HEWLETT® PACKARD

MEASUREMENT SOLUTIONS DIVISION

HP DAC Express Data Recorder/Logger Systems and Software

Field Training Manual

Table of Contents

1. Introduction

HP DAC Express Overview

Combined time-based measurements for static and dynamic signals

For the first time from HP, scanning A/D measurements (E1413C) and high speed digitizer measurements (E1432A/33A) can be made at the same time using the same user interface. These important measurements of noise, vibration, temperature, pressure, strain and more are required by a broad range of customers but are usually accomplished in two separate steps with two different systems today.

HP DAC Express improves productivity by combining these two steps into one!

Dramatic reduction in data acquisition set up time

Unlike C++, Visual Basic, LabVIEW and HP VEE, HP DAC Express requires NO programming. This includes the common tasks of:

- Instrument identification and setup
- Channel naming and assignment
- Engineering unit conversion for transducers
- Sample timing and triggering
- On-line measurement monitoring with a variety of display types
- Recording data and system configuration information
- Exporting recording data to analysis and report generation applications

HP DAC Express gets your customers to their data faster.

Market Opportunity

HP DAC Express solutions are aimed directly at the **$200M/yr design verification** market that is growing at 8-10% per year. Our VXI hardware has successfully addressed the high-end applications where users are accustomed to writing their own software, but there has been significant growth in the market for solutions which do not require complex programming. However, most of these solutions do not provide the measurement speed and accuracy available in HP VXI hardware. Now the best of both worlds are presented in HP DAC Express Data Recorder/Logger solutions.

HP DAC Express System solutions are easy to set up without sacrificing accuracy or data throughput performance.

Target Customers

Companies that design and manufacture **electro-mechanical or mechanical components**, assemblies, or products must do extensive design verification testing. The ever increasing sophistication of products today means that more automated, higher speed, and more accurate systems are required to keep up with the competition.
They test to ensure that their designs meet objectives for:

Functionality
Durability
Safety regulations
Environmental regulations

Example of products being tested include:

Pumps and motors
Lawn and garden equipment
Automotive assemblies and accessories
Major appliances
HVAC (heating, ventilation, and cooling) equipment
Aerospace/defense components

Value Proposition

To developers and users of DAC systems, the HP DAC Express platform is the one solution that:
-is easy-to-use, scaleable, and customizable,
-significantly reduces system development time and testing costs,
-provides high quality, dependable data,

and is competitively priced.

2. Product/Solution Overview

HP DAC Express Product Family

Although most of the R&D project effort was focused on software development, with additional investment by marketing and manufacturing for ordering, integration, and testing processes, HP can now offer more complete data acquisition solutions than ever before by combining HP DAC Express software with hardware and factory integration.

E9801A HP DAC Express Data Acquisition Software - for customers with existing VXI measurement hardware
US List Price $595

E9814A HP DAC Express Data Recorder/Logger System - for combined dynamic and static measurement applications
US List Price - starting at $39,950

E9812A HP DAC Express Data Logger System - for static-only measurement applications
US List Price - starting at $11,900

E9810A HP DAC Express Integrated System - for custom configurations of VXI hardware based on HP DAC Express software and E8491A VXI I/O (Firewire)
US List Price - starting at $2,940

HP E9801A Product Description

The HP DAC Express software is based on standards. The code modules (about 10MB total) are written in C++, Visual Basic, and interface with Active X COM objects. This provides an optimum combination of fast data transfer code and graphical user interface objects. The first release of the software will support the following hardware and VXI interfaces:

E1432A 51.2KHz Digitizer (E1562D/E required)
E1433A 192KHz Digitizer (E1562D/E required)
E3240A to E3243A Breakout Boxes
E1434A Arbitrary Source
E1413B/C 64ch Scanning A/D's
E1501A to E1518A SCP's for E1413C
E8491A IEEE-1394 VXI Interface (Firewire)
E1406A HP-IB VXI Interface
National Instruments MXI-2 Interface

Other hardware support will be added in future releases.

HP E9814A Product Description

This top-of-the-line system is targeted at applications with both static and dynamic signals. The base configuration provides:

16 channels of E1432A dynamic measurements
16 channels of E1413C static measurements

Data throughput rates are unmatched by any other system with a non-programming user interface. It is complete with a 13-slot mainframe and IEEE-1394 VXI interface. Additional E1432A's and E1413C's with the customers choice of signal conditioning can be added. See the ordering information section for details.

HP E9812A Product Description

This system is targeted at static-only measurement applications.
The base configuration provides:

16 channels of E1413C static measurements

Data throughput rates are the same as the static data rates of the E9814A. Additional E1413C's with the customers choice of signal conditioning can be added. See the ordering information section for details.

HP E9810A Product Description

When you can't meet your customer needs with the E9814A or E9812A, use the E8910A to configure a custom system. This might be necessary if the standard signal conditioning (SCP's and Breakout Boxes) are not appropriate. Or if the application requires other products and product combinations such as:

E1433A 192Ksa/sec Digitizers
E1433A's combined with E1413C's
Mainframes with Enhanced Monitoring

Note: it is not recommended to combine E1432A's and E1433A's in a single HP DAC Express system. The master clock is shared by all modules and therefore the E1433A's would be limited to 51.2Ksa/sec maximum sample rate.

3. Finding/Qualifying Customers

Target Customers

Primary target customers for HP DAC Express are found in the design and test departments of light industrial manufacturing companies. They are working on product programs such as:

Pumps and motors
Lawn and garden equipment
Automotive assemblies and accessories
Major appliances
HVAC (heating, ventilation, and cooling) equipment
Aerospace/defense components

The key applications are verifying design functionality and testing product life or durability. These require measurements of:

Temperature
Pressure
Flow
Noise
Vibration

Secondary target customers can be found in defense/aerospace companies where environmental testing for products such as satellites also require extended measurements of physical parameters such as temperature and strain.

Key People within the Organization

- Managers and design engineers of engineering departments or product program teams that specify the tests; the design engineers may also conduct the tests in medium to smaller sized companies.
- Managers and test engineers or technicians of technical centers or test departments that conduct the tests; these people are usually part of a support organization to product teams or may be an independent consulting company that offers the service.
- Managers of system integration teams, internal or external, that develop and/or acquire test systems for internal engineering use or as part of a contract with the specifying company.

Current Customer Situation

Companies with diverse product lines have to frequently re-configure test equipment for new product testing. They cannot afford to dedicate test equipment to a single product. Test requirements may not be finalized until late in the product program so software for automated testing must be developed quickly, in hours or days, not weeks. The test results must be absolutely dependable and repeatable; retesting later is considered to be a major expense and delay in a product release. Managers can justify spending more money for test equipment if they can see a savings in test development time.

Problems with Current Data Acquisition Systems

Most equipment with the accuracy and measurement speed required for these applications is not easy to program. The traditional approach has been HP BASIC, C or C++, or Visual C and Visual Basic. But these often require many days or weeks to write and debug code.

Over the last five years, graphical programming languages such as HP VEE and NI LabVIEW have become very popular. In fact, LabVIEW is now the leading software choice for developers of data acquisition systems. However, these languages were not developed specifically for data acquisition and have significant limitations.

- No tabular format for ease of setup and viewing multiple channels
- Data transfer rates limited to a few thousand samples/sec
- No convenient means of browsing previously collected data
- Test programs are hard to interpret and document

Lately, there have been a number of new data acquisition products with software that does not require programming. HP BenchLink is an example of this type of solution. These main limitation of these solutions is low channel count and low data transfer rates. None of these have combined static and dynamic measurements.

Why Customers Want HP DAC EXPRESS

Customers want to:

- Set up and acquire data without programming
- Easily scale the number of channels from tens to hundreds
- Condition and linearize common transducers
- Measure static signals and dynamic signals at appropriate rates
- Save data to disk at high transfer rates
- Have dependable data and repeatable results
- Convenient on-screen display monitoring while recording measurements
- Ease of exporting data for analysis and report generation.

An Example Application

Pump/Motor Testing
The basic goal is to verify that the flow vs pressure curve of the pump/motor combination meets the design specifications. This requires transducers for:

Inlet pressure (head or psi) – 1 static channel
Outlet pressure (head or psi) – 1 static channel
Flow (volume or mass) – 1 static channel
Temperature (fluid, pump, motor, bearings) – 1 to 10 static channels

Other parameters that are usually measured are:

Vibration – accelerometers on pump and motor - 1 to 3 dynamic channels
Noise – microphones (located according to OSHA standards) – 1 dynamic channel
Pump blade passing frequency (pressure transducer) – 1 dynamic channel
Cavitation point – when reduced suction pressure causes differential pressure across pump to drop by 3%
Pump power – voltage and current (requires isolation transformers) 2 static channels

4. Presenting/Demonstrating the Product

Communicate Value Proposition

To developers and users of DAC systems, the HP DAC Express platform is the one solution that:
-is easy-to-use, scaleable, and customizable,
-significantly reduces system development time and testing costs,
-provides high quality, dependable data,

and is competitively priced.

Excitement Features

- Combined measurements of static and dynamic parameters
- Non-programming, intuitive interface - requires no training
- Online monitoring displays created in minutes with drag and drop
- Convenient data browser viewing of previously recorded data
- Powerful, dependable, HP VXI measurement hardware

Showing the System

HP DAC Express has a hardware simulation mode that allows you to demo the software without VXI hardware connected. Example hardware setups and recorded data will be included with the software so that you can “load and show” without taking time to configure channels and monitoring displays.

A demo walk-through in slide format is available on the Web at:
http://www.tmo.hp.com/tmo/pia/data_acq/PIAProd/tutorials/English/DX_Tour.html.

For customers who want to evaluate HP DAC Express before buying, a demo version (60 day timeout) can be down-loaded from the Web in early March. A CD-ROM version will be available through LitStation later.

This demo software has all the functionality of the full product including control of VXI instruments, but has a life of only 60 days after installation. Most customers will be able to use HP DAC Express without reading the manual or using Help.

5. Positioning Among HP Products

HP DAC Express systems are focused at multi-channel, analog recording applications for electromechanical testing. The use model is very simple and the user can become an expert in hours. Although the software provides for only analog acquisition at this time, future plans include digital I/O, frequency, and output control so that the product under test and its environment can be controlled for full automated acquisition and control.

HP VEE

This is a much more comprehensive graphical programming environment that supports nearly all VXI hardware. Although it is relatively easy to program due to the graphical nature, it still requires a programming thought process including debugging and compiling. Becoming a expert requires months of experience with the language. HP VEE should continue to be HP's premier software offering for many general purpose applications.

If HP VEE does not meet your customer's needs for ease of setup or data throughput speed, show them HP DAC Express.

HP BenchLink and the 34970A

Actually, HP BenchLink Data Logger served as the starting point for the use model of HP DAC Express. Users of HP BenchLink will feel right at home with HP DAC Express. There are some differences in the data browser and export functions but in general HP DAC Express has more capability. Think of HP DAC Express as HP BenchLink “PRO” for VXI data logging hardware.

The most important difference is that HP DAC Express can provide much higher data measurement rates with its VXI instrument platform. If HP BenchLink isn’t fast enough or won’t support enough channels, sell them up to HP DAC Express.

6. Competitive Analysis

Total Data Acquisition Market

Data recording and logging applications are a significant part of the $200M/yr design verification market. HP DAC Express addresses the portion of this market at the high end that requires higher channel counts and faster sample rates than provided by most solutions.

Market estimates show that HP is the largest supplier, but with less than 10% of the data acquisition market. Other vendors – over 100 -- make up the other 90% of the market. National Instruments and Kinetic Systems are the key competitors in high performance applications.

National Instruments

NI LabVIEW: base package $995 US List, full development $1995 US List
National has achieved a leading position with LabVIEW development software products. "The software is the instrument" is their continuing theme. They are a significant competitor with a line of PC plug-ins and VXI products including data acquisition, controllers and other instrument products.

Like HP VEE, LabVIEW requires the test developer to use programming and debugging techniques even for simple data recording applications. Several months of programming experience are required before users become proficient at developing data acquisition programs. Even then, developing a typical program will take 10 times longer than with HP DAC Express. LabVIEW is a good general purpose tool but it is not optimized for data acq applications.

NI Measure: $495 US List
This product is a set of Excel addins for DAC applications using PC plugins, GPIB, parallel, or serial port devices. No specs are available for measurement throughput. A common complaint of customers who use Excel to view large data files is that it is limited to approximately 65,000 data points.

NI VirtualBench-Logger: $195 US List
VB-L is another non-programming DAC user interface for Window compatible DAQ PC plugins. It is included at no charge with all NI temperature measurement instruments. The maximum speed is 100 Sa/sec/ch for up to 16 channels. It will support up to 384 channels at slower rates. There is no dynamic measurement capability.

NI DASYLab: basic version $1095 US List, full version $1395
Data acq applications are developed by building an icon-based flowchart of acquisition, control, and analysis functions. This software was developed by a German company and is resold by NI.

Additional information is available at http://www.natinst.com/products/.

KineticSystems

Kinetic is a strong competitor with years of experience in the data acquisition market, particularly at the high end. They provide both static and dynamic acquisition solutions. They are a manufacturer of standardized high performance data acquisition products including VXI and CAMAC (computer-controlled computer-sided measurement and control) I/O modules and interfaces to popular computer buses. Kinetic is committed to supporting the high-tech needs of science and industry. Their focus will likely remain on targeting high-end niche markets where the issues of high-performance, accuracy, and speed are principal end-user requirements.

AC10 DAQ Director Data Acquisition Software: $5000 US List
This is a prepackaged DAC application written in NI LabVIEW and only runs in the NT environment. The user must make entries in a Visual Basic configuration file and an Access data base in order to initialize and operate the software. Measurements are made using KS VXI hardware connected with the proprietary KS Grand Interconnect fiber-optic I/O to an external PC. DAQ Director does support multiple mainframes.

No performance specs are currently available but their target applications include high-end measurements so this may be the nearest competitor to HP DAC Express in terms of measurement throughput. There is, of course, a significant difference in the price of the software.

No programming is required to use the software as configured, however, any customization requires the purchase of the full NI LabVIEW development system. KS offers custom programming services that indicate that this is not a simple task.

Additional information is available at http://www.kscorp.com/www/vxi/software/ac10.html.

Sony Precision Technology

Another class of solution for many applications is the DAT data recorder. A basic DAT recorder is relatively inexpensive but multi-channel recorders are much more expensive due to multiplexing circuitry. The main advantage is long record times provided by the tape media.

The A/D technique used provides suitable AC accuracy for dynamic signals but there are no specs for DC offset or noise. So low level measurements such as temperature or strain are not practical.

PC216Ax (16ch) $21,200 US List
PCCX32Ax (additional 16ch) +$10,800 US List
PCIF260 (enhanced parallel port I/O HW plus PCScanII SW) $1900 US List

Additional information is available at http://www.sonypt.co.jp/200ax/.

7. Ordering Information

The HP E9814A Data Recorder/Logger and the HP 9812A Analog Data Logger are configured as fully functional systems with the addition of the customers PC or the optional HP PC. More channels and signal conditioning can be easily added to meet your customers needs. However, to make the system ordering simple, only the E1432A and E1413C with a limited choice of mainframes are included and the choice of SCP's is limited to the most popular.

If your customer needs can't be met with these systems, then start with the E9810A Integrated System (includes HP DAC Express software and Firewire) and add the mainframe and VXI modules of choice. At the present time, we are only offering factory integrated systems with Firewire because it is the best value for data acquisition I/O.

The Option AUC on VXI modules, BoB's, and SCP's supported by HP DAC Express is used to add hardware to the factory integrated systems and must be included in the same order section as the E9812A, E9814A, or E9810A.

For details, refer to the configuration guide at:
http://bbs.lsid.hp.com:8080/html/products/e980x/prodinfo.htm

Additional Configuration Information

General

- Only a single mainframe is supported at this time.
- The E1421A 6-slot Mainframe is not included in factory integrated bundles because the E8401A 13-slot mainframe is a better value.

E1432A

- Options UGV (local bus) and ANC (32 MB RAM) are REQUIRED.
- The number of E1432A modules that can be supported is only limited by the number of slots available and the max power required (depends on the BoB configuration selected).
- Other supported options:
  - 1D4 (source)
  - AYF (tach)
  - 1DD (delete 12 chan.)
  - 1DE (delete 8 chan.).
- Options 1D4 (source) and AYF (tach) cannot both be ordered in the same module.

E1433A

- Option UGV (local bus) and ANC (32 MB RAM) are REQUIRED.
- The number of E1433A modules that can be supported is only limited by the number of slots available and the max power required (depends on the BoB configuration selected).
- Other supported options:
  - 1D4 (source)
  - AYF (tach)
  - 1DL (delete 4 chan.)

- Options 1D4 (source) and AYF (tach) cannot both be ordered in the same module.

Note:

- It is not recommended to combine E1432A and E1433A in the same system.
  1) There is a measurement accuracy problem (phase error) in this configuration, although it is not a large error for low frequency applications.
  2) The sample rate will be limited to 51.2 KSa/sec because the master clock is shared by these modules.
- Support of an external trigger requires that at least one module (of: E1432A, E1433A, E1434A) must have an "external trigger" connector. This connector is absent if the module has the #1D4 (source) option. So, if all of these modules have the source option, HP DAC Express will not support external triggering.

E1562D/E

- Only one E1562D/E is supported in HP DAC Express systems (required for use of E1432A or E1433A).

E1434A

- Option UGV (local bus) is NOT REQUIRED. If the module does not have option UGV (local bus), it must be placed so that it doesn't interrupt the local bus (i.e it can't be between other modules with local bus).
- Other supported options:
  - 1D4 (source)
  - 1DM (delete 2 chan.).
- Options not supported by HP DAC Express (but OK to have in the module): ANC (32MB RAM), ANM (4MB RAM). Release 1.0 doesn't use this extra memory

E1413C

- The number of E1413C modules that can be supported is only limited by the number of slots available and the max power required including SCP's. (generally not a problem unless E1510A Sample/Hold or E1511A Transient Strain SCP's are used).
- Up to 8 SCPs can be installed on each E1413C module.
- Compatible SCPs: E1501A – E1518A.

I/O Configuration Information

HP E1406A

HP-IB is supported and is useful with the E1413C when total data rates less <15KSa/sec are required. It is not recommended for use with E1432/33A. Factory integration is not available because Firewire is the preferred I/O for new system purchases.

NI GP-IB

This I/O is expected to work (when used with the NI PCI card) but has not been tested at this time. Contact MSD technical support if this is a requirement for your customer.

NI MXI-2

MXI-2 is being tested and is expected to meet or exceed the performance of Firewire, although it is more expensive. It is not available with factory integration.

The module has a local bus and must be physically separated from HP modules with local bus (E1432A, E1433A, E1562, perhaps E1434A) by at least one slot. Be sure to allow for this consideration in calculating the number of slots used. Physical keying helps to preclude incorrect placements.

8. Sales Tools & Programs

Sales & Technical Literature

HP DAC EXPRESS Product Overview

This 12-page document contains a detailed description with features, benefits, and a specs overview. It is available in two places.

HP LitStation pub #: 5968-0434E
Data Acquisition web site (http://www.hp.com/go/data_acq).

HP Data Acquisition Web Site!

The HP DAC Express press release will be featured in "News Releases" and product information links to data sheet and overview documents will be included by end of first quarter.

Data Acquisition Promotion Plans

Objectives: Implement unified DAC outbound programs that drive home the message *"HP DAC solutions extend your engineering senses and accelerate your progress towards the right results at the right time."* This is a new message for our customers. It will reposition the playing field against competitors that provide programming building blocks rather than out-of-the-box solutions. We will focus this message on two key audiences:

- Our traditional high-end automotive and aerospace/defense customers – representing the market "high ground" that HP currently owns. This fortifies and protects this segment with increased preference for our current VXI platform, new VXI products, and solution partners.
- The larger number of mid-range DAC customers whose needs cannot be met by PC plug-in systems or turnkey boxes with limited channels and data throughput rates. This represents a greater opportunity to regain the base that HP once held with the 3497 and the 3852.

We will utilize new and traditional media to deliver our message. These will include customer and field web sites, literature, direct mail, targeted ads, and face-to-face seminars and shows. The goal is to generate more sales leads than our channels can handle.

Highlights & Metrics: Specific worldwide activities and objectives in FY'99 include:

Web & New Media: Through monthly updates, freshen and expand the content of our worldwide, 24/7 library of product and application information (for sales and support). Build a growing, regular readership by pulling prospects and customers to the site with monthly email mini-newsletters that include useful information. A similar approach will be used for our DAC Field Web site. Additionally, we will continue to use Web banner ads to reach prospects electronically. *Metrics*: Build customer email subscriber list to over 1000; increase Web site accesses from 13,000/mo. to 20,000/mo.

Promotion & PR: Build awareness of and preference for HP DAC products in our two target markets while reinforcing our message. Use small, targeted direct mail and advertising

programs in key countries. Leverage customer successes into articles in key DAC magazines. Publish newsworthy press releases to coincide with major product releases. *Metrics*: Increase significant DAC press appearances; direct mail response rates >5%; meet expense targets.

Shows and Seminars: Generate awareness of HP DAC solutions by maintaining a high profile at key DAC shows with demos and papers from HP and partners, along with face-to-face seminars in key cities. Shows planned in FY99 include: The Data Shows (Fred Bode); SAE Expo; IMAC; Sensors Expo; ISA Expo; and Messcomp. DAC Seminars are planned in the U.S., UK, France, Germany, China, Taiwan, Korea, Singapore, Australia, and India. *Metrics*: Invitations mailed before each major show; leads and follow-up completed within 2 weeks after; submit at least 3 tech paper proposals and deliver at least one; pursue partner co-funding; meet expense targets.

Product Literature: Develop DAC Family Brochure in Q2'99. Localize key pieces in Europe and Asia. Minimize printing costs by relying on LitStation and Web downloads. Evaluate role of T&M Catalog pages to determine its priority. Metrics: Available at launch date; error-free; meet expense targets.

Publicity and Media Management

Rebuild relationships with key DAC-focused magazines:

- Sound and Vibration
- Personal Engineering and Instrumentation News
- R&D's Data Acquisition Newsletter
- Test Engineering
- InTech
- Sensor's Magazine
- VXIbus Newsletter

1999 Event Participation

MSD plans to participate in the following events:

- IMAC XVII Show – Modal Analysis conference, Orlando, February 8-11, 1999
- Bode Data Shows and DAC Seminars – US-wide during 1999
- Sensors Expo – Major sensors and data acquisition show, Baltimore, May 4-6, 1999
- SAE Traverse City Show – Noise, vibration, harshness (NVH) show, May 17-20, 1999
- MessComp – Large test and measurement show, Germany, September 1999

Note: more detailed information about these events can be found in the DAC Expressions newsletter on the MSD web site)