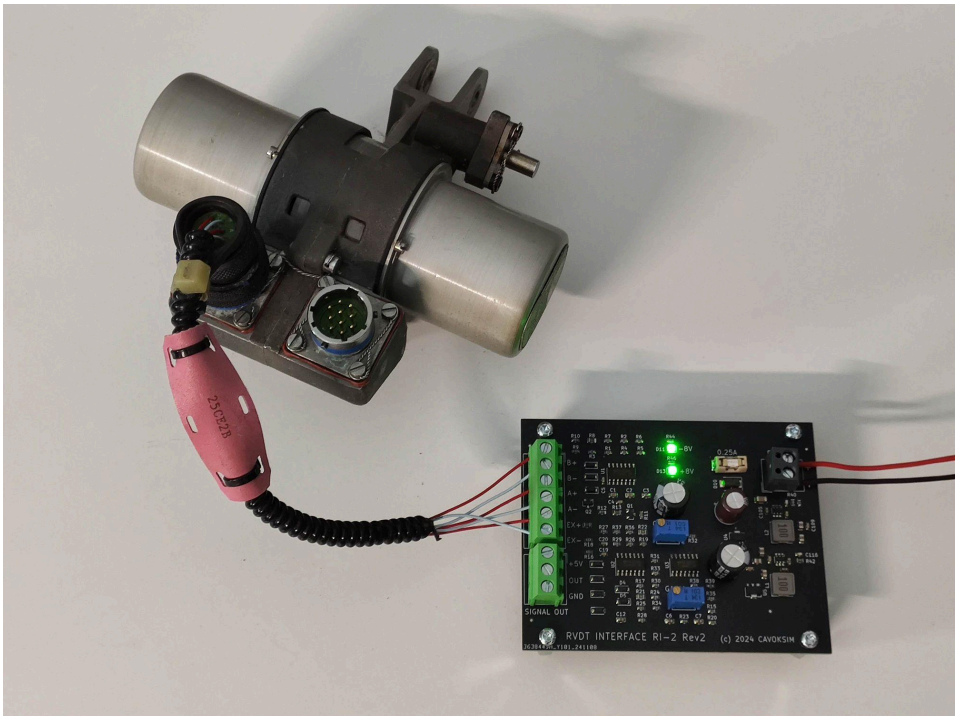
RVDT Interface RI-2



Manual

Rev 1.0 11/2024

Disclaimer

- ➔ Please read this manual carefully before installing your product
- ➔ Please follow all Precautions to safely install your product. When these guidelines are not followed the product or the aircraft component to be interfaced might be damaged. This damage will then not be covered by warranty.

Important Precautions

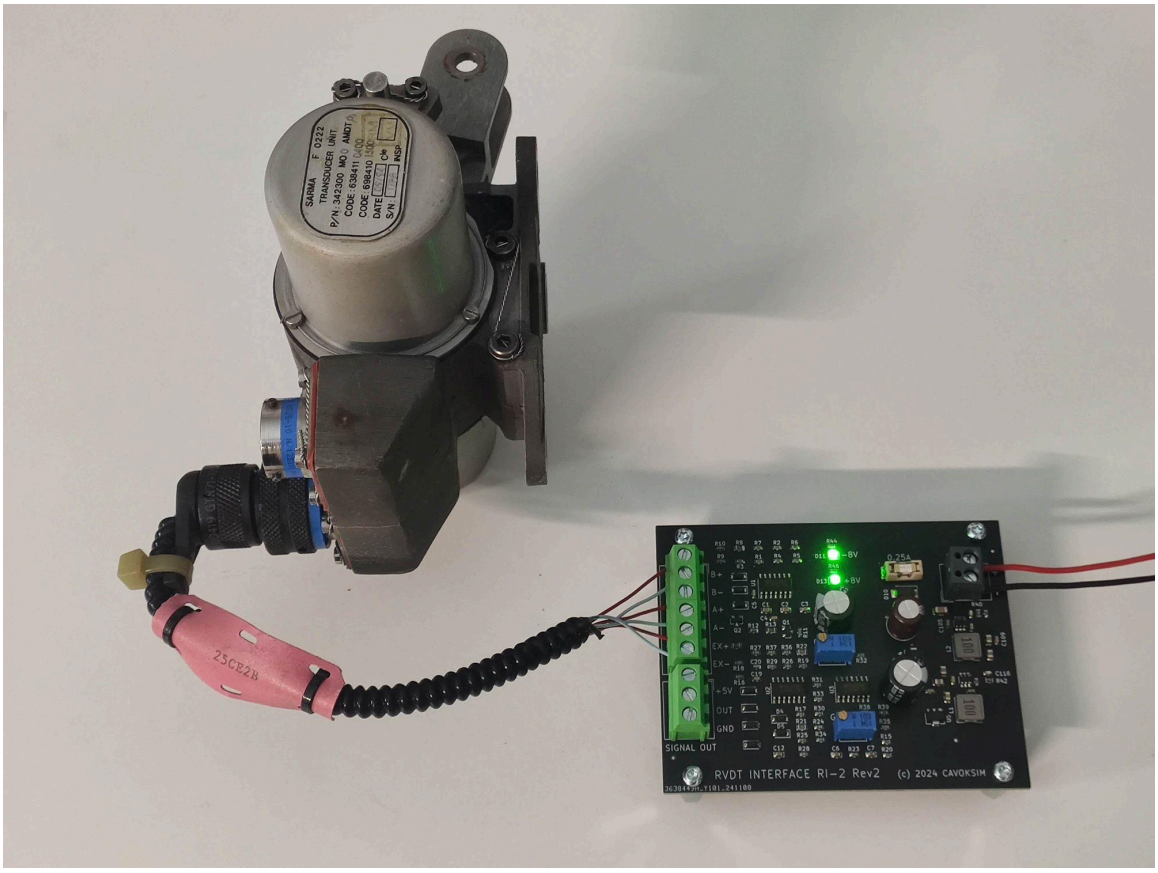
- **Protect the boards from moisture and high humidity. Moisture can cause malfunctions of the controller board.**
- **Take extra care when connecting the supply voltage to the board. Applying a voltage that is too high or has reversed polarity or applying the voltage to the wrong board terminals can damage the boards. Do not connect or disconnect input power to the board while the power is switched on. The controller boards have reverse polarity protection for the 28v input only. All other terminals are not protected.**
- **Install the boards in a way that protects them from touching metal objects or conductive surfaces that might create short circuits with exposed solder joints and components of the boards.**
- **There are small SMD components the boards that can be easily mechanically damaged. Handle the boards with care.**

Table of contents

1 Introduction

The interface RI-2 is designed to interface a RVDT (rotary variable differential transformer) transducer with any standard analog input card (analog joystick interface). For more information please read the paragraph ‘RVDT explained’ below. In essence, the RI-2 board makes the RVDT transducer behave like a potentiometer. Potentiometers are commonly used in flight simulation.

The RI-2 is specifically designed for use with the RVDT transducer used in Airbus aircraft for rudder pedal position sensing. The unit used for testing was a SARMA transducer P/N 34200. The RI-2 will likely work with other types of RVDT and LVDT transducers as well, but this has not been tested and is not guaranteed to work. The transducer used for testing this board is shown below:

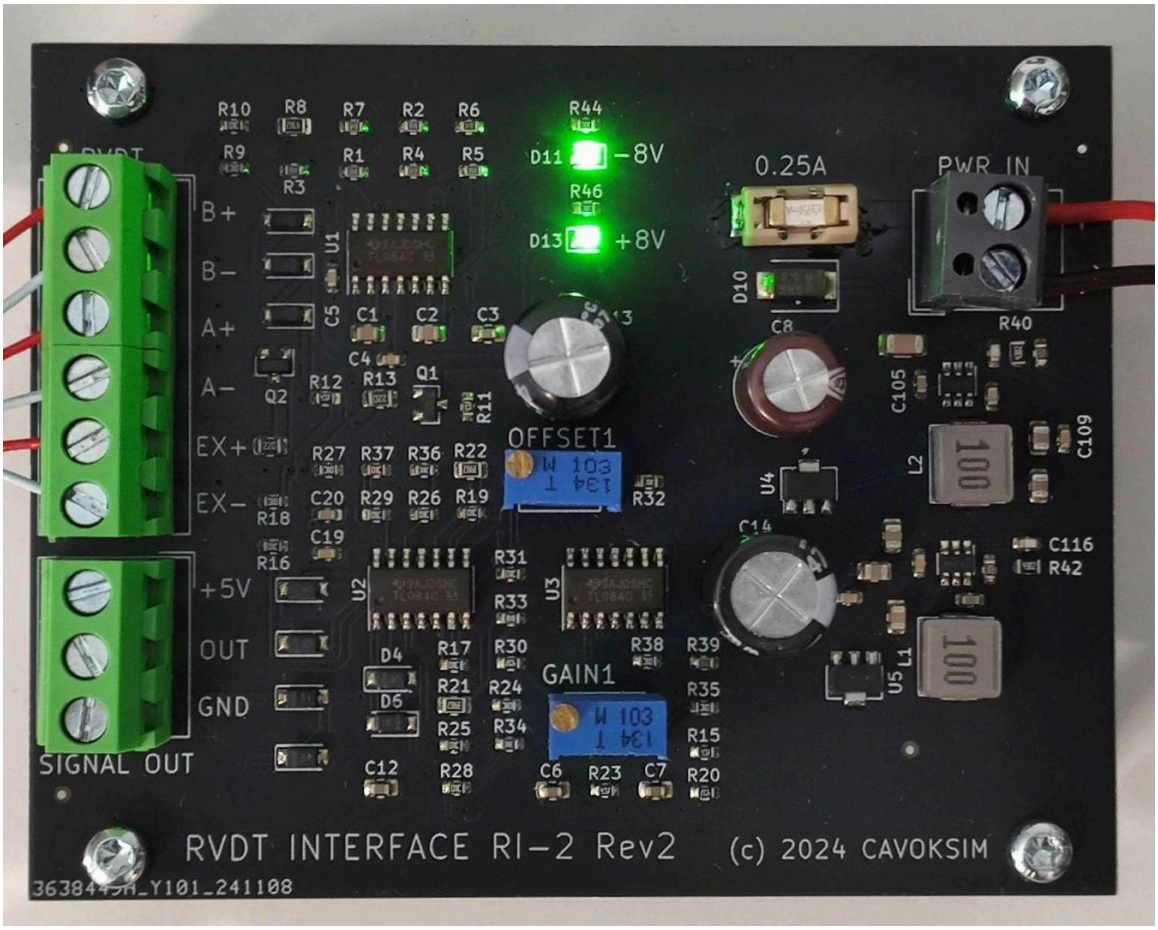


RVDT background information

Both potentiometers and RVDT have the same function: They measure a rotation angle and convert it into an electrical signal. But they use different principles to archive this. Potentiometers are variable resistors that can easily be connected to a voltage source and provide a DC voltage proportional to the rotation angle. That makes them easy to connect to an analog to digital converter. RVDT transducers are more complicated to interface. The simplified principle is that an AC sine wave is generated by the RI-2 board and supplied to the RDVT exciter coil. The RI-2 board then receives AC feedback signals from the A and B coils of the RVDT. It compares the strength of the feedback waveforms to measure the position angle. The result is converted into a variable DC voltage that can be read by a standard analog to digital converter similar to a potentiometer.

RVDT transducers are often used instead of potentiometers in aircrafts. They are extremely robust and rugged and much more reliable. Therefore they are most suitable for safety critical applications and extreme environments.

2 Connection



The function of each terminal of the RI-2 board is printed on both the front and back side of the board. It has 6 terminals that need to be connected to the 3 coils of the RVDT transducer. As mentioned before this board is intended to be used with a SARMA transducer used for Airbus rudder pedals. This transducer unit has 2 identical transducers connected to a common shaft. For simulator purposes only one of the two transducers needs to be connected. Each transducer has an identical 10 pin MIL connector. Only 6 of the 10 pins are used. There are small letters printed inside the connector to identify the pins. Connect the transducer connector pins to the RI-2 board as follows:

Transducer pin	RI-2 board terminal
D	B+
E	B-
G	A+
H	A-
A	EX+
B	EX-

There is no risk of damage to the transducer or board if any pins are connected incorrectly. To help find the correct pins of an unknown transducer, you can measure the resistance between pins with a multimeter: The resistance should be:

- between A+ and A- around 142 Ohms
- between B+ and B- around 142 Ohms
- between EX+ and EX- around 167 Ohms

The exact resistance measured is not important. Between any other pair of pins there should be no connection.

Power supply

The Ri-2 is designed for a standard supply of between 24-28V. It can also operate in an extended range of 18-32V max. The power consumption is low and the current at 28V is only about 40mA. The board has reverse polarity protection, but make sure to connect the power supply correctly as printed on the board. When power is supplied 2 green indicators should light up on the board to indicate that its +/-8V onboard voltage converters are working.

3 Operation

IT IS RECOMMENDED TO MEASURE THAT THE FULL SCALE OUTPUT VOLTAGE OF THE RI-2 IS IN THE CORRECT RANGE (0..5V) BEFORE CONNECTING AN ANALOG INPUT CARD TO THE OUTPUT.

Connect the OUT terminal to the input of the analog card. Connect GND of the RI-2 to GND of the analog card. Connect the +5V terminal to the 5V supply of the analog card.

IMPORTANT: The +5V terminal is not used to supply power from the analog card to the RI-2 board. Its purpose is to protect the analog card from overvoltage in case the RI-2 is not correctly adjusted. It is therefore important to make this connection.

Testing

Before connecting the analog card, first test the output voltage range of the RI-2 with a voltmeter. Move the transducer to both end stops and check that the output voltage stays between 0 and 5V. If not, adjust it as described in the following paragraph. When the output voltage is verified to be correct, connect the analog input board. Check that you receive the full deflection inputs in your simulator SW. Please note that the Airbus RVDT output is non-linear. It means that its sensitivity (voltage change for a given change in deflection angle) is highest around the neutral position and decreases towards full deflection. This is desirable in the real aircraft because the rudder pedals will mostly be used with only small deflections and the accuracy for large deflections is less important. The onboard flight computers that receive the signal account for the non linearity. However, PC based flight simulations are written to expect inputs from a linear potentiometer. Without correction, the rudder pedals would be overly sensitive around the neutral position when using a RVDT. It is therefore recommended to adjust the response curve of the rudder pedals accordingly by software to correct the non linear behavior of the RVDT.

Output voltage calibration

The RI-2 is preadjusted for a full deflection output range of 0 to 5V (end stop to end stop) when used with a SARMA transducer as shown before. Normally there should be no adjustments necessary.

Do not change the calibration of the RI-2 board unless you notice issues or measure incorrect output voltages. Possible issues would be clipping (the analog input card shows full deflection when the transducer has not reached an end stop) or reduced resolution (the analog card does not show full deflection when the transducer has reached an endstop).

When any of these problems are noticed, the output voltage of the RI-2 can be adjusted. Disconnect the analog input card. Connect the transducer and switch the power supply on. Measure the voltage between OUT terminal and GND. It should be close to 0 (but not below 0) at one end stop of the transducer and close to 5V (but not above) at the other end stop. If the voltage is not correct, adjust it with this procedure:

- move the transducer to the end stop where the lowest voltage is shown. Then locate the trimmer labeled OFFSET. Adjust this trimmer until the voltage is close to 0, but not a negative value.
- Move the transducer to the opposite end stop. Locate the trimmer labeled GAIN. Adjust the trimmer until the output voltage is close to, but not above 5V
- Adjusting the GAIN trimmer will slightly change the previous OFFSET adjustment. It is therefore necessary to repeat the first 2 steps several times until the optimum position for both trimmers is found

If in doubt, contact CAVOKSIM for assistance!