

DVC-8

CLASSICAL SHOCK CONTROLLER

OPERATION MANUAL

Windows Xp/Vista Version 2.41

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Serial # 500 UP

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DVC-8 CLASSICAL SHOCK CONTROLLER OPERATING INSTRUCTIONS

1) PRODUCT DESCRIPTION.

The DVC-8 series are vibration control systems for use with IBM compatible personal computers; it is essentially a programmable digital waveform generator and data acquisition system with sophisticated control and analysis software. It is shipped along with a computer interface card, Windows Xp/Vista/7 software on a CD and a 3' cable, although a complete system would also have a shaker, amplifier, and an accelerometer at a minimum. It is available as both the 8-channel DVC-8 and 4-channel DVC-8/4 and 16 channel DVC-8/16 models.

It is designed for controlling a wide variety of classical shock tests with ease of use and automated record keeping; classical shock tests are those defined by geometric shaped shock waveforms (e.g. sine, triangle, rectangular, parabolic, etc.).

The computer interface card installs in the computer in a PCI slot; it is a 16 bit 16 channel data acquisition card with two 16 bit analog outputs and has a 24 line 8255 type digital interface. Several vendor cards may be used, but all follow the I/O Tech DaqBoard1000 SCSI-3 connector interface. The PCI card is installed by the Windows plug-and-play software, and the board configuration must be checked after installation.

The DVC-8 Controller module connects to the computer interface card via a short SCSI-3 HD68 male- male cable, and all drive and feedback connections are made with the BNC connectors. A 6 pin Molex type connector is available for remote control of the System. The DVC-8 Controller can be configured for either 4 or 8 channel operation in Sine, Random, or Classical Shock modes; the software automatically detects the Controller configuration and enables the appropriate features.

Persons new to vibration testing should read the tutorial in section 1.1 to gain a better knowledge of the processes and terms used. Additional information is available on the web site www.vibrationworld.com which is supported by the manufacturer.

1.1) VIBRATION TESTING DESCRIPTION: Vibration testing is the process of applying a controlled amount of vibration to a test specimen, usually for the purposes of establishing reliability or testing to destruction. In practice the test article is securely mounted on a shaker table or actuator, which may be operated by electro-dynamic or hydraulic force; typically hydraulic force is used at very low frequencies because of the large displacements involved, and electro-dynamic force is used where higher frequencies are involved.

An electro-dynamic shaker is a linear motor: a moving coil in a fixed magnetic field that is the same principle used in the construction of a loud-speaker. The magnetic field is generated by either permanent magnets or by DC current in a field coil, and audio power is provided by an amplifier of suitable rating, typically about 10 watts of audio/ pound force generated.

Some type of signal source is necessary to drive the amplifier, and an accelerometer is needed to measure the vibration response of the test article. Accelerometers are referred to as "Integrated", meaning they have a built-in amplifier and need a current source for power, or "Charge" type, requiring an external charge-converter to make a usable signal from their output. If the test article is large, then the response may vary across its surface and multiple accelerometers may be used and the outputs averaged.

The overall response curve is usually VERY non-uniform due to the response curves of the amplifier and shaker, and mechanical resonances of the shaker, test article, and mounting fixtures. To cure this, a controller is used to servo the actual measured response to the desired response curve. Controllers may be rack-mounted analog instruments or digital computer-based products.

The signal source usually attempts to simulate the real-world environment that the test article will operate in. Two methodologies are commonly used: Swept-sine and Random testing. In the Swept-sine approach the frequency is swept back and forth with amplitudes corresponding to the desired test levels. In Random testing the frequency spectrum of a noise source is shaped to represent the environment that the article will operate in. An additional test approach is Classical shock testing where the article is subjected to one or more high level shock pulses; this is similar to a one time drop-test that might occur in shipping. In all three approaches the test level can be increased until destruction occurs, thus establishing the safety margins.

1.2) SPECIFICATIONS.

INPUT CHARACTERISTICS:

INPUT CHANNELS: One control and 3, 7 or 15 additional monitor channels.

INPUT SENSITIVITY: Settable from 5 to 1000 MV/G, 20 Vp-p max input.

CURRENT SOURCES: Four, eight, or 16, 4 MA each input, 18 VDC compliance, software selectable.

REMOTE CONTROL: Equalize, Abort, Start, and Pre-Test; 5 volt logic activated by switch closure to ground.

SOFTWARE REMOTE CONTROL: Control of major functions by remote software; refer to the application note for details.

OUTPUT CHARACTERISTICS:

OUTPUT SIGNAL: 1024 point filtered analog drive waveform.

DRIVE LEVEL: 16 Vp-p maximum.

PEAK LIMITING: User settable from 0 to 16 Vp-p maximum drive output.

DYNAMIC RANGE: > 60 Db.

CONTROL CHARACTERISTICS:

WAVEFORMS: Half-sine, triangle, trapezoidal, rectangular, initial or terminal peak saw-tooth, quarter-sine, parabolic cusp, sine-burst, or custom shape.

WAVEFORM GENERATION: 16 bit x 1024 points with 12 bit amplitude scaling.

PULSE DURATION: 1 to 100 Msec.

MODES: Single pulse or repetitive pulses, with settable pulse count and rep rate.

TEST LEVEL: 0.5 to 200 G-peak.

POLARITY: Positive or negative pulses.

CONTROL PROFILES: Up to 99 shock profiles may be saved and recalled from disk.

CONTROL ACCURACY: +/- 1 Db typical.

SAMPLING FREQUENCY: 1.28 Khz to 10.24 Khz.

EQUALIZATION TIME: < 10 seconds for low level equalization of system transfer function.

TEST ARTICLE PROTECTION:

ABORT / ALARM LIMITS: User selectable from 1 Db to 99 Db.

OVERALL LIMITS: Overall D, V, A limits settable by user.

CONTROL SIGNAL LOSS: Open loop detector check.

PRETEST LIMITS: Settable by user.

EQUALIZATION: Low level equalization of system.

MANUAL ABORT: From mouse, keyboard or optional remote panel.

TEST DOCUMENTATION: Any of the following screens can be viewed or printed out on a printer:

TEST PROFILE: Control profile and predicted velocity and displacement

EQUALIZED SYSTEM RESPONSE: Response acceleration, velocity and displacement of any of the 4, 8, or 16 input channels.

DRIVE OUTPUT: Output analog drive waveform of card of card.

SHOCK RESPONSE SPECTRUM: Equivalent response of a single degree of freedom system to the acceleration spectrum.

SYSTEM REQUIREMENTS:

COMPUTER: Pentium 1Ghz or better with SVGA display, 512 Mb RAM and 20 Mb of hard disk space required

POWER REQUIREMENTS: Powered by wall power supply, 1 W required.

SIZE: 2.5öH x 7.25öW x 9öD Controller box with standard 1/3 AT size PC interface card (4.5" x 4.5").

CONNECTIONS: Via SCSI-3 connectors and cable from computer to Controller box and BNC connectors to signals; optional remote control connections via 6 pin Molex connector.

2.) INSTALLATION.

2.1) SOFTWARE INSTALLATION. The software should be installed on the computer before the hardware is installed. There are two programs to install on the computer: one for the PCI interface card installed inside the computer, and the DVC-8 software for vibration control; each comes standard on CD's provided. The software installs for all versions of Windows; the Windows NT/2000/Xp/Vista driver is automatically installed.

The DVC8CSC.EXE software comes on a CD and requires about 20 mb of hard disk space. The disks also contains some sample profiles; using the program in the Demo mode is highly recommended as a training tool to get used to the software without risking possible damage to the equipment. Load by inserting the CD into the disk drive and follow the directions and it should automatically install on the hard drive; run SETUP.EXE on the CD if it doesn't automatically start. The default directory is C:\Program Files\DVC8, but it can be changed during the setup if desired, although not recommended. Currently only 32 bit versions of Windows are supported.

To install the software for the IOtech Daq19000 board, insert the CD and run the Setup program, agree to the EULA, select DAQ1000 from the drop down list, next and check only DaqView and DacX Support and install.

The DVC8CSC program is 32 bit software intended for use on all Windows platforms; please read the CD QuickStart instructions or go to www.vibrationworld.com for the latest help on operation with Windows Vista.

2.2) HARDWARE INSTALLATION. Turn of the computer and install the DVC-8 computer interface card in a PCI expansion card slot of an IBM compatible personal computer of Pentium grade or better with Windows software; next connect the SCSI-3 cable between the computer and DVC-8 box and connect the wall power supply to the DVC-8 and plug it in. A 1 Gb Pentium or better computer is recommended for superior performance. The PCI card is installed by the Windows plug-and-play software, and the board configuration must be checked after installation.

The DVC-8 Controller module connects to the computer interface card via a short SCSI-3 HD68 male- male cable, and all drive and feedback connections are made with the BNC connectors. A 6 pin Molex type connector is available for remote control of the System. The DVC-8 Controller can be configured for either 4, 8 or 16 channel operation in Sine, Random, or Classical Shock modes; the software automatically detects the Controller configuration and enables the appropriate features. Remote control is accomplished by switch closures to ground by any of the 4 Remote Control pins on the Remote connector; refer to the connector pin-out diagram.

After the hardware installation above, turn on the computer and the system should detect a new PCI card. The Daq1000 must be initially configured according to the instructions in the I/O Tech instructions before it is ready for use. This involves finding the DaqSetup application in the Windows Control Panel; switch to classic view if you can't locate it.

SCREEN DESCRIPTIONS.

The Classical Shock Windows software features a Control Panel screen and many windows offering expanded information; a description of each of these screens follows.

3.1) CONTROL PANEL. This is a "virtual instrument" screen that mimics a real instrument with large digital displays, a plot of the response, LED type indicators and a monitor section that displays all system parameters. The operation is controlled either by the mouse or from the keyboard with single key keystrokes; the active keys are listed in the HELP Keyboard menu; for example "S" is start, "A" is abort, etc. The operator has full control of system operation with the mouse or a few easily remembered keys. Operation is "automatic" with the controlled response following the desired profile. If an abort condition is encountered the Stop button will change from green to red and one of the following messages appear: OPEN LOOP, LOW GAIN, OVER-TEST, >D-LIMIT, >V-LIMIT, or >A-LIMIT.

3.2) MENU BAR. If the setup conditions of the test need to be checked or changed, or files saved, loaded or printed, use the Menu Bar to list all of the setup conditions and the profile to be run. Use the mouse or up/down arrow keys to move the cursor to the item to be changed and click or press enter and the default value will be displayed. If that is OK, click on OK or press enter and nothing is changed. If you wish to make a change, type in the new value and enter; if it is out of bounds it is thrown out. If the value is a choice, (e.g. SLOW, ON, etc.) click on the desired choice.

The Menu Bar is divided up into categories; selecting one will drop down a menu listing the items that the user can set. The categories are listed below:

3.3) RESPONSE PLOT. This graphic screen is a LINEAR-LINEAR graph of the frequency range and acceleration range. The selected profile will be displayed in white and the responses in red, purple, brown and blue. If the Trip limits have been turned on, they will be displayed in yellow. Velocity and Displacement will be plotted also if checked. Channel #5 through 8 responses are displayed (and Printed) with the same colors as #1-4, but with dashed lines. The plot can be zoomed in/out using the VIEW menu commands or the Up/Down scale arrows or the X,x,Y,y hotkeys. 16 Channel systems allow "page-flipping" between channels #1-8 and channels #9-16.

3.2.1) FILE MENU:

A) OPEN PROFILE- Opens a Windows dialog box to select the path and name of the previously saved test profile to be loaded. Opening a profile loads all of the setup parameters with it. Profiles are normally named as DVCFILEC.*, where * is a number from 000 to 999, or *.prf files, but any name with any extension can be used instead. *Caution: when opening or saving files, the last used folder will be displayed; be sure that you are saving them where you want, and not creating orphan files!*

B) OPEN REPORT- Opens a Windows dialog box to select the path and name of the previously saved test report to be loaded. Opening a report loads all of the setup parameters with it. Reports are normally named as DVCTESTC.*, where * is a number from 000 to 999, or *.rpt files, but any 8 character name with a 3 character extension can be used instead.

C) OPEN DVC-4 PROFILE- For opening legacy DVC-4 profiles, which will then be converted to DVC-8 format when saved. Opens a Windows dialog box to select the path and name of the previously saved test profile to be loaded. Opening a profile loads all of the setup parameters with it. Profiles are normally named as DVCFILEC.*, where * is a number from 000 to 999, or *.prf files, but any 8 character name with 3 digit extension can be used instead.

D) SAVE PROFILE- Opens a Windows dialog box to select the path and name where the test profile is to be saved. Saving a profile saves all of the setup parameters with it. Profiles are normally named as DVCFILEC.*, where * is a number from 000 to 999, or *.prf files, but any 8 character name with a 3 character extension can be used instead. *Caution: when opening or saving files, the last used folder will be displayed; be sure that you are saving them where you want, and not creating orphan files!*

E) SAVE REPORT- Opens a Windows dialog box to select the path and name where the test report is to be saved. Saving a report saves all of the setup parameters with it. Reports are normally named as DVCTESTC.*, where * is a number from 000 to 999, or *.rpt files, but any 8 character name with a 3 character extension can be used instead. *Note: the response plot is saved with the current background color; if the report will be printed out later, it may be desirable to use the white background to save ink.*

F) EXPORT TEST DATA- Exports the test setup parameters and test data into an Excel-format file; the suggested naming convention is DvcDataC.*, where * is a user assigned number. Refer to the application note on the installation CD or on www.vibrationworld.com for full details on the file format.

G) PRINTER SETUP- Opens a Windows dialog box to select printer to be used and it's setup options.

H) PRINT- COLOR- COLORS | MONOCHROME- Sets the colors outputted to the printer to either the same colors as the screen, or all black for high contrast printouts. With some printer drivers this will automatically choose either color or black & white printing; others require setting the printer to color mode in the printer setup.

I) PRINT REPORT- Prints the report on the default printer, or the one selected in Print Setup.

J) EXIT- Opens a Windows dialog box to confirm your intention of exiting the program.

3.2.2) SYSTEM MENU:

A) COMPUTER INTERFACE- Selects the interface between the computer and DVC-8 box; currently the DAQ1000 PCI card is the only supported interface.

B) ACTIVE INPUT CHANNELS- May be set to 4, 8 or 16, but never more than the system configuration allows. An 8 channel system can be set to 4 if the other channels are not needed for somewhat faster loop times or for use with older slower computers. Two 8 channel systems can be installed in one computer and operated in a Master/Slave manner for 16 channels. The inactive menu functions will be grayed out depending on the selection.

C) PCI CARD ADDRESS- Dialog box to set the computer interface card address, for the Daq1000 PCI card the Windows plug-and-play software sets the address, which is typically board #0. *This number must match the system setting for the controller to work!* If two systems are installed in a computer for 16 channel operation, the Master will be board #0 and the Slave will be board #1.

D) UNITS- Set the units to be used, either English (Gø, IPS & mils), Metric (mm.,cm/sec.,m/sec².), or Hybrid (Gø, cm/sec & mm).

E) NUMERIC SEPARATORS- Selects either English (1,000.00) or Metric (1.000,00).

F) MANUAL MODE STEPS- Opens a dialog box to set the step size for Manual Level control; the default value is 0.1 (+/- 10% increments).

G) MAX. DISPLACEMENT- Dialog box to set the maximum displacement allowable to protect the shaker. This value should be supplied by the shaker manufacturer.

H) MAX. VELOCITY- Dialog box to set the maximum velocity allowable to protect the shaker. This value should be supplied by the shaker manufacturer.

I) MAX. ACCELERATION- Dialog box to set the maximum acceleration allowable to protect the shaker. This value should be supplied by the shaker manufacturer.

J) LOW GAIN TRIP POINT- Dialog box to set the Low Gain error message trip point. Enter the Low Gain Trip point in Db. greater than 1.0. Low-Gain is defined as the compression point, or Db below maximum drive output where at least 0.25 G feedback is expected.

K) OPEN LOOP TRIP POINT- Dialog box to set the Open Loop error message trip point. Enter the Open-Loop trip point in Db. greater than 0.1. Open-Loop is defined as the minimum

compression point (maximum drive output voltage allowed).This should be set above normal operating levels.

L) CALIBRATION FACTORS, CH#-- GAIN: Dialog box to reset the channel #1 through 8 or 16 scale calibration factors. The nominal value is 1.00. *NOTE: Altering this value will affect the system accuracy; this should be done as part of the calibration procedure.*

M) UPDATE CALIBRATION FACTORS: Saves the current calibration factors in the file `DVC8CAL.DAT` located in the `C:\Program Files\DVC8` folder.

3.2.3) INPUTS MENU:

A) INPUT SENSITIVITIES- Lists the four or eight input channels; selecting any one brings up a dialog box to set that CHANNEL #1 sensitivity from 5-1000 MV/G. . *Note that the maximum input voltage is 2.00 volts; therefore a 10 MV/G signal will limit at 200 G and a 100 MV/G signal will limit at 20 G, etc.*

B) CURRENT SOURCES- Lists the four or eight input channels; selecting any one will place or remove a check mark next to the appropriate channel and turn that CHANNEL #, 4 MA current source, either ON or OFF.

C) ACCELEROMETER: MODEL# | SERIAL# - Opens Windows dialog boxes to record the accelerometer model # and serial #.

D) REMOTE CONTROL- Select whether the Remote control inputs are activated or disabled.

E) SOFTWARE REMOTE CONTROL- Enables control of the DVC8DSC.EXE software by another program through a shared file; a check mark indicates activation. The standard Remote Control functions are accessible and all keystroke commands; refer to the application note at the end of this manual and sample programs on www.vibrationworld.com for full details and examples.

3.2.4) SHOCK SETUP MENU:

A) PULSE SHAPE: HALF-SINE | TRIANGLE | TRAPEZOIDAL | INITIAL PEAK SAWTOOTH | TERMINAL PEAK SAWTOOTH | QUARTER-SINE | PARABOLIC CUSP | SINE-BURST | CUSTOM- Choose the pre-defined geometric pulse shape or import a custom shape, which opens a Windows dialog box to select the path and name of the previously generated waveform to be loaded. Custom wave shapes are normally named as `DVCWaveC.*`, where * is a number from 000 to 999, but any character name with a 3 character extension can be used instead. The file is a 1024 point numerical list with a range of +1 to 61; please read the application note titled "Custom Shock Waveshapes" on www.vibrationworld.com for the details.

B) PULSE AMPLITUDE- Opens a dialog box to set the test peak amplitude from 0.5 to 200

G's.

C) PULSE DURATION- Opens a dialog box to set the pulse duration from 1 to 100 Msec.

D) POLARITY: POSITIVE | NEGATIVE- Set the pulse polarity.

E) REPETITION MODE: SINGLE PULSE | REPETITIVE- Set the mode for either a single or multiple pulses.

F) SAMPLING FREQUENCY: 1.28 | 2.56 | 5.12 | 10.24 KHZ.- Normally set to 5.12 Khz for pulse widths of around 10 Msec; use slower rates for long pulses.

G) COMPENSATION MODE: AUTOMATIC| MANUAL- Defaults to the automatic mode where the pre- and post-compensation pulses are optimized for minimum velocity and displacement at the end of the shock pulse; the values will vary depending on the shape of the pulse.

H) COMPENSATION LEVELS| PRE-PULSE LEVEL| POST-PULSE LEVEL- Opens dialog boxes allowing the user to specify custom values for the pre- and post- pulse compensation levels; the values are saved with the test profile.

3.2.5 TEST SETUP MENU:

A) CONTROL MODE- Selects between normal Automatic Mode and Manual Mode. In Manual Mode Equalization is disabled, an Up/Down arrow control appears to set the output level, and the input channels function as general purpose data-acquisition channels.

B) SHAKER LOAD COMPENSATION- Pre-compensates the waveform for the type of load expected; the choices are Minimum, Moderate, Normal, Heavy, and Maximum. Normal is the default.

C) EQUALIZATION LEVEL- Opens a dialog box to set the equalization level in G's; the default value is 1.0.

D) PRETEST LEVEL- Opens a dialog box to set the pretest level in -Db.

E) ABORT LIMITS- Opens a dialog box to set the abort limits in Db. The upper and lower limits are symmetrical.

F) #PULSES- Opens a dialog box to set the total number of shock pulses.

G) REPETITION RATE- Opens a dialog box to set the repetition rate of the shock pulses in seconds/pulse.

H) MAX DRIVE LEVEL- Opens a dialog box to set the maximum output level in volts peak.

- I) TITLE-** Allows the user to enter a title to be used with the plots and saved with the test.
- J) TEST SUBTITLE1-** Dialog box that allows the user to type in a sub-title for the report up to 60 characters long that will be printed at the top of the plot.
- K) TEST SUBTITLE2-** Dialog box that allows the user to type in a sub-title for the report up to 60 characters long that will be printed at the top of the plot below SubTitle1.
- L) AUTO PRINT-** Prints the test report at the conclusion of a test if turned on (checked in the menu).
- M) AUTO SAVE-** Saves the test report at the conclusion of a test if turned on (checked in the menu). The user will be prompted for the path and filename at the start of the test.
- N) AUTO EXPORT DATA-** Saves the test report at the conclusion of a test if turned on; at the start of the test the user will be prompted for the filename and path. It saves the test data to the designated file for later inserting into Word or Excel reports. See the Export Data folder on the installation CD for details and sample templates.
- O) DEMO ROUTINE-** Runs the demonstration program if checked; if the BussCheck detects that the card is not installed or not communicating the program will be placed in the Demo mode. The Demo mode runs simulated tests, but all normal features are active.

3.2.6 TEST RUN MENU:

- A) EQUALIZE-** Starts the process to equalize the system gain by using low level pulses as set in the Test Setup menu; same action as clicking on the Equalization button.
- B) PRETEST-** Generates a shock pulse at the Pre-Test level as setup in the Test Setup menu; same action as clicking on the Pre-Test button.
- C) START-** Generates a shock pulse at the full test level or starts a series of pulses as setup in the Test Setup menu;; same action as clicking on the Start button.
- D) ABORT-** Aborts the test and resets the pulse counter; same action as clicking on the Abort stop sign button.

3.2.7 VIEW MENU:

- * Only active when 8 channel operation is activated.

A) VIEW CHANNELS| ALL- Allows selecting any combination of available channels to be displayed at once

VIEW CHANNELS| CH#1-8- Allows viewing any combination of Ch#1-8 channels to be displayed at once

VIEW CHANNELS| CH#9-16- Allows selecting any combination of Ch#9-16 channels to be displayed at once on 16 channel systems. This feature allows "page-flipping" between the lower and upper 8 channels to limit screen confusion.

B) TEST PROFILE- Plots the test that has been previously setup; the items that are plotted depend on the selections made below.

C) CH#1 RESPONSE- Plots the channel #1 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below.

D) CH#2 RESPONSE- Plots the channel #2 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below.

E) CH#3 RESPONSE- Plots the channel #3 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below.

F) CH#4 RESPONSE- Plots the channel #4 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below.

G) CH#5 RESPONSE- Plots the channel #5 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below. *

H) CH#6 RESPONSE- Plots the channel #6 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below. *

I) CH#7 RESPONSE- Plots the channel #7 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below. *

J) CH#8 RESPONSE- Plots the channel #8 test article response to the test that has been previously setup; the items that are plotted depend on the selections made below. *

K) CH#9 RESPONSE through CH#16 RESPONSE will be active in 16 channel systems; the colors will be the same as Ch#1-8.

L) DRIVE WAVEFORM- Plots the drive waveform that will be used to generate the desired shock pulse; it usually bears little resemblance to the shock pulse shape due to the system transfer function.

M) SHOCK RESPONSE SPECTRUM- . Plots the shock response spectrum, or SRS of the CH#1 response. The SRS is the predicted response of a set of single degree-of-freedom masses

to the applied shock, and is thought to better simulate the results of a shock in a real physical object

N) ACCELERATION- Plots the acceleration curve if checked.

O) VELOCITY- Plots the velocity curve if checked.

P) DISPLACEMENT- Plots the displacement curve if checked.

Q) ABORT LIMITS- Plots the abort limits if checked.

R) REFRESH SCREEN- Redraws the screen to remove clutter.

S) PLOT BACKGROUND- BLACK- Selects black as the plot background color; black views the best on-screen, but uses excessive ink during printing when using COPY TO CLIPBOARD to export into other applications.

T) PLOT BACKGROUND- WHITE- Selects white as the plot background color; white doesn't view as well as black on-screen, but uses less ink during printing when using COPY TO CLIPBOARD to export into other applications.

U) X-AXIS SCALE- ZOOM IN- Expands the scale of the plot X-axis one step.

V) X-AXIS SCALE- ZOOM OUT- Contracts the scale of the plot X-axis one step.

W) Y-AXIS SCALE- ZOOM IN- Expands the scale of the plot Y-axis one step.

X) Y-AXIS SCALE- ZOOM OUT- Contracts the scale of the plot Y-axis one step.

3.2.8 TOOLS MENU:

A) COPY TO CLIPBOARD- Copies the plot onto the system clipboard to be incorporated into other applications.

B) COPY DATA TO CLIPBOARD- Copies the test data to the Windows clipboard for pasting into Word or Excel reports. See the Export Data folder on the installation CD for details and sample templates.

3.2.9 HELP MENU:

A) ABOUT SOFTWARE- Displays the version number of the software and pertinent phone numbers.

B) ABOUT HARDWARE- Reads the Controller configuration registers and displays the serial # and lists the hardware capabilities.

C) KEYBOARD- Displays the keyboard hot keys that control operation without a mouse.

D) WHAT'S NEW- Lists the new features in this version.

E) ONLINE HELP- Opens a Windows help file containing the on-line manual

F) AUTHORIZATION CODE- Opens a window to enter an authorization code if additional software packages have been purchased; unlocked systems do not require an authorization code and the setting should be left at zero.

3.3 PLOT SCREENS:

3.3.1) TEST PROFILE SCREEN. This graphic screen is a plot of the calculated acceleration response Vs time, along with the predicted velocity and displacement plots, if enabled in the setup; select the Test Profile plot in the VIEW menu. The predicted acceleration will be displayed in red and the velocity in yellow and the displacement will be displayed in purple. Abort limits will be displayed in white also if they have been checked.

Selecting other choices in the VIEW menu at any time can alternate the four plots. The plots can be labeled in either English or Metric units and scaled up and down in both amplitude and time-scale with the arrow keys or arrow buttons at the plot origins..

3.3.2) SYSTEM RESPONSE PLOT SCREEN. This graphic screen is a plot of the actual recorded system response to the applied shock, along with the velocity and displacement curves that would accompany that acceleration waveform if enabled; select CH#1 RESPONSE, or any of the other channels in the VIEW menu. The plot can be labeled in either English or Metric units and be scaled with the arrow keys or arrow buttons at the plot origins. The acceleration is plotted in red, the velocity in yellow, and the displacement in purple. The plot can be zoomed in/out using the VIEW menu commands or the X,x,Y,y hotkeys.

3.3.3) DRIVE WAVEFORM. The drive waveform is computed from the results of the equalization process and is the analog voltage waveform needed to produce the desired acceleration response; it generally has a largely triangular shape to overcome the velocity component of the shaker. The waveform is stored in a look-up table as 16 bits x 1024 points and clocked out at the sampling rate; the overall amplitude is then scaled by another 12 bits of amplitude resolution.

3.3.4) SHOCK RESPONSE SPECTRUM. The shock response spectrum, or SRS, is the predicted response of a set of single degree-of-freedom masses to the applied shock, and is thought to better simulate the results of a shock in a real physical object. It dates back 50 years when shocks were measured by a set of various length vibrating reeds with pencil leads attached; the lengths of the pencil lines were plotted to produce a plot of the effect of the shock over the frequency range. It is still popular and MIL-STD-810 explains the relationship between SRS and common shock waveforms. Currently it is calculated by taking a FFT of the acceleration waveform and entering it into a formula simulating $Q=10$ resonances at each spectral line.

4.) OPERATING INSTRUCTIONS

4.1) SHOCK CONTROLLER OPERATION. The Setup items should be checked over and modified as necessary; review the Setup parameters by clicking the appropriate menu item. The PULSE SHAPE and DURATION should match that of the test being run, e.g. 11 Msec Half-Sine. Set the AMPLITUDE and POLARITY as desired and the TOTAL pulse COUNT; if the count is >1 the REP RATE can be set in seconds/pulse. The ABORT LIMITS can be set from 1 to 99 Db over-test and the SAMPLING RATE varied if either a longer time window or more resolution is needed. The level used for EQUALIZATION can be changed, as well as the PRE-TEST LEVEL, if there is reason to do so. The INPUT sensitivity should match those of the accelerometer used and the CURRENT SOURCE turned on if needed.

Check that the shock numbers are indeed what you wanted by viewing it in the Test Profile plot screen.

A test can be run from either the Predicted Performance or the System Response Plot Screens. Turn the amplifier gain up and click on the Equalize button or press "E" and the system should perform a low-level equalization and display a confirmation message.

Start the test by clicking on START or pressing (S) and the response will be displayed in red in the CH#1 Response plot screen; if the system was not previously equalized, it will do so first at this time. Click on the ABORT stop sign or press (A) to stop a test. If a hard copy is desired, click Print in the File menu.

Profiles can be stored or read from disks with the SAVE PROFILE and OPEN PROFILE items in the FILE menu; the same with test results using SAVE REPORT and OPEN REPORT; the default profile and setup is stored in DVCFILEC.000 and will be used unless the file cannot be found. Profiles are saved in the format DVCFILEC.XXX unless changed; note that ALL setup parameters are stored with the profile.

If there are any problems with running a test or control accuracy, then the controller self-check described in section 5.1.1 should be run.

5.) SERVICE:

5. 1) TROUBLESHOOTING. The controller is usually blamed for problems in vibration test systems when in fact controllers rarely ever fail and setup and cabling us usually the actual problem. The controller self-check is the best way to verify proper operation of the controller. If you are unable to locate the problem please have your serial # from the HELP|ABOUT HARDWARE menu, software versions from the HELP|ABOUT SOFTWARE menu, and equipment description ready before calling for technical support. The serial # is also located on the label on the bottom of the DVC-8.

5.1.1 BUSS-CHECK FAILS. Most likely the system address for the PCI computer interface does not match the setting in the SYSTEM|ADDRESS menu item; refer to section 2.2 Software Installation for instructions on checking the settings. Start by running the Daq Configuration utility to verify the PCI card performance and check cabling and the DVC-8 power module.

5.1.2 CONTROLLER SELF-CHECK. Connect the SERVO OUT to the CH#1 input with a BNC cable and run a test, preferably the default 15G 11 Msec half-sine one. Press "E" and the controller should equalize. Press "S" and a shock pulse should be generated and captured
The servo should control at the specified levels throughout the run; repeat for all channels by using 5 Tee's and BNC cables to all inputs and the Channel #1 through #8 plots should be superimposed. If not, see 5.1.3 below.

5.1.3 POOR ACCURACY. Run the self-check in 5.1.2; if the plot inaccuracies exceed +/- 1 Db (10%), then something is wrong and must be found before real tests can be run. If erratic errors are observed, check for ground loops, excessive cable lengths, loose connections, or other noise-inducing problems. *Plug all instrumentation into the same 115V circuit as the computer to minimize ground differences and choose a ground point common to the amplifier and shaker ground.*

5.1.4)) WON'T PRINT OR PRINTER ERROR MESSAGE. The wrong printer might have been selected in Print Setup, or no printer has been installed at all in Windows. Installing a generic printer in Windows Printer Setup will suffice if no printer is to be used.

5.1.5) SCREEN LOCKED UP. Communication problem; check that both the address of both the card and software are the same, that the card is firmly seated in the connector, and that no other card is installed with the same address. If the computer goes to sleep or hibernates while running a test, the computer may freeze up waiting for data; it is best to set the Windows Power Settings for NEVER for the sleep and hibernate timeout settings.

5.1.6) NO VIBRATION OUTPUT OR LOW GAIN MESSAGE. Check that the cables are securely connected and that the amplifier gain was turned up. If the red compression bar graph drops yet there is no shaker table motion, then the signal is not getting to the amplifier, the amplifier is not functioning, etc; use standard troubleshooting techniques to diagnose the problem. Using an external signal generator set to 200 Hertz into the amplifier may be of assistance.

5.1.7) OPEN LOOP MESSAGE APPEARS. Check that the current sources or power supplies were turned on, that all cables are connected, the amplifier is turned on with gain up and all interlocks satisfied, and that there is motion on the shaker table. Open Loop implies that the controller put out its maximum drive voltage and less than 0.25 G response was returned; this is usually an accelerometer problem.

5.1.8) WON'T READ PROFILE. Check that the profile is stored on the default drive in the current directory, which is typically C:\Program Files\DVC8. If the folder wasn't checked when previously saving files, they may have been orphaned into lost locations; perform a search for that filename to find the missing file.

5.1.9) >D-LIMIT, >V-LIMIT, or >A-LIMIT MESSAGE APPEARS. The system limits that were set up in the SYSTEM CONFIGURATION sub-menu have been exceeded; check that the limits were properly set and that the level and/or frequency are not exceeding the limits. This is very important as exceeding limits can cause very expensive damage to the shaker, and it is important to determine the cause before proceeding. The first place to start is the test profile that has been entered: does it provide reasonable margin below the shaker limits? Be sure that correct units were entered, as in entering numbers as inches instead of mils, or confusing mils with mm.

5.1.10) WINDOWS PROBLEMS. The DVC-8 software is supplied in 32 bit Windows Xp/Vista format; be sure that you are using the right driver to match the computer operating system. Serial #s above 500 use V2.4x. See HELP|ABOUT SOFTWARE for version #s. Currently only 32 bit versions of Windows are supported.

5.1.11) WRONG POLARITY PULSE. Switch the leads from the shaker coil to the amplifier.

5.2) UPGRADING SOFTWARE WITH THE LATEST RELEASE:

The Setup disks contain approximately 40 files in compressed (zipped) format; most of them are Microsoft Windows shared files that are necessary for the program to run, but do not change with program upgrades. In fact the only files that change are the .EXE files (named DVC8DSC.EXE for Sine, DVC8DRC.EXE for Random, and DVC8CSC.EXE for Shock); to upgrade is a simple matter of copying a new version over the old one. Setup de-compresses (un-zips) the files when installing them so the un-zipped version must be used in upgrades.

The files are normally placed in a directory or folder named C:\Program Files\DVC8; locate and open the folder using Windows Explorer and identify the .EXE file (approximately 500K in size).

If you have an upgrade disk, insert the new disk and in Windows Explorer click the appropriate drive, select the new file, then click EDIT and then COPY; scroll down to the previously located folder and click to open it; now Click EDIT and then PASTE and you will be asked if you want to copy the new one over the old one, and click YES. The new file will replace the old one and you are finished.

The latest versions of the software are always available for downloading from the Internet; the WEB site URL is listed in the HELP|ABOUT SOFTWARE menu message.

Additional information is available on the web site www.vibrationworld.com which is supported by the manufacturer.

DVC-8 CLASSICAL SHOCK CALIBRATION PROCEDURE:

1. TEST EQUIPMENT REQUIRED:

- 1.1:** Personal Computer, Pentium or better running Windows
- 1.2:** Digital Voltmeter, true RMS reading.
- 1.3:** Low-current shunt (e.g., 100 ohm or 1K-ohm 1% resistor), or DC current reading DVM.
- 1.4:** BNC cables and "tee"s.

NOTE: The Fluke 8060A true RMS Multi-meter meets all requirements of sections 1.2-1.3.

2.1: The DVC-8 is a digital vibration controller that uses a PCI expansion card for the computer interface; it performs the functions of signal generation and control of a shaped-waveform generator and analyzer; there is also a switch-able accelerometer power supply on each input. There are no adjustments on the system; all tests are of a verification nature. The card should be installed in a personal computer and the cable connected to the DVC-8 connector in the rear of the chassis. The computer should be turned on and the DVC Shock software should be loaded in, which should come up in the CONTROL PANEL screen mode.

3. CURRENT SOURCE TESTS:

3.1: Connect a DC current reading DVM, or precision resistor and DVM from Channel #1 Input to ground: a BNC cable with BNC-Banana jack adapter is a convenient way to accomplish this.

3.2: Activate the channel #1 current source with the **Inputs | Ch#1 Current** menu selection; click on the menu item to turn on the current source. Verify a DC current flow of 4.0 +/- 0.5 MA on the Input.

3.3: Move the meter to Channel #2 input connector, and repeat the steps in section 3.2 except use the **Inputs | Ch #2 Current** menu selection. Verify a 4.0 +/- 0.5 MA current on Channel #2 input also.

3.4: Repeat for channels #3 through #4, #8 or #16 as appropriate.

4. PERFORMANCE VERIFICATION:

4.1: "Tee" the Ch#1 INPUT to the SERVO OUTPUT and to inputs #2 though #8 and set up a 15 G-peak, 10 Msec HALF-SINE test in the SHOCK SETUP menu, and 6 Db Pretest in the TEST SETUP menu. Turn the current source OFF in the INPUT menu.

4.2: Click on the EQUALIZE button and a "system equalizing- please wait" message will appear at the bottom of the screen; after ten seconds it should be replaced with a "Equalized" message.

4.3: Click on the START button and a shock pulse test should successfully complete and the results be displayed; repeat several times and verify that the peak amplitude is 15 +/- 1 G. If out of tolerance, adjust the calibration factor in the SYSTEMICAL FACTORS|CH#1 GAIN menu until within tolerance and save the results.

4.4: Click the PRE-TEST button and verify that the test is successfully completed at the level reduced by the pre-test vales (50% for 6 Db); repeat several times.

4.5: Switch to channel #2 with the VIEW|CH#2 RESPONSE menu and verify normal operation of channel #2.

4.6: Repeat for channels #3 through #4, #8 or #16 as appropriate.

This completes the calibration procedure.

6.1) CONNECTOR PINOUT, SCSI-3 HD68 FEMALE:

P7

6.2) CONNECTOR PINOUT, REMOTE CONNECTOR:

P6

EQUALIZE	1	O
ABORT	2	O
START	3	O
PRETEST	4	O
N/C	5	O
GROUND	6	O

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