

## Testing Medical Electronic Devices

# Application

- Generate Cardiac Pulses
- Monitor low-level Signals
- Pacemakers
- Ultrasound Equipment
- Medical Beds
- Patient Monitoring Systems



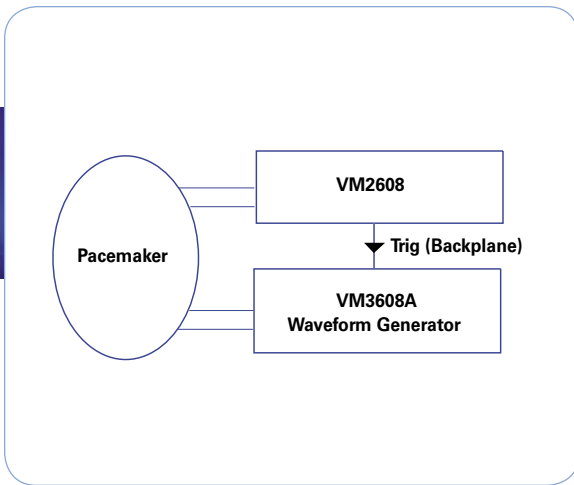
### Overview

Medical Electronic devices typically monitor micro-volt level signals. Due to stringent FDA requirements, the testing of these devices needs to be very repeatable. The leading manufacturers of medical devices use VXI Technology's line of high-density instruments (VMIP™ family) and switching systems (SMIP/™ family). These products have been designed with the medical electronics community in mind. Several instruments and switching systems can be combined in a very small footprint to resolve multiple applications.

The sample suite of instruments would include :

<b>CT-400</b>	13-Slot VXIbus mainframe (alternatively, a small CT-100C 6-slot chassis can be used)	
<b>Slot 0 Interface</b>	This allows the VXIbus cardcage to be controlled from a host computer, via GPIB (HPIB), PCI, FireWire, Ethernet or other connectivity method	
<b>Slot 1</b>	VM2608 VM3608A VM3640A	- 16-bit 8-channel digitizer - 16-bit 8-channel DAC/low frequency AWG - 50MS/s AWG
<b>Slot 2</b>	VM2710A VM1548C VM7004	- 6.5 digit system DMM - 48-channel open-collector I/O - programmable resistor (load simulation)
<b>Slot 3</b>	VM1602 VM6068 VM7000	- counter-timer/event recorder - telemetry interface - prototyping module for signal conditioning
<b>Slot 4</b>	SMP2001A SMP3001 SMP4001 SMP6001	- power switch - scanner/multiplexer - shielded matrix - coaxial switch

All appropriate switch modules are shielded and all instruments are optimized for micro-volt signals. Our modular approach to instruments and switches also allows products to be easily configured.



## Application - Testing Parameters

The application is to digitize the output pacing pulse from the pacemaker, triggering at a set point. A waveform generator then simulates the output from the heart delayed at a programmed interval from the pacing pulse trigger.

The VM2608 is an 8-channel digitizer that has large memory and a programmable differential input amplifier with ranges from  $\pm 0.1$  V to  $\pm 40$  V (16 bits of resolution). Extensive triggering capability is available.

The pacemaker pulse is fed into the VM2608 (after any desired signal conditioning). The input range is set accordingly. The trigger is set to trigger at a known point on the waveform (positive or negative slope and threshold). This trigger is also routed to the TTL backplane trigger line to initiate the VM3608A waveform generator.

The VM3608A is an arbitrary waveform generator, with each channel running at 100ks/s. It also has extensive triggering capability as well as waveform segmenting, linking, etc. It is set up to trigger from the TTL backplane trigger line generated by the VM2608. Memory segments are loaded for the delays and the cardiac waveforms. Once a trigger is received, the VM3608A generates the delay segment and then automatically advances to the cardiac pulse. On the next trigger, different delay segments and/or pulses can automatically be generated.

The salient features of the VM2608 and VM3608A that lend themselves to medical electronic testing are:

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|----------------|--|
| <b>VM2608</b>  | <ul style="list-style-type: none"> <li>16-bit resolution (3.05 <math>\mu</math>v)</li> <li>100ks/s per channel</li> <li>Input channel triggering w/programmable Thresholds and slopes</li> <li>Ability to drive VXIbus TTL trigger lines for Synchronization</li> <li>Deep memory</li> <li><math>\pm 0.02\%</math> accuracies</li> </ul>                             |
| <b>VM3608A</b> | <ul style="list-style-type: none"> <li>True 16-bit 100ks/s converters</li> <li><math>\pm 10</math> V or <math>\pm 20</math> V o/p range, <math>\pm 0.15\%</math> accuracy</li> <li>Waveform linking, segmenting, looping, advancing, etc.</li> <li>Up to 1 MWord memory</li> <li>Extensive triggering</li> <li>FIFO mode for large FDA approved waveforms</li> </ul> |

The VM2608 and VM3608A together use only 2/3 of a VXIbus card slot. One of the following instruments could be used to complete the VXIbus card:

1. **VM7004**      4-channel Programmable Resistor Card for simulating loads
2. **VM1602**      1  $\mu$ s differential event recorder/time stamp for capturing serial or parallel patterns (counter/timer).
3. **VM2710A**      6.5 digit DMM, V dc, V ac, current and resistance.

A software driver is also available with the demo that simulates the application

