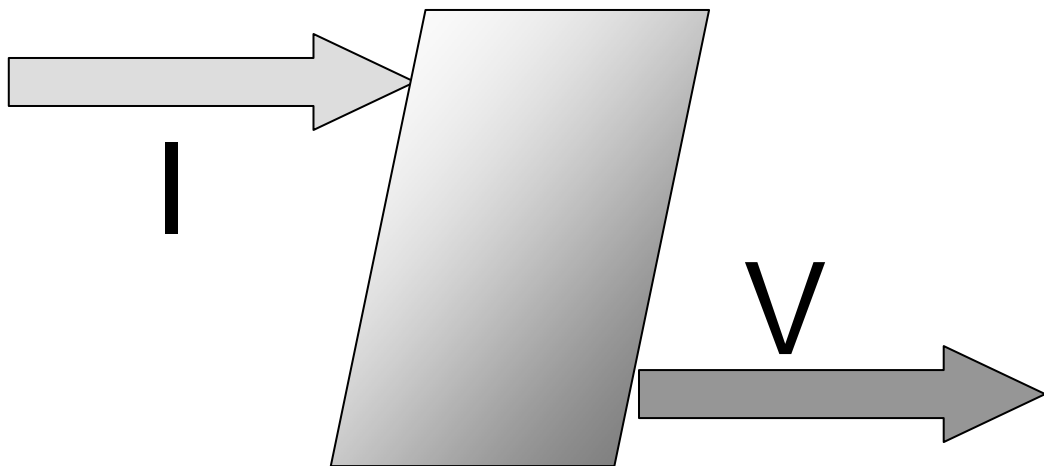


# T-IVA001S

Highly Sensitive Galvanometer Amplifier that can Measure Picoamperes

## Operating Instruction Manual



## Features

A highly sensitive galvanometer amplifier for use with current source sensors that include a photodiodes and photomultiplier tubes.

The accuracy of this type of amplifier is determined by the accuracy of the transistor, the current that leaks from the connectors, connection cables, and printed boards, and the input current of the amplifier.

The product was designed and manufactured with close attention paid to these issues with the optimum parts selected, and by carefully reviewing arrangement and structure of the printed board. It's extremely simple structure provides a good SN ratio and reliable use.

The product utilizes the direct current power supply method, which has the edge of a better SN ratio and only requires a single power supply. The low level of current required as well as the voltage level indication function via use of an LED both ensure reliable use of the product with dry batteries as well.

## Specifications

Conversion Gain:  $1E9$  (transistor  $1\text{ G}\Omega$ ) [ $A \times \Omega$ ]

Conversion Error:  $\pm 1\% \pm 1\text{ pA}$  (25C or less)

Frequency Property: approx.  $45\text{ Hz} \pm 3\text{ dB}$  (signal source resistance  $10\text{ G}\Omega$  / output voltage  $\pm 8\text{ V}$ , power supply  $30\text{ V}$ )

Noise Output Voltage: approx.  $\pm 200\text{ }\mu\text{Vrms}$  (input open, electrostatic shield, 25C)

Maximum Output Voltage: approx.  $\pm 12\text{Vp}$  (power supply voltage of  $30\text{ V}$ )

Output Resistance:  $50\text{ }\Omega$

Maximum Output Current: approx.  $\pm 10\text{ mA}$

Recommended Output Current:  $\pm 100\text{ }\mu\text{A}$  or less

Connectors: BNC (both input and output)

Power Supply Voltage Range:  $\text{DC}9\text{V} \sim 30\text{V}$  (Supplied externally. The battery level indication LED will turn off when below about  $10\text{ V}$ )

Consumed Current: At power supply voltage of  $10\text{ V}$ : approx.  $6\text{ mA}$  / at  $30\text{ V}$ : approx.  $7.6\text{ mA}$

Temperature Range:  $5\text{C} \sim 40\text{C}$

Recommended Operating Ambient Temperature:  $25\text{C}$  or less

Dimensions:  $35\text{ (h)} \times 80\text{ (w)} \times 75\text{ (d)}$  (protrusions such as switches not included)

Weight: approx.  $200\text{ g}$  (connection cables and other accessories not included)

## Accessories

Cable with a connector for direct current power supply: 1

Snap holder with a connector for dry battery (006P x 1): 1

(Batteries not included when shipped from the factory)

Case feet (set of 4)

## How to Use the Product (Please read this carefully because any failure to follow the instructions could damage the product)

The case of the product has been connected to the GND (middle point created internally) in the signal circuit.

With the power supply connection of the product **the outside of the connector plug is for positive voltage and the middle (core) for negative (or 0) voltage.** Reversing them may result in damage to the product as there are no protective measures.

**The GND in the signal circuit is a middle point created internally and 1/2 of the external power supply voltage. Please note that it is not common to the negative (or 0) of the external power supply.**

When connecting the power supply ensure to first shift **the bar of the toggle switch off (middle)** via the front panel.

**Next, shift it to battery indication (LED, downwards), and then confirm that the LED lights up. If the LED does not light up the polarity of power supply may have been reversed, in which case ensure not to turn the switch on (upwards).**

**Turn the switch off (middle) again and check the polarity of the power supply and ensure that the voltage is over 9V.**

**Only turn the switch on (upwards) after having confirmed that the LED lit up.**

**The LED being lit up will increase the current being consumed by the power supply.**

Please note that it will affect the service life of the batteries if the product is running on batteries.

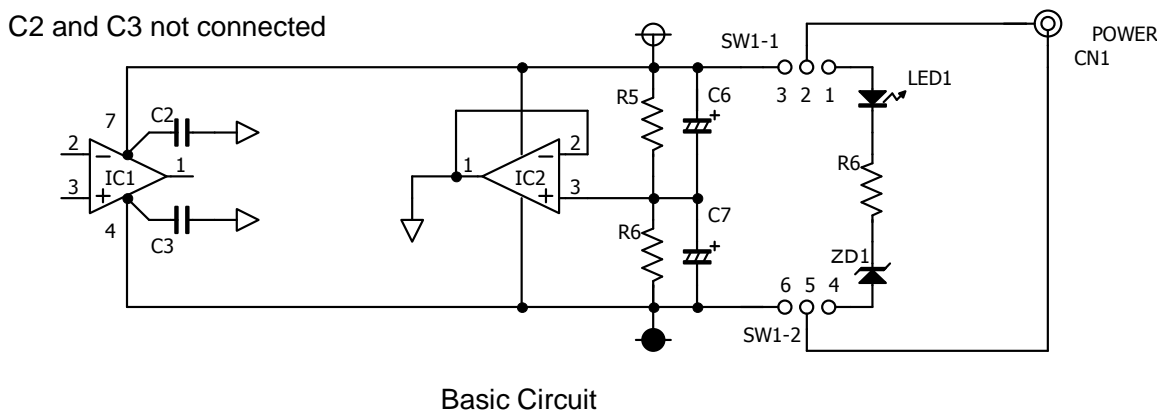
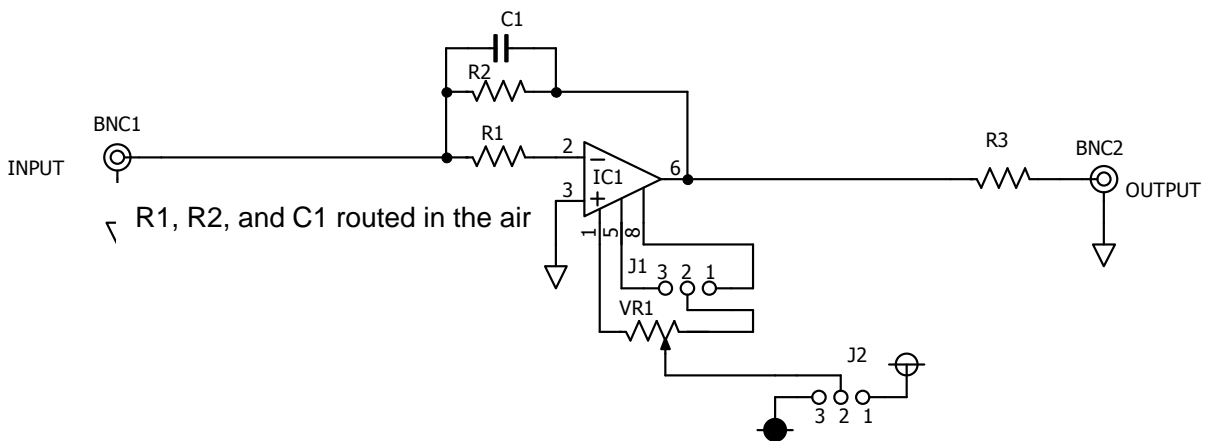
The product will then immediately start running with reversed output. If current enters the product input you will get negative voltage at the output. Contrarily, if current leaves the product you will get positive voltage at output.

If you have voltage at the output of the amplifier when the input is open turn the offset adjustment potentiometer to adjust it to be 0 V. At that time the surrounding noise may prevent you from adjusting it correctly. Ensure care is taken with the input connector shield. Turning the potentiometer too quickly or in the same direction for too long could break it. Ensure to only gently and slowly turn it.

## Operating Principle

All the circuit diagrams used in the product are shown at the end of this document. The frequency property of this type of circuit largely depends on the property of the input signal source. The frequency property shown in the specifications was measured using the connection shown in the specifications. Different results may occur if the property or values of the signal sources differ.

High frequency signals of relatively large amplitude being input into the product could result in the phenomenon where the output is biased to being either positive or negative. If that does occur change the sensor with one that will not generate such a high frequency component.



With the circuit system used in the product the conversion gain can be obtained with the formula provided below:

$$\text{Output Voltage} = \text{Input Current (A)} \times \text{Conversion Resistance (R2) (\Omega)} \quad [\text{V}]$$

This then means that the sensitivity is determined by the resistance value.

Please note, however, that if you increase the values of the transistor in thereby enhancing the sensitivity a larger impact from current leaking due to smudges on the surface of insulating materials, including connectors and printed board, may occur. Conversely, however, the resistance values being too small may limit the maximum output current of the amplifier.

Furthermore, any error in the resistance value used here will be reflected as a conversion error, and hence the resistor needs to be of high precision with a small temperature coefficient. Metal film resistors and other types of large wattage typically provide the best results.

### **Limited Warranty**

The Turtle Industry (Turtle-Ind) warrants each product of its manufacture to be free from defects in material and workmanship subject to the following terms and conditions. The warranty is effective for half a year after the shipment by Turtle-Ind to the original purchaser.

The obligation of Turtle-Ind under the warranty is limited to servicing or adjusting any product returned to the head office of Turtle-Ind for this purpose and to replacing any defective part thereof. Such product must be returned by the original purchaser, transportation charges prepaid, with sufficient and detailed proof in writing of the defect. If the fault has been caused by misuse or abnormal conditions of operation, repairs must be paid for. Prior to repair, in this instance, a quotation will be submitted. Service or shipping information will be notified depending on the difficulty encountered. Model and serial numbers must be supplied by user. Batteries are specifically excluded under warranty.

Turtle-Ind shall not be liable for any injury to persons or property or for expenses incurred by the use of any Turtle-Ind product.

**If you think the product is not working properly**

Cut off the power supply right away, list the symptoms, and contact us at the following:

1-12-4, Nishineminami, Tsuchiura-shi, Ibaraki, Japan, 300-0842

**Turtle Industry Co., Ltd.**

**Service Support Section, Technical Division, Technical Department**

**FAX: +81-29-843-2024**

**Email: [tokyo@turtle-ind.co.jp](mailto:tokyo@turtle-ind.co.jp)**

We will ensure to handle the problem promptly.