TT-2D USERS MANUAL

Resonance indicator LED

Button A

Button B

Power/fine frequency

← Transducer connection

← LCD display

← Coarse frequency set

Figure 1 Control Location

1 INTRODUCTION

The TT-2D is designed to test acoustic transducers for resonance over the frequency range of 500 Hz to 500 KHz. The TT-2D tests all types of transducers, including transformer-coupled and magnetostrictive devices. The load characteristic (capacitive, resistive, or inductive) and impedance at resonance are displayed on the two line LCD display. The leakage resistance of the transducer can be measured and displayed over the range of 10 ohms to 5 megohms.

2 CONTROL FUNCTIONS

Refer to figure 1 for the location of the controls discussed in this section.

2.01 TRANSDUCER CONNECTION

The transducer output connects to the transducer under test. **WARNING, do not connect a source of power to this connector. If you do, the TT-2D will be seriously damaged. This is an output only.**

2.02 LCD DISPLAY

Normally displays the frequency on the lower line and the impedance and relative phase on the upper line. Battery voltage and software version are displayed for 3 seconds when the power is turned on.

2.03 COARSE FREQUENCY SET KNOB

This controls the frequency sent to the transducer from less than 500 Hz to over 500 KHz.

2.04 POWER/FINE FREQUENCY SWITCH

This knob controls the power and is also used to fine tune the frequency setting. The frequency range is about 10% of that set by the coarse frequency control.

2.05 BUTTON A

The main function of this push button switch is to select the resistance measuring mode. When this button is pressed, the DC resistance of the transducer is displayed in ohms on the bottom line of the display. The range covers 10 ohms to 5 megohms. Press button ‘B’ once to return to normal operation.

2.05.01 During power-up, press button ‘A’ to increase the display contrast.

2.06 BUTTON B

The main function of this push button switch is to select one of the three frequency ranges. The range increments each time this button is pressed. Each range covers a decade as shown below:

2.06.00.01	Range 1:	500 Hz to 5 KHz.
2.06.00.02	Range 2:	5 KHz to 50 KHz.
2.06.00.03	Range 3:	50 KHz to 500 KHz.

2.06.01 During power-up, press button ‘B’ to decrease the display contrast.

2.06.02 To make a selected frequency range as the default range, select the range and *before* releasing button ‘B’, press button ‘A’. Release both buttons when the display shows ‘FR store’ on the bottom line. This range will be selected each time the TT-2D is powered-up.

2.07 RESONANCE INDICATOR

This LED brightens when the frequency approaches the resonant point of the transducer. The brighter the LED, the lower the impedance is. The LED also flashes on power-up while the TT-2D initiates the self-test routine.

3 GETTING STARTED

Connect the TT-2D XDUCER output to a transducer. Turn the power on and the TT-2D will go through a self-test routine while displaying the battery voltage. While the TT-2D is in the self-test mode, the contrast may be set and stored by pressing buttons ‘A’ or ‘B’. After the TT-2D displays the frequency on the bottom line, select the appropriate frequency range by pressing button B. Rotate the coarse frequency control while watching the resonance indicator LED for resonant points. There will be three resonance points for most transducers. Choose the one that has the brightest indication on the LED. Fine tune the frequency with the fine frequency control while watching the display for the lowest Zo indication. The phase indication will usually be near zero when the impedance is at a minimum.

3.01 SORTING OUT MULTIPLE RESONANCE POINTS

Most all transducers you test will have three major resonance points. A major resonance point has a significant peak in the resonance indicator and a low impedance over a narrow frequency range. The problem is to determine the correct resonant point. This will usually be the frequency where the most power is transferred from the face of the transducer. Check the energy transfer at each resonant point by pressing on the exact center of the transducer face with a fingertip while observing the impedance displayed on the top line of the LCD. The readings will change noticeably with moderate finger pressure. The resonant point that produces the most pronounced change of impedance is usually, BUT NOT ALWAYS, the correct operating frequency for the transducer.

3.02 MEASURING TRANSDUCER IMPEDANCE

The transducer impedance at resonance is indicated on the upper left of the LCD. The relative phase angle is displayed in the upper right of the LCD. A negative (-) sign indicates the load looks capacitive to the TT-2D, and a

positive sign (+) indicates the load is inductive. The lowest impedance reading will usually occur when the relative phase angle displayed is less than ten.

3.03 TRANSDUCER DC RESISTANCE

Press button 'A' to check the resistance of the transducer. The measurement range is from 10 ohms to 5 megohms. Piezoelectric transducers that are not transformer coupled should indicate "> 5 Megs" of leakage after a few seconds. Transformer coupled transducers usually have only a few ohms of resistance, and the LCD will indicate "<10 Ohms."

4 HOW IT WORKS

The TT-2D sends a signal through a 100 ohm resistor to the transducer under test. The voltage waveform at the transducer is sampled at three specific points per cycle. The relationship of the voltages at the sample points determine the impedance and relative phase of the voltage across the transducer. The impedance is calculated and displayed over the range of 1 to 9990 ohms and the relative phase shift is displayed to the right of the impedance reading. A plus (+) sign (voltage leads current) indicates an inductive load, and a minus (-) sign (voltage lags current) indicates a capacitive load. The numbers following the polarity sign range from 0 to 30, with the higher numbers indicating a higher reactance.

5 CALIBRATION

Calibration of the TT-2D should not be necessary unless repairs have been made or internal parts have been changed. The calibration is done with the output short-circuited. The TT-2D is then checked with a 100 ohm and 1000 ohm resistor across the output to see if the displayed readings are within specifications. The equipment required to check the TT-2D calibration follows:

5.00.01	Frequency counter with .005% or better accuracy.
5.00.02	100 ohm 5% resistor.
5.00.03	1000 ohm 5% resistor.

5.01 CHECKING SHORT CIRCUIT LOAD CALIBRATION

Turn the TT-2D on. Check the displayed battery voltage. It must be greater than 6.5 volts. If not, replace the battery. Set the frequency to 50 KHz and short the output by connecting the test cable clip-leads together. The impedance should read within +1 to -1. If the reading is not within this range the unit should be calibrated. See the SHORT CIRCUIT LOAD CALIBRATION procedure below for instructions.

5.02 CHECKING RESISTIVE LOAD CALIBRATION

Turn the TT-2D on and set the frequency to 50 KHz. Short the clip leads and verify that the reading is within +/- 1 ohm. If the reading is out of spec, try the SHORT CIRCUIT CALIBRATION procedure.

5.02.01 Connect the 100 ohm resistor to the clip leads and verify the displayed reading is 100 +/- 10 ohms. If the reading is not within specifications the unit must be returned to the factory for repair.

5.02.02 Remove the 100 ohm resistor and connect the 1000 ohm resistor. Verify that the displayed reading is 1000 +/- 100 ohms. If the reading is not within specifications the unit must be returned to the factory for repair.

5.03 CHECKING FREQUENCY ACCURACY

Set the TT-2D as close as possible to 50 KHz. Connect the counter to the XDUCER jack and verify that the displayed reading is within 0.05% (+/- 0.025 kHz at 50 Khz) of that on the frequency counter. If the reading is out of spec the unit must be returned to the factory for repair.

5.04 SHORT CIRCUIT LOAD CALIBRATION

Turn the TT-2D on and store frequency range 3 as the default. Set the frequency to 50 Khz. Turn TT-2D off. Connect the clip leads together to short circuit the output. Press and hold both the 'A' and 'B' buttons and then turn on the power. Watch the display and release both buttons *immediately* after the display shows 'Cal mode'. If the buttons are not released quickly, the unit will not enter the calibration mode. Wait a few seconds after the display changes to "ADC=xxx" on the top line and then press button 'B' to store the ADC calibration value. Turn the TT-2D off then back on. Check to make sure the impedance reads within +/- 1 ohm. If not, check the test lead for continuity and repeat the calibration. If the reading is still out of specification the unit must be returned to the factory for repair.

5.05 OHM METER CHECK

Turn the TT-2D on and press button "A" to put the TT-2D into the DC resistance measurement mode. Short the clip leads together and verity that the display reads < 10 Ohms. Open the clip leads and verify the display reads > 5 M ohms. Place a 10 K resistor across the clip leads and verify the display reading is between 9000 and 11000 ohms. If the readings are out of specification the unit must be returned to the factory for repair.

6 BATTERY TEST

The battery should be replaced if the voltage falls below 6.5 volts as indicated on the display when the TT-2D is powered-up.

6.01 BATTERY REPLACEMENT

The battery compartment is located on the back side of the TT-2D. Turn the TT-2D face down and remove the battery cover by pressing down and outward with your thumb. The cover will then slide free from the case, exposing the battery. If possible, use 9V alkaline batteries for replacement.

7 SPECIFICATIONS

FREQUENCY RANGE:	.5 to 500 KHz, typically .1 to 550 KHZ.
FREQUENCY ACCURACY:	0.05% of indicated frequency +/- 1 digit.
FREQUENCY RESOLUTION:	0.01 KHz
IMPEDANCE RANGE:	5 - 1000 ohm, usable 1 - 9990 ohms.
IMPEDANCE ACCURACY:	10% of indicated reading.
TRANSDUCER TYPES:	All types, including transformer coupled.
BATTERY TYPE:	Standard 9V transistor radio type.
CURRENT DRAIN:	20 mA avg, 60 mA max.
EST BATTERY LIFE:	6 to 8 hours continuous use.
RECOMMENDED BATTERY:	Alkaline type similar to EVER READY #522 or equivalent.
WEIGHT:	11 ounces with battery and test cable.
SHIPPING WEIGHT:	2 pounds.

8 WARRANTY INFORMATION

Unit will be repaired free of charge for one year from date of purchase providing there is no water damage or other evidence of improper use or handling. Purchaser must ship unit prepaid to address below; EDI will pay the return freight. Please call before shipping your unit back to us.

Phone: 1-757-421-2968 Fax: 1-757-421-0518

For repair ship to:

Electronic Devices, Inc.
3140 Bunch Walnuts Road
Chesapeake, VA. 23322
ATTN: Service Department

Please enclose a note describing the problem.

9 COMMONLY ASKED QUESTIONS

9.01 HOW TO SET THE CONTRAST

To set the contrast, turn the TT-2D off and back on. Press button ‘A’ or ‘B’ while the battery voltage is displayed. The contrast setting is stored when the impedance and frequency display appears approximately three seconds after releasing the buttons.

9.02 HOW TO CHANGE THE FREQUENCY RANGE

To change the frequency range press button ‘B’. The range (1, 2, or 3) will be displayed while the button is held down. When the button is released the TT-2D will operate on that range.

9.02.01 The frequency range can be stored so it is selected whenever the TT-2D is turned on. To store the range select it as above, but do not release button ‘B’ when the range number is displayed. While the range number is displayed, press button ‘A’ then release both buttons. The display will momentarily read “FR store” to indicate the frequency range has been stored to memory.

9.03 HOW TO MEASURE LEAKAGE

Press and release button ‘A’ and the display will read “Ohms chk” on the top line. The resistance will be displayed on the bottom line in exponential format. For example, a 1,200 ohm resistor will read “1.20E+03" on the bottom line of the display. If no leakage is present, the display will read “>5M ohms”. Allow several seconds to elapse for the reading to stabilize. To return to normal operation, press and release button ‘B’.

9.04 HOW TO DETERMINE IF A TRANSDUCER IS DEFECTIVE

A transducer is defective or the wiring is faulty if no resonant points are observed. All transducers should have a strong indication of resonance at or near the published operating frequency.

9.04.01 A multi-element transducer with one damaged element may resonate at the correct frequency, but the impedance reading will change by a good amount. If there is any doubt, compare the readings to a known good transducer. When making comparative readings, both transducers must be tested in air or in water. Do not compare the reading in air to the reading in water as there will be a big difference in the measured impedance.

9.04.02 If a transducer indicates any measurable leakage (less than 5M ohms), the wiring should be checked. If the wiring is not leaky, the transducer should be replaced even if it is working ok on the depth sounder. Becuase of the high pulse voltage used, a leaky transducer will soon break down internally and cease to operate.