# Wilcoxon Research P702B/P702BF-1 operating guide

Power unit/amplifier for piezoelectric transducers with internal amplifiers


**Caution:** This manual should be read carefully before installation.

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## 1.0 Introduction

The P702B power unit/amplifier is a portable power source with integral signal conditioning for use with internally amplified accelerometers. Signal conditioning includes amplification, integration and fault indication.

## 2.0 Description

The P702B power unit/amplifier is a portable unit specifically designed to furnish 2.4 mA constant DC current (+27 VDC) necessary to operate the internal charge amplifiers of Meggitt Sensing Systems and similar piezoelectric transducers (accelerometers and velocity sensors.) In addition the P702B provides signal conditioning, includes features such as selectable gain levels of 1, 10, 100, extremely low-noise, integration to yield velocity output, battery condition indication, and visible overload or open/shorted cable indication. This gives the test engineer broad capabilities for the accurate measurement and recording of vibration signals over a wide range of test situations. Also virtually any high impedance charge-type accelerometer can be operated with the P702B with the addition optional charge converter accessory, CC701. The P702B also has built-in ESD protection to guard against damage of the internal electronics.

All switches and controls are on the front panel. Transducer input and output BNC connectors are located on the rear panel, as is a connector for the optional line adapter/charger, See Figure 1 in the appendix.

The P702BF-1 is identical to P702B, except that the frequency response of the P702BF-1 is specified as –3 dB from 0.5 Hz to 20 kHz (versus 0.5 Hz to 50 kHz for the P702B) in acceleration mode. Other than the high end frequency response, the P702BF-1 is identical to the P702B in terms of operation, maintenance and troubleshooting.

## 3.0 Operation

### 3.1 Theory of operation

The P702B power unit/amplifier consists of the major circuits and components shown in Figure 2 in the appendix. Panel functions are shown in Figure 1. The power module provides + 27 VDC through an internal 2.4 mA (other values between 2.0 and 10 mA can be furnished on request) constant current diode to the transducer, as well as the DC excitation for the selectable gain amplifier, the fault indicator circuit, and the integrating circuit.

The power is normally supplied from the three internal 9 volt batteries. When the optional LA704 Line Adaptor is used, the internal batteries are automatically disconnected when the adaptor's output cable is plugged into the power jack on the rear of the P702B unit. See Figure 3 in the appendix for correct jumper placement.

The vibration signal fed into the P702B Transducer input connector passes through a low pass filter (optional) and to the first gain stage which amplifies the signal by X1 or X10 according to the gain switch setting. The signal is split and one path is routed to an integrating amplifier to become an output signal proportional to velocity (mV/in/sec). It then rejoins the non-integrated signal at the ACCeleration/VELocity selector switch. When the switch is in the ACCeleration position, the signal goes directly to the second

stage gain amplifier which can introduce an additional X1 or X10 gain. By using different combinations of first and second stage gains, the output can be set for gains of X1, X10 or X100.
The fault monitoring circuit is built around a dual comparator which senses the DC voltage supplied to the transducer's internal amplifier. The comparator circuit is of the window type and when the transducer's bias output voltage exceeds the normal range, 6-16 VDC, depending on the transducer type, it illuminates the FAULT indicator. Abnormal voltages which can be caused by extended signal overloads within the transducer's internal charge amplifier may trip the circuit. Normally, small transients will not cause the fault indicator to light as it has a rather long time constant to prevent low frequency, high amplitude signals from causing the indicator to illuminate erroneously.

The P702B can be supplied by the factory with an optional 6 dB per octave roll-off RC low-pass filter incorporated into the amplifier.

### 3.2 Inspection

After carefully unpacking the P702B power unit/amplifier, inspect the external parts for damage to switches, indicators and connectors. If there is damage, file a claim with the carrier who transported the instrument. Retain the shipping container and packing material for use in case reshipment is required.

### 3.3 Preparation for use

Depress toggle the ON-OFF-BATT power switch to the BATT momentary contact position. The battery condition indicator should show a steady green light. Release switch. Connect the proper cable to the TRANSDUCER input connector on the P702B and to the transducer to be powered. This cable should be free of kinks and cable connectors should be clean. Connect a coaxial cable to the output BNC connector on the rear panel of the P702B and to the readout or recording instrument.

If the optional line adaptor (LA704) is to be used, plug the adaptor's output cable into the jack on the rear panel of the P702B. Then plug the line cord of the adaptor into a source of 110 V 50/60 Hz power (or 220 V 50/60 Hz for the LA704-220). Internal batteries of the P702B are now disconnected (with Ni-Cd jumper in the alkaline position) and the unit can be operated from the power line via the LA704.

**Note**: For units factory equipped with Ni-Cd batteries (or if the unit has been modified with the NC3 Ni-Cd kit) there is an internal jumper near the batteries that must be set to the correct position for charging the Ni-Cd batteries.

**Note**:On units with the Ni-Cd battery option, a jumper inside the unit needs to be set so that the batteries may be charged by the LA704 line adapter. DO NOT USE ALKALINE BATTERIES IN THE P702B WITH THE JUMPER SET TO THE Ni-Cd POSITION! Alkaline batteries are not rechargeable and may explode and/or cause a fire if the jumper is set incorrectly and the line adapter is connected to the P702B.

### 3.4 Use in measurement system

After the vibration measuring system (consisting of the P702B power unit/amplifier, accelerometer, readout instrument and connecting cables) is prepared as discussed above, the following procedure is recommended to put the system into operation.

Set the gain range switch to the desired value of 1, 10, or 100 depending on the acceleration range or the velocity range and the sensitivity of the accelerometer. The output of the P702B is limited to 6 Volts, so this will limit the output for any sensitivity/gain combination.

For vibration measurements in 'g' values, use an accelerometer as the input. Set the ACCeleration/VELocity switch to the ACC position. For a typical Wilcoxon Research accelerometer (like model 793, with a sensitivity of 100 mV/g) a 10g vibration level would produce a 1 Volt output at the sensor.

The formula for this is $V_{out}$ = sensitivity x vibration level x gain (assuming no integration). In this example, the output voltage is calculated as follows:

Sensitivity = 0.100 Volts (100 mV)
Vibration level = 10g
Gain = X1

$V_{out}$ = 0.100 x 10 x 1 = 1 Volt

If $V_{out}$ exceeds 6 Volts, the red FAULT indicator will light. If all other reasons for the fault have been eliminated (see sections 3.1 and 4.3) the cause may be:

- Too much gain selected on the P702B, and/or
- In the lowest gain setting (X1), a less sensitive accelerometer may be required to lower the output voltage fed to the P702B so the output voltage drops below 6 Volts.

If a signal proportional to velocity is desired, set the ACCeleration/VELocity switch to VEL. In this position, the input signal is integrated to velocity with a calibrated output sensitivity of 100 mV/in/sec for a 100 mV/g accelerometer.

If a velocity transducer is the input to the P702B with the selector switch in the ACCeleration (no integration) position, the output will be proportional to velocity with a sensitivity equal to the sensitivity of the velocity transducer. Gains of X10 and X100 may be applied to this signal as long as the output voltage of the P702B does not exceed 6 Volts.

If the selector switch is set to velocity (single integration) with a velocity transducer as the input signal, the output will be proportional to displacement. For a 100 mV/in/sec velocity transducer, the calibrated output sensitivity of the P702B will be 38.6 mV/mil.

**Note**: If the P702B power unit/amplifier is to be used in connection with a high Impedance charge-type accelerometer rather than the internally amplified transducers, a charge converter accessory (CC701) is required. The specifications of the CC701 should be consulted to insure compatibility with the selected accelerometer.

**Note**: If the P702B power unit/amplifier is to be used with another accelerometer with integral amplifier (not a Wilcoxon Research type), its specifications must be compatible with those of the P702B.

### 3.5 Filtering

The P702B power unit/amplifier can be supplied with a low-pass filter on special order.
The P702BF-1 is supplied with 20kHz low pass filter that gives a system response that meets MIL 740-2 when paired with a WR 742TF-1 or 726TF-1 accelerometer.

### 3.6 Precaution in use

The P702B should not be subjected to environments in excess of its specified temperature and humidity ranges. It should be protected from condensation and corrosive atmospheres.

## 4.0 Maintenance and troubleshooting

The P702B power unit/amplifier is fully adjusted and ready to operate when received from Wilcoxon Research. A new set of 9 volt alkaline batteries are mounted in the unit. Typically, the batteries have an operational life of greater than 80 hours.

### 4.1 Battery replacement

Batteries need replacement when the battery condition indicator no longer glows as the ON/OFF/BATT switch is depressed to the BATT position. Turn the P702B upside down, remove the four retaining screws in the cover bottom and carefully slide the chassis out from the cover box. The batteries are located inside supported on three sides by the PCB and resting on a foam pad. Simply unplug the snap-on connectors and plug in the new batteries. Replace them in the cutout in the PCB, slide chassis back in to cover box and replace the four retaining screws. Check the battery condition indicator to make sure the new batteries function correctly.

### 4.2 Initial checks

Depress ON-OFF-BATT power switch to BATT position. The battery condition indicator should show a steady green light. Release switch. Connect the proper cable to the TRANSDUCER input BNC on the P702B and to the transducer to be powered. This cable should be free of kinks and cable connectors should be clean. Connect a coaxial cable to the output BNC connector on the rear panel of the P702B and to the readout or recording instrument. For the initial checks, a T-connector may be placed on the TRANSDUCER BNC and the accelerometer cable connector to one side of the T-connector. The other side is left open.

Set ON-OFF-BATT power switch to ON. The FAULT monitor light will glow red during the approximately 20 second warm-up time of the P702B. If this monitor continues to glow, the transducer and its cable should be carefully checked to locate and correct the fault. If the monitor ceases to glow, indicating correct operation, the open end of the T-connector should be shorted by connecting a short wire from connector center to shell. The FAULT monitor should make the glowing stop. Disconnect the cable to the transducer. The FAULT monitor should now glow again to indicate the presence of the open cable. Reconnecting the cable should make the glowing stop. The system is now ready for operation. The T-connector may be left in place or removed.

If the optional line adaptor (LA704) is to be used, plug the adaptor's output cable into the jack on the rear panel of the P702B. Then plug the line cord of the adaptor into a source of 110 V 50/60 Hz power (or 220

V 50/60 Hz for the LA704-220). Internal batteries of the P702B are now disconnected and the unit is operated from the power line.

**Note**: The tests above apply whenever the unit is powered by its internal batteries (Alkaline or NI-CD) or from the line adaptor.

### 4.3 FAULT monitor

If the FAULT monitor signal light glows red (after the 20 second warm-up period), the measurement system should be carefully checked to see if any of these seven conditions exist:

- Accelerometer is not connected
- Accelerometer has internal open connection
- Accelerometer has internal short.
- Cable assembly has internal connection (break)
- Cable assembly has internal short
- Accelerometer's internal amplifier is overload
- Optional charge converter (CC701) is malfunctioning/overloaded

If none of these faults appear to be present, but the fault monitor continues to glow, the easiest way to check is to substitute another P702B unit (known to be in good working condition) in the measurement system. If this restores proper operation, the original P702B is malfunctioning and should be returned to the factory for repair.

### 4.4 Electrical calibration

The validity of the measurements performed by the vibration measurement system depends on the continuing proper function of the P702B power unit/amplifier. We recommend that an electrical calibration of the measurement system be performed regularly (once a year) or before any extensive series of vibration measurements.

An electrical signal should be substituted for the accelerometer signal for the purpose of calibration. The output of a sinusoidal signal generator at a recommended frequency of 100 Hz is fed through an RC network into the TRANSDUCER input connector of the P702B. This network consists of a 100 MF capacitor in series with the input, and a 4.7 KΩ resistor across the input. The signal generator is set to produce an output signal amplitude of 1 V rms On the P702B and will vary according to GAIN switch setting. To verify gain, divide the voltage at the P702B's output BNC by the voltage at the P702B's TRANSDUCER input BNC.

See Figure 4. The P702B may also be returned to Meggitt Sensing Systems for recalibration.

## 5.0 Accessories and options

LA704 line adaptor
The LA704 wall plug-type adaptor supplies regulated 27 VDC power to the P702B from a 108 to 120 Vac, 50 to 60 Hz power line.

LA 704-220 line adaptor
The LA704-220 is similar in operation to the LA704 but is a slightly larger desktop unit for use in Europe and other countries that have 220 V, 50 to 60 Hz power line. The output cord mates with and supplies 27 VDC to the P702B unit. The input cord is a pigtail fitted with the IEC 320 connector for maximum flexibility. It is the user's responsibility to supply the required cord to conform with local standards.

CC701 charge converter
The CC701 contains a low-noise PiezoFET® amplifier which converts a high impedance signal from a charge-type accelerometer to a low impedance, voltage signal compatible with the P702B. The charge amplifier circuit in the CC701 allows it to be located near the accelerometer or connected directly to the TRANSDUCER input connector of the P702B.

## 6.0 Technical assistance

### 6.1 Technical assistance

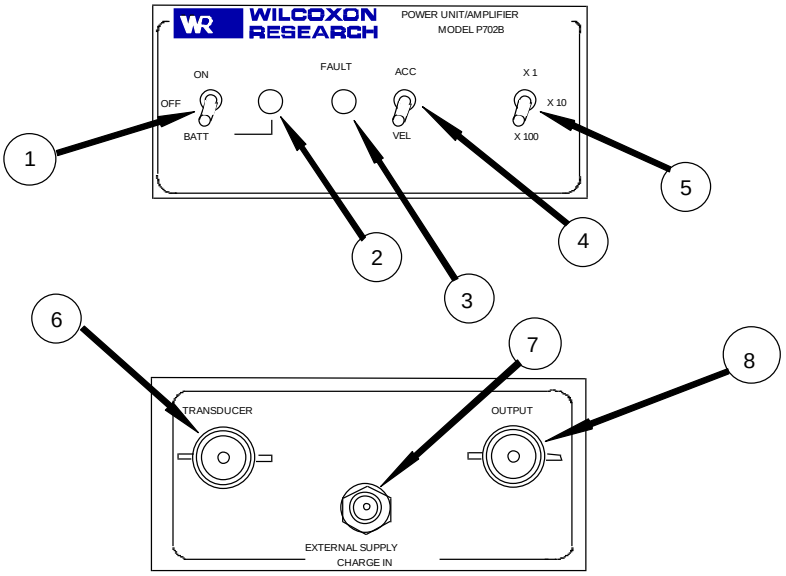
For technical assistance, please contact Meggitt Sensing Systems at 301-330-8811 or email wilcoxon@meggitt.com.

### 6.2 Customer service

To obtain a return goods authorization number, please contact customer service at 301-330-8811, or fax 301-330-8873.

## Appendix

Figure 1 – Panel functions




1. ON-OFF-BATT power switch
2. BATTery condition indicator: green LED
3. Circuit FAULT monitor: red LED
4. ACCeleration/VELocity selector switch
5. GAIN range switch
6. TRANSDUCER Input jack (BNC)
7. CHARGE INput jack (for optional LA704 line adaptor)
8. OUTPUT jack (BNC)

Figure 2 – P702B circuits and components

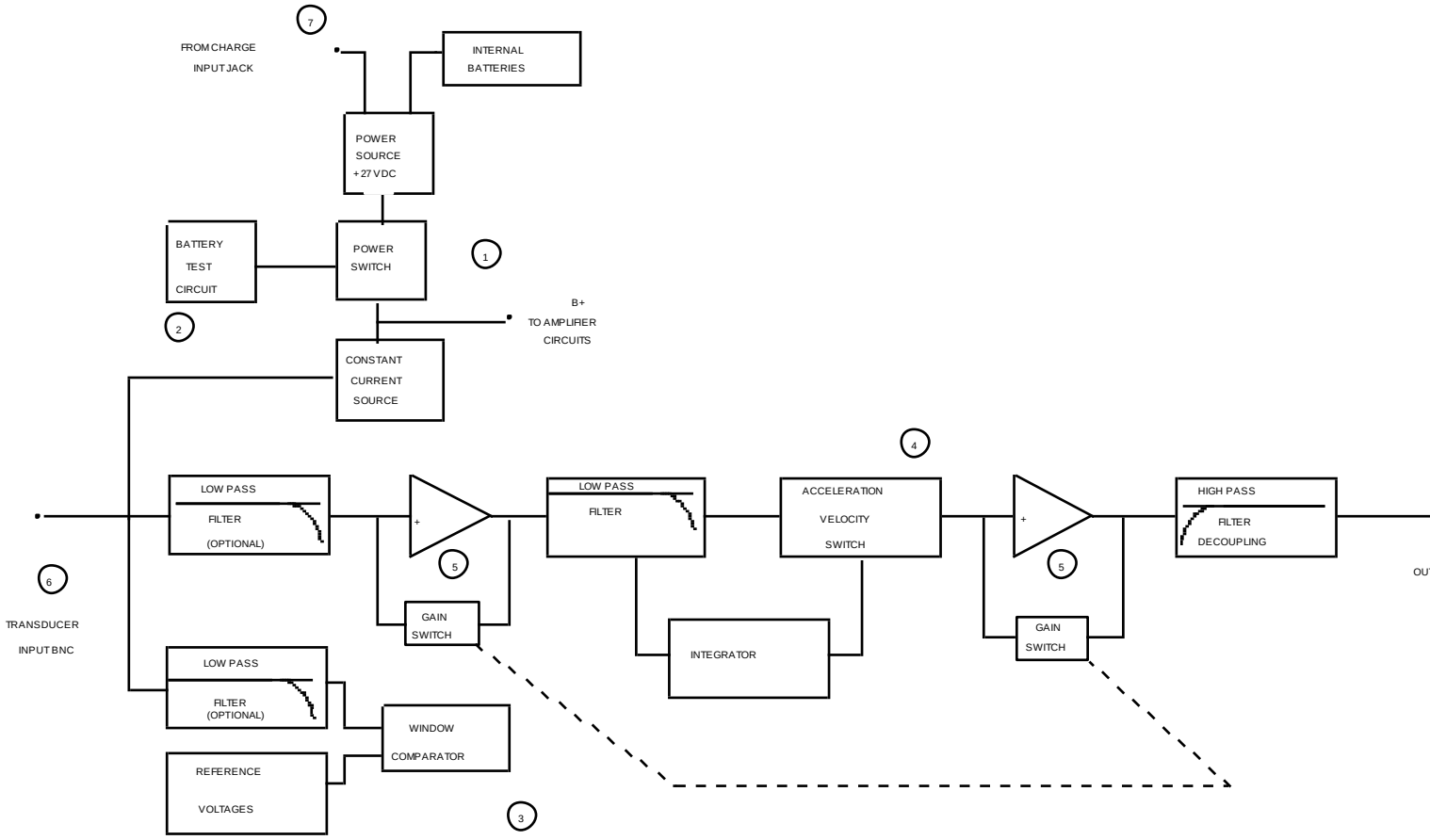


Figure 3 – Jumper placement

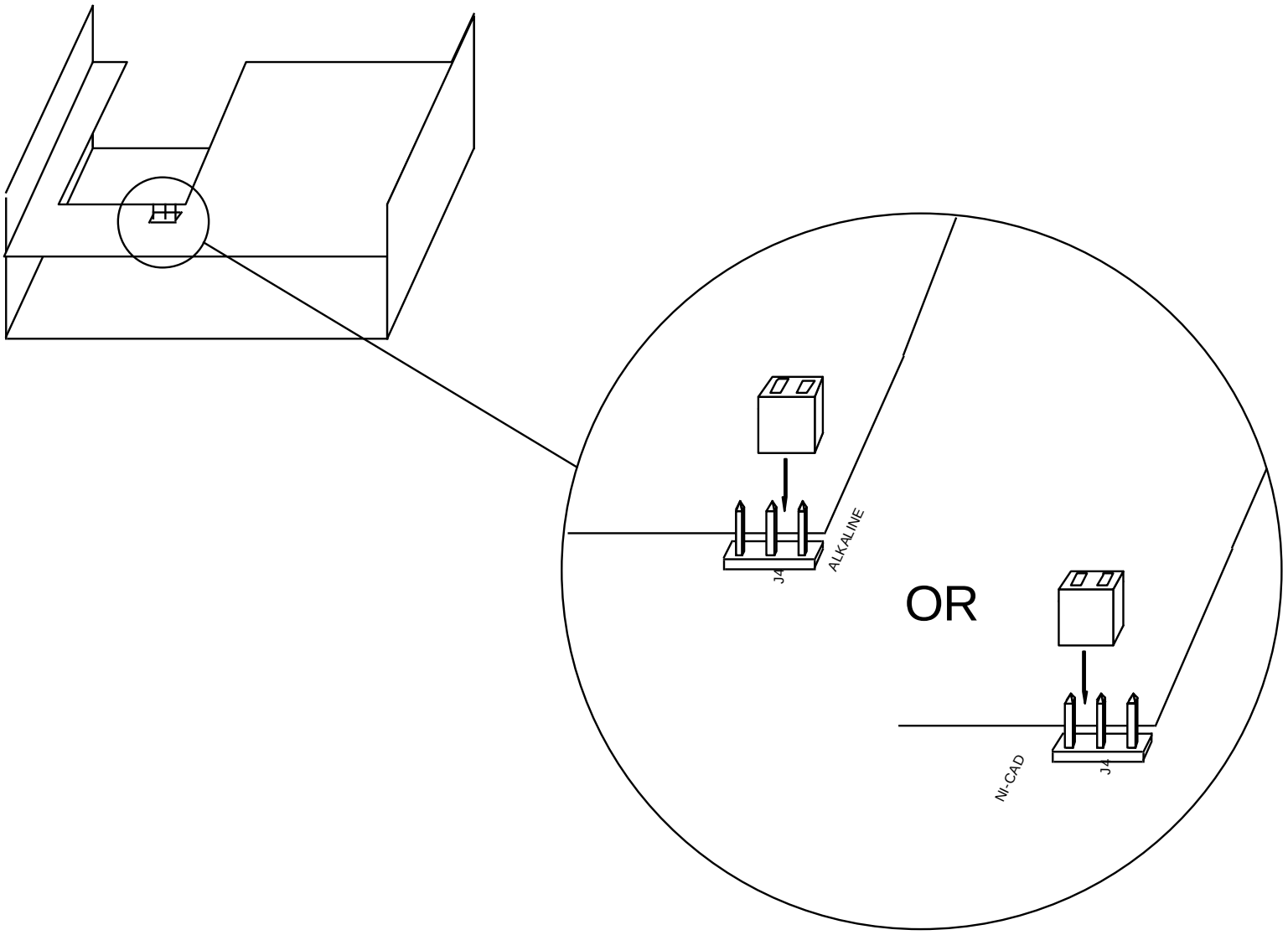
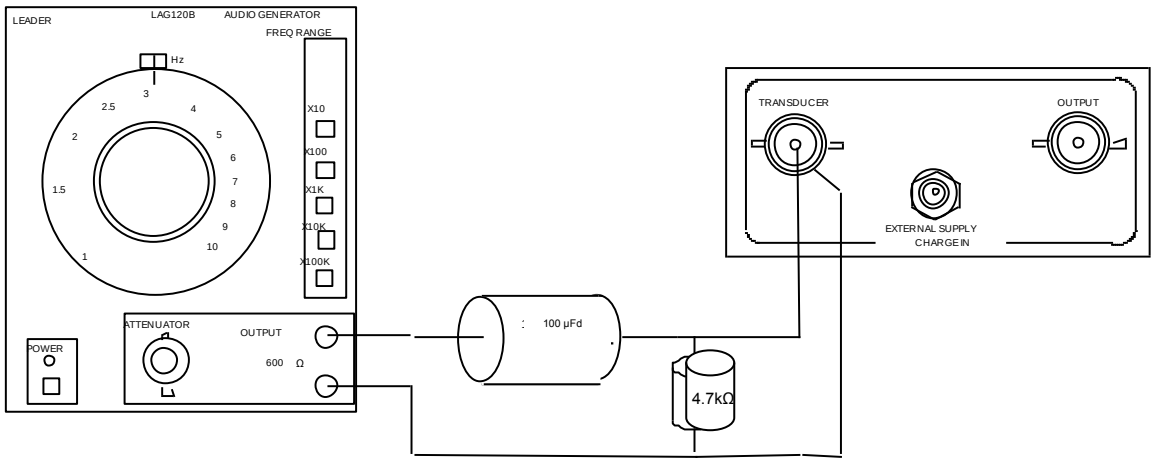
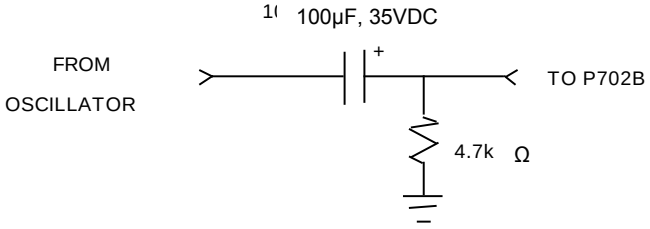


Figure 4 – Electrical calibration test set-up

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