

NDT

JAMES INSTRUMENTS

Non Destructive Test Equipment



V-V-100

Vu-Con® System

Operator's Manual

Original Instructions: Revision July 2018

Notice



The Vu-Con® System has been tested in accordance with the EU regulations governing Electro-Magnetic compliance and it meets required directives.

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We: James Instruments Inc.

Of: Chicago, IL

In accordance with the following Directive(s):

2006/95/EC Low Voltage Directive

hereby declare that:

Equipment Vu-Con® System

Model Number V-V-100

is in conformity with the applicable requirements of the following documents

Ref. No.	Title	Edition/date
ASTM C 1383	Standard Test Method for Measuring the P-Wave Speed and the Thickness of Concrete Plates Using the Impact-Echo Method	2010
EN 61000-6-3	Electromagnetic compatibility (EMC). Generic standards. Emission standard for residential, commercial and light-industrial environments	2007
EN 61000-6-2	Electromagnetic Compatibility (EMC) Part 6-2: Generic Standards—Immunity for Industrial Environments	1999

I hereby declare that the equipment named above has been designed to comply with the relevant sections of the above referenced specifications. The unit complies with all applicable Essential Requirements of the Directives.

Signed:



Name: Michael Hoag

Position: President, James Instruments Inc.

Location: Chicago, IL

On: 7/5/2018

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Introduction

The James® Instruments Vu-Con® is a state of the art ultrasonic instrumentation system designed to determine the quality and thickness of concrete and masonry structures. Utilizing the ASTM standard for Impact - Echo Method, the Vu- Con is one of the most reliable and ruggedly designed instruments for the field-testing of concrete to date. The Vu-Con® is a completely solid state unit with no moving parts, plus its lightweight design make the unit rugged enough for even the harshest environment.

By striking concrete sharply, compression waves or P-waves are produced in the material. The surface response of these waves are recorded. Then by analyzing and interpreting this response, internal features such as thickness of the concrete can be determined. The Vu-Con® measures the velocity of sound in concrete by determining the time it takes for a compression wave to travel to two transducers, which are set at a predetermined distance. The Vu-Con® can then measure the thickness by determining the resonance of the concrete plates as the P-Wave travels between both parallel surfaces of the plates. The response from the transducers, representing the oscillation of the material from the impact, is first viewed and analyzed with respect to time; i.e. how the surface moves as time continues. This signal can then be transformed using a Fourier transform, and displayed with respect to frequency. By analyzing this signal with respect to frequency, internal features in the concrete can be found. The accompanying literature details what can be found with this system, and it is suggested the user reviews this material before attempting a detailed test analysis.

The Vu-Con® comes with 2 sets of 2KHz to 60KHz flat frequency response transducers that are ideal to detect any displacement in a tested area. It also comes with 6 stainless steel balls for striking the concrete. The first transducer set is a single hand held transducer - used mostly for measuring the thickness of concrete and defect analysis. The second transducer set is 2 transducers - separated 300mm from each other to get an accurate velocity reading. Using the Impact – Echo method with both sets of transducers; cracks, voids, honeycombing and delaminations can be determined in a reinforced concrete structure.

(Note: It is vital to use the conductive gel with the transducers so an accurate P-wave reading can be taken. If no conductive gel is used during testing, unacceptable P-wave readings may be taken.)

The Vu-Con® system refers to a text book to further explain the Impact-echo method. This text book explains the results the method should generate with different structures. The reference book, “Impact - Echo Nondestructive Evaluation of Concrete and Masonry” gives a detailed explanation of the waveforms and Frequency spectrum graphs that are associated with each field test taken.

Testing for Velocity

The James® Instruments Vu-Con® System allows the user to test for the speed of sound (or the velocity) through a concrete or masonry structure. This is done using a dual transducer arrangement with a predetermined distance apart of 300mm; per the ASTM standard. Follow the procedure below to test for the velocity with the Vu-Con®.

Step 1. Connect the dual transducers to the Channel 1 & 2 inputs on the Vu-Con®.

(Note: The lead transducer (1 on the top) should be connected to Channel #1, while the trailing transducer should be connected to Channel #2 of the Vu-Con®.)

Step 2. Turn the unit “ON”, and the title screen will appear in the display for about 5 seconds. This is followed by the main menu. Now, while using the up or down arrow keys, scroll down to the **Vu-Con Selection** option, and press “Enter”.

The recommended Gain setting is 50 for both channels. While the recommended Sample Rate should be set to 1M for each channel. And finally, the recommended Trigger level is 10%. Pressing the “Escape” key returns you to the main menu screen.

Step 3. Prepare the surface of structure to be tested. Remember there must be good contact between the base of the transducer and the structure being tested. If the surface is not smooth, the user may try grinding the test area being tested is recommended. Remove any loose debris before applying transducers to the area being tested. Apply conductive gel on the surface of the structure

where the transducers will be applied. An even coat of conductive gel is recommended; too much or not enough gel can cause incorrect readings of the P-Wave from the transducer.

Step 4. Choose the Velocity menu on Vu-Con® main screen by pressing “Enter”.

The top line of the Velocity sub screen reads, “**Vu-Con is not ready.**” Pressing “Enter” again, enables the Vu-Con® for a velocity test to be made, the top line should now read, “**Vu-Con is ready**”.

The user can now strike the test surface near the first transducer with the 6mm or 8mm hardened steel balls. The impact strike should be positioned on the centerline passing through both transducers. The impact should be approximately 5.9 inches away from sensor # 1.

(Note: Avoid touching the transducer with the hardened steel ball when striking the concrete surface, as this may trigger the system with an invalid signal. The system should be triggered only by the impact of the steel ball on the concrete surface.)

Step 5. The Vu-Con® will generate a voltage versus time waveform for analysis. On the display screen, the signal received by Channel 1 will appear. Move the cursor along this signal using the right & left arrows keys to find the **first** negative peak (or the first change in slope as shown in Fig. 1 and 2 respectively).

Now go to the next test number, to view the waveform produced on Channel 2. Again adjust the cursor position to the first negative peak (or change in slope). Afterwards, you will notice near the top of the screen, the P-Wave velocity will appear.

(Note: Without adjusting the 2nd Channel cursor position, the velocity displayed will be incorrect, and may show “Out of Range” on the display.)

Repeat this test about three times to check the consistency of the velocity results. Use the average of three tests as the velocity.

(Note: If the results show a difference greater than 500m/s, repeat the velocity measurement three more times.)

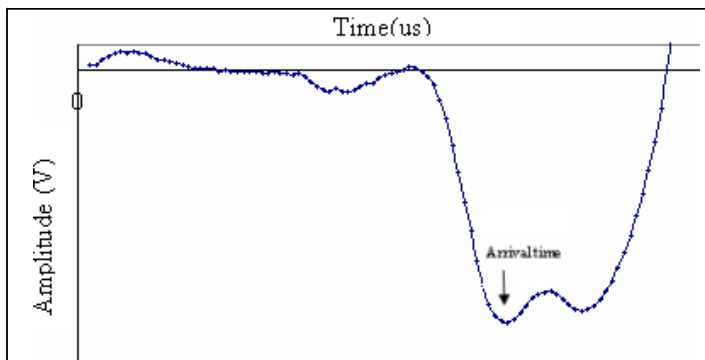


Fig.1. P-wave arrival time signal from channel 1

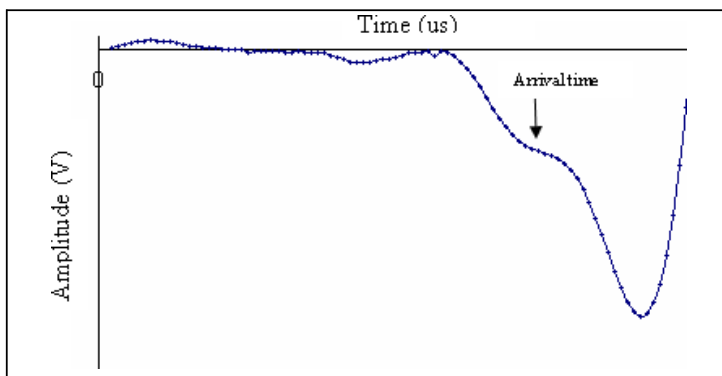


Fig.2. P-wave arrival time signal from channel 2

For more information about the voltage versus time waveform graphs please review the Impact-Echo book mentioned in the Introduction above.

Instrument Contents List

Each James® Instruments Vu-Con® System comes with the following items included in the carrying case.

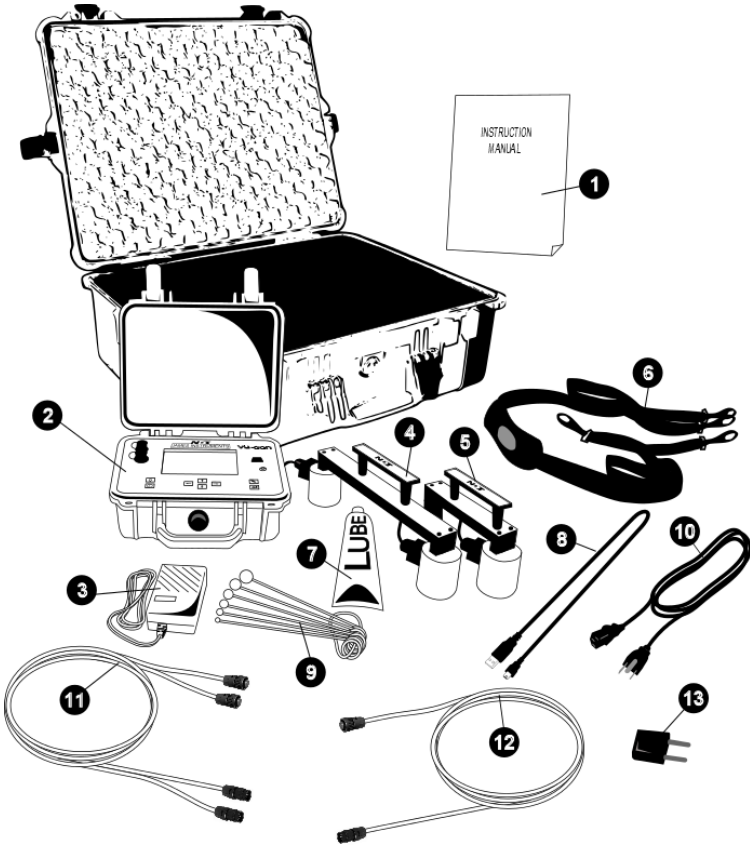


Figure 4: Vu-Con® System Contents

Contents List

Item #	Description
1	Instruction Manual and software.
2	Main Unit.
3	Battery Charger (#S-3180).
4	Velocity Transducer.
5	Thickness Transducer.
6	Carry Strap.
7	CIP Grease
8	USB Cable.
9	Impactor Set (#V-V-130)(Sizes: 6, 8, 10, 12, 14, 16mm)
10	Power Cord.
11	Dual Extension Cable.
12	Single Extension Cable.
13	Travel Adapter.

Vu-Con® System Overview

The following is an overview of all of the external features of the Vu-Con® System.

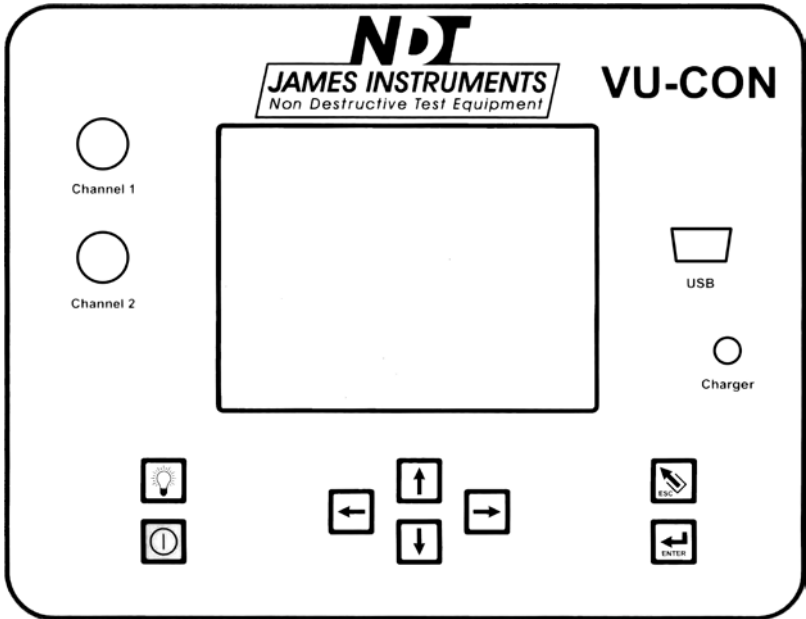










Figure 5: Vu-Con® System Overview

Control Panel Buttons

Key	Definition
	The power button. Momentarily push this button to turn the unit “on”. Pressing this button again will turn the unit “off”. Upon power up, the unit will display the locate screen. Press the escape key to exit back to the Main Menu.
	The up arrow button. This key is used to scroll through various settings and wave frames.
	The down arrow button. This key is used to scroll through various settings.
	The left arrow button. This key allows you to scroll through various settings.
	The right arrow button. This key allows you to scroll through various settings.
	The enter button. Pressing this key allows you to choose main menu selections. The enter key also allows you to prepare the Vu-Con® for operation.
	The escape button. Pressing this key allows you to exit and return to the main menu screen from any sub-screen.
	The back light button. Depressing this key will turn the back light “on” and/or “off”. (Note: When testing in the field for long periods of time, and to lengthen the battery life, it is best to turn the backlight “off”.)

Using the Shoulder Harness

Removing the Lid

For ease of use in the field, the Vu-Con® cover (or lid) can be removed and the shoulder harness installed. To do so, fully open the case and the top cover can be pushed back off of the case hinge pins. (Note: For older units a slight angle may be necessary to remove the cover.)

Attaching the Shoulder Support Straps

The support straps can be used to hold the Vu-Con® unit, once the lid has been removed. When using the support straps, make sure that an eyelet hook is connected to each corner of the Vucon case. Two of the hooks clip to the O-rings in front, while the other two clip around the hinge pins in back.

► Follow the steps below:

1. Attach the straight portion of the support straps to the front two metal O-rings of the Vu-Con®.
2. Attach the other two straps (which are stitched to the straight portion of the harness) to the now exposed hinges of the case.
3. Pull the supplied support strap over your head so that the rubber guard is resting on the back of the user's neck.
4. Now adjust the strap position accordingly so the Vu-Con® is within reach and readable. (see Figure C below)

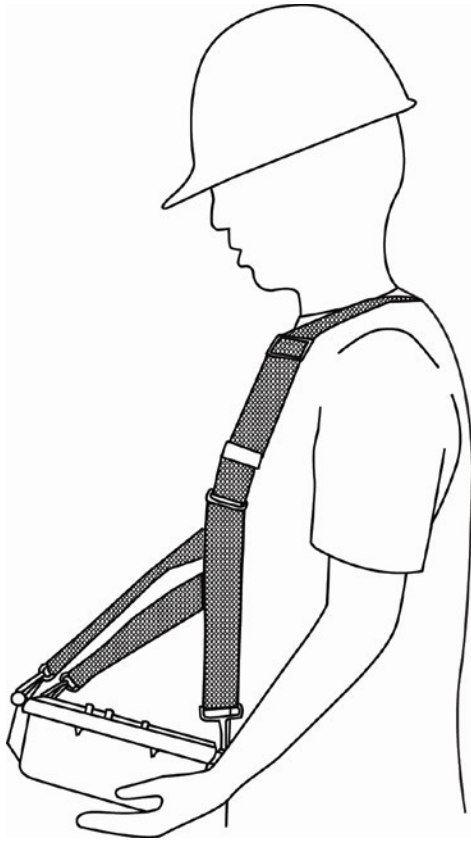


Figure 3: Vu-Con® Support Strap

Velocity Menu

Velocity is the first analysis the user needs to perform in order to take an accurate thickness field test. This test procedure measures the velocity of the P-wave through the concrete. This can vary quite significantly even within the same structure. The test procedure should be done close to the area where the eventual thickness test will be taken later. The velocity measurement requires 2 transducers separated at a predetermined distance of 300mm. Two transducers have already been provided with the appropriate distance ready for use.

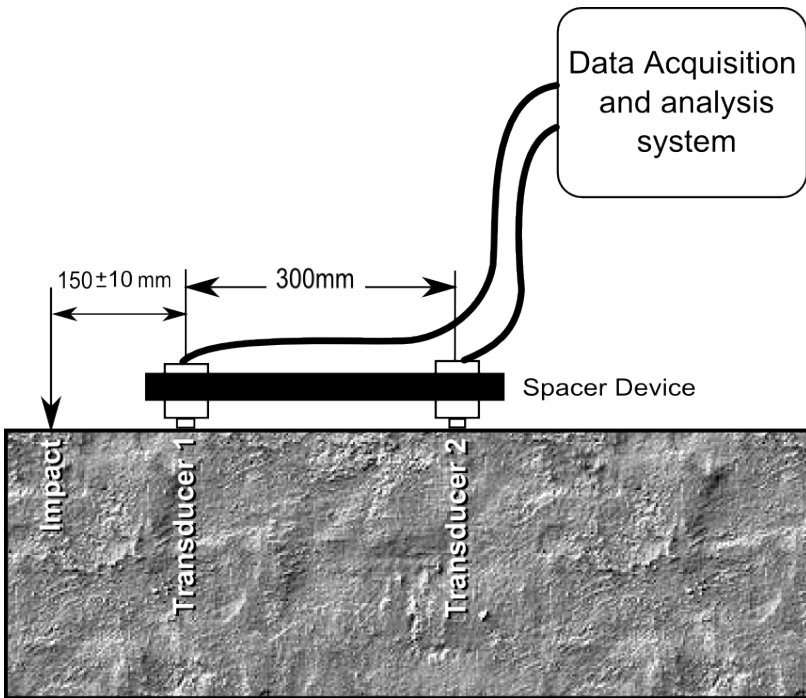


Figure 6: Velocity Impact – Echo Test Method

Impacting the concrete with a hardened steel ball 150mm (~ 5.9 in.) away from the first transducer sends a P-Wave across both transducers. The objective here is to measure the precise arrival time of the P-Wave at the two transducers. (Thus, only the start of the waveforms are critical here.) Then, based on the difference in the arrival times and knowing the distance between the transducers, the velocity value can be calculated (1). According to theory, the greater the distance the more accurate the result; however, because of attenuation in the wave front, there is a practical limit beyond which particle displacements are too small to be detected. Thus, it was found a distance of 300mm was more than adequate for use with concrete.

The accuracy of the P-Wave speed depends mainly on the spacing of the transducers as previously stated, and the digital sample rate. An adequate sample rate is 500K Hz. The Impact - Echo method works best on smooth surfaces, although sometimes rough and grooved surfaces have shown to give acceptable results. Yet, it is recommended to grind down rough or grooved surfaces before testing is to be done.

It is very important to set the Vu-Con® selection options to your specifications. The gain and sample (or capture) rate will determine what kind of sine wave output the Vu-Con® generates for analysis.

Thickness Menu

A velocity reading must first be taken with the Vu-Con® before the thickness can be determined. This menu can be used to determine not only thickness but also to evaluate internal features as well. An impact next to the transducer with a hardened steel ball sends a compression wave through the concrete. This wave travels through the concrete until it hits the bottom plate; the wave travels back up to the transducer and then to the Vu-Con® for analysis. Figure 4 compares the response of the Impact - Echo transducer that has a solid concrete plate and a concrete plate with a large crack.

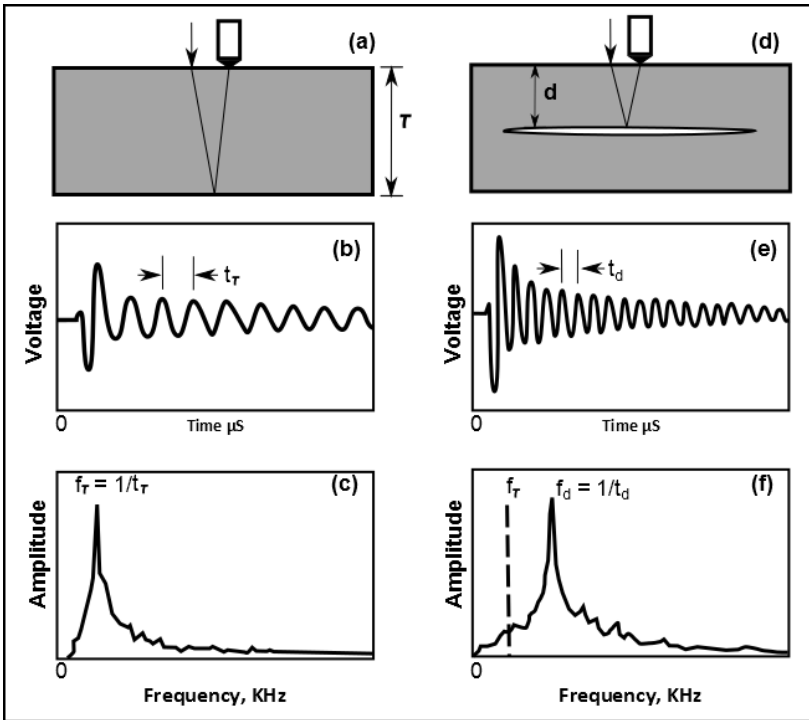


Figure 7: a,b,c: Impact Echo response to a solid plate.

d,e,f : Impact Echo response to a concrete plate with a large crack.

Voids, cracks, honeycombing and delaminations can all be determined by an Impact - Echo thickness test. The following pages show examples of waveforms and the frequency spectrum of the faults mentioned above.

Cracks & Voids

Large or small cracks can be detected by the Vu-Con® by utilizing the Impact-Echo Method. A crack is defined for impact-echo purposes as an interface or separation where the minimum crack width is about 0.5mm or larger. A crack or a void in a structure creates a concrete / air interface. Figure 5 show the wave graph and frequency spectrum of a structure with a large and small crack or void.

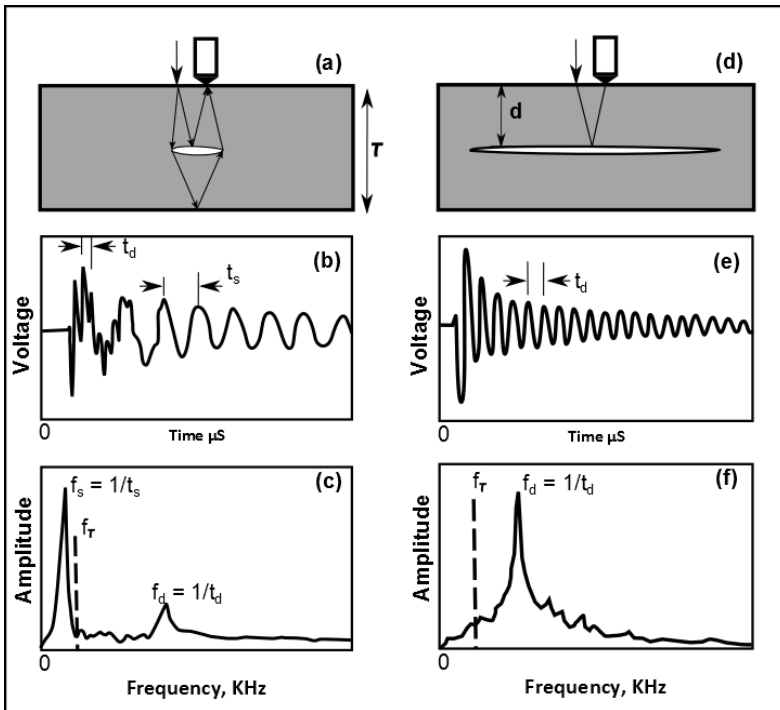


Figure 8: Wave graph and frequency spectrum of a structure with a large (a,b,c) and small (d,e,f) crack or void.

Honeycombing

When a region of unconsolidated concrete has a number of small voids it is usually referred to as honeycombed concrete (or honeycombing). The presence of honeycombing is very visible using the Vu-Con®. There will be many peaks in the waveform and in the frequency spectrum (figure 6). This is caused by the numerous voids inside the concrete structure.

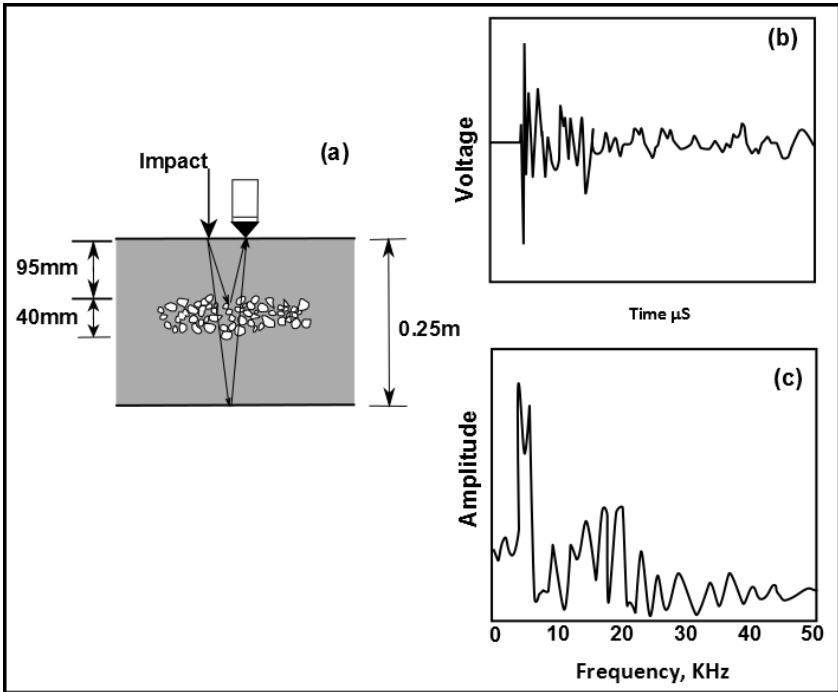


Figure 9: Results obtained from an impact-echo test on a concrete slab containing honeycombing: (a) cross-section, (b) waveform, and (c) spectrum.

Delaminations

Delaminations have been a consistent problem on reinforced concrete; especially on bridge decks, because rebar corrosion breaks the concrete on top of the steel reinforcement network. Delamination also occurs frequently in a repaired structure - between the repair concrete and the parent concrete. Many different techniques like the flexural modes of vibration have been used to hear the hollow sound of delaminations in a concrete slab. Dragging a chain or using a hammer to listen for delaminations are two common techniques used in the field. The Vu-Con® uses the ASTM Impact-Echo method to locate delaminations in concrete slabs. Figure 7 shows the Impact-echo response when there is delamination in a concrete slab being tested.

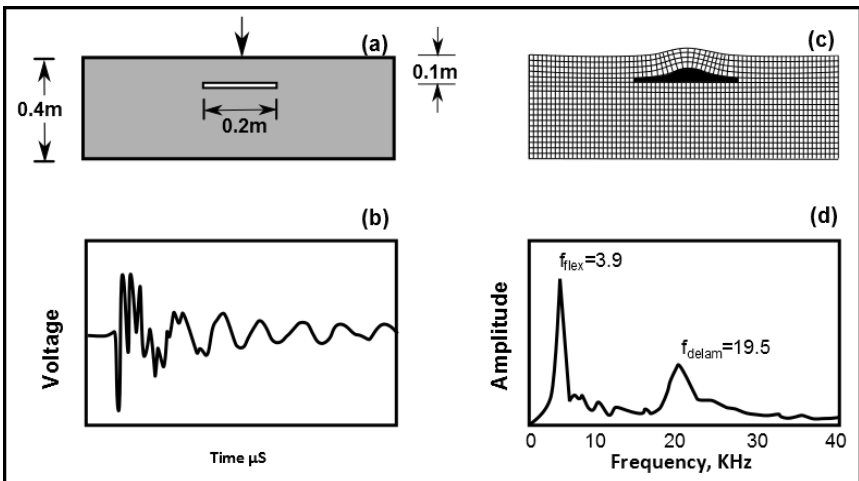


Figure 10: Impact-echo response of plate containing a 0.1cm deep delamination, (a) cross-section (b) finite element model (deformed shape greatly exaggerated), waveform, and (d) spectrum.

Vu-Con® Menu

The Vu-Con® selection menu allows the user to select the properties for the testing of velocity and thickness. The gain for both channel 1 and channel 2 can be adjusted according to the user's needs. The sample rate and trigger level can also be adjusted as desired by the user. Factory settings for the Vu-Con® are as follows:

Channel 1 & 2 Gain = 25

Channel 1 & 2 Sample Rate = 500K

Trigger Level = 40%

To adjust the gain, sample rate and trigger level please follow these steps:

On the main menu screen, scroll the cursor up or down using the arrow keys until you get to the Vu-Con® "Selections" menu option. Press the Enter key....

Vu-Con® Selections

The Vu-Con® enters a sub screen titled "Current Selections". Scroll up or down to the option to be changed. Use the right and left arrow keys, to change the values of the selected option. (The gain should be adjusted when testing different depths of concrete.) The Vu-Con® gain can be adjusted from 0.1 to 50. Gain is defined as "the ratio of an output quantity to an input quantity". A lower selected gain will produce a higher voltage range displayed waveform. A voltage range that's too high may result in a waveform with small amplitude making it difficult to examine. A higher gain selection will produce a lower voltage range displayed waveform. A voltage range that's too low may cause clipping of the transducers signal. Thus, for a smaller cover depth, adjust the Vu-Con® to a smaller gain. Likewise, a thicker cover depth will use a higher value gain.

The gain selections above are to be used to determine the “Thickness”, which requires the single displacement transducer provided with the Vu-Con®. When a “Velocity” test is to be determined, the gain should be selected according to the sensitivity of the transducers. (Note: Both velocity transducers are factory manufactured at 10x gain.) The Gain value selected from the Vu-Con® selection menu must match the transducer gain so the arrival of the P-wave is determined accurately.

- The sample (or capture) rate can be adjusted from 250K to 2.0M Hz, thus setting the sample frequency at 250K displays a sampling period of 4096us. A frequency of 500K will display a sampling period of 2048us. The higher the frequency is set, the lower the sampling period becomes for analysis on the display. Pressing the “up” arrow key after a test displays the captured waveform - frame by frame; where up to 4 frames can be seen.

- The Trigger level is adjusted in percentages from 10% to 90%. This level determines how hard the user needs to strike the test sample area in order to activate the Vu-Con® to start recording. (A starting point of 40% is recommended to be used.)

Pressing the Escape key returns the user to the main menu so a field test can be started.

System Setup

The system setup option on the main menu screen allows the user to make modifications to the system configurations. Once in the “system setup” sub menu modifications can be made.

Changing Date

Press the up or down arrow keys until you get to the system setup menu option desired.

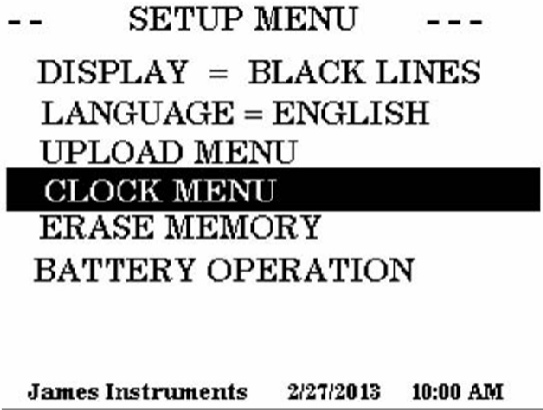


Figure 11

Press Enter. The Setup Menu sub screen should appear.

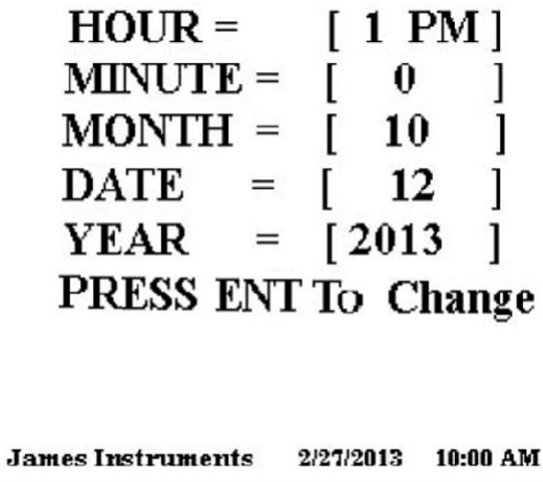


Figure 12

Hour = [1 PM]

- Press the right or left arrow keys to set the proper hour, press the down arrow key when the hour value has been set.

Minute = [0]

- Press the right or left arrow keys to set the proper minute, press the down arrow key when the minute value has been set.

Month = [10]

- Press the right or left arrow keys to set the proper month, press the down arrow key when the month has been set.

Date = [12]

- Press the right or left arrow keys to set the proper date, press the down arrow key when the date has been set.

Year = [2003]

- Press the right or left arrow keys to set the proper year. When you have properly set the correct date and time, press the enter key to save changes made.

```
HOUR = [ 1 PM ]
MINUTE = [ 0 ]
MONTH = [ 10 ]
DATE = [ 12 ]
YEAR = [ 2013 ]
PRESS ENT To Change
```

James Instruments 2/27/2013 10:00 AM

Figure 13

Pressing the Escape key will return you to the main menu screen.

Upload Data

Install the Vu-Con® software to the PC to be used. While in the software screen, verify the correct COM port is chosen from the Tools menu. To activate the Upload process, press the Lightning Bolt icon in the upper left. “Please Start Upload” should appear on the PC screen. Now on the Vu-Con® upload screen, choose the test or FFT to be uploaded and press Enter. Once completed, basic information and the raw data can be seen. To view the waveforms on your PC, press the Graph icon. (For more instructions, see the USB Connection information on p.42.)

Warning Overflow

When this warning notice is viewed on the display, it is an indication to the user that data is about to be overwritten.

This warning appears for the following 2 reasons only:

1. After the memory has been Erased (or cleared) by the user.

This message is seen on the display until after the first test is taken; at which point the “Warning Overflow” message will disappear... until reason 2 below.

2. The saved test number exceeds 240 tests. At this point, the user needs to upload the saved data to a PC, or risk losing ALL of their saved test data taken earlier.

Language Option

- Press the up or down arrow keys until you get to the system setup menu option. Press Enter.

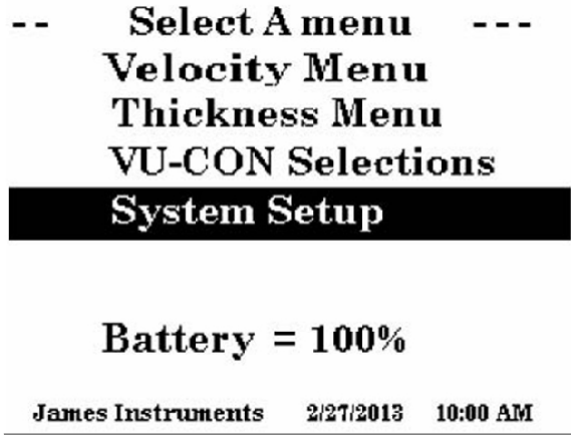


Figure 14

The Setup Menu sub screen should appear.

- Scroll through the Setup menu using the up or down arrow key. Select the Language menu option by pressing Enter. The display should read the following.



Figure 15

- Use the left or right arrow keys and choose English or Spanish as the language to be used with your Vu-Con®.
- Pressing the Escape key will return you to the Main Menu Screen.

Erase Memory

- Press the up or down arrow key until you get to the System Setup menu option. Press Enter.

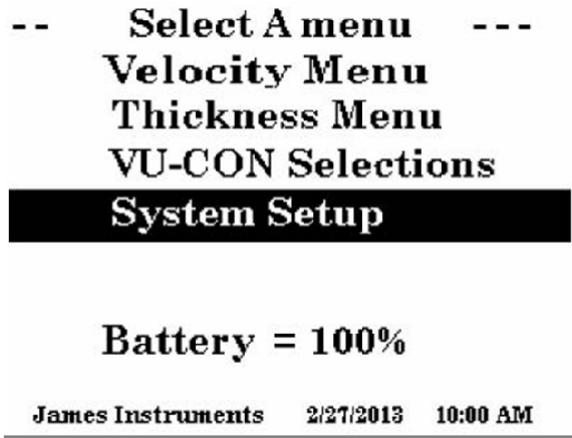


Figure 16

The Setup Menu sub screen should appear.

- Scroll through the Setup menu using the up or down arrowkeys. Select the Erase Memory option by pressing Enter. The display should read the following.

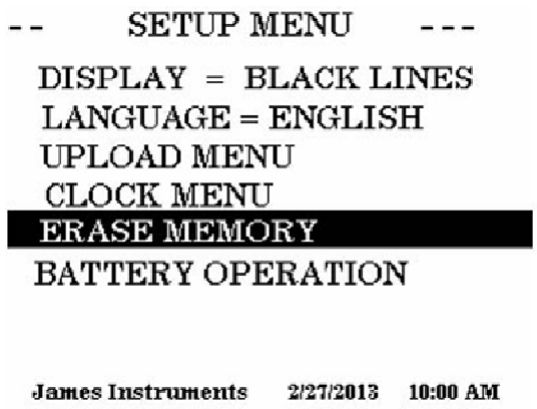


Figure 17

- Press Enter once, and a message telling you to press Enter again should appear.



Figure 18

- Pressing Enter a second time will erase all stored data in the memory of the Vu-Con®.

Pressing the Escape key will return you to the Main Menu Screen.

(Note: After erasing the memory, “Warning Overflow” will appear on the display until after the 1st test is completed.)

Display Cursor

- Press the up or down arrow keys until you get to the system setup menu option.

Press Enter.

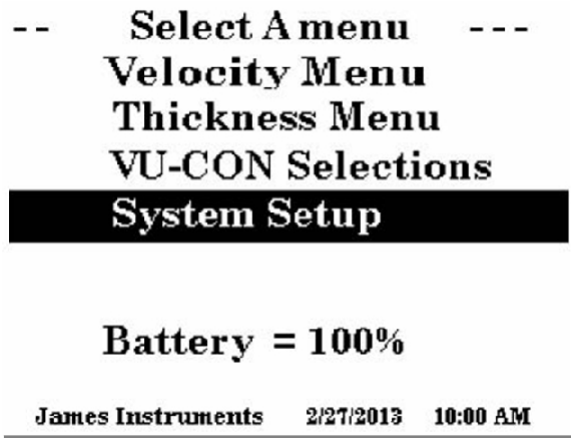


Figure 18

The Setup Menu sub screen should appear.

- Scroll through the Setup menu using the up or down arrow keys. Select the Display option by pressing the Enter key. The display should read the following:

DISPLAY=

- Pressing the left or right arrow keys will give the option to choose Black Lines or White Lines.

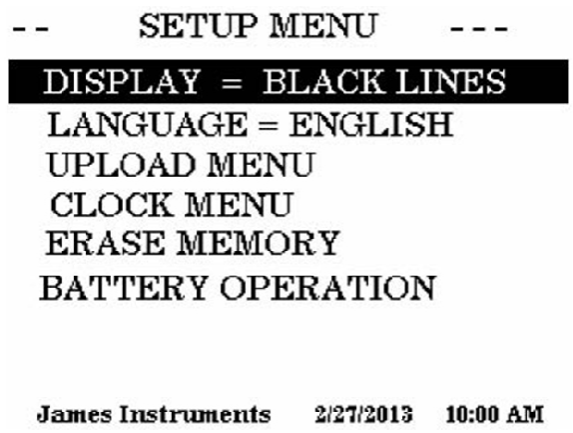


Figure 19



Figure 20

- Pressing the Escape key will return you to the Main Menu Screen.

Battery Operation

The Vu-Con® uses a 14.4V Lithium-Ion battery with a built-in thermo-sensing circuit. This circuit allows for a suitable charge, and maintains the voltage to the cells (< 4.1V). Additionally, this circuit provides the proper charge current to lengthen the battery's life.

At full charge, the bottom of the display will show **BATTERY=100%**. (**Note:** This value may be inaccurate, if the battery counters were reset without properly charging the unit.)

- The battery status can be viewed in the “**System Menu**”, under the “**Battery Operation**” mode.
- When the charger is supplying power to the unit, the battery is charging, and the charge counter (“**Charge CTR**”) will increase.
- When the unit is ON, and the charger is disconnected from the unit, the discharge counter (“**Discharge CTR**”) will increase.
- The battery will continue to charge even after the microcontroller times out - display and unit turn OFF automatically.



Figure 21

-- BATTERY STATUS—
DISCHARGE CTR = xxxx
CHARGE CTR = xxxx

Hit ENT to Clear Reg
BATTERY = 100%

Figure 22

Battery Charge:

1. Connect the charger to a working outlet, and then to the charger input on the unit's front panel. Although, it is recommended for the unit to be OFF during a charge, the user can monitor the charging process in the screen above.
2. If the Charge counter slows to a stop (and does not increase), this is an indication the charge is complete. The battery now has a full charge, and needs to be reset. To do this, go to: Main Menu / System Menu / Battery Operation - press "Enter" to zero the counters. This action also resets the battery circuit mentioned above, and will correct any miscounts. (If charging is still an issue, review the Repair Policy on p.55.)

Resetting the battery counters should be done both before and after (at least) a 4hr charge.

When done so, the battery status (or %) on the display screen will be accurate.

3. When the Battery percentage reaches ~ 40-50%, be sure to charge the unit again. (Go to step 1)
4. A fully charged battery will allow up to for 4-6 hours of continuous field testing.
5. To extend the battery's run time (in the field), turn "OFF" the background light.

Simple Guidelines for Battery Maintenance.

1. When allowed to discharge and charge regularly, the end user will experience a better Battery life span (orcycle).
2. Lithium-ion batteries do not need to be fully charged; as the charger can aid its performance.
3. Shallow discharges provide more cycles than deep discharges.
4. It is recommended to fully charge the unit (4-6hrs) before a lengthy field test is performed.
5. As a general rule, it is best to charge the battery both before and after each use. There is no memory effect, so it is a good practice to recharge the unit after each use, or at the end of the day - if used daily.
6. Charge the battery at a moderate temperature. Do not charge below 0deg C (or < 32deg F).
7. Lithium-Ion batteries suffer from stress when exposed to heat. Therefore, to lengthen the life of the battery, avoid elevated temperatures > 30deg C (or > 86deg F).
8. Lithium-Ion batteries may fail when stored for long periods of time in a discharged state. Thus, before a prolonged storage period, be sure to apply a charge to the battery. It's recommended once every 2 months to recharge the battery to keep it fresh. You should store the Unit (and battery) during this period at room temperature.
9. Replacing or repair of the battery should be done by a trained James® Instruments technician. Please follow the repair policy located on p.55.

Testing for Velocity

The James® Instruments Vu-Con® system allows the user to test a concrete or masonry structure for velocity using 2 transducers that are 300mm apart to meet the ASTM (C1383) standard.

The following is a procedure to test for velocity using the Vu-Con®.

Step 1. Connect the Velocity transducers to Channel 1 & Channel 2 inputs on the Vu-Con®.

(Note: The first transducer is labeled “1” and should be connected to Channel 1 of the Vu-Con®. The second transducer should be connected to channel 2 of the Vu-Con®.)

Step 2. Turn the unit “on”, and the title screen will appear for 5 seconds. Afterwards, the main menu screen will appear. Using the up or down arrow keys scroll down to “Vu-Con® Selections” and press Enter.

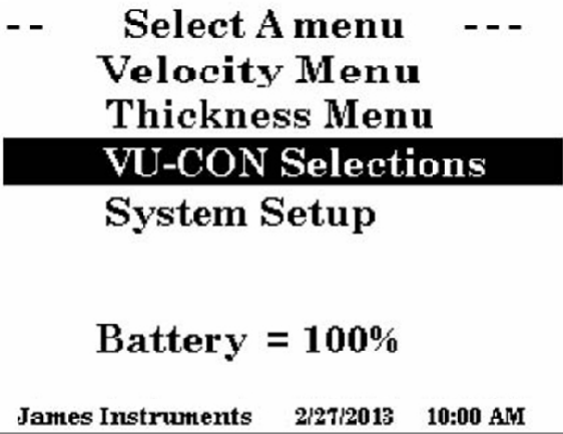


Figure 23

Choose the desired Gain for each channel, the Capture (or sample) rate and Trigger level.

- CURRENT SELECTION - - -
CHANNEL 1 GAIN = X.X
CHANNEL 2 GAIN = X.X
CAPTURE RATE = X.X
TRIGGER LEVEL = 10%

Figure 24

(Note: the Gain range is from 0.1 – 50, and the Capture range is from 250K – 2M Hz.)

A good starting point is adjusting the Gain to 25 or 50, and the Capture rate to 2M Hz; though a different set of values may be better suited for your test sample.

Step 3. Prepare surface of structure to be tested. Good contact between the base of the transducer and the structure being tested is crucial. If roughness is a problem, grinding of the area being tested is recommended. Remove any loose debris before applying transducers to the area being tested. Apply conductive gel on the surface of the structure where the transducers will be applied. An even coat of conductive gel is recommended; too much or not enough gel can cause incorrect readings of the P-wave from the transducer.

Press the Escape key to return to the main menu screen.

Step 4. Scroll up and select the Velocity Menu on the Vu-Con® main screen, and press Enter.

```

--      Select A menu      ---
Velocity Menu
Thickness Menu
VU-CON Selections
System Setup

Battery = 100%

James Instruments    2/27/2003    10:00 AM

```

Figure 25

The top line of the Velocity sub screen reads “Vu-Con® is not ready”.

```

--      VELOCITY MENU      ---
VU-CON IS NOT READY
TEST 2 IS CHAN 2
VELOCITY = XXXX m/s

```

Figure 26

Pressing Enter prepares the Vu-Con® for a velocity test, the top line now reads “Vu-Con® is ready”.

```
--      VELOCITY MENU      ---  
VU-CON IS READY  
TEST 2 IS CHAN 2  
VELOCITY = XXXX m/s  
  
James Instruments  2/27/2013  10:00 AM
```

Figure 27

Impact the concrete surface close to the first transducer using the 6mm or 8mm hardened steel balls. (Fig. 8) The impact should be at a distance of 150 ± 10 mm from the center of the first transducer. The impact should also be positioned along the centerline passing through both transducers.

Step 5. The Vu-Con® will generate a voltage versus time waveform for analyzing. (Fig. 28) (For more information about this waveform /graph - refer to the “Impact – Echo” book, Chp.7)

Step 6. The Vu-Con® will display the channel 1 graph. Now using the side arrow keys, move the cursor to the start of the first valley that appears on the graph. (Note: The Vu-Con® uses the negative pulse of the first wave.) This position is the arrival time of the P-Wave. The system will save this value for Ch1 in order to compute the P-Wave velocity. Additionally, until the cursor on channel 2 is also moved, the velocity displayed may be incorrect - saying, “Velocity is out of Range”.

Step 7. Press the Escape key and select the following test number. (ex. Test #2) Press the Enter key and the Vu-Con® will display the graph for channel 2. Again, use the arrow keys to move the cursor to the start of the first valley that appears on the graph. The system will save this value to compute the correct P-Wave velocity. This P-Wave value will be used in the following tests to compute the thickness (figure 8). (If desired, return to the previous test # and

press Enter to view the first graph. Pressing Enter again will initiate the Spectrum Calculation process; taking ~ 45 sec. The Vu-Con® will calculate the thickness of the concrete using Ch1's waveform. Once completed, press the Escape key and the velocity & thickness values can be clearly seen (similar to pg. 33).

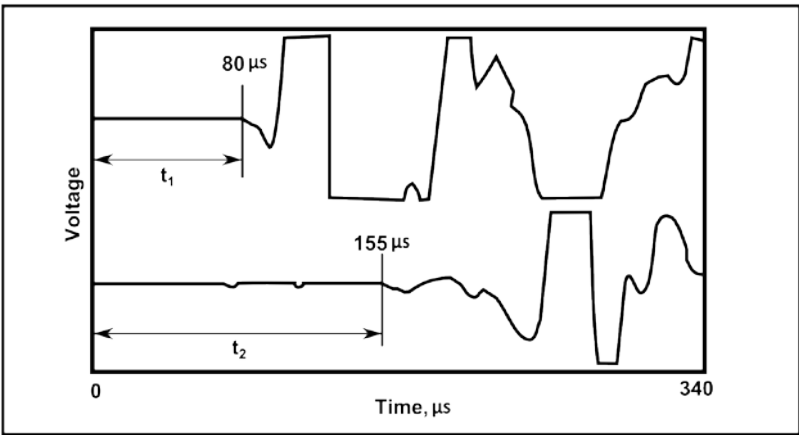
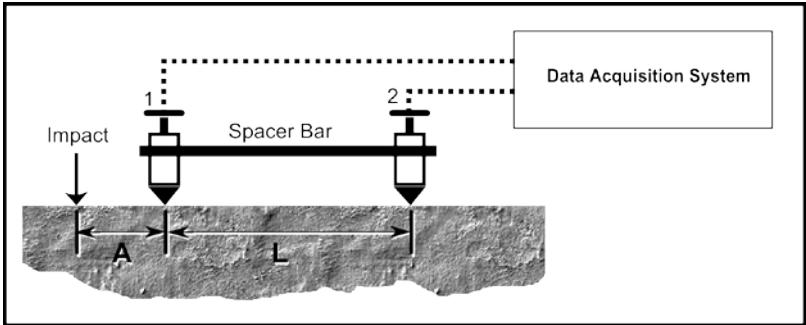


Figure 28

Testing for Depth

The James® Instruments Vu-Con® allows the user to determine the depth of the structure being tested. A velocity test must first be performed to determine an accurate plate thickness. The following is the procedure to test for thickness of your concrete or masonry structure.

Step 1. Connect the single hand held transducer to the Vu-Con® channel 1.

Step 2. Turn the unit “on”, and the title screen will appear for 5 seconds followed by the Main Menu screen.



Figure 29

Using the up or down arrow keys scroll to “Vu-Con® Selections”, and press enter.

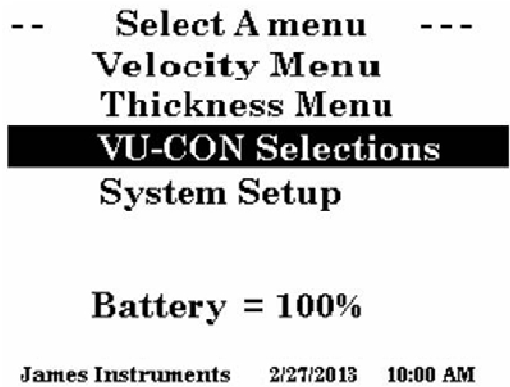


Figure 30

Choose your desired gain and capture rate for channel 1. (Note: Channel 2 - not used here.) The proper Gain will allow the display of the full Waveform amplitude without limiting the Transducer output on the screen.

- CURRENT SELECTION - - -
CHANNEL 1 GAIN = X.X
CHANNEL 2 GAIN = X.X
CAPTURE RATE = X.X
TRIGGER LEVEL = 10%

Figure 31

Pressing the escape key returns you to the main menu screen.

Step 3. Prepare surface of structure to be tested. Good contact between the base of the transducer and the structure being tested is crucial. If roughness is a problem, grinding of the area being tested is recommended. Remove any loose debris before applying transducers to the area being tested. Apply conductive gel on the surface of the structure where the transducers will be applied. An even coat of conductive gel is recommended; too much or not enough gel can cause incorrect readings of the P-Wave from the

transducer.

Step 4. Choose the Thickness menu on Vu-Con® main screen, and press Enter.

```
-- THICKNESS MENU ---  
VU-CON IS NOT READY  
TEST 1 IS CHAN 1  
VELOCITY = XXXX m/s  
THICKNESS = XXXX m/s
```

Figure 32

The top line of the Thickness menu sub screen reads, “Vu-Con® is not ready”. Pressing enter prepares the Vu-Con® for a Thickness test, the top line now reads, “Vu-Con® is ready”.

```
-- VELOCITY MENU ---  
VU-CON IS READY  
TEST 2 IS CHAN 2  
VELOCITY = XXXX m/s  
  
James Instruments 2/27/2013 10:00 AM
```

Figure 33

Impact the concrete surface with a hardened steel ball ranging from 8mm to 16 mm. The impact should approximately be between 4 and 10 cm away from the transducer.

Step 5. The Vu-Con® will generate a voltage versus time waveform for analyzing (figure 34). (Note: For more information about the voltage versus time waveform graph please see the “Impact - Echo” book given with the system.)

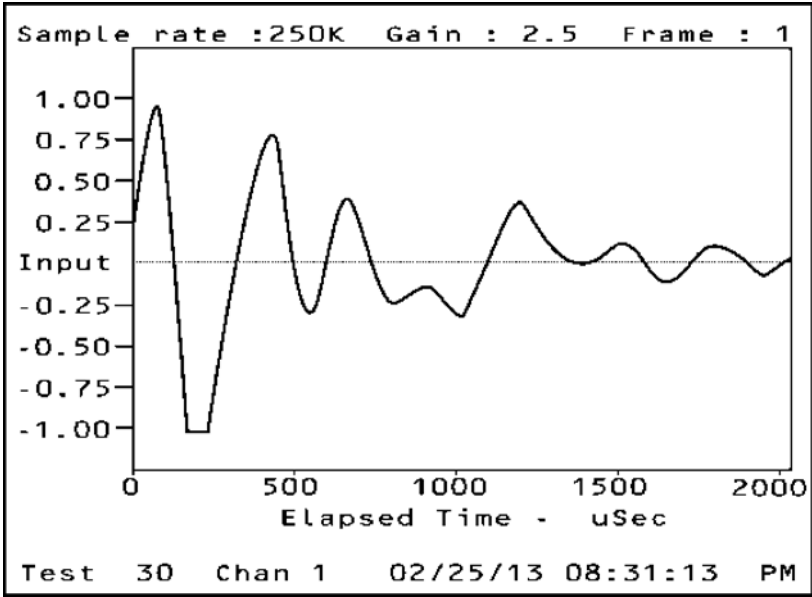


Figure 34

Press the Enter key to obtain the frequency spectrum.

Press the up arrow key one time and the second frame of the waveform is displayed; up to four frames can be displayed for viewing. When the up arrow key is pressed the fifth time the Vu-Con® starts calculating the frequency spectrum. (Note: the spectrum calculation can also be started by pressing Enter once the waveform is displayed.) The frequency spectrum takes ~ 45 seconds to calculate.

For more information on the Thickness frequency spectrum please review the “Impact-Echo” book (or supplement) supplied with the Vu-Con® system.

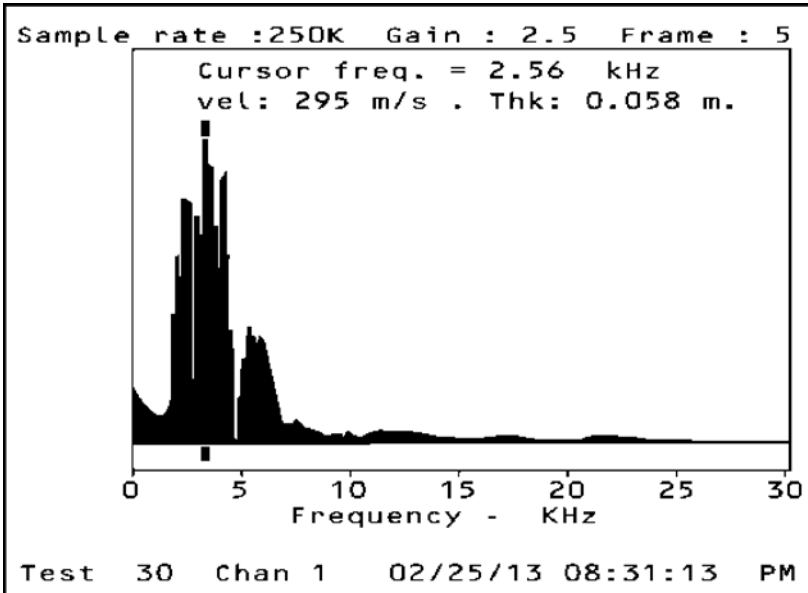


Figure 35

The frequency spectrum screen (figure 35) has a cursor that allows you to determine the depth of your structure at different frequencies. Use the right or left arrow keys to scroll the cursor to different frequency values.

USB Connection

Connect the unit to the correct serial port of your P.C. using the supplied serial cable. Press the up or down arrow keys until you get to the system setup menu option.



Figure 36

Press Enter. The Setup Menu sub screen should appear. Scroll through the Setup menu using the up or down arrow keys.



Figure 37

Select the upload menu option by pressing Enter. The display should read the following.

```
--- UPLOAD MENU ---  
TEST UPLOAD = XX  
FFT UPLOAD = XX  
  
James Instruments  2/27/2013  10:00 AM
```

Figure 38

Use the up or down arrow keys to select TEST data or FFT data. Pressing the left or right arrow keys allows you to select which TEST or FFT data number you want uploaded. Press Enter, and the upload process will begin.

```
--- UPLOAD MENU ---  
TEST UPLOAD = XX  
FFT UPLOAD = XX  
  
UPLOAD IN PROGRESS  
  
James Instruments  2/27/2013  10:00 AM
```

Figure 39

During Test upload the display reads, "Upload In Progress". When the Vu-Con® is finished uploading the data, the display will read - "Upload Is Complete".

--- UPLOAD MENU ---
TEST UPLOAD = XX
FFT UPLOAD = XX

UPLOAD IS FINISHED

James Instruments 2/27/2013 10:00 AM

Figure 40

During the FFT upload the Vu-Con® first calculates the Frequency Spectrum. The display will read, "Calculating Spectrum".

--- UPLOAD MENU ---
TEST UPLOAD

Calculating Spectrum
Please Wait

James Instruments 2/27/2013 10:00 AM

Figure 41

This may take as long as 45 second to be calculated. The Vu-Con® will immediately start to upload after the FFT has been calculated. Pressing the Escape key will return you to the Main Menu screen. For more information regarding uploading the data to a personal computer please refer to Tools in the Vu-Con® software.

Maintenance

- Review the Battery Basics section (on pg. 30) to properly charge the battery for the Vu-Con® before fieldtesting.
- Clean and remove the excess couplant grease from the Transducer surface after using; before storage.
- For Calibration and Repair go to the Warranty Information below, and see section 2b - items i and ii.

Safety

- Do not submerge unit in water. This can cause electrical shock.

Specifications

Vu-Con® System V-V-100

Instrument Weight	6 lbs. (2.75Kg)
Ship Weight	17 lbs. (7.7 Kg)
Dimensions	4.5 x 8.5 x 10.5 (114.3mm x 223.5mm x 267mm)
Frequency Range	50kHz
Impactor Sizes	6, 8, 10, 12, 14, & 16mm (6 sizes)
Gain Selection	.1, .5, 1, 2.5, 5, 10, 25, 50 (8 options)
Battery	14.4 Volt. 4-8 hours of continuous use; longer with the backlight "OFF".
Display	320 by 240; backlit for daylight use
Storage	200 plus readings
Software	Windows compatible 9x/me 32MB Ram, 100MB Ram
Temperature	0° - 50°C

Warranty Information

1. Contract

Unless otherwise stated all sales transactions are expressly subject to these terms and conditions. Modification or additions will be recognized only if accepted in writing by an authorized Officer of James® Instruments Inc. (hereinafter referred to as “James” or the “Company”), or an officially designated representative. PROVISIONS OF BUYER'S PURCHASE ORDER OR OTHER DOCUMENTS THAT ADD TO OR DIFFER FROM THESE TERMS AND CONDITIONS ARE EXPRESSLY REJECTED. NO WAIVER OF THESE TERMS AND CONDITIONS OR ACCEPTANCE OF OTHERS SHALL BE CONSTRUED AS FAILURE OF THE COMPANY TO RAISE OBJECTIONS.

2. Warranties

The Company only warrants the equipment manufactured or supplied by the Company as set forth herein. James® makes no other warranties, either expressed or implied (including without limitation, warranties as to merchantability or fitness for a particular purpose). In no event shall James® be liable for any type of special, consequential, incidental, or penal damages, whether such damages arise out of or are a result of breach of contract, warranty, negligence, strict liability or otherwise. Warranty shall not apply where the equipment manufactured or supplied has been subject to accident, alteration, misuse, abuse, improper storage, packing, force majeure, improper operation, installation, or servicing. In addition, the following shall constitute the sole and exclusive remedies of Buyer for any breach by James® of its warranty hereunder.

a. New Products

James® warrants the equipment manufactured or supplied by James® as set forth herein. This limited warranty can only be exercised by the original purchaser of the equipment from James® or authorized James® Agent and is not transferable to any subsequent owner or party. This limited warranty gives you specific legal rights, and you may also have other rights which vary from case to case.

i. For James® Equipment

James® warrants that James's equipment will be free from defects in materials and workmanship for a period of twenty-four (24) months on the electronic portion and six (6) months on the mechanical portion from the date of shipment of equipment from James® to Buyer. Should any defects be found and reported by the Buyer during the applicable limited warranty period, the defect will be corrected upon return of the item to James®. James® will, during the applicable new equipment warranty period, provide the necessary replacement parts and labor to correct the defect.

Excluded from the new equipment warranty are all consumable and wear and tear items such as impact bodies, penetrators, connection cables, etc. These items are subject to usual wear and tear during usage. Refer to the Consumable, Wear and Tear Items section of this warranty document.

Option For Extended Limited Warranty Coverage

The original purchaser of any new equipment of James® which have been identified or labeled by James® from time to time in James's sole discretion as being eligible for extended warranty coverage shall have the option to purchase certain extensions of the applicable limited warranty provided hereunder to the electronic portion of any such items for either a twelve (12), twenty-four (24) or thirty-six (36) month period (up to a possible maximum limited warranty coverage period for the electronic portions of such new James® equipment of sixty (60) months) by purchasing any such twelve (12), twenty-four (24) or thirty-six (36) month limited warranty extension period either all the time of the purchase of any such item(s) or within ninety (90) days from the date of delivery of the subject item(s) of the original purchaser of such item(s). The price for each such extended limited warranty coverage period shall be as determined by the Company from time to time and all such purchases of any extended warranty coverage periods shall only be effective upon a completed purchase order and payment directly between James® and the original purchaser of any such item(s). The extended warranty coverage periods are only valid with respect to the original purchaser of such item(s) from the Company and such extended warranty coverage is not transferable to subsequent owners of the subject item(s) or any other parties. Upon the purchase of any extended limited warranty coverage period, the Company will issue a certificate to Buyer evidencing the details of the applicable extended warranty coverage period purchased by the Buyer.

ii. For Other Manufacturer's Products Supplied by James®

Products of other manufacturers supplied as such by James® are warranted by James® only to the extent of any warranty provided by the original manufacturer, if any.

iii. For Parts and Sub-Assemblies

Parts or sub-assemblies purchased by the Buyer to perform its own repair work etc. are warranted as provided hereunder by James® for six (6) months from date of shipment of material from James® to Buyer.

iv. For Consumables, Wear and Tear Items

James® supplies consumable items and items subject to wear and tear during normal usage of James® supplied products. These items are not covered under warranty. Buyer is to check for proper fit, form and function of such items upon receipt of such items. In case of a defect condition, Buyer can return the item to James® for evaluation within thirty (30) days of the date of shipment to the Buyer. James® reserves the exclusive right to issue full, partial, or no credit to the Buyer based on the condition of the returned item and circumstances related to the return. Examples of items in this category: connection cables, test blocks, impact bodies, penetrators, probes, extraction liquids, calibration liquids, pins, recording paper, test plugs, etc.

b. Calibration and Repair

i. For Calibration Services

James® does not warrant the calibration of any equipment. James® does however warrant the equipment manufactured by it, in proper working condition, to be capable of being adjusted to meet James® printed specifications, if any, for accuracy and performance as to the particular model type during the period of warranty applicable as stated above.

ii. For Repair Services

James® warrants repair work performed under the direct control and supervision of James® personnel for a period of three (3) months from the date repairs are completed either at James® or at the customer site. Should the defect for which the repair work was performed reoccur within this period, James® will supply the necessary parts and labor (repair at James facility) or parts (repair at Buyer facility) required to repair the original equipment defect for which the repair parts and labor were required. Additional repair charges that may be incurred in conjunction with any repair service warranty event will be invoiced at the James®

customer service rates and policies in effect at the time of the event.

Excluded are all consumable and wear and tear items such as impact bodies, probes, connection cables, etc. These items are subject to usual wear and tear during usage. Refer to the Consumable Wear and Tear Item section of this warranty document.

c. Warranty Claims

i. For Warranty Claim Processing

James® has established James® organizations in the Americas, and Europe. Please visit the James® web site www.ndtjames.com for latest address and contact information for the James® organization nearest you.

3. Regulatory Laws and/or Standards

The performance of the parties hereto is subject to the applicable laws of the United States. The Company takes reasonable steps to keep its products in conformity with various nationally recognized standards and such regulations, which may affect its products. However, the Company recognizes that its products are utilized in many regulated applications and that from time to time standards and regulations are in conflict with each other. The Company makes no promise or representation that its product will conform to any federal, provincial, state or local laws, ordinances, regulations, codes or standards except as particularly specified and agreed upon for compliance in writing as a part of the contract between Buyer and the Company. The Company prices can not include the cost of any related inspections or permits or inspection fees.

4. Notices

Notice by either the Company or Buyer will be made only by facsimile or similar electronic transmission, effective on the first business day after confirmed receipt, or by letter addressed to the other party at its address as provided in this Agreement, effective three (3) business days after deposit with the U.S. Postal Services, postage prepaid, or one (1) business day after deposit with a recognized overnight express service.

5. Interpretation

Should any term or provision contained In the contract contravene or be invalid under applicable law, the contract shall not fail by reason thereof but shall be construed in the same manner as if such term or provision had not appeared therein.

6. Assignability

Neither this contract nor any claim arising directly or indirectly out of or in connection herewith shall be assignable by Buyer or by operation of law, without the prior written consent of Company. This document shall be binding upon and inure to the benefit of each party hereto and their respective permitted successors and assigns.

7. Governing Law

This Agreement shall be governed by and construed in accordance with the internal laws of the State of Illinois, without regard to its conflict of laws provisions. Buyer and the Company expressly agree to submit to the personal jurisdiction of the federal and/or state courts sitting in Chicago, Illinois, U.S.A. and agree that such courts may be utilized if necessary to obtain injunctive or any other relief. The Hague Convention and the United Nations Convention on Contracts for the International Sale of Goods shall not apply to the construction or interpretation of these Standard Terms and Conditions or affect any of its provisions.

END.

Repair Policy

United States | Canada | International

Ship the instrument in a box that meets UPS, Fed Ex, and standard shipping regulations. Enclose a note describing the problem(s) you are having. Include the name and phone number of the contact person in your organization.

The instrument will be evaluated within one week of receipt. The contact person will be notified with an estimate of the cost of the repair.

Upon receipt of your authorization of repair and payment terms, delivery time will be 2 weeks from that day.

If you need the repair back sooner than this, you have the option of paying an express service fee of 10 percent of the purchase price of said instrument, plus the repair cost. With this service, you can receive the instrument back within 3 working days in the USA (5 working days for Europe).

International repair shipments must contain a commercial invoice listing the instrument being returned and must contain the words:

Country of manufacture: USA

Instrument being returned to manufacturer for repair – no value for customs, value for carriage only.

Ship the complete system to:

Attn: Repair Department James Instruments, Inc. - USA 3727 North Kedzie Avenue Chicago, IL 60618-4503 USA	Attn: Repair Department James Instruments, Inc. – Europe Windmolen 22 7609 NN Almelo The Netherlands
---	--

Home page: www.ndtjames.com

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Purchase Date: _____

Serial Number: _____