ECG Simulator

M310

- **Waveforms — Four shapes stored in each plug-in ECG Memory Module.**
- **Durations — Two for each shape, in a 2 to 1 ratio.**
- **Rate — 40 to 300 BPM in 10 steps.**
- **Amplitude — 0.05 to 5.0 mV in 11 steps.**
- **Polarity — Normal or Inverted.**
- **Trigger switch produces arrest, a single beat or multiple beats at any rate.**
- **5 lead output — RL, RA, LA, LL and V.**
- **Battery power or external power source.**
- **Certificate of Conformance traceable to NIST is available.**

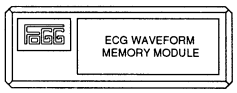
Verify Performance & Calibrate ECG Monitors, Heart Rate Meters & Alarms

This compact, battery-powered ECG Simulator is designed for performance testing, demonstration and training applications. It uses plug-in Memory Modules that let you select from a variety of normal and abnormal shapes appropriate for your test and training applications. This means that you can test fetal and adult ECG monitors, ECG recorders, and Holter and Stress Test Systems with the same simulator.

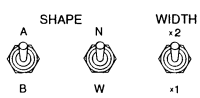
The Model 310 offers precise, independent control of the width, rate, amplitude and polarity of the ECG in addition to selection of the shape from four waveforms in each plug-in Memory Module. It allows testing of ECG monitors and heart rate meters as specified in the ANSI/AAMI Standard[1].

[1] *The American National Standard for Cardiac Monitors, Heart Rate Meters and Alarms, ANSI/AAMI, EC13-1992.*

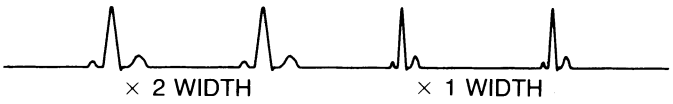
CONTROL FUNCTIONS & TECHNICAL INFORMATION

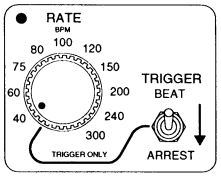


Plug-in Memory Modules contain four shapes that simulate ECG complexes useful for testing the critical performance parameters of ECG monitors, heart rate meters and recorders. The four shapes are designated AN, AW, BN and BW. Memory Modules are available with a variety of waveshapes including normal, wide (PVC), ST elevation/depression and tall T-wave.



The shape is chosen using the A/B and N/W SHAPE switches. The WIDTH switch determines the duration of the selected shape independent of the RATE switch setting. At a WIDTH setting of X2, the ECG complex has twice the duration of the X1 setting as illustrated.





The RATE is selected in 10 calibrated steps from 40 to 300 BPM, ±0.5% of setting. The selected rate can be changed to zero by moving the TRIGGER switch to the ARREST position. When it is released, the simulator output returns to the selected rate. When the RATE switch is in the TRIGGER ONLY position, a single beat is produced each time the TRIGGER switch is moved to the ARREST position and released, providing a means of manually generating additional rates. For example, a rate of 20 BPM can be manually generated by triggering a beat every three seconds. The red RATE indicator LED is illuminated for each beat produced in all modes of operation.

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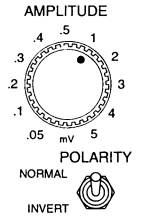
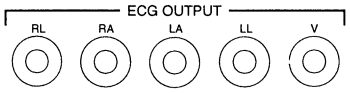


The AMPLITUDE of the R-wave is selected in 11 calibrated steps from 0.05 to 5.0mV, ±2% of setting, ±10µV. This defines the amplitude at the LA terminal referenced to RA. The POLARITY switch selects either NORMAL or INVERTED polarity.



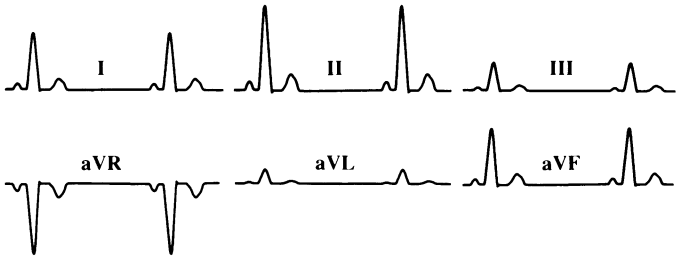
Color coded banana jacks are provided for the ECG OUTPUT. Banana plug snap stud adapters are supplied for direct connection of snap, clip and grabber terminations on lead wires.

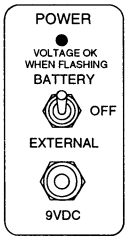
The output at each ECG terminal for an amplitude switch setting of 1mV is: zero for RL, zero for RA, 1mV for LA, 1.5mV for LL and 2mV for V. The outputs at other amplitude settings are proportional.

The table below shows the calculated R-wave value for each lead selected by a monitor at a simulated amplitude switch setting of 1mV.

LEAD	DEFINITION	CALCULATION	CALCULATED VALUE
I	LA-RA	1.0 - 0.0	1.00mV/mV
II	LL-RA	1.5 - 0.0	1.50 mV/mV
III	LL-LA	1.5 - 1.0	0.50 mV/mV
aVR	RA- 0.5(LA+LL)	0.0 - 0.5(1+1.5)	-1.25mV/mV
aVL	LA- 0.5(LL+RA)	1.0 - 0.5(1.5+0)	0.25 mV/mV
aVF	LL- 0.5(LA+RA)	1.5 - 0.5(1+0)	1.00 mV/mV
V	V-0.333(LA+RA+LL)	2.0 - 0.333(1+0+1.5)	1.17 mV/mV

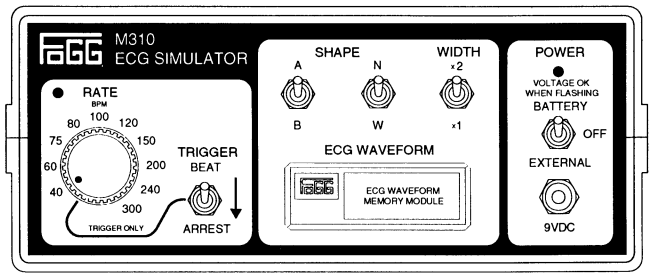
A tracing of the limb leads at an amplitude setting of 1mV is illustrated below:

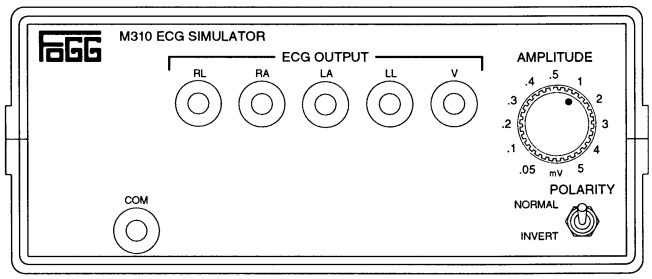




POWER: Internal BATTERY or EXTERNAL power source can be selected with the POWER switch. A green flashing LED indicates the status of the power source selected. As the voltage approaches a minimum required value, the LED flashes more slowly and finally goes out when the limit is reached. The external power source must have an output of 6 to 12 Vdc at 150 mA.

SIZE: 6.0"W x 2.5"H x 6.25"D.
WEIGHT: 2 pounds net (0.9 kg), 3 pounds shipping (1.4 kg).





TESTING ECG/APNEA MONITORS

When testing monitors that detect both respiration and ECG, the Model 310 ECG Simulator can be used with the Fogg M98C Respiration Simulator. The Respiration Simulator features selection of basal impedance, impedance variation and respiration rate.

ACCESSORIES

Carrying Cases are available that accommodate single or multiple instruments with adequate space for test leads and Cables.

ORDERING INFORMATION

A basic test system consists of the M310 ECG Simulator and an ECG Memory Module. The simulator is supplied with snap stud output adapters, batteries and a User Manual with Schematics and Parts List. A Certificate of Conformance traceable to NIST is available.

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