

## Testing and Diagnosing Embedded Control Boards

The MicroMaster processor board test solutions from International Test Technologies can be used to test all types of CPU-based boards. This application brief shows how the solution can be configured to test an embedded control product, such as an automotive or aerospace boards.

The tester is driven by an external PC, and consists of a CPU emulator, which takes control of the UUT's processor. Once in control, test programs and diagnostics can be directed and sequenced under the control of the host PC. Additionally an I/O stimulus/measurement unit is available, which provides the facilities to stimulate and/or measure activity on the boards I/O connector. Using this top-down and bottom-up approach full testing can take place in seconds, rather than minutes

Figure 1 shows the components of the solution, and figure 2 shows an optional fixture, which can be used to automate the connection of UUT to the test instruments – ideal for high volume production test.

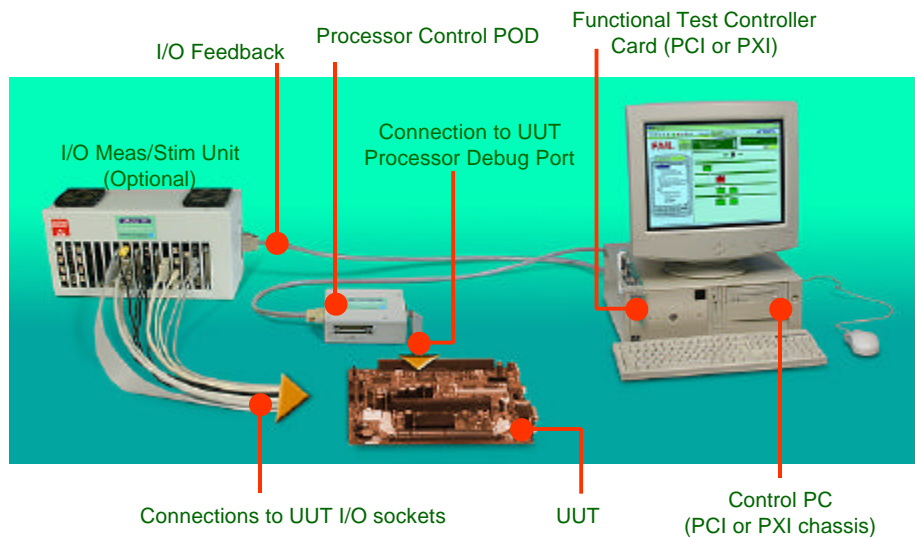


Fig. 1 – Test Solution Components



Fig. 2 – Fixture for Automated Connection

Figure 3 shows how the tester's hardware components are configured for an automotive application, and the table overleaf shows the test sequence and program, which is run by the tester. Results returned are pass/fail, or pass/fail with full diagnostics to bus and component level.

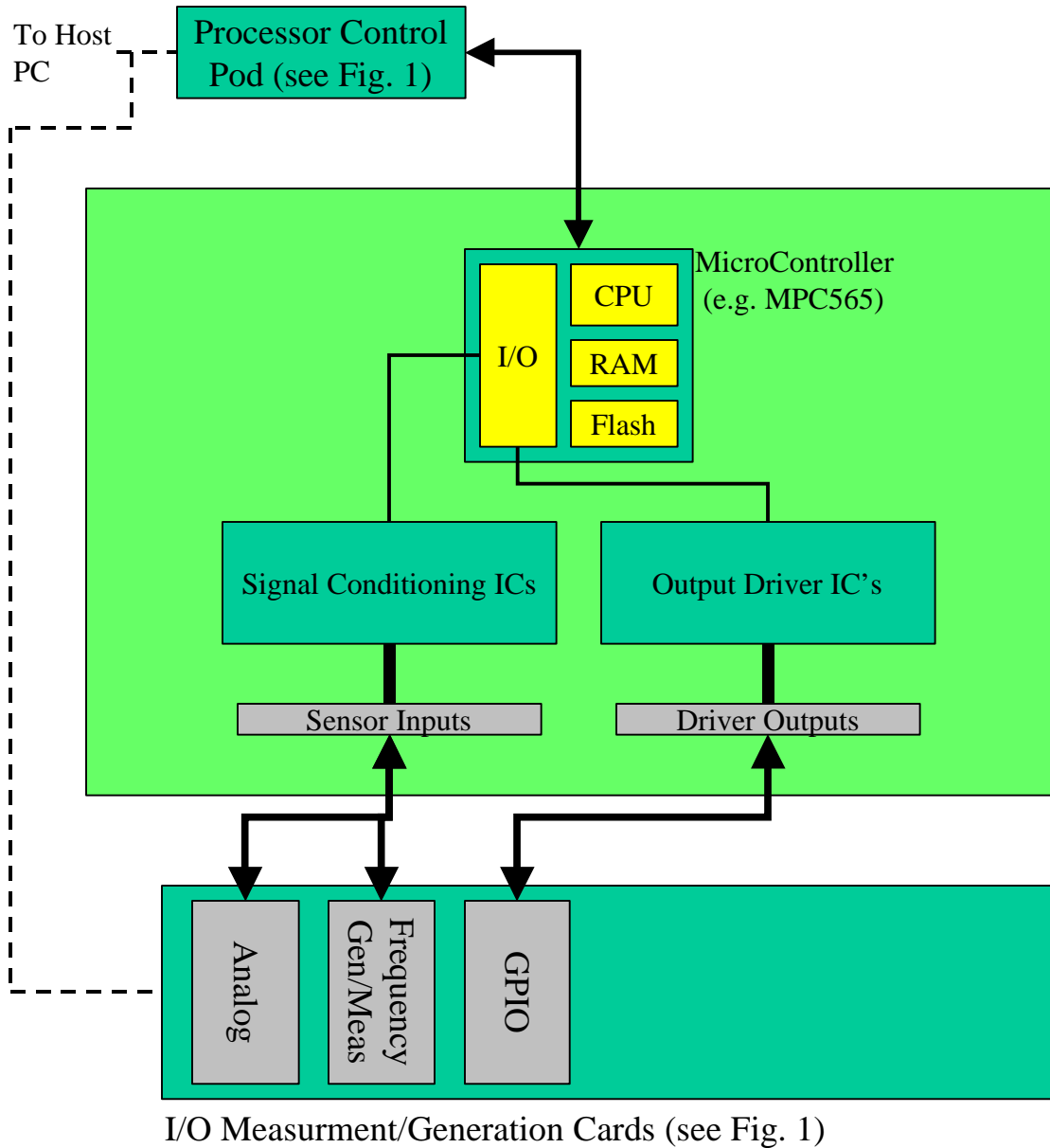


Fig. 3 – Embedded Control Test

## Test Sequence and Coverage

Test Name	Test Sequence	What it Tests
Power	<ol style="list-style-type: none"> <li>1. Power on UUT</li> <li>2. Check key voltages using analog test card.</li> </ol>	<ol style="list-style-type: none"> <li>1. Key voltages within range?</li> </ol>
CPU	<ol style="list-style-type: none"> <li>1. CPU ID Check</li> <li>2. CPU BIST Check</li> <li>3. Take control of CPU</li> </ol>	<ol style="list-style-type: none"> <li>1. CPU OK?</li> <li>2. CPU infrastructure OK?</li> </ol>
General Bus	Boot ROM Bus Test	Verifies access to boot flash
Flash Test	<ol style="list-style-type: none"> <li>1. ID Check</li> <li>2. CRC Check</li> </ol>	<ol style="list-style-type: none"> <li>1. Verifies access to flash from CPU.</li> <li>2. Verifies flash and flash contents.</li> </ol>
RAM	<ol style="list-style-type: none"> <li>1. Memory test for opens, stucks and shorts to all buses.</li> <li>2. Optional test for all memory cells.</li> </ol>	<ol style="list-style-type: none"> <li>1. Verifies all buses from CPU to RAM</li> <li>2. Verifies that all RAM cells are operational.</li> </ol>
Microcontroller I/O Test	<ol style="list-style-type: none"> <li>1. Register Test</li> <li>2. Configure for normal operation</li> </ol>	<ol style="list-style-type: none"> <li>1. Verifies communications and buses from CPU to I/O functions</li> <li>2. Verifies I/O registers.</li> </ol>
Sensor Inputs	<ol style="list-style-type: none"> <li>1. Simulate all sensor inputs using ITT's analog and frequency generation/measurement cards.</li> <li>2. Verify sensor inputs using A/D, timer, and general I/O readback at microcontroller using CPU emulator.</li> </ol>	<ol style="list-style-type: none"> <li>1. Verifies sensor input connector.</li> <li>2. Verifies signal conditioner IC's and components.</li> <li>3. Verifies microcontroller I/O functions.</li> </ol>
Driver Outputs	<ol style="list-style-type: none"> <li>1. Generate and change board outputs by accessing the microcontroller I/O functions using CPU emulator.</li> <li>2. Verify driver outputs using ITT's general purpose I/O card.</li> <li>3. Repeat for various output levels</li> </ol>	<ol style="list-style-type: none"> <li>1. Verifies driver output connector.</li> <li>2. Verifies output driver IC's and components.</li> <li>3. Verifies microcontroller I/O functions.</li> </ol>

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