



## **MPX-2 SYSTEM OVERVIEW**

FocusTest designs, manufactures, and integrates systems ideally suited for calibrating and test of silicon based sensors and actuators, including MEMS accelerometers, gyros, switches, and pressure sensors. The MPX-2 series ATE provides a high performance *and* cost effective solution to the unique problems associated with testing these and similar devices. The system is designed to provide the highest possible production test throughput for a wide range of IC's and modules characterized by low to medium pin count and inherently long test times. The system is also well suited for testing non-MEMS devices such as automotive and smart power IC's and modules. The highly parallel and scalable system architecture provides a solid test platform base, preserving your investment in test capability as your products migrates from characterization testing in the laboratory to the production floor.

### **The Total Low Cost Solution from FocusTest**

The foundation of the system is MPX-2 ATE. The ATE system is designed for use in manually operated test applications or with automated handlers and probe stations.

For automated applications, the system can be integrated with standard MEMS stimulus/gravity fed handler systems (i.e. Multitest). In this case, the ATE is typically configured to service 2-4 devices simultaneously. Many times this standard automation is not practical due to device package, mechanical stimulus or other test requirement constraints. In this case, the MPX-2 can be combined with a variety of mechanical excitation sources, environmental conditioning, and automation equipment to create a fully integrated turn-key system. For these applications, the ATE is typically configured to service from 8-32 or more DUTs simultaneously. The MPX-2 environment simplifies the control and monitoring of shakers, rate tables, pressure controllers, ovens, thermal forcing units and material handling equipment.

A well designed test fixture is a key component required to achieve accurate and reliable test for MEMS devices. FocusTest has a wealth of experience in this area, and has can deliver manual or automation compatible fixtures as part of a fully turn-key solution.

Tables I and II show MPX-2 based MEMS systems applied to either a standard or custom system.

<b>System Component</b>	<b>Function</b>
MPX-2 ATE System	<ul style="list-style-type: none"> <li>• Electrical stimulus/measurement for the DUTs</li> <li>• Control of mechanical stimulus</li> <li>• Test program development and debug</li> <li>• Production test execution</li> <li>• Test results database</li> <li>• Overall system control</li> </ul>
Standard MEMS handler	<ul style="list-style-type: none"> <li>• Automated handling and binning</li> <li>• Electrical DUT contact</li> <li>• Mechanical DUT clamping</li> <li>• Coupling to MEMS stimulus</li> <li>• Connection to ATE</li> <li>• Environmental conditioning</li> </ul>

**Table 1 – ATE System with Standard MEMS Handler**

<b>System Component</b>	<b>Function</b>
MPX-2 ATE System	<ul style="list-style-type: none"> <li>• Electrical stimulus/measurement for the DUTs</li> <li>• Control of mechanical stimulus</li> <li>• Test program development and debug</li> <li>• Production test execution</li> <li>• Test results database</li> <li>• Overall system control</li> </ul>
Mechanical Stimulus	<ul style="list-style-type: none"> <li>• Shaker, Rate Table, or Pressure controller</li> </ul>
Test Fixture	<ul style="list-style-type: none"> <li>• Electrical DUT contact</li> <li>• Mechanical DUT clamping</li> <li>• Coupling to MEMS stimulus</li> <li>• I/O cabling to the ATE</li> <li>• Thermal environment for the DUTs</li> </ul>
Environmental Conditioning	<ul style="list-style-type: none"> <li>• Thermal source for the test fixture.</li> </ul>
Material Handling	<ul style="list-style-type: none"> <li>• Automated material handling and binning</li> </ul>

**Table 2 – ATE System with Custom handler**

## **A Tester Built From The Ground Up For MEMS**

The MPX-2 is optimized to give you what you need and doesn't include what you don't. The result is a price/performance ratio unequalled by conventional mixed signal IC test systems. The hardware architecture and system software makes programming multiple devices in parallel transparent to the test engineer.

The multi-channel MPX-2 provides the electrical stimulus, measurement instrumentation, and control for the system. The ATE can be interfaced to either a standard MEMS multi-site handler or a custom multi-site test fixture integrated with the mechanical stimulus specific to the MEMS device being calibrated and tested.

The fixturing for custom solutions includes provisions for accepting hot and cold air from a thermal source, allowing testing over a wide temperature range. In this case, a proprietary multi-device carrier provides a thermal environment for the devices during test as well as convenient method of indexing multiple devices into the fixture simultaneously.

The modular design of the system allows for flexibility with regard to the mechanical stimulus, DUT package type, and number of parallel sites. This flexibility makes it possible to upgrade and reconfigure for new product requirements. High volume production can be realized by adding a carrier based material handling and temperature soak chambers.

The ATE equipment and application hardware/software developed for a low-channel count/low-volume laboratory system used for early device characterization can be directly applied to the high-channel count/high-volume production solution. This feature allows the user to leverage his investment in application software and avoids duplication of effort and correlation problems when it comes time for production.

### **Open, Flexible System Architecture, Yet Highly Integrated and Synchronized**

The system is built around a 5 card-slot core group consisting of 4 universal FocusTest instrument slots, with all their resources as well as additional external instrument I/O routed into the FocusTest Smart-Connect™ Loadboard. This group typically supports the instrumentation requirements of 8 MEMS devices. However, the system architecture allows hardware resources to be allocated based on the number of DUT pins and the corresponding test requirements, providing the test engineer a flexible architecture capable of addressing a wide range of devices and test requirements. The base MPX-2 is available in a single 5-slot group “8 DUT Channel” model and scalable up to a “32 DUT Channel” configuration. Optimized instrument configurations, multiple test heads and PXI chassis, and multiplexing can be employed to achieve significantly higher channel densities for highly parallel applications.

A PXI chassis allows for integration of standard instrumentation covering a wide range of functionality, speed and accuracy. DMM's, Digitizers, Thermocouple inputs and RF sources/measure modules are instruments typically resident in the MPX-2 system PXI chassis. The PXI instruments are fully hardware and software integrated into the MPX-2 ATE system to allowing for flexibility in trigger and synchronization of the measurements involving multiples instruments or even DUT generated events.

### **High Accuracy Analog Source and Measure Instruments**

The system provides independent per-DUT precision FocusTest PMU's with standard source/measure I ranges from 2uA (0.1 nA resolution) to 200mA, and V range from -2V to +9V. The PMUs can be used either for DUT power, or for parametric testing. High-I output options are available up to +/- 100A and High-V output options up to +/- 900V. Full hardware triggering is available to synchronize the PMUs with other system instruments. Modulation inputs are available as well as built-in waveform programming

capability, which allows for user generated arbitrary or periodic voltage and current waveforms.

### **Functional Digital Subsystem Targeted To This Class Of Devices**

MEMS devices and smart power modules are usually application-ready, with a serial communications interface (SPI, UART, I2C, CAN, Philips Monitor) or user-custom programmable digital control and status lines. The FocusTest  $\mu$ SRM (Micro Stimulus/Response Module) instrument coupled with the PEM (Pin Electronics Module) provides each of 8 DUTs with an independent controller, 4 Drive/Compare digital pins, and 8 additional digital I/O pins, 4 of which can be configured as medium-resolution A/D channels. These controllers can be clocked as Masters by the MPX-2 system clock, or as Slaves by its associated DUT's generated clock, providing complete independent isolated operation during test, allowing I/O lines to be set or read based on DUT-specific events such as startup lock or wait until a DUT output reaches specific level. Each channel has its own 512 Kbyte memory for DUT setups, special tightly coordinated measure routines, and DUT output acquisition storage to be read back on the high-speed MPX-2 System data bus for analysis by the system computer.

### **System Software Designed For Parallel Test, Based On Standard Tools**

FocusTest Frameworks™ software provides a complete environment for application development and debug, test sequencing, datalogging, production test flow, and automation communication. The environment is based on National Instruments TestStand, Labwindows/CVI, and Microsoft SQL Server products - providing the user with a well documented and supported software base. Built-in support is included for controlling shakers, pressure controllers, rate tables, and thermal conditioning units. Operator interfaces are designed to handle multi-site production test operation. Calibration and diagnostic routines for system hardware maintenance are also included.

### **Unique Temperature Solution For Medium Volume Production Test**

High throughput production test typically requires separate in-line stations pre-soaked at ambient, cold, & hot. This expensive equipment that can usually only be justified for very high volumes of devices. With FocusTest's special high-rate temperature transition test fixtures coupled to a thermal forcing unit, 32 or 64 devices can be rapidly cycled through a full 25C, -40C, +125C temperature cycle and tested (rate, pressure, vibration), providing medium volume throughputs in the range of 100 – 250 units/hour throughput on a single small station. Because the entire fixture is small and localized, complete stations can be replicated to achieve higher production capacity at modest cost, with the important benefit of redundancy and low down time.

### **Your Application Configured and Shipped 'Ready To Go'**

All the above mentioned DUT communication interfaces come installed standard, as well as several standard basic test examples such as CONTACT, IDD, POWERUP\_READY\_TIME, all programmed for parallel test. If you supply us your device pins and test requirements (datasheet, etc), FocusTest will provide a recommended Loadboard schematic configured to your application, with basic tests modified to match your Loadboard. You could potentially begin testing your devices as soon as the system

arrives. FocusTest is happy to quote complete turnkey systems as well as a basic complete system with several of your key tests up and running, with or without the actual production fixtures. Your in-house engineers can then concentrate on working out final device development details on the actual equipment that will be used in production.

### **Additional Information**

Questions and requests for further information should be directed to:

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