Building a 1000+ Channel Dynamic Test System

Grant Smith, Dewetron Inc., Charlestown, Rhode Island

Industrieangen-Betriebsgesellschaft mbH (IABG) in Munich, Germany, tests and certifies a wide variety of major aerospace systems for use in space. IABG facilities include sophisticated shock, acoustic and modal test stands and huge environmental chambers. Due to the rigorous requirements of air and spacecraft, the facility maintains equipment of only the highest performance. Recently, IABG went on a worldwide search for the latest in large-scale data acquisition equipment, and after an exhaustive evaluation, Dewetron was chosen not only as an equipment provider, but also as a partner.

The main application for the test system will be structural and component tests for air and spacecraft projects. Dewetron provides a complete hardware solution based on a common software platform, DEWESoft. Although DEWE-Soft is already a turnkey application, it has been designed specifically with DCOM software extensibility. IABG plans to take advantage of this flexibility, extending the functionality of DEWESoft by adding its own application-specific and proprietary calculations. A main feature of the system is the modularity that allows testing with high channel count but

also structural tests using fewer input channels. Both applications use the same user interface and software. Because it is based on standard Dewetron test hardware and software, development required less than six months to finalize.

System Configuration. A 512-channel system is shown in Figure 1. In the final stage, the test system will provide 1,024 channels, using six high-speed computer systems connected by a Gigabit Ethernet network. Four of them are data acquisition systems, each providing 256 channels. Another system provides a 16-channel arbitration generator that is used to control external shakers. The last computer acts as main server, which stores data and also controls all the other systems. Each of the 256-channel units can also be used independently as a portable data acquisition unit in the field.

Signal Amplifier. As a front-end system, the powerful Dewetron MDAQ-ACC series modules are used. Each of them provides 16 phase-synched input amplifiers, programmable switched filters on each channel and selectable input ranges for accelerometers. Each sensor may be checked for defects and malfunctions. A dynamic calibration signal is applied to
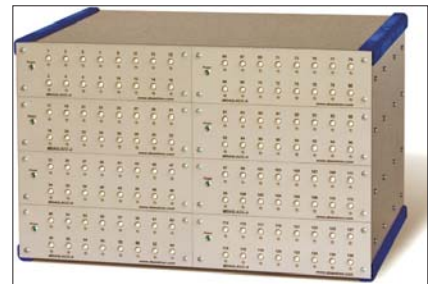

Figure 2. DEWE-MDAQ-PCI-128 signal amplifier.

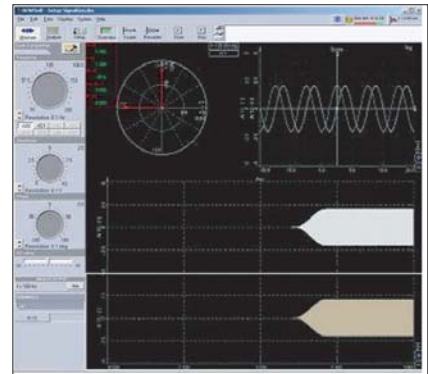*Figure 3. DEWE-Orion-1624 A/D converter*
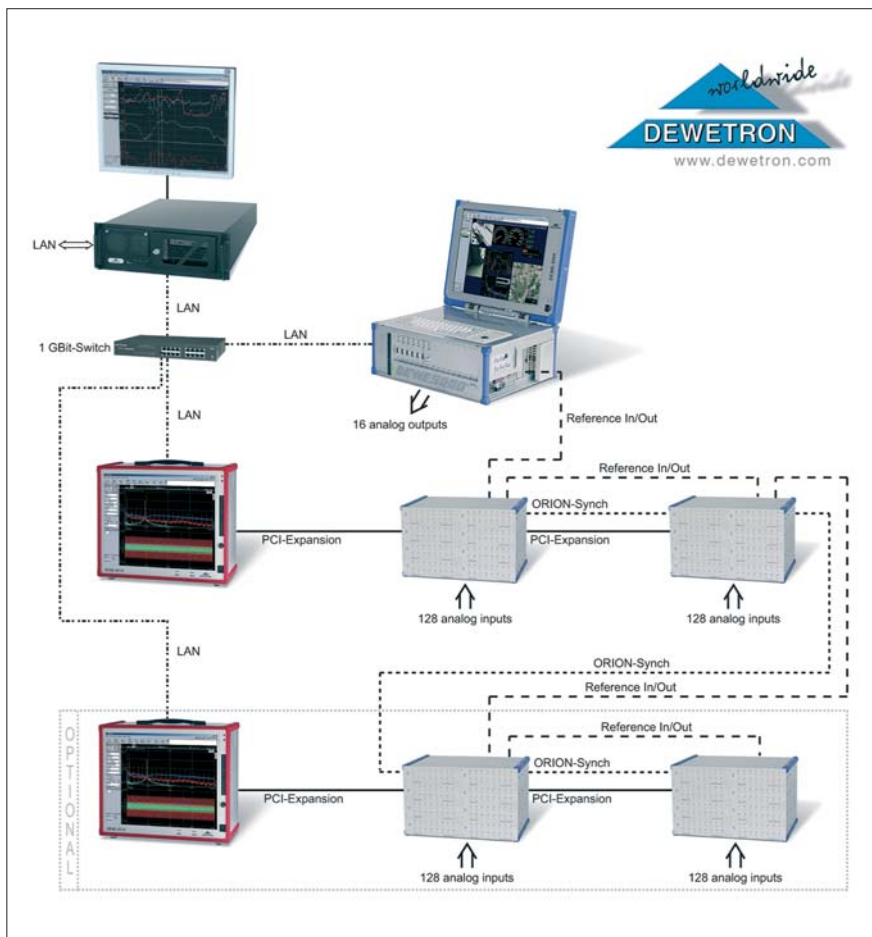

Figure 4. FGEN frequency generator option.

calibrate the input modules. System functionality is certified at the beginning of every test.

A/D Converter. Dewetron Orion-1624 A/D cards are used throughout. Each Orion card provides 16 synchronized, 24-bit, A/D converters with a dynamic range of 110 dB and a continuous sample rate of up to 200 kS/sec per channel. The Orion cards are synchronized by a Dewetron proprietary sync-clock technology circuit that allows acquisition of 1,024 or more channels with absolute synchronization. By using over-sampling technology (each channel is sampled at 25 MHz) the Orion boards provide extremely steep anti-aliasing filters for each input channel, equivalent to a 100-pole analog filter.

Function Generator. The new Dewetron FGEN-16 system provides 16 synchronous output channels with built-in function generator having extremely low distortion (THD < 0.005% and frequency stability of typically < 5 ppm). Each output signal can be set in steps of 1 mV and frequency resolution of 0.1 mHz in selectable ranges of DC to 20 kHz (so that resonance frequencies of the tested unit can be detected). The phase ratio between channels can be set with a resolution of

Figure 1. Dewetron 512-channel test system.

0.1° to correct phase shifts in the system. To avoid damage to the unit under test, the function generator provides several security features.

All control of amplitude, frequency, and phase shift are done in real time without any signal disturbance. The system output can be set to SINE, SWEEP, BURST, STEP SINE, CHIRP and NOISE (with definable low and high bandwidth) and ARBITRARY.

Test Options. A complete test scenario is controlled by the server, including powering up the acquisition units, setting input parameters, and defining different test conditions. During measurement, the acquisition clients calculate up to 256 FFT spectra, which are stored on the server. At the same time, all 256 input signals are stored in a high-speed RAID memory array. Each of the 256-channel units allows visualization of all channels in real time on the built in 19-in. screen. The common software package used in this application is DEWESoft. Additional functionality for this special application has been implemented by using the built-in DCOM interface, which allows customer specific expansion.

Conclusion. This test and measurement system today is one of the most advanced systems for structural and stress tests worldwide. All tests can be done either automatically or manually. The modularity allows measurements of up to 1,024 or 4 × 256 channels.

————

The author can be contacted at: grant.smith@dewamerica.com.