No.	Description
=====	=====
08-14000	TA-100 Transducer amplifier
10-04100	DTX-1 Blood pressure transducer (requires TC-GRA adapter cable below)
10-04210	TC-GRA Adapter Cable for DTX-1 transducer
10-04010	PS-1000/A-1 Differential transducer, $\pm 70\text{cmH}_2\text{O}$ range, not for liquids
10-04011	PS-1000/A-004 Sensitive differential transducer, $\pm 10\text{cmH}_2\text{O}$ range, not for liquids