

# MODEL 2991 IMPEDANCE CONVERTER



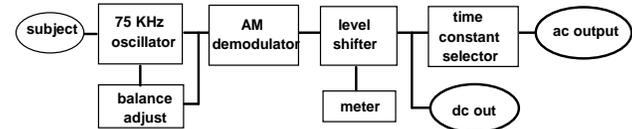
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## Introduction

Measurement of the electrical signals that precede or accompany most biological events is often difficult. Measurement problems stem mainly from very low signal amplitudes, high source impedances, and vulnerability to power line interference.

The Model 2991 Impedance Converter provides a way around these difficulties. Instead of trying to measure very small voltage changes, the Model 2991 measures the correlated impedance changes. These range from 0.2 ohm for an impedance cardiograph to over 5 ohms for an impedance respiration transducer. Whether impedance changes are due to resistance, capacitance, or inductance variations, or more usually, a combination of these, the Model 2701 converts them into DC voltages.

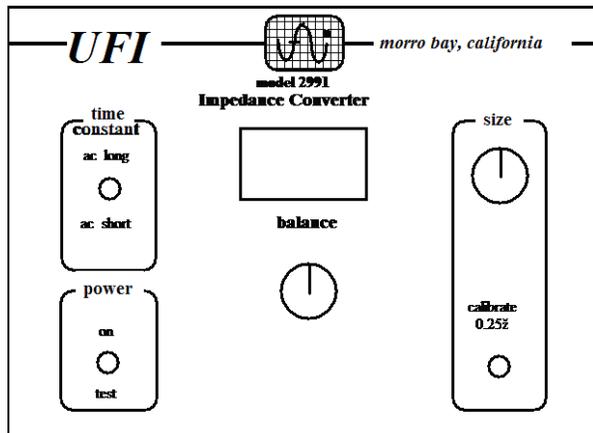
## Circuit description



- A load-sensitive 75 kHz oscillator forms the heart of the impedance converter. Changes in subject impedance modulate the amplitude of the oscillator: a 1% impedance change shifts the output voltage about 10%, or 0.5 volts.

- The AM demodulator picks off just the relatively slow variation in the oscillator output envelope and discards the 75 kHz oscillations. The level shifter offsets the signal so that a balanced oscillator output presents a zero voltage to the meter.
- The Model 2991 has both DC and AC outputs; the latter is amplified by a factor of about 10 compared to the former. A selector switch allows a choice of two AC-output time constants: 0.1 seconds, to see relatively fast changes in subject impedance, and 1 second, to see just the slower changes.

## Controls and connectors



## Power switch

- In center OFF position, Model 2991 is powered down.
- Set to ON position for normal operation.
- Set to TEST to check battery. Battery is OK if meter needle is on or above "B/OK" line. Otherwise, replace battery.

## Calibrate 0.25Ω switch

- Press switch to decrease input impedance by a calibrated 0.25 ohm.

## Balance control and meter

- 10-turn potentiometer adjusts impedance conversion oscillator, which must be rebalanced for major impedance changes.

## Time constant switch

- Set to AC LONG position to record respiration and other slowly varying phenomena where a stable DC baseline is needed.
- Set to AC SHORT position for rapidly changing signals like those from impedance cardiographs, pulse plethysmographs, or fluid bubbles where a stable DC baseline is not required.

## Size control

- Adjusts amplitude of signal to downstream recorder or plotting software. Pointer usually may be set to 12:00 (straight up) or lower position.

- For high sensitivity, and if transducer is very stable, control may be turned fully clockwise.
- Impedance changes of 20 ohms or less can saturate the DC output if *size control* is turned up all the way. Model 2991 will not be harmed but will not record DC data.
- To restore DC output, turn *balance control* until meter approaches zero, then turn *size control* counter-clockwise.

### Input connectors

- Attach transducer leads to the two green binding posts located on the right side of the back panel.

### Output connectors

- BNC receptacle nearer left side of back panel supplies DC signal to downstream equipment. Should be used for static or slowly changing input impedances like respiratory volume or strain-gauge force or displacement.
- BNC receptacle nearer center of back panel supplies only amplified AC signal to downstream equipment. Select time constant of 0.1 or 1.0 second with *time constant switch*.

## Using the Model 2991

### General procedure:

- Attach transducer leads to *input connectors*, then attach transducer to your subject, if any;
- adjust *balance control* to zero the *meter*-- counter-clockwise to move needle left, clockwise to move right – then begin recording.

### To measure respiration:

- Place electrodes on subject's sides (trans-thoracic) at about level of 5th or 6th pair of ribs. UFI Model 1081 or other standard ECG electrodes work well; larger electrodes yield larger signals.
- Do *not* use solid gel or gum electrodes.
- Needle electrodes work well with animal subjects.
- Model 2991 impedance values for subject will *not* equal DC resistance measurements. Typically the latter are lower by a factor of about 100.

### To use as pulse plethysmograph:

- Cut two strips aluminum foil long enough to wrap around body segment such as finger.
- Coat strips with UFI Model 1090 Biogel® or other electrode gel.
- Wrap strips around ends of body segment; hold with alligator clips, but do not cut off blood flow.
- attach electrodes to Model 2991 *input connectors* and adjust *balance control* to center *meter*.
- Pulse amplitude varies among subjects; 50-millivolt peak-to-peak signal is typical.

### To measure **psycho-galvanic reflex:**

- Set up Model 2991 and electrodes as for pulse plethysmograph;
- adjust *size control* so pulse is barely visible.
- Signal baseline shift indicates emotional reaction.

### To use with **strain gauge:**

- Use the “General procedure” described above.

### Other applications:

- See UFI website,

### Model 2991 specifications

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| • Impedance range                            | 1 to 2000 ohms                                 |
| • DC output level for 0.25% impedance change | 250 mV   |
| • AC output level for 0.25% impedance change | 2 V  |
| • Operating frequency                        | 75 kHz   |
| • Noise                                      | 5 mV or less, peak-to-peak                     |
| • Output impedance                           | 4000 ohms                                      |
| • Power supply                               | Standard 9V alkaline battery                   |
| • Size                                       | 6.8"W x 2.5"H x 4.8"D<br>(17.1 x 6.4 x12.1 cm) |
| • Weight                                     | 17 ounces (478g)                               |

### Warranty and repair

All UFI instruments are warranted against defects in materials and workmanship to the original purchaser for a period of one year from the date of original purchase. This warranty is void if our inspection shows the equipment has been tampered with; or installed at variance with factory-designated procedures; or has been subjected to negligence, misuse, or accident beyond normal usage; or has had the serial number altered, defaced, or removed.

All questions regarding the warranty should be directed to:

Customer Service Department  
UFI  
545 Main Street, Suite C-2  
Morro Bay, CA 93442  
Email: mail@ufiservingscience.com

No third party, including any dealer or agent, is authorized to assume any liability for UFI.

When corresponding or communicating with UFI concerning your equipment, please include the model and serial numbers.