

DIGIMET[®] 3000



Vacuum and Pulsation Tester

Operator's Manual – 4C ***Digimet 3000 Version 4.0***

Dear Digimet User:

Thank you for your purchase of the Digimet 3000. It's a very good idea to read the manual before operating any instrument, such as your new DIGIMET 3000. Please remember to read the manual thoroughly at some point for a complete understanding of the Digimet and its functions.

Thanks, again.

L. J. Engineering, Inc.

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INTRODUCTION

The Digimet 3000 is a 5-key, hand-held, battery operated, microprocessor-based vacuum and pulsation multi-function testing meter for measuring vacuum level characteristics and pulsation attributes in a milking system. The Digimet 3000's stored data can be either viewed on its LCD screen, uploaded to a computer or printed to the **Digimet® Printer**.

The Digimet 3000 stores and displays the following types of information:

- Average Vacuum level
- Maximum Vacuum level until reset by user
- Minimum Vacuum level until reset by user
- Fluctuation level with user-set time frames
- Pulsation ratio with A, B, C and D phases in percentages and milliseconds
- Evaluation of the B phase - B Fluc
- Maximum and Minimum vacuum per pulse
- Pulses per minute
- Pulsation Limits can be set for various pulsation attributes.
- In the Pulsator Ratio Function when limits are not met or exceeded the value will blink.
- Unit calculates the Limping Ratio
- Milk/Rest ratio with user-selected Liner Collapse Point
- Electrical pulsation with On versus Off time, Maximum & Minimum voltage per pulse, PPM
- Units measured may be Inches Hg mercury or kilopascals (kPa)
- Data items can be labeled
- Up to five 10-second graphs can be saved and later printed or downloaded. Graphs can be printed to the Digimet Printer or uploaded to a computer.

- Pulsator data can be stored as single or dual pulsation.
- User set auto shut-off

PHYSICAL CHARACTERISTICS

Digimet 3000 Enclosure

The Digimet 3000 is enclosed in a durable black ABS plastic case with dimensions of: 7.50" in length x 4.00" in width x 1.26" in depth.

Display

The Digimet 3000 has a 16-character by 4-row LCD dot-matrix display capable of displaying the alphanumeric character set plus additional characters (#, etc.). The display supports the character attribute of blinking. The front panel includes a protective clear window to cover the display.

Keypad

The Digimet 3000 has a front panel consisting of a durable and washable plastic face and integrated membrane key switches, with access for all input receptacles. The front panel incorporates the following membrane keys:



The specific functions of these keys are described in the section titled: **MENU & DISPLAY SYSTEM**.

Vacuum Input

The Digimet 3000 has a 1/8" tube receptacle located on the front panel for attachment to an external vacuum source, vacuum line, etc. **The vacuum input will not be damaged by the intrusion of**

moisture or liquids, but care should be taken to prevent this from happening. If, for example, milk were allowed to enter the transducer and dry, the performance of the transducer could be affected. A filter is provided to keep liquids from coming into contact with the transducer. **IMPORTANT: THE FILTER MUST BE USED AT ALL TIMES.**

If milk accidentally enters the transducer area, the transducer should be rinsed with water. Please refer to the section **Cleaning** for further instructions. If milk is allowed to dry inside the transducer, the transducer will need to be replaced.

The Acrodisc filter will not allow milk to pass through it. As long as milk is not allowed to sit in the filter, milk will not adhere to the filter membrane. Keeping the filter clean will allow for repeated use. Check the filter periodically to determine whether it has become plugged or restricted. To do this, check Digimet 3000 readings on one of the pulsation (vacuum) Functions with and without the filter in place. If similar readings are obtained then the filter is not plugged.

The tube that comes out of the Digimet 3000 at the port labeled VACUUM is connected to a quick-disconnect male fitting (DM3-16-03). When the Digimet is not in use, a white plug (DM3-16-06) plugs the opening of the male fitting. When in use, attach the Acrodisc filter (DM3-15) to the male fitting and TIGHTEN. Attach to the Acrodisc filter a 4' length of 5/32" plastic tubing which is used to connect the Digimet 3000 to the vacuum system. Note: the 5/32" tubing has a small tube clamp on the end that connects to the Acrodisc. This provides for a tighter fit to the smaller 1/8" slip-fit end of the Acrodisc.

Three methods can be used to connect the

tubing to the vacuum system: 1) A needle connector and stainless steel needle. **Be sure needle does not become plugged during use.** (See the section Use of stainless needle.) 2. A "T" fitting is supplied to accommodate plugging into the short pulsation air tube without use of a needle. 3) A 1/4" plastic pipe fitting with a 5/32" nipple is also provided to tap into plastic pipe systems, as well as a plastic pipe plug to be used when the fitting is

Electronic Pulsator Input

The DIGIMET 3000 has two banana jack receptacles located on the front panel. These jacks are located side-by-side with a distance between them that accommodates a standard 3/4" double banana plug or single plugs as provided with the unit. **THE UNIT WILL FUNCTION PROPERLY WITH EITHER POLARITY OF INPUT.**

RS-232 Serial Port (9-Pin)

This 9-pin serial connector is used to connect the Digimet 3000 to either the Digimet Printer or a computer. Cables are provided. The serial port has a small plastic dust cover for protection. This port is labeled **Serial**.

Carrying Case – Standard

The DIGIMET 3000 padded canvas carrying case is approximately 9" long x 5" wide x 3 1/2" deep. Case includes a compartment for the DIGIMET 3000 with two inside straps to keep the unit in place, and an additional compartment for storing items such as vacuum tubing, banana plugs, extra batteries, etc. A shoulder strap is also provided.

Large Carrying Case

The Large Hard Carrying Case is approximately 15-3/4" x 9-7/8" x 6-7/8". It is divided into compartments which

accommodate the Digimet 3000, the Digimet Printer, AC wall transformer (for the printer) and accessories. A shoulder strap is also provided.

Fittings Supplied with DIGIMET 3000

The Digimet can accommodate two types of input: 1) vacuum; 2) electrical pulsation. Fittings are supplied to facilitate both forms of input.

Vacuum Port – The vacuum port is labeled VACUUM and consists of a quick-disconnect male luer fitting (DM3-16-03) with a white plug (DM3-16-06) attached. The white plug serves as prevention against debris entering the vacuum port when the unit is not in use. A quick counter-clockwise turn will remove the white plug from the male luer fitting.

During operation, the vacuum port with its male luer fitting is attached to an Acrodisc filter (DM3-15) which is connected to approximately 4' of 5/32" tubing. A small hose clamp is provided to secure the hose to the Acrodisc filter, tightly. **Note: the Acrodisc filters should be used at all times.** To connect the free end of the tubing to the vacuum system, the user has several choices: 1) A needle connector (DM3-Connector) is provided for use with the stainless needle (DM3-17), which is inserted into rubber components of the milking system. (See section **Miscellaneous-Use of stainless needle.**) 2) 5/32" nipples may be fitted into the vacuum system for connecting the 5/32" tubing. A sample of such a fitting is provided with your Digimet 3000 (pipe fitting DM3-PIPE and plug DM3-17-02). The pipe fitting is a 5/32-27 NPT fitting. See the section, **Tapping holes**, for instructions on tapping holes for this fitting. 3) A pulsator tube adapter "T" fitting (provided) can be used to check pulsation

line vacuum instead of using the stainless needle. Connect opposing sides of the "T" fitting to the short pulsation air tube at the milk claw and the middle of the "T" to the Digimet 3000 plastic tubing.

SPECIFICATIONS

This section defines the operating conditions and performance specifications which apply to the Digimet 3000.

Power

The Digimet 3000 operates on four AA alkaline batteries. The Digimet 3000 will operate for approximately 40 hours before batteries need to be changed. When the batteries are low, in the upper right-hand corner, a "B" will blink, indicating low battery level. The unit will still function but the batteries should be replaced. If the batteries are not supplying sufficient power for the unit to function properly then the screen will go blank and the unit will turn itself off. The battery compartment is located just behind the LCD display with the opening on the back side of the unit. **Care should be taken to install batteries in the proper direction.** Data stored in the Digimet is not affected by turning the unit off. If the batteries are replaced, however, they should be replaced within an hour of removal or **storage data will be lost.**

Vacuum Input

In this manual, VACUUM refers to a differential pressure, with atmospheric pressure as the reference. Zero vacuum equates to a zero difference from atmospheric pressure. Positively increasing vacuum equates to a decreasing of pressure relative to atmospheric pressure (i.e. less than atmospheric pressure).

The Digimet 3000 will accept a vacuum input with the following characteristics:
 Range — 0-18" Hg, equivalent to 0-60.9 kPa
 Frequency — 30 -120 Pulses Per Minute, equivalent to .5-2 Hz

Electronic Pulsation Input

The Digimet 3000 will accept an oscillating electrical input from 0 volts to +/- 30 DC volts. Over-voltage protection is provided for inputs up to 50 DC volts so that the unit will not be damaged. The electrical input accommodates up to 40 amps. The polarity of the input signal is rectified to guarantee that all voltages are positive. An internal filter is incorporated to eliminate sharp voltage spikes that occur during solenoid switching. DO NOT TOUCH CONNECTORS TO 110-VOLTS OR 220-VOLT AC INPUTS.

Resolution and Accuracy

Vacuum Display and Unit Relationships

All vacuum (pressure) measurements will be displayed according to the selected Vacuum Display Unit. The available units are Inches of Mercury ("Hg) and kilopascals (kPa).

The following provides an orientation to the equivalency of various pressure units:

1 atm ≈ 30.0" Hg ≈ 14.7 psi ≈ 101 kPa

The actual conversion factor used is:

1" Hg = 3.3864 kPa

The following resolutions are used:

Units	Precision	Display Range	Example
"Hg	100ths	18.00	12.05
kPa	10ths	60.9	45.5

The performance specifications for the various measurement types are defined in

Measurement	Units	Resolution	Accuracy
Vacuum	"Hg	0.01	+/- .06
Vacuum	kPa	0.1	+-.2
Time	msec	1	+ -1
PPM	ppm	0.1	+-.1
Ratio	%	0.1	+-.1
Voltage	DC Volts	.1	+-.3

the table below. Specifications are for the entire operating range of the Digimet 3000, and for a temperature range of 32-150 degrees Fahrenheit.

Calibration

The Digimet 3000 is factory calibrated. Its components are designed so that losing calibration is unlikely, but if the unit is subjected to harsh environments or treated roughly, it may need factory recalibration at some future time. But, as any electronic instrument, yearly recalibration is recommended.

FUNCTION

This section describes the operation and features of the Digimet 3000.

The functions of the Digimet 3000 are divided into the following areas:

System Functions

- Auto Shutoff
- Battery Low Indication
- Reset
- Data Display Hold
- Store/Recall
- Store Graph
- Print/Upload
- Limping data
- Timer Stamp
- Labeling
- Auto Zeroing

Menu & Display System

Measurement Functions

- Vacuum Level
- Pulsator Ratio
- M/R Ratio
- Pulsation Electronic

Utilities

- Upload/Print all data
- Upload Graph
- Print Graph
- Fluctuation Time Frame
- Liner Collapse Point
- Type of Pulsation Storage
- Display Units - " Hg or kPa
- Type Pulsation - Dual/Single
- Auto Shutoff
- Clear Storage Memory
- Print Limping Data
- Set Pulsator Limits

The measurement Functions are fully independent from one another. Information (unless it is "stored") is not retained when switching from one Function mode to another.

Auto Shutoff

The Digimet 3000 provides for automatic shutoff of the unit after a user selectable period of time from 0 to 30 minutes of non-use. This is set in the Utility Menu, item number eight. See section on **Utility Menu**. This feature is designed to maximize battery life. "Use" of the unit is defined as presses on the front panel keys. Each depression of a key will cause an internal timer to reset to zero. This timer is continually counting, and when it reaches the specified time, the Digimet 3000 will shut off. **When the Digimet 3000 is auto-shutoff, all currently displayed information will be lost**, the same as if a user had switched the unit off. (Stored data is not lost.) When the unit is auto-shutoff and subsequently turned back on, it will perform the normal start-up

sequence defined in the section entitled **Start-up Display**.

Battery Low Indication

The Digimet 3000 detects when the battery power is low and displays a message. The Low Battery indicator is a blinking "B" in upper right corner of the screen. See more about the Battery Low Indication under heading **MENU & DISPLAY SYSTEM**.

Reset

The Vacuum Level Measurement function has the ability to "reset" the Max. and Min. Vacuum readings. Vacuum Level Min/Max Reset is further discussed in the section entitled **Vacuum Level Function**.

Data Display Hold

The Digimet 3000 has the capability to "freeze" the data currently displayed, with the use of the Hold mode. The entire set of measurements for a Function that is held will be frozen, including items not visible within the display window. This allows the user to scroll through all measurements. When placed in Hold mode, the Digimet 3000 will continue to sample input and calculate the measurements for the current function; however, the display will not be updated with the current information, but will display the measurements at the time the unit was placed in Hold mode. When accessing the Option Menu to utilize Hold, within a particular Function, the MENU key must be pressed. The data that is on the screen the instant the Menu key is pressed will be the data held.

When the Digimet 3000 is then placed in the Continue mode, the display will be updated with current measurements. This operation is analogous to a split-time feature of a stopwatch. The Hold mode is automatically released when the measurement Function is exited. For example, if the unit is in Hold mode within

the Vacuum Level measurement Function and then the Pulsator Ratio Function is selected, the Pulsator Ratio function will begin in the Continue mode.

All measurement Functions have the Hold mode capability.

Store/Recall

The Store/Recall function allows for the storage of screen data within the Digimet 3000’s memory, and for the recall to the Digimet display, printing to the Digimet Printer or uploading to a computer.

Store

The Store function of the Digimet 3000 allows a measurement set to be stored for later viewing (recall) or uploading (to a computer) or printing (to the Digimet Printer). A measurement set contains all measurement parameters of the Function being stored plus a label of up to 16 characters or if no label is inputted a timer-stamp will be associated with the data. This data is stored into dedicated storage slots (selected by the user) and remains in storage even if the unit is turned off and back on.

Each measurement Function contains a maximum number of measurement sets that can be stored, and each slot is numbered. This means that storage space reserved for a particular Function cannot be used by any other Function.

The following storage is provided:

<u>Measurement</u>	<u># Storage Slots</u>
Vacuum Level	10
Pulsator Ratio	60
M/R Ratio	30
Pulsation Electronic	5
Graph Storage	5

Some measurements require a minimum start-up time before data is displayed (see section titled **MEASUREMENT FUNCTIONS**). This is generally approximately two or three seconds, depending on the measurement. If the required start-up time has not elapsed, the Store option will not be available, it is surrounded by < > on the display screen.

If the unit is in the Hold mode the held data will be stored. Otherwise, the data that is current at the time Store is selected will be stored.

When the Store screen appears, choose the storage slot number where the data is to be stored. An empty slot has neither a timer-stamp or a label next to it. The next screen will allow a label to be attached to the item being stored. The top of the screen will indicate “Label Slot 01”. The 01 would change depending on the number of the slot. Below this, there will be 16 hyphens indicating 16 available characters for the label. The cursor will be all the way to the left under the first character. Choose characters for the label by using the up and down arrow key on the keypad. The up arrow key will start with A,B,C,D and so on through some symbols and numbers. The down arrow key starts with the (space),#,0,1,2 and so on. Once the character is chosen, press the Enter key to advance to the next character. When done with the label press the Menu key to Save. If the Menu key is pressed without selecting any characters for a label, a timer stamp will be associated with the data stored. This timer-stamp is described in the section **Timer-Stamp**. Once the item is saved, the Option Menu will re-appear.

Store Graph

This option appears in all three of the pneumatic functions in the Function Option Menus. The time period for graph length is

set at this time from 2 seconds to 10 seconds. Up to five separate graphs from 2 seconds to 10 seconds each, can be stored. On subsequent store graphs the unit will remember storage time and will not need to be changed unless you desire a different time period. **Please note:** It is a good practice to match the fluctuation time frame - a variable in the Vacuum Level Function (set in the Utility Menu), with the store graph time period so the numeric data printed out on the graphs, matches the activity of the graph. For example, you would want to set the Fluctuation Time Frame to 3 seconds (Utility Menu item #4) if you wanted a graph period of 3 seconds. This practice is only applicable for the Vacuum Level Function. The Fluctuation Time Frame is not a variable in the other pulsation functions. **Another note regarding Fluctuation Time Frame and Graphing time:** If the Fluctuation Time Frame is less than the Graph time, then the Fluctuation figure, which will print-out on the graph, will cover the last portion of the graph which includes the period of the Fluctuation Time Frame. For example, if the Fluctuation Time Frame is 2 seconds and the Graph time is 3 seconds then the Fluctuation figure will be for the last 2 seconds of the 3 second graph. If the Fluctuation Time Frame is greater than the Graph time, then the Fluctuation figure will be for the time period of the graph. For example, if the Fluctuation Time Frame is set for 5 seconds and the Graph time is for 3 seconds, the Fluctuation figure will be for 3 seconds.

When you first enter Store Graph, a screen will appear with 5 storage slots. After choosing the slot the next screen will allow a label. It is not necessary to choose a label. In the case where no label is chosen the graph will have a timer stamp associated with it. When the label screen

is exited, the screen will indicate, **Enter for 3 sec. of graph. Up/Down changes. Menu to exit.** (This assumes that 3 seconds is the chosen graph period). Time can be set from 2 seconds to 10 seconds. Pressing the appropriate key will either exit without saving or you will enter the function in the Recording Mode. In this mode an **R** will appear in the upper right corner of the Digimet screen. There is a short delay before the unit begins Storing the graph. When the **R** begins to blink, storing data has begun. The initial delay allows the readings to stabilize. **Note: If you want to capture a particular activity, start the activity the moment the "R" starts to blink.**

After the **R** stops blinking, storage is complete. You can now use **Print Graph** to graph to the Digimet Printer or use **Upload Graphic Data** to upload graph data to the computer for viewing on the Computer Screen. **Upload Graphic Data** and **Print Graph** are both options that appear in the Utility Menu, item 2 and 3. The reason for these different options is because the Digimet formats the data differently depending on the ultimate way that the data will be viewed.

Recall

Data that has been previously stored may be recalled for display by the Digimet 3000. The particular measurement set that will be recalled depends on the current

measurement Function. That is, the Digimet must be in a measurement Function for this option to be available. If a slot does not contain any stored data, the Digimet will not allow selection of that slot for recall.

When the RECALL screen appears, if there is stored data in a particular slot, there will be either a label or a timer-stamp next to the numbered slot. Only twelve characters of the label will appear in the Store screen.

When data is recalled, it is displayed on the Digimet 3000 display in the same format as during normal sampling operation, except that the recall slot number appears (blinking) at the upper right corner of the display screen. Both recalled data and held data can be stored in multiple slots, allowing the user to "make a copy".

Print/Upload

The Print/Upload function allows the user to Print an individual item to the Digimet Printer or Upload an individual item to a computer via a serial port. In order to print, the Digimet Printer must be connected to the Digimet 3000 (See section on the **Digimet Printer**). The printer cable supplied with the Digimet Printer has a 25-pin male serial connector at one end and a 9-pin male serial connector at the other. The 9-pin end connects to the Digimet 3000 and the 25-pin end connects to the Digimet Printer. The next step is to supply the Digimet Printer with power using the supplied AC wall transformer. Turn the Digimet Printer "ON". Press the Enter key to select Print/Upload. A screen will appear with storage slots identified along with either labels or timer-stamps (same as in Recall). Choose the item to Print/Upload by selecting the item with the up and down

arrow keys. Select the item by pressing the Enter key. The next screen will indicate that the numbered slot with the attached label will be sent. Press Enter to send, Menu key to exit without printing or uploading the item. If there is a loose cable connection or the Digimet Printer is not "ON" then an error message "No Clear to Send" will appear and remain on the screen. If the "No Clear to Send" remains on the screen, then press the Menu key to exit and the connection problem must be corrected. If all is OK then the item data will be sent to the Digimet Printer.

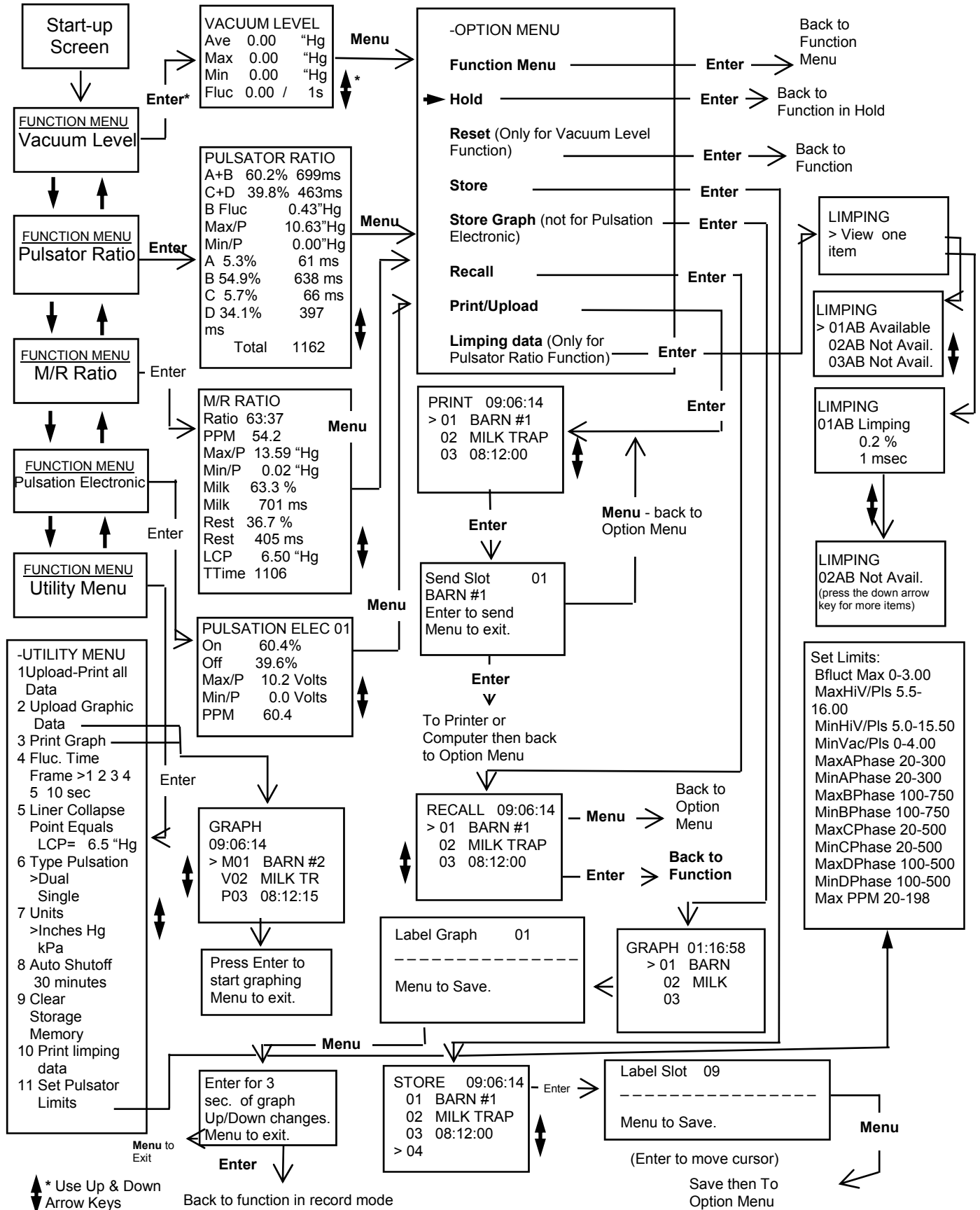
The above procedure would be identical for Uploading an item to the computer except for a few differences. To upload, the supplied 6' computer cable (supplied with the Basic Digimet 3000) which has 9-pin connectors at each end, one is a female and one is a male connector, must be used. The male end attaches to the Digimet 3000 and the other to the computer. The second difference would be that the software to upload data from the Digimet 3000 must be loaded and running on a computer to complete the upload procedure. Other than these two differences the steps for Uploading would be the same as for Printing. For information on the software requirements for uploading data from the Digimet to a computer, see the section on **SOFTWARE**.

Limping data

In versions greater than 3.2, a feature was added to the Pulsator Ratio Function called the **Limping data**.

The difference in the milking ratio of the right and left sides of the pulsator is referred to as "limping ratio". Limping may be caused by plugged or worn small air tubes, plugged or leaking pulsator tubing,

Figure A - Menu Navigation



as well as the pulsator itself.

When using the Digimet 3000 in the **Dual Storage Mode**, pulsator data is stored in slots labeled 01A, 01B, 02A, 02B ... 30A, 30B. When both the A and B slots are filled with pulsator data, the Digimet will calculate the Limping data. The Limping data is an item which appears in the Option Menu of the Pulsator Ratio Function. The Limping data will appear as a percentage and in milliseconds.

The Digimet 3000 evaluates the A + B phase of each side of the pulsator and indicates the difference as a percentage and in milliseconds. For example, Limping data would appear as follows:

07AB Limping
0.1 %
2 msec.

The Limping data can be viewed on the Digimet's display, printed to the Digimet Printer or uploaded to a computer for viewing and/or printing. The printing of Limping data from the computer is available on the DigiData program version 3.4 and greater.

Timer Stamp

In conjunction with the Store/Recall function, a clocking mechanism is built in. The purpose of this clocking mechanism is to provide an internal real-time counter that is used to timer-stamp the stored measurement data. Unless a label is chosen the timer-stamp will appear in the Store, Store Graph, Recall, Print/Upload, Upload Graph and Print Graph screens. When an item is printed or uploaded the timer-stamp in addition to the label, if chosen, will appear. The clock will increment every second with a range of 12:00 hours. Thus when the clock reaches

11:59, the next increment will roll the clock over to 00:00.

Labeling

When storing data or graphs, prior to storage but after choosing the storage slot, a screen will appear giving you the opportunity to label your stored item. You can use up to 16 characters. Use the up and down arrows to choose the character/number/symbol. Press the Enter key to advance to the next character. Holding the arrow keys down for more than two seconds will advance the characters automatically. When done with your label pressing the Menu key will exit and save your data or graph. Exiting, with the Menu key, without entering labeling will attach a timer stamp to your data. So, it is not mandatory to choose a label.

Auto Zeroing

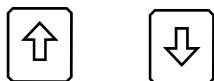
The Digimet 3000 has an auto-zero capability. Due to temperature variations which can affect certain components, the Digimet 3000 is designed to auto zero. This takes place any time the Digimet is in the Vacuum Level Function or one of the pulsation (vacuum) Functions with **NO VACUUM INPUT** applied. At this time, the Digimet displays all zeros for Avg Vac, Max Vac, Min Vac, and Fluctuation. (Note: If the unit has just displayed vacuum readings, it may be necessary to reset Max Vac before a zero reading is obtained.) The Pulsation (vacuum) Functions will appear blank when auto-zeroed.

Therefore, the following procedure is recommended: When taking Vacuum Level of pulsation (vacuum) Function measurements, periodically take a reading with no vacuum input to allow the Digimet 3000 to auto-zero.

MENU & DISPLAY SYSTEM

The menu system is navigated via the front panel keys. The basic menu/function structure is depicted in Figure A on Page 14. The structure and operation of the menu/display are designed to provide easy access to all of the Digimet 3000 features.

The use of the keys is as follows:



These keys are used to scroll the screen. For menus, these keys are also used to change the current selection. Once the bottom of a screen has been reached (or the last item selected), subsequent pressing of the down arrow will have no effect, that is, the screen will not loop back to the top. Similarly, pressing the up arrow will have no effect after the top of the screen is reached. The arrow keys are also used to change data in the Utility Menu and to choose letters or characters for labels. Both to be described in a later section.



The Enter key is used to make a selection or a change of some kind. This could be changing to a new Function, changing a system parameter, etc. But this key is always associated with some effect on the Digimet system.



The Menu key is used to access menus. The Digimet utilizes "pop-up" menus which are easily accessed with the Menu key.

Navigation

Navigation through the Digimet menus and functions is illustrated in Figure A page 14.

Display Standards

The design of the display system follows some basic standards in order to provide a consistent user interface.

The top line will always display a title in capital letters, indicating the purpose of the current screen. This will either be the name of a menu or the name of a measurement Function. This title line does not scroll.

Hold Indicator: For all measurement Function displays, the top right two character spaces are designated for indicating that the unit is in Hold mode. Hold mode is signified by the presence of a single, blinking character "H". Sampling or real-time mode is indicated by the absence of the character "H".

Recall Indicator: The same two character spaces (top right) are reserved to indicate the number of a recalled set of measurements. The recall function is described in section titled **Store/Recall**.

Battery Low Indication

A low battery, as detected by system circuitry, will be indicated on the display by a blinking "B" in the display status area (upper right corner).

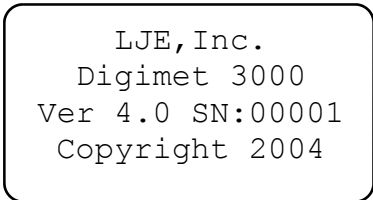
The battery low indication (blinking "B") on the display means the batteries will soon

expire, causing the unit to cease functioning. The unit will operate properly for several hours after the low battery indicator appears on the screen.

IMPORTANT: STORED DATA IS NOT LOST WHEN THE BATTERIES EXPIRE OR ARE REMOVED FOR REPLACEMENT, ASSUMING THAT FRESH BATTERIES ARE REINSTALLED WITHIN AN HOUR.

Start-up Display

Each time the Digimet 3000 is turned on, the following initial screen will be displayed:



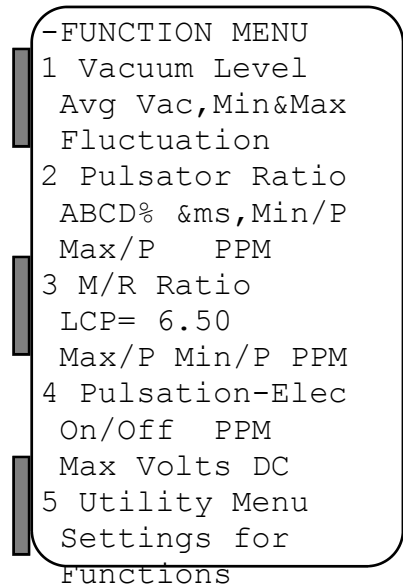
This start-up screen will be displayed for 5 seconds.

The following screen layout diagrams (shown on the next couple of pages) illustrate two ways in which a screen is scrolled. The first is as a "page." A screen with a page scroll displays lines in sets of three (excluding the top line which does not move). These three-line page groupings are identified by shading. The second method of scrolling is a single-line scroll, in which individual lines are scrolled continuously (rather than in groups as with the page scroll).

Function Menu

The Function Menu is the system's main menu. It allows the selection of a particular measurement Function or of the Utility Menu.

After the initial Start-up Display, the



selection on the Function Menu will default to the first option. Upon selection of an option from the Function Menu, and subsequent return to the Function Menu, the last-selected item will be the default selecti

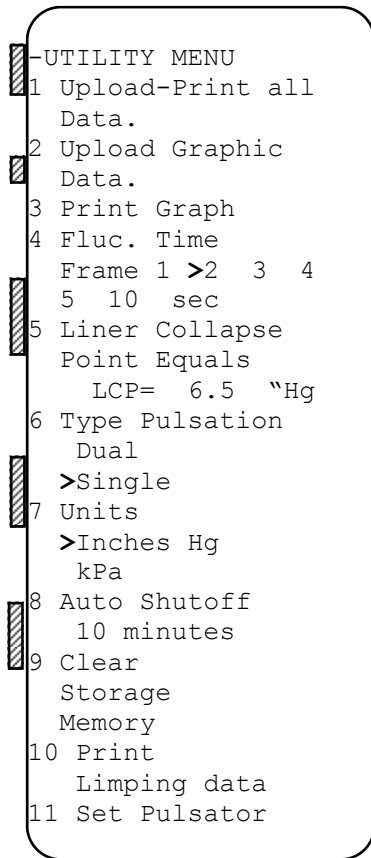
Action of Keys

Menu	None
Enter	Go to selected measurement Function or Utility Menu
Up arrow	Previous item on Function
Down arrow	Next item on Function Menu

UTILITY MENU

The Utility Menu allows the user to change several Digimet settings which include:

- Upload/Print all data
- Upload Graph
- Print Graph
- Fluctuation Time Frame
- Liner Collapse Point
- Type of Pulsation storage
- Display Units
- Auto Shutoff
- Clear Storage Memory



- Print Limping data
- Set Pulsator Limits

The Utility menu is depicted above:

	<u>Action of Keys</u>
Menu	Return to Function Menu
Up arrow	Previous screen/selection
Down arrow	Next screen/selection
Enter	Edit the value on the displayed screen

The > symbol points to the current setting. The enter key is used to access the Editing mode, which is indicated by a blinking "E" in the upper right of the display. While in Editing mode, the (up arrow) and (down arrow) keys function to change the current value. Edit mode may be exited by either pressing the Enter key to save any changes, or pressing Menu to abandon any changes that have been made in the current setting. The editing of

the various settings is described in the following paragraphs:

Upload-Print all Data

Pressing the Enter key will initiate transmission of data to either the Digimet Printer or a waiting computer. The Digimet Printer must be on if printing is to take place otherwise an error "No Clear to Send" will appear at the bottom of the screen. If transmission is to a computer then the receiving program must be up and running. If not or there is a poor cable connection between the Digimet and the computer the same error will appear, "No Clear to Send". To exit without sending data to the printer or computer press the Menu key. **Note:** If you get no response from the printer after attempting to print or data that was sent appears garbled, turn the Digimet OFF then ON. If you are using the Digimet Printer, unplug it. Sometimes resetting either device by turning OFF then ON or unplugging, will solve the problem. Data once stored in the Digimet is not lost even if an upload fails. The data is securely stored in the Digimet Memory. To erase stored memory you would have to **Clear Storage Memory** (ninth item in the Utility Menu) or leave the unit without batteries for more than an hour. This command will upload or print to the Digimet Printer all numeric data. Graphs must be printed or uploaded separately. See Upload Graphic Data (Item 2 in the Utility Menu) and Print Graph (Item 3 in the Utility Menu).

Upload Graphic Data

This Utility Menu item is used to upload graphs from the Digimet to a computer. These graphs are formatted to be viewed on the computer screen and, ultimately, they can be printed to the computer's printer. **They are not intended to be sent to the Digimet Printer.** However, if the **raw data is desired**, as shown below,

time "Hg
.000 12.00
.008 12.01
.016 12.02
(etc.)

you can Upload Graph Data to the Digimet Printer. The print-out will include all the time and vacuum data in numeric form, not a graph. There are 125 readings made each second. So, for a two second graph, the raw data will consist of 250 readings.

After pressing the Enter key, the Graph storage menu will appear. There are 5 storage slots for graphs. If there are stored items, the slots will either have a timer stamp next to the slot number or there will be a label which would have been put in at the graphing time. Also, the slot number, 01, 02, 03, 04, or 05 will have either a V for Vacuum Level, P for Pulsator Ratio or a M for Milk/Rest Ratio in front of it, to designate which function the graph originated from. Once you choose the slot pressing the Enter key, the next screen will be **"Press Enter to start graphing. Menu to exit."** At this point, **before** pressing the Enter key again, the Digimet 3000 should be connected to a serial port of a computer with the 6 foot serial cable provided. The DOS program or Windows program provided should be up and running on the computer in order to accept the uploaded graph. The following will be the steps to take utilizing the Windows Program provided – Digidata. Explanation of uploading using the DOS program can be found in the SOFTWARE section.

- Press the Upload Graph button on the Digidata computer screen, the button will change to "Press Digi then Here".
- Press Enter on the Digimet one more time.

- Press the "Press Digi then Here" button. Button changes to "*****Uploading." As uploading is taking place this button will change to "*****Still Uploading". When uploading is completed the button will say "*Done Uploading". The Save Graphic file window will then appear. Choose a name for your graph file and be sure it ends with .dgr.
- Press the OK button in the Save Graphic files window.
- Your graphic file has been uploaded from the Digimet and saved as a computer file.

If, however, the message, **"No Clear to Send"** appears and remains, then the Digimet does not have a good connection or something is wrong with the hookup. If this happens, pressing the Menu key will exit the screen and the connection problem will have to be solved.

The steps are listed here again for Uploading graphic data from the Digimet to the Computer.

1. Connect the 6 foot serial cable to the Digimet and the computers serial port.
2. Open the Digidata program.
3. Go to the UTILITY MENU item 2 Upload Graphic Data on the Digimet.
4. Press Enter on the Digimet.
5. Choose your Graph to upload on the Digimet.
6. Press Enter on the Digimet, one time.
7. Press the Upload Graph button on the Digidata computer screen, the button will change to "Press Digi then Here".
8. Press Enter on the Digimet one more time.

9. Press the “Press Digi then Here” button. Button changes to “*****Uploading.” As uploading is taking place this button will change to “*****Still Uploading”. When uploading is completed the button will say “*Done Uploading”. The Save Graphic file window will then appear. Choose a name for your graph file and be sure it ends with .dgr.
10. Press the OK button in the Save Graphic files window.
11. Your graphic file has been uploaded from the Digimet and saved as a computer file.

Print Graph

This Utility Menu item is used for printing graphs to the Digimet Printer. These graphs are only formatted for the Digimet printer.

Pressing the Enter key will bring up the Graph storage menu (same menu as in Upload Graphic Data). Choose the slot to print. There are 5 storage slots for graphs. If there are stored items, the slots will either have a timer stamp next to the slot number or there will be a label which would have been put in at the graphing time. Also, the slot number, 01, 02, 03, 04, or 05 will have either a V for Vacuum Level, P for Pulsator Ratio or a M for Milk/Rest Ratio in front of it, to designate which function the graph originated from. Once you choose

the slot pressing the Enter key, the next screen will be “**Press Enter to start graphing. Menu to exit.**” At this point, **before** pressing the Enter key again, the Digimet 3000 should be connected to the Digimet Printer and the Digimet Printer should be on. Pressing Enter again will initiate the printing of the graph on the Digimet Printer.

Fluctuation Time Frame

While in Time Frame Edit mode, the up arrow key will move the marker to the left and the down arrow key will move the marker to the right, indicating the selected setting. Fluctuation time frame can be set to 1, 2, 3, 4, 5 or 10 seconds. The Fluctuation time frame establishes the time frame for the variable - Fluctuation in the Vacuum Level Function. The Digimet is looking for the Max and Min value over the period set here and outputs that difference to the display and calls it Fluctuation.

Liner Collapse Point (LCP)

While in the LCP Edit mode, the up arrow and down arrow keys are used to increase or decrease the liner collapse point. Prolonged pressing down of the key will cause rapid advance of the value. LCP can be set from 0.0 inches Hg/0.0 kPa to 18.0 inches of Hg/60.9 kPa.

Display Units

While in the Display Units Edit mode, the up arrow and down arrow keys are used to position the marker next to the desired setting. Choices for display units are Inches Hg and kPa.

Type of Pulsation Storage

Storage slots for the pneumatic functions of Pulsator Ratio and Milk/Rest Ratio can be either numbered 1,2,3,4, etc. (Single pulsation) or 1A, 1B, 2B, 2C, etc. (Dual pulsation). Use the up and down arrow

keys to move the indicator. To choose that item, press the Enter key. This item can not be changed without first clearing storage memory.

Auto Shut-off

User can set the desired time for the unit to automatically shut-off for non-use. This time can be set from 0 to 30 minutes. Press the Enter key to put the unit into the Edit mode, then use the arrow keys to select the desired time.

Pressing the Menu key or Enter key will take you back to the Function Menu.

Clear Storage Memory

Clear Storage Memory is the last item that appears in the UTILITY MENU. The Clear Storage Memory screen contains no Edit mode. Pressing the Enter key will cause the screen to change to:

```

-UTILITY MENU
9 Clear Memory
  > No
    Yes
    
```

The marker will default to NO. To move the marker to YES, press the down arrow key. Pressing the arrow keys repeatedly will move the marker back and forth, from YES to NO. To choose Clear Memory, move marker to YES, then press ENTER. If clearing memory is not desired, move marker to NO and press ENTER or press MENU key at any time. Pressing the MENU key will exit back to the FUNCTION MENU. **IMPORTANT: WHEN CLEARING MEMORY, ALL MEMORY SLOTS--10 IN VACUUM FLUCTUATION FUNCTION, 60 IN PULSATOR RATIO FUNCTION, AND 30 IN MILK/REST FUNCTION, 5 IN THE PULSATION ELECTRONIC AND 5 GRAPH STORAGE SLOTS--WILL BE ERASED.**

There is no selective erasure of individual memory slots.

```

-UTILITY MENU
10 Print
   Limping data
    
```

Print Limping data – Limping data can be printed to the Digimet Printer or uploaded to a computer by using Utility Menu item 10, Print Limping data.

DISPLAYS

```

VACUUM LEVEL
Avg   0.00  "Hg
Max   0.00  "Hg
Min   0.00  "Hg
Fluc  0.00 / 1s
    
```

Vacuum Level Function Display

The Vacuum Level Function displays those measurement calculations as described in the section on the Vacuum Level Function. The display format is depicted in the following column:

In addition to the calculated measurements, the current Fluctuation Time Frame setting will also be displayed as " /1s " on the last line, where 1 second is the current setting.

```

PULSATOR RATIO
A+B  60.2%   696ms
C+D  39.8%   460ms
B Fluc      .33 "Hg
Max/P           13.68"Hg
Min/P           0.00"Hg
A   11.3%    131 ms
B   48.9%    565 ms
C   12.0%    139 ms
D   27.8%    321 ms
Total 1156 ms
    
```

Pulsator Ratio Function Display

The Pulsator Ratio Function displays those

Figure B

Function	OPTIONS Function Menu	Hold/Cont.	Reset	Store	Store Graph	Recall	Print/ Upload	Limping data
Vacuum Level	X	X	X	X	X	X	X	
Pulsation Ratio	X	X		X	X	X	X	X
M/R Ratio	X	X		X	X	X	X	
Pulsation Electronic	X	X		X		X	X	
Display after selecting Enter	Go to Function Menu	Return to Measurement Function - Hold or Continue	Return to Measure ment Function	Go to Store Menu then to Label Screen	Go to label screen then to screen that indicates time avail.	Go to Recall Menu then recall data	Item selection	Choose how to view Limping data

measurement calculations as described in the section on the Pulsator Ratio Function. The display format is shown on the previous page:

```
M/R RATIO          02
Ratio      61:39
PPM        51.9
Max/P      13.67 "Hg
Min/P       0.00 "Hg
Milk       60.8 %
Milk       703 ms
Rest       39.2 %
Rest       452 ms
LCP        6.50 "Hg
TTime     1155 ms
```

Milk/Rest Ratio Function Display

The Milk/Rest Ratio Function displays those measurement calculations as described in the section, Milk/Rest Ratio Function. The display format is shown in the previous column:

Pulsation-Electronic Function Display

The Pulsation-Electronic Function displays those measurement calculations as described in the section, Pulsation-Electronic Function. The display format is:

```
PULSATION ELE 01
On          50.4%
Off         49.6%
Max/P      14.0 Volts
Min/P       0.0 Volts
PPM        60.0
```

Option Menu

The Option Menu is activated by pressing the Menu key while in any of the measurement Functions. The Option Menu presents various selections that relate to that function as described below:

```
OPTION MENU
>Function Menu
  Hold
  Reset
  Store
  Store Graph
  Recall
  Print/Upload
  Limping data
```

The Option menu will display Hold as an option when the measurement is in the continuous mode, and will display Continue as an option when the unit is in the Hold Mode. Pressing the Menu key while in the Option Menu will immediately return to the current measurement Function; a blinking "H" will appear if the unit is in the Hold mode.

Most of the measurement Functions require the same menu of options. However, there are some options which do not apply to a given measurement, in which case the option will not appear on the menu. Furthermore, the results of selecting a particular option from within various Functions may differ in terms of navigation through the display system.

The available options for each Function are described in **Figure B** on the preceding page. The figure also shows the results of selecting a particular option from within each Function.

Store/Recall Menus

The Store and Recall Menus are used to select a storage slot when either storing or

recalling a measurement data set. Except for the display title, the Store and Recall Menus are the same and are presented here:

```
STORE          00:05:27
>1  00:04:19
  2  MY BARN #1
  3  PIT BY WEST
  .
  .
30   00:15:45
```

The title will display either STORE or RECALL depending on the operation. The current timer appears in the upper right. The screen lists all storage slots available for that measurement Function, the number of which depends on Function (see section **Store**) The timer-stamp of the data stored in each slot is also displayed or up to eleven characters of the chosen label. The currently selected slot is indicated by the marker >. The up and down arrow keys are used to scroll through the list of available storage slots until the marker is next to the desired slot, with the list of storage slots scrolling onto the screen as scrolling continues. Pressing the Enter key will take you to the Label screen shown below.

```
Label Slot 03
^ - - - - - ...
Menu to Save
```

Selecting the Menu key will store the current data to the selected slot (Store), or recall stored data from the selected slot (Recall). In the case of Recall, the Label

screen would not appear. After selecting the slot to recall and pressing the Enter key you would be returned to the Function, viewing the chosen item. From the Recall screen one can return to the Option menu by pressing the Menu key. When data is being stored, any slot may be selected. When data is being recalled, only slots displaying a timer-stamp or label containing data and will be recalled.

Store Graph Menus

From the Store Graph menu item in the Options Menu the screen on the next page will appear:

```

GRAPH      00:05:27
> 1      00:04:19
  2      MY BARN #1
  3      PIT BY WEST
  4
  
```

There are 5 available slots numbered 01 to 05. Choosing a slot will take you to the label screen shown below:

```

Label      Graph      03
^ - - - - - - - - - -
Menu to Save.
  
```

After choosing a label pressing the Menu key will take you to the next screen which allows you to choose the graphing time period.

```

Enter for 2
sec. of graph.
Up/Down changes.
Menu to exit.
  
```

Pressing the Enter key will take you to the function display with an **R** in the upper

right corner and the unit will be in the recording mode.

Since the same Store Graph menu can be accessed by all three of the pneumatic functions; Vacuum Level, Pulsator Ratio and Milk/Rest Ratio, when items are eventually recalled to print or upload, the item number will be appended to include a V,P or M preceding the number. This allows one to determine which particular function the graph was obtained in. See item 2 **Upload Graphic Data** in the **Utility Menu** section.

MEASUREMENT FUNCTIONS

This section defines the various measurements that are calculated by the DIGIMET 3000. All measurements are calculated based on a periodic sampling of the input level; this approach applies to both vacuum input through the vacuum transducer and electrical input via the banana jack input. **Depending on the Function being used, 2-3 seconds may be required for measurements to stabilize.**

Measurement Constants

The following user-selected constants are used in various measurement calculations: (See section on the **Utility Menu** for details of selecting the constants.)

Fluctuation Time Frame - The Fluctuation Time Frame may be selected as 1, 2, 3, 4, 5 or 10 seconds. See section on **Vacuum Level Function** for more information on Fluctuation Time Frame.

Liner Collapse Point (LCP) - The Liner Collapse Point is used in the Milk/Rest

Ratio calculation, and may be selected in the range from 0.0" to 18.0" Hg, in .1" Hg increments, when the designated Display Unit is " Hg. When the Display Unit is kPa, the LCP may be selected from 0 to 60.9 kPa, in .3 kPa increments. See the section on **Milk/Rest Ratio** for further explanations of the Liner Collapse Point.

Display Units

Display Units either " **Hg or kPa** are used during the conversion of vacuum measurements to display (output) format. This includes all vacuum measurement data and Liner Collapse Point. **Please note:** When using the Digidata.exe Windows program to view the DigiMet 3000 data, it is possible to mix different Units, for example, you could measure some items using kPa and others using "Hg. But calculations made, like comparing pulsator max vacuum levels, will not be correct. To get correct calculations, use **ONLY** "Hg or kPa for all measurements.

Type Pulsation

Type Pulsation is a setting to determine how the Pulsator Ratio and M/R Ratio storage slots will be identified. In the Dual setting, storage slots will be identified as 1A, 1B, 2A, 2B and so on to 15A and 15B. In the Single setting, storage slots will be identified as 1, 2, 3, and so on to 30. In order to change from one storage type to another, all the data must be cleared that is presently stored.

Auto Shutoff

This constant allows the user to determine how long the unit will run without automatically being shut off. It can be set from 0 minutes to 30 minutes.

Vacuum Level Function

The Vacuum Level Function measures a

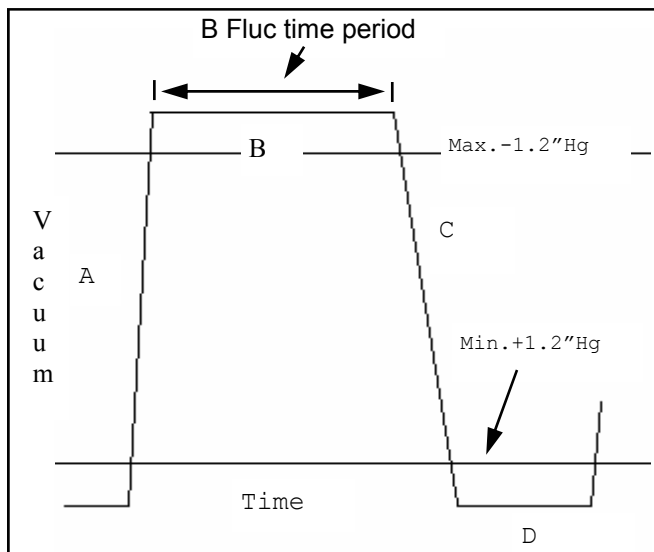
relatively stable vacuum input, which may vary due to loading of the vacuum system with pulsators, controllers and other milking machinery. The Vacuum Level Function is comprised of the following measurements:

- Average Vacuum
- Maximum Vacuum
- Minimum Vacuum
- Vacuum Fluctuation

Average Vacuum level is calculated by the use of a digital filter which presents the average value of the vacuum line. Several display update periods may be required to display the actual Average Vacuum level.

Because of the averaging filter, there will be an elapsed time before the calculations (and the display) reach the Average Vacuum when the Function is first engaged. Likewise, there will be a delay for the measurement to return to zero if the vacuum source is removed.

Maximum Vacuum and Minimum Vacuum are absolute measurements in that they represent the overall minimum and maximum vacuum pressures encountered throughout the entire measurement function. These measurements can be "reset", at which time the output will represent the absolute minimum and maximum vacuum since the reset occurred. When the Vacuum Level Function is first engaged, these two measurements are essentially in a "reset" state in that they will monitor vacuum since the Function was engaged. **Note: When Vacuum Level function data appears on graphic printouts using the**



Digimet Printer or viewed on the computer screen, the AVE. VACUUM figure will be the average for the last 1/2 second of the Graph period.

Vacuum Fluctuation

Vacuum Fluctuation represents the difference from the absolute minimum and maximum vacuum levels for a given time period. This time period is the currently set Fluctuation Time Frame, described in section on the Measurement Constants. The calculation of Vacuum Fluctuation uses a set of absolute minimum and maximum vacuum values. These values are automatically "reset" with each Fluctuation Time Frame. Thus they represent the overall maximum and minimum vacuum levels for each single Time Frame. At the end of each Time Frame, the Vacuum Fluctuation for that time frame is calculated as the difference: Vacuum Fluctuation = Maximum Vacuum - Minimum Vacuum. This measurement is not calculated until the vacuum level has been monitored for one Fluctuation Time Frame period.

Pulsator Ratio

The Pulsation measurements are calculated based on four time intervals called A, B, C and D. These intervals indicate the various phases of pulsation which are marked by a crossing of the vacuum levels 1.2" Hg above the minimum and 1.2" Hg below the maximum vacuum of the single pulsation cycle. A typical pulsation cycle and the A-B-C-D points are depicted above.

For pulsation measurements, the beginning of a pulsation is considered to be the point that begins the A phase of the curve, at time a. Calculations are as follows:

$$\begin{aligned} \text{Total Time} &= a' - a \\ \text{Pulses Per Minute} &= 60 \text{ seconds} / \text{Total Time} \\ \text{Min} / P &= \text{Minimum vacuum per pulse} \\ \text{Max} / P &= \text{Maximum vacuum per pulse} \\ \text{B Fluc} &= \text{Fluctuation in the B phase} \\ A(\text{time}) &= b - a \\ B(\text{time}) &= c - b \\ C(\text{time}) &= d - c \\ D(\text{time}) &= a' - d \\ A+B(\text{time}) &= A(\text{time}) + B(\text{time}) \\ C+D(\text{time}) &= C(\text{time}) + D(\text{time}) \\ A\% &= A(\text{time}) / \text{Total Time} * 100\% \\ B\% &= B(\text{time}) / \text{Total Time} * 100\% \\ C\% &= C(\text{time}) / \text{Total Time} * 100\% \\ D\% &= D(\text{time}) / \text{Total Time} * 100\% \\ A+B\% &= A+B(\text{time}) / \text{Total Time} * 100\% \\ C+D\% &= C+D(\text{time}) / \text{Total Time} * 100\% \end{aligned}$$

Setting Pulsator Ratio Limits

Limits for the individual pulsation parameters can be set for the Pulsator Ratio Function. See page 40 for default settings.

The Digimet 3000 Version 4.0 allows users to **set limits for pulsator ratio parameters**, like a high and low value for the B phase of pulsation. When a user is collecting data with the Digimet 3000, **the**

Digimet 3000 display will blink when a parameter value falls outside the desired limits. This will give guidance to a user as to a potential problem with a pulsator and/or an indication of values that are not appropriate.

Limits for the following Pulsator Ratio parameters can be set:

- Minimum and Maximum limits can be set for Maximum Vacuum per Pulse; A, B, C & D Phases; and Pulses per Minute.
- A Maximum limit can be set for B Fluctuation and a Minimum limit can be set for Minimum Vacuum per Pulse.

When viewing data in real time or viewing stored data, the values that are outside the set limits will blink on the Digimet display.

To set limits, first go to the Utility Menu which is the Function Menu number 5. Press the Enter key, then the down arrow key to Set Pulsator Limits which is number 11 in the Utility Menu. 11 Set Pulsator Limits is the last item in the Utility Menu. Then press the Enter key.

To set limits, move the arrow at the left, by pressing either the Up or Down arrow key.

When the arrow is beside the parameter that you desire to set limits, press the Enter Key. An E will appear in the upper right corner of the Digimet display indicating that you are in the Editing Mode. Use the Up or Down arrow keys to set the desired values.

Limits for the following Pulsator Ratio parameters can be set:

B Fluc Max can be set from 0.00 to 3.00 in increments of .50 inches Hg.

Max Hi Vac/Pulse can be set from 5.50" Hg to 16.00" Hg in increments of 0.50 inches of Hg.

Min Hi Vac/Pulse can be set from 5.00" Hg to 15.50" Hg in increments of 0.50 inches of Hg.

Min Vac / Pulse can be set from 0.00" Hg to 4.00" Hg in increments of 0.50 inches of Hg.

Max A Phase can be set from 30 to 300 in increments of 1 msec and must be at least 10 msec greater than Min A Phase.

Min A Phase can be set from 20 to 290 in increments of 1 msec and must be at least 10 msec less than Max A Phase.

Max B Phase can be set from 110 to 750 in increments of 1 msec and must be at least 10 msec greater than Min B Phase.

Min B Phase can be set from 100 to 740 in increments of 1 msec and must be at least 10 msec less than Max B Phase.

Max C Phase can be set from 30 to 500 in increments of 1 msec and must be at least 10 msec greater than Min C Phase.

Min C Phase can be set from 20 to 490 in increments of 1 msec and must be at least 10 msec less than Max C Phase.

Max D Phase can be set from 110 to 500 in increments of 1 msec and must be at least 10 msec greater than Min D Phase.

Min D Phase can be set from 100 to 490 in increments of 1 msec and must be at least 10 msec less than Max D Phase.

Min PPM (pulses per minute) can be set from 20 to 198 in increments of 1 PPM and must be at least 2 PPM less than Max PPM.

Max PPM can be set from 22 to 200 in increments of 1 PPM and must be at least 2 PPM greater than Min PPM.

Press the Enter key to Save that parameter. To set another parameter, use the same procedure. To exit Set Pulsator Limits, press the Menu key.

If measurement Units is set to kPa then the pulsator parameters must still be set in Inches of Mercury but readings will respond to their kPa equivalent.

B-Phase Fluctuation

B Fluc stands for B-Phase Fluctuation and is a parameter that appears on the

third line below C+D % ms in the Pulsator Ratio function. B Fluc is displayed in either "Hg or kPa and is the amount of fluctuation during the B Phase of the pulsation wave as calculated by the Pulsator Ratio.

The B phase of the Pulsator Ratio is the phase which corresponds to the open and/or milk phase. The B Fluc parameter is intended to give an indication of movement within the top portion of the B phase, which would ideally be straight. Since, the B phase begins at 1.2" Hg below Maximum vacuum on the upwards slope of the curve and continues to 1.2" Hg below Maximum vacuum on the downwards slope, the end points of the B phase are excluded from evaluation in the B Fluc parameter. Technically, 1/16 of the B phase at both the beginning and the end of the phase are not included in the B Fluc calculation. Therefore, 87.5% of the B phase is evaluated, with the difference between the maximum level and minimum level during that period outputted as B Fluc.

Milk/Rest Ratio

The Milk/Rest ratio is the ratio of the time when the teat cup liner is not collapsed (Milk) to when it is collapsed (Rest). Collapse of the liner is based on the differential of a pulsating vacuum (vacuum and atmospheric air) on the outside of the liner, between teat cup and liner, and a (relatively) steady vacuum on the inside of the liner.

The point on the pulsation curve at which the liner collapses should be determined by the user. This is a simple and straightforward calculation:

A. Determine the average vacuum at teat end using the DIGIMET 3000 with its Vacuum Level Function.

B. Determining the differential pressure required to collapse the liner needs to be determined. The differential pressure required to collapse the liner is generally: 1) specified by the liner manufacturer; 2) specified by other sources; 3) determined by a simple test; or 4) determined using several rules of thumb:

RULES OF THUMB: Thin-walled liners, on the average, require a differential pressure of 2" Hg in order to collapse. Medium-walled liners require, on the average, 5" Hg of differential pressure to collapse. Thick-walled liners need, on the average, 7" Hg of differential pressure to collapse.

Based on the two values found in A and B, a point referred to as the Liner Collapse Point (LCP) is determined:

$$\text{LCP} = \text{Average Vacuum} - \text{Differential Pressure to collapse liner}$$

The DIGIMET 3000 allows LCP selection by the user; any average vacuum and liner differential pressure combination can be accommodated (see Liner Collapse Point in the Utility Menu section).

To calculate the M/R ratio, the current input sample is compared against the currently set LCP. If the input vacuum is greater than or equal to the LCP, the pulsator is in the Milk phase; otherwise, it is in the Rest phase.

The following calculations are made:

$$\begin{aligned} \text{Total Time} &= \text{Milk Time} + \text{Rest Time} \\ \text{Ratio Milk} &= \text{Milk Time} / \text{Total Time} * \end{aligned}$$

100%
Ratio Rest = Rest Time / Total Time *
100%
Max / P = Maximum vacuum per pulse
Min / P = Minimum vacuum per pulse

Pulses per Minute = 60 sec/Total Time

Note: Regarding Pulsator Ratio or Milk/Rest Ratio function data which appears on Digimet Printer graphs or computer graphs: The numeric data represents the last complete waveform which appears on the graph.

Pulsation Electronic

The method of calculating the Pulsation-Electronic measurements is similar to the Milk/Rest ratio. Here, the trip point is fixed at 6 volts. This allows a good indication for the beginning and end of a pulse in either 0-12 or 0-24 volt systems. The two time intervals, ON interval and OFF interval, are calculated along with the absolute minimum and maximum voltage values. At the end of each pulse, the min/max values are reset.

The following is then calculated:

ON = On Interval / Total Time * 100%
OFF = Off Interval / Total Time * 100%

Max V/P = Maximum voltage DC per pulse
Min V/P = Minimum voltage DC per pulse

Pulses per min. = 60 sec / Total Time

CALIBRATION

The DIGIMET 3000 requires factory calibration in order to characterize the various components in each particular unit. Because of the high accuracy and stability

over time of the components, subsequent calibrations are generally not anticipated. However, since the DIGIMET 3000 may be exposed to conditions that could be harsh for an electronic instrument (roughly handled, left on a hot car seat for a day, etc.) it is a good idea to periodically check the DIGIMET 3000 against a known accurate standard. To insure accuracy it is recommended to return the Digimet 3000 to the factory for re-calibration once per year.

Unit Initialization

The DIGIMET 3000 leaves the factory with the following initial settings:

Storage Memory Cleared
Time Frame = 1 sec
LCP = 6.5" Hg
Display Units = " Hg
Type Pulsation - Single
Auto Shut-off set at 10 minutes

Auto-Zero

When the DIGIMET 3000 is set to the Vacuum Level Function with no input, it will auto-zero. See section on Auto-Zero for further details.

HARDWARE SPECIFICATIONS

This section describes the DIGIMET 3000 hardware design.

Microprocessor

The DIGIMET 3000 uses a Motorola microprocessor to provide the system functions. The microprocessor runs at 4.0 Mhz.

Power Subsystem

The power system is supplied by four AA alkaline batteries.

Vacuum Sensing

The external vacuum source is attached to the DIGIMET 3000 via a male luer quick-disconnect fitting attached to the port labeled VACUUM.

Electronic Pulsation Input

The electronic pulsation input is designed to accept an oscillating voltage between 0 and 24 DC volts at a maximum of 40.0 Amps. The polarity of the input signal is rectified to guarantee that all voltages are positive. An RC filter is used on the input to eliminate sharp voltage spikes that occur during solenoid switching.

DIGIMET PRINTER

The Digimet Printer is an OmniPrint OM190 Serial Printer which uses a AC wall transformer to supply it with power. Its operation as it relates to use with the Digimet 3000 will be outlined here.

Digimet Printer Settings

The Digimet Printer is set at the WDR factory for use with the Digimet. Those settings are:

Baud rate = 9600

Data Bits = 8

Parity = NONE

Stop Bits = 1

Digimet Printer Operations

The Printer uses adding machine 2 1/4" inch rolls of paper. The printer ribbon is an **Epson HX-20 cartridge ribbon**. These items can be obtained at WDR or at your local stationary/computer store.

The Digimet Printer will need to be connected to the provided AC transformer which is plugged into 120 AC power.

See the section on CABLES to determine the properly cables to use with the Printer and Digimet.

Digimet Printer to be used with the Digimet 3000

The Digimet Printer unit consists of the printer

and power supply. The paper roll and printer ribbon are stored within the printer enclosure.

To turn the printer on – press the ON button (ON button blinks **green**).

To turn the printer off – press and hold the OFF button until the FEED button blinks **red**. (the button blinks once, quickly)

When printing, the ON button appears solid **green**.

After printing, the FEED button will need to be pressed to see all that has printed.

Note: If, when initiating printing, nothing happens, do one or all of the following: 1) Make sure there is saved data in the Digimet 2) Make sure the Digimet Printer is ON 3) Make sure the connector at the Digimet and at the Digimet Printer are snug 4) Turn off the Digimet Printer and the Digimet and start over.

To open the printer to change paper or to change the print ribbon, lift the top cover up. To close, lower the top cover and press slightly forward to close completely.

Paper rolls are 2 1/4 inch (57 mm) wide and are adding machine paper rolls. If the roll is too tight in the printer compartment it might be necessary to remove some of the paper from the roll.

To run a printer test, turn off the printer then press the FEED button and the ON button at the same time. When the printer stops printing the first time while running the printer test, press the FEED button, again. The instructions to do so appear below the tear edge of the printer.

Note: Sometimes lights may appear dim on the printer but you can determine whether or not the unit is on by pressing the FEED button. If the printer feeds paper, unit is ON, if not, the unit is OFF.

SOFTWARE

Two programs are provided with the Digimet 3000, one a Windows program and the other a DOS program. The Windows program called BigTree Digidata.exe is for uploading, displaying and printing data from the Digimet 3000. The DOS program, BigTree Upload.exe is for uploading data from the Digimet 3000 to a computer, ONLY. It is provided as a secondary method for uploading data from the Digimet.

Computer Requirements

1- in order to upload data from the Digimet to the computer an unused **COM** port is needed on the computer. All cables provided with the Digimet and Digimet Printer would require a **9-pin male com port** at the computer. As long as there is an unused com port, adapters can be found to ultimately connect to the needed 9-pin connectors of the Digimet cables. (USB to serial 9-pin connectors can also be used)

To Upload data from the Digimet to a computer:

1. Collect and Store data in the Digimet.
2. Connect the Digimet and the computer with the 6' computer cable. One end connects to the Digimet serial port. The other end connects to the computer's 9-pin serial port (com port).
3. Use either the DOS program Upload.exe or the WINDOWS program Digidata.exe.

DOS program Upload.exe

The Upload.exe program is a DOS program used to upload data from the Digimet to the computer. The Upload.exe program is supplied on the computer disk which accompanies the Digimet. It can be loaded to your hard drive by entering at

the prompt

```
>COPY A:\UPLOAD.EXE C:\
```

To run the program, either in DOS or a Dos window in WINDOWS, simply get into the proper directory and type in UPLOAD. Follow the commands on the screen. The default file name for your file to be uploaded is upload.dat, but you can name your files what ever you want. Other sections in this manual will explain what commands are used in the Digimet to upload data to the computer; Print/Upload, Upload/Print all data, Upload Graphic Data, Print Graph and Print Limping data.

When you are ready to upload data to the computer, run upload.exe. The screen will indicate that it is waiting for data. **Note: If, before you initiate the Digimet to send data, you see a few characters on the computer screen, start the procedure over.** Then press the appropriate keys on the Digimet. When the Digimet has completed the upload, press the Enter key on the Computer to close the file. Your upload.dat file or what ever you have named it will be ready to be viewed, printed etc. To determine when uploading is complete see section **When is Uploading complete.**

When using upload.exe, the default name is upload.dat but you can change this to anything you would like. Now, if you are saving a number of files then you would change the upload part to something else or you would continually save over your existing file. You could name them graph1.dat or dairy.dat. You do not need to keep the .dat ending, either.

WINDOWS program DigiData.exe

The WINDOWS program is on the disk provided with your Digimet and can be

loaded into your computer by running the Setup program. This section will outline all the functions of the program.

Click on the Digimet icon to run the program.

To view data, open a file that has been previously uploaded and saved or upload data by using the commands at the right hand side of the display.

Upload Item

From the Digimet screen in any of the four functions, choose Print/Upload. Select the item by choosing your labeled or timer-stamped item. The next screen will indicate that after pushing the Enter key you will send data to the Digimet. BUT, before taking that last step, put the computer program into the Upload mode, to accept the data from the Digimet, by clicking the **Upload** Item command in the upper right corner of the screen. At this point, the command button on the computer will have changed to Done Upload Item and will be highlighted in red. Now, press the Enter key on the Digimet. As soon as the option screen appears on the Digimet this is the signal that the Digimet has completed the send. Now, on the computer screen, click the Done Upload Item. This will place the data in the computer and in the appropriate function screen. See section on CABLES in order to properly hook the Digimet to the computer.

Viewing Data

The Digimet data can be viewed in either a standard format or grid format. This choice is made in the Menu item, VIEW. In the Standard Mode, the number of the Tab will be red if there is data in the storage item. You can use the mouse or arrow keys to move to different tabs.

Notes

The window below the main window in the Standard Mode is used for notes referring to the item chosen. Notes only appear in the Standard viewing mode. Notes will appear on the print-outs. In the dual pulsation storage mode, only one set of notes is available for a dual chamber pulsator.

MENU

File - New

Start a new file.

File - Open

Open files that contain data that has been previously uploaded from the Digimet. The files end with .dm3. Only that type of file (.dm3) will be retrieved into the digidata program for display of numeric data.

File - Save As

Files that can be saved have a .dm3 ending. When saving numeric data, the file must end with .dm3. The Save BMP command saves a bitmap graphic picture of the graphs that are displayed in this program. One note, they are big files approximately 250k bytes.

It is not necessary to save graph files as BMP files. This would only be necessary if you wished to save graphs to view in other programs. The .dgr graph files, which can be viewed by the DigiData.exe program are redisplayed each time from the original data .dgr files. Also, to save a file as a .BMP, you must be viewing a graph file on the computer screen with the Display Graph command.

File – Set Printer Font

Use this feature to obtain the most desirable printout.

File - Print

The following are print options to the printer attached to your computer:

Print Vacuum Level Data in either a standard or grid format. Print Pulsation Electronic data. Print Pulsator Ratio data in dual or single display mode. The dual print will include comparisons of the two chambers of the dual pulsator. Print the Milk/Rest ratio data in grid format. The next to last print option is Print Graph. This will print the graph that is displayed with Display Graph. The Start time of the printed graphs is indicated at the left corner of the graph. The graph increments is also indicated at the bottom of the graph. Graph increments are 250 milliseconds. A graph printout is shown on page 47. The last Print option is Print Limping Data and consists of the Limping data calculations.

File - Exit

Exit the DigiData program. A warning window will appear recommending that the numeric data be saved to a file.

Options - Label Data Set

Label data file with up to 16 characters.

Options - Set Com Port

Com port 1, 2, 3 or 4 can be used to upload data from the Digimet. If the wrong Com port is set or the one chosen is presently in use by some other device, like the mouse, the program will exit if you press the Upload Item, Upload All, Upload Graph, Rec. archive data command buttons. This is the Com port that you will use to connect the Digimet to the computer.

Options - Type Pulsation

This option only effects the Pulsator Ratio and the M/R ration functions. In the Dual mode the items are labeled 1A-1B etc., in the single mode the items are labeled 1, 2, 3 etc. when viewing the standard viewing mode. In grid viewing mode, in single mode the items are listed one after the other. In the Dual mode, each two items are compared.

Options - Graphing

This allows you to set the following options for graphs 1) Minimum and Maximum lines will appear on the graphs, 2) the number of Y axis ticks can be chosen and 3) vertical grid lines can be used.

Options – Set Pulsator Limits

Refer to page 27 of this manual for information about setting pulsator limits. Same limits can be set in the Digidata program as in the Digimet 3000 Version 4.0 unit. In the Digidata program the terms Max. Vac / P - Maximum and Max. Vac / P – Minimum are referring to the terms MaxHiV/PIs and MinHiV/PIs in the Digimet 3000. All other terms are the same as appear in the Digimet 3000 Utility Menu – Set Pulsator Limits.

Options – View Pulsator Limits

This will show the limits that have been set for the corresponding pulsator parameter.

View Grid or Standard

Grid view or standard view are the choices.

View Inches Hg or kPa # IMPORTANT #
When measurement units are set to inches of Hg or set to kPa in the

Digimet 3000, the corresponding measurement should be clicked here so that the proper calculations take place regarding the indication of whether or not a value is acceptable or outside the limits set in Options – Set Pulsator Limits menu item. The Default is set to Inches of Hg.

Graph Settings

When the graph screen is visible ie. the Display Graph command is pressed and a graph is being viewed then by pressing the menu item Graph Settings, the min/max “Hg and the start and finish times for the graph can be chosen.

Help

Displays phone number for assistance which is 1-800-635-6413 or 949-598-9700 or Fax 949-598-9075 or email info@sentinelproducts.com.

At the right side of the screen are 7 command buttons. Note: Two of the command buttons **Send to D. Printer** and **Rec. archive data** are not used.

Upload Item

This command is used to accept the uploaded data from the Digimet when the Print/Upload command is entered on the Digimet. The Print/Upload command appears in the Options Menu of each of the four functions, Vacuum Level, Pulsator Ratio, M/R Ratio and Pulsation Electronic. Here are the steps for Upload Item (Print/Upload data from the Digimet): 1) Hook up Digimet to computer using 6 foot computer cable with 9-pin connectors on each end. 2) With both the computer and the Digimet ON, go to the Print/Upload command in the Function you wish to Upload, pressing Enter will take you to the Menu to choose the specific item you wish to upload. The

next screen will say Send Slot 01 (with the label indicated) Enter to send. Menu to exit. Before you go any further, go back to the computer and press the Upload Item command button. This will ready the computer for the transfer of data. Pressing the Enter key, now, on the Digimet will send data to the computer. As soon as the screen is back to the Options Menu (the Digimet), this is the signal that the transfer is complete. On the Digimet, the words **No Clear to Send** may appear at the bottom of the screen (the Digimet). This is perfectly normal. As the buffer fills up in the receiving machine (Digimet Printer or computer) this signal will appear. **Now if these words stay indefinitely then there probably is something wrong with the connection. See the section on Troubleshooting.** Then press the same command on the computer which now reads (in red) Done Upload Item. At this point the upload has taken place and the Digimet data will be in the appropriate storage area in the computer program. For example, if you are viewing the Standard View then the tab number of the storage item uploaded will be highlighted in red. If you click on the tab the data will appear in the window in the center of the screen. If you are viewing the grid view then the data will appear under the appropriate column number. This would be the procedure for each item that you wished to upload. This data along with other uploaded items can be saved to a file using the File - Save As - Save As (data, archive files). These files can be saved with a .dm3 ending. Dm3 files can be viewed again on the computer by File-Open. Only dm3 files can be viewed on the computer screen. **See section on Saving Files.**

Upload All

In the Utility Menu of the Digimet there is the **Upload-Print all Data** command. This will upload all the numeric data at the same time from the Digimet to the computer.

First, connect the Digimet and the computer,

Second, press Upload All command on the computer screen, Third press Upload-Print all Data item number 1 in the Digimet Utility Menu. As soon as you do this, the word Menu to abort will appear at the bottom of the Digimet screen. When that goes away the Digimet has completed the send. Now, press the Upload All command, (which is now Done Upload All. in red) on the computer screen.

Note: If you have a Digimet version 3.0 and above, do the First step as listed above, but continue with the Second step here:

Second, Press the **Upload All** command button on the DigiData screen. The caption on the button will change to **Press Enter-Digimet**. Press the Enter key on the Digimet. The caption on the button on the DigiData screen will change to **Uploading**. When the computer and Digimet are done uploading, the program will **beep** and the caption on the button will change to **Press here-Done**. Press the button and the Digimet 3000 data will appear in its respective slots in the DigiData program.

Note: If you are uploading just a few items, for example, 2 Vacuum Level items, you may need to press the Enter key a few times to get the button to change from **Press Enter-Digimet** to **Uploading**.

All your data will now be in their

appropriate slots in the program. Note: This data is now in the computers memory to save it you must go to File - Save As - Save As (data, archive files) and save data to a file. These files can be saved with a .dm3 ending. Dm3 files can be viewed again on the computer by File-Open. Only dm3 files can be viewed on the computer screen. See section on Saving Files.

Upload Graph

This command is for uploading graphs from the Digimet to the computer meant for display on the computer. Let me explain, the Digimet stores two types of graphs, 1) graphs for display on the Digimet Printer and 2) graphs for display on the computer monitor. Graphs viewed on the computer monitor could also be printed to the **computers** printer.

Graphs are transferred from the Digimet using the Upload Graphic Data command in the Digimet Utility Menu. The Upload Graphic Data command would be chosen in the computer and the graph would be saved as a .dgr file in the computer. This graph can be displayed on the computer screen with the Display Graph command.

The Upload Graphic Data command on the computer screen is specifically for graphs that will be viewed on the computer screen and **not** graphs that will be printed to the Digimet Printer.

Upload graphic data from the Digimet to the Computer using the following steps:

1. Connect the 6 foot serial cable to the Digimet and the computers serial port.
2. Open the Digidata program.

3. Go to the UTILITY MENU item 2 Upload Graphic Data on the Digimet.
4. Press Enter on the Digimet.
5. Choose your Graph to upload on the Digimet.
6. Press Enter on the Digimet, one time.
7. Press the Upload Graph button on the Digidata computer screen, the button will change to "Press Digi then Here".
8. Press Enter on the Digimet one more time.
9. Press the "Press Digi then Here" button. Button changes to "*****Uploading." As uploading is taking place this button will change to "*****Still Uploading". When uploading is completed the button will say "**Done Uploading". The Save Graphic file window will then appear. Choose a name for your graph file and be sure it ends with .dgr.
10. Press the OK button in the Save Graphic files window.
11. Your graphic file has been uploaded from the Digimet and saved as a computer file.

Display Graph

Use the Display Graph command on the computer screen to display a saved graph. You will be asked for the file name. All graph files for display are saved as .dgr files. After choosing the file name the graph will appear on the screen. While a graph is being displayed the Display Command button changes caption to Close Graph and is in red. Choose Close Graph to close. **If Graph Settings (see**

below) have been changed re-display the graph using the Regraph button which is located next to the Close Graph button.

While a graph is being displayed, the Menu item **Graph Settings** at the top of the screen is enabled. By clicking on this item, four graph variables can be set. 1) Maximum vacuum level 2) Minimum vacuum level 3) Start time for the graph and 4) Finish time for the graph. The reason for Start and Finish times is because the Digimet can store up to a 10 second graph but you don't have to view the whole graph on the computer screen. You can look at just a portion of the graph by setting Start and Finish times. To remove the graph variables from the display click on Graph Settings again.

Send to D. Printer

Not Used

Rec. archive data

Not Used

Graph data

When a graph is being displayed on the computer screen, pertinent data regarding the graph appears in a window in the lower right area of the computer screen. This data also prints out with the graph when printed.

Saving Files

This section will explain what different computer files are saved when using the software for the Digimet 3000.

.dm3 files - These files can be viewed in the Windows program DigiData.exe. They are the numeric data files.

.dgr files - These files would be graphic data files that are uploaded to the

computer using the **Upload Graphic Data** Utility Menu command and meant for viewing on the computer display either with the Windows program DigiData.exe or another computer program. (See the section on **Use of other programs**.)

When is Uploading complete?

This section will explain when uploading has been completed.

1) When using the Print/Upload item from the Digimets Option Menu after you have chosen the item to upload, you will be in the Send Slot screen of the Digimet. After you press the Enter key, the Digimet will send the data. When the Option Menu screen re-appears, uploading has ended.

2) Using Upload-Print all Data from the Utility Menu, when you initiate sending data on the Digimet by pressing the Enter key, the bottom line on the Digimet screen will say "Menu to abort". When this line goes away, uploading is complete. Note: If the message "No Clear to Send." appears and remains on the screen, then there is a problem with the connection, possibly the computer is not on or the com port is not the correct one.

3) Upload Graphic Data - See the previous section titled **Upload Graph**.

Use of other programs

Other communication programs can be used to receive data from the Digimet into the computer. The Digimet utilizes the serial communication standard EIA-232, formerly RS-232. Settings would need to be Baud rate=9600, Data BITS=8, Parity=None and Stop Bits=1. The data is sent in ASCII format.

Once data is transferred to the computer either with another communication

program or with the DOS program provided, other spreadsheet, wordprocessing etc. programs could be used to view the data. Also, the graph files that are sent to the computer by using the Upload Graphic Data command in the Digimet can be viewed by other graphing programs.

CABLES

There are two types of cables that are provided:

A six-foot computer serial cable with a male 9-pin D-sub connector at one end and a female 9-pin D-sub connector at the other is provided with the basic Digimet package and would be needed for any uploading to a computer.

The other cable is used with the Digimet Printer. The Digimet Printer cable is a short cable with a 25-pin male at one end and a 9-pin male connector at the other. This cable connects to the Digimet's serial port with the 9-pin end. The other end connects to the Digimet Printer (the 25-pin male end).

Note: A 9-pin female com port is necessary on the computer. If a 9-pin connector is not available, adapters can be obtained from your local electronics store. When hooking up cables to the Digimet 3000, the Digimet Printer or your computer serial port, it is not necessary to turn them OFF.

PARTS LIST

Standard Carrying Case	DM3-FCASE
Large Carrying Case	DM3-LCASE
5/32" Plastic tubing	DM3-TUBING5/32
Needle connector	DM3-16-01
Stainless needle	DM3-17
Acrodisc filters	DM3-15
Plug (vacuum port)	DM3-16-06
Male Quick Disconnect luer fitting	DM3-16-03

Banana Plugs (both red & black)	DM3-08
Grommet (at vacuum input)	DM3-14
Batteries (4 AA)	DM3-19-01
Pipe fitting (1/8-27 NPT to 5/32)	DM3-PIPE
Pipe fitting plug	DM3-17-02
Pulsator fitting	DM3-18
Computer cable 6'	DM3-COMPC6
Printer cable	DM3-PCABLE
Dust cover 9-pin	DM3-DUSTC
AC transformer	DM3-ACTRANS
Digimet Printer	DM3-PRINTER
Digimet Software Disk	DM3-DISK

MISCELLANEOUS

Tapping Holes for vacuum test points

Tapping holes for pipe fitting DM2000-17-01 (1/8-27 NPT fitting) can be accomplished as follows:

A 1/8-27 NPT fitting requires a 11/32" tap drill, then tap threads with a 1/8-27 NPT tap. Pipe threads are tapered. This usually requires a tapered reamer, which is not necessary for thin, soft materials such as plastic pipe. When tapping, do not go too deep. It's easy to do so in thin pipe walls.

Comparing Electronic and Pneumatic Pulsation

Electronic and pneumatic pulsation readings will differ because of the following:

1) Since the electronic wave is a square wave and the pneumatic wave is sloped, the calculated ON/OFF ratios will differ to a small degree.

Depending on where ON time (milk time) is calculated on the pneumatic wave, for example, the ratio will be affected. In the Milk/Rest function, the user selects the Liner Collapse Point, affecting the point on the wave at which the ratio is calculated.

2) Pulsation-chamber vacuum does not move as quickly as an electronic voltage signal.

3) Condition of the liner and other rubber goods may influence readings.

4) Finally, the pulsators may not be operating properly due to air leaks, etc.

Cleaning

The DIGIMET 3000 can be externally wiped clean with a damp cloth and mild dishwashing soap. Tubes should be periodically flushed with water to remove milk residues.

Acrodisc filters are provided to protect against the intrusion of milk onto the transducer membrane. If milk is allowed to enter the unit and to dry, performance of the DIGIMET 3000 most likely will be affected. If milk gets into the transducer inlet, immediately rinse it out in the following manner: Using a syringe, shoot a small amount of rubbing alcohol, GENTLY into the vacuum port. IMPORTANT: DO NOT INSERT THE NEEDLE FURTHER INTO THE PORT THAN THE FACE OF THE UNIT (I.E., ONE SHOULD STILL BE ABLE TO SEE THE NEEDLE POINT). DOING SO MAY CAUSE DAMAGE TO THE TRANSDUCER MEMBRANE. Let the alcohol drain out. Rubbing alcohol is preferable to water because water will leave a residue plus, alcohol will evaporate fairly quickly while water will not.

Use of Stainless Needle

When using the needle to puncture rubber components, be sure the inside of the needle is absolutely clear of obstructions. A thin piece of wire can be used to clear the inside of the needle of any obstruction once the needle has been inserted into the rubber component.

Obstructions, i.e. small pieces of rubber inside the needle, will affect readings.

Serial Number

The DIGIMET 3000 serial number is located on the back of the unit at the bottom of the label. It also appears on the initial screen when the unit is turned on.

Configurations

The Digimet 3000 is sold in a few different configurations depending on the users' requirements.

Basic Digimet 3000:

This package includes the Digimet 3000, Standard Carrying Case, tubing & accessories, computer cable, computer software disk and manual.

Digimet 3000 Complete:

This package includes the Digimet 3000, Large Carrying Case, Digimet Printer, AC wall transformer, tubing & accessories, printer cable, computer cable, computer software disk and manual.

The following items can be purchased separately:

Digimet Printer:



Side view

Large Hard Carrying Case: This case can hold the Digimet 3000, accessories, the Digimet Printer & cables and the AC wall transformer.



Packing List

Depending on the configuration purchased, your shipment could include different items.

Items included with your **Basic DIGIMET 3000** packaging.

1. DIGIMET 3000
2. Standard Fabric Carrying Case with strap
(continued on next page)

Inside compartment or laying on face of DIGIMET 3000:

(1) 4' length of plastic 5/32" tubing with small hose clamp and Acrodisc attached.

Small container includes:

- (3) plastic tie wraps – for attaching Acrodisc filters to the tubing. Tighten tie wrap, then cut off excess.
- (3) needle connector
- (1) Acrodisc filters
- (1) Stainless needle
- (1) 1/8-27 NPT fitting
- (1) 1/8-27 NPT plug

Also enclosed in case:

- (2) "T" Pulsator fitting
- (1) Set of banana plugs (red and black)
- (4) AA Alkaline Batteries
- (1) Computer cable 6'

3. Outside of carrying case, inside shipping box:

- CD with computer software
- Operator's Manual

Additional accessories could include the following:

Digimet Printer - Printer, AC wall transformer and printer cable.

Large Hard Carrying Case with carrying strap

Trademarks

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Troubleshooting

Error #380 - If you get this error when trying to display a graph, the digidata.ini file is missing, possibly. It should be in the same directory that the digidata.exe program resides. If, for some reason, the DigiData.ini file gets corrupted, there is an original copy which can be used which is located on the distribution disk. Also, this error may mean that the file path length is too long for the graph title. The graph title is limited to 80 characters.

Not a .dgr file - If you get this message when trying to load a graphic file into the DigiData program - **Upload Graph**, it may be that you saved a file and gave it a dgr ending, but it is not a real .dgr file. Or you are trying to load a file that does not end in .dgr.

Default Pulsator Ratio parameter limits:

Bfluct Max – 1.00, MaxHiV/PIs – 13.00
MinHiV/PIs – 12.00, MinVac/PIs – 0.00
MaxAPhase – 150 ms, MinAPhase – 80 ms
MaxBPhase – 560 ms, MinBPhase – 480 ms
MaxCPhase – 150 ms, MinCPhase – 80 ms
MaxDPhase – 250 ms, MinDPhase – 200 ms
Max PPM – 62.0, Min PPM – 58.0

L. J. Engineering, Inc. has set these default values because in their opinion these parameter limits fall within the acceptable ranges which they are most familiar with. These default values are in no way cast in stone. We would recommend that the user of the Digimet 3000 consult their equipment dealer, the company that provides their equipment, the manufacturer of the equipment and/or dairy equipment consultants, etc., to determine the best values for their equipment and systems.

Graphs & Printouts

The following pages will examine the different printouts that can be printed with the Digimet 3000 and the Digimet Printer. Refer to other parts of this manual for information on printer operations and correct hook-up to the Digimet 3000.

Printed material can be obtained by using the commands listed below:

From each of the function's Option Menu, the **Print/Upload** command will print numeric data for each item stored similar to Recalling an item and viewing it on the Digimet 3000 display. The data listed below is a representation of the information that would print from a stored Vacuum Level item:

All numeric printouts will have a similar format.

VACUUM LEVEL				Function
Barn #1 at trap				Label (up to 16 characters)
Location	Timer			Location refers to slot storage number
01	01:52:47			Timer stamp
Ave	12.01	"Hg		Ave, Max Min and Fluc data
Max	12.03	"Hg		
Min	11.99	"Hg		Fluctuation time frame
Fluc	0.04/	1 sec period		

The Pulsator Ratio Function data printout is shown below:

PULSATOR RATIO

Function heading

If no label is chosen then this space will appear blank.

Location Timer
 01 01:56:55

Location
 Timer stamp

A+B 49.9% 582 msec
 C+D 50.1% 584 msec
 B Fluc 0.11"Hg
 Max/P 12.00"Hg
 Min/P 0.00"Hg
 A 4.8% 56 msec
 B 45.1% 526 msec
 C 8.9% 104 msec
 D 41.2% 480 msec
 Total 1166 msec
 PPM 51.4

Function data

The Milk/Rest Function printout data appears below:

MILK/REST RATIO

Function heading

Pulsator A

Label

Location Timer
 02 02:01:04

Location and Timer stamp

Ratio 50/50
 Pulses/Min 51.8
 Max/P 12.00
 Min/P 0.00
 Milk 50.3%
 Milk 582 msec
 Rest 49.7%
 Rest 575 msec
 LCP 6.50"Hg
 Total: 1157 msec

Function data

The following is print-out data for the Pulsation Electronics function:

PULSATION ELECTRONICS

Function heading



Box #2

Label



Location Timer
01 02:03:05

Location slot and timer stamp



On 50.3%
Off 49.7%
Max/p 24.3Volts
Min/p 0.0Volts
Pulses/Min 51.7

Function data



To obtain a print-out of all the numeric data stored in the Digimet 3000, at one time, use the Utility Menu item **1 Upload-Print all Data**. This is item 1 in the Utility Menu. All the data will print out, one item after the other.

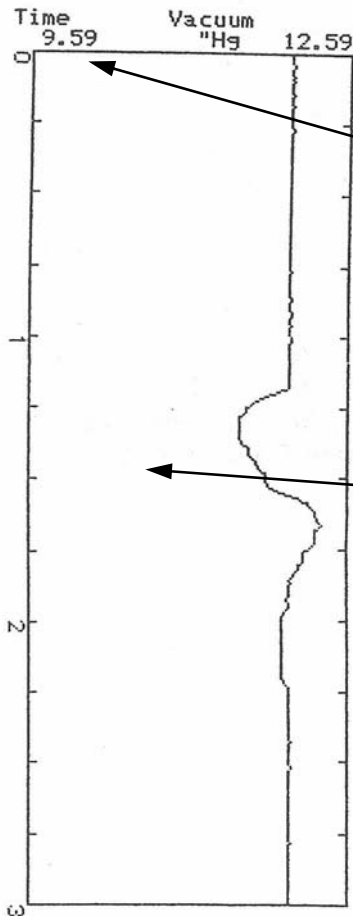
Graphs can be saved in each of the three pneumatic functions; Vacuum Level, Pulsator Ratio and Milk/Rest Ratio. To print the graphs to the Digimet printer use the item **3 Print Graph** in the Utility Menu.

A Vacuum Level graph and associated numeric data is shown below:

```
VACUUM LEVEL
MY BARN
Location  Timer
V01      01:55:45
Ave 11.99 "Hg
Max 12.29 "Hg
Min 11.53 "Hg
Fluc 0.76/ 3 sec period
```

The numeric data is listed in the same manner as the Vacuum Level print-out data on the previous page.

Note: This graph has a 3 second Fluctuation time frame and also a 3 second graph. It is not mandatory that this be done in this manner **but it is recommended, because the Min, Max and Fluc. figures will then directly be represented in the graph.**



At the top of the graph there are two vacuum level figures. They represent the span of the graph ie the minimum vacuum level that can be represented on the graph and the maximum level that can be represented on the graph. **These figures are not the min. and max. of the data.**

Vacuum Level graphs will indicate a minimum span of 3 "Hg or its kPa equivalent if the min. and max. vacuum levels are within a 3 inch span. Otherwise the minimum and maximum borders of the graph will be .3 above maximum and .3 below minimum.

Tick marks are indicated each 250 milliseconds and each second is marked by a numeral.

The Ave. figure in Vacuum Level graphs is for the last 500 milliseconds of the graph period and not the average for the entire graph period.

A Pulsator Ratio graph and associated numeric data is shown below:

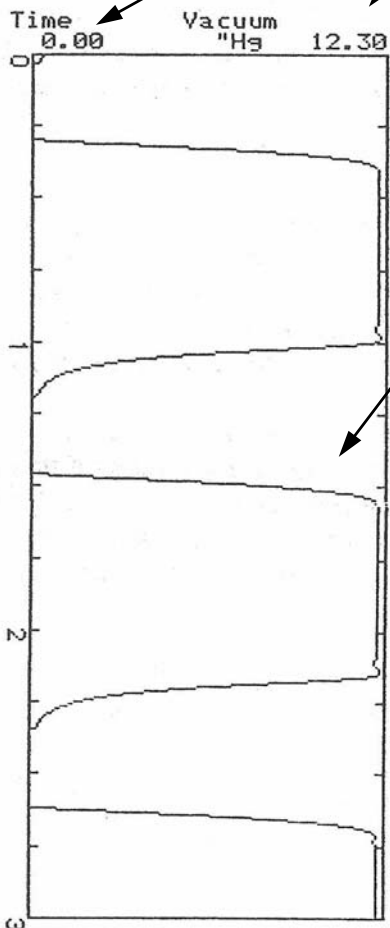
```

PULSATOR RATIO
1ST PULSATOR
Location  Timer
P02      02:00:27

A+B 59.4%    693 msec
C+D 40.6%    472 msec
B Fluc 0.12"Hg
Max/P 12.00"Hg
Min/P 0.00"Hg
A 4.9%      58 msec
B 54.5%     635 msec
C 8.9%      104 msec
D 31.7%     368 msec
Total: 1165 msec
PPM 51.5
    
```

The numeric data is listed in the same manner as the Pulsation Ratio print-out data on the previous page.

The minimum and maximum borders of the graph are indicated at the top. The maximum border will be .3" Hg above the maximum obtained vacuum level. If the minimum goes to 0.00 then the minimum border will be 0.00. Otherwise, the minimum will be .3"Hg lower than the minimum obtained vacuum level.



Tick marks are indicated each 250 milliseconds with each second indicated by a numeral.

Note: The numeric data at the top of the print-out, A+B, C+D etc. is calculated from the last complete waveform which appears on the graph. This means that if part of the last pulsation waveform is cut-off then the numbers represent the complete waveform preceding it.

Since there is no Fluctuation time frame in the Pulsator Ratio function it is not necessary to match the Fluctuation time frame from the Vacuum Level function with the graph period desired for Pulsator Ratio graphs.

A Milk/Rest Ratio graph and associated numeric data is shown below:

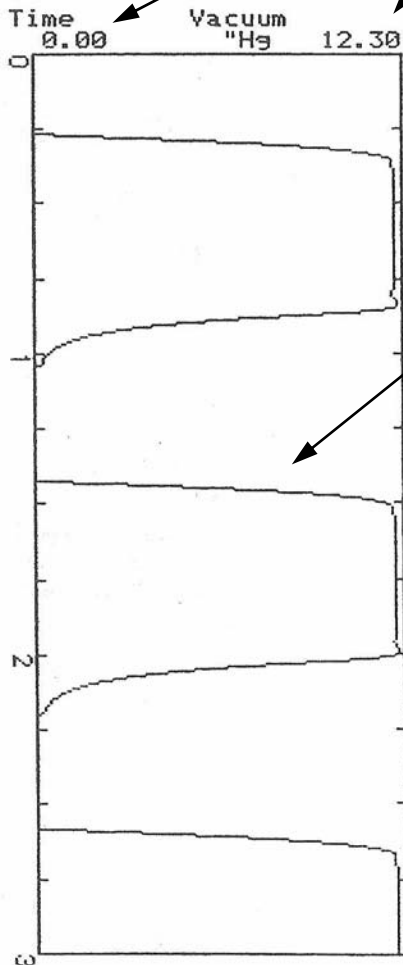
```

MILK/REST RATIO
M/R
Location  Timer
M03      02:02:01

Ratio 50:50
Pulses/Min 51.7
Max/P      12.00"Hg
Min/P      0.00"Hg
Milk       50.4%
Milk       585 msec
Rest       49.6%
Rest       574 msec
LCP        6.50"Hg
Total: 1159 msec
    
```

The numeric data is listed in the same manner as the Milk/Rest Ratio print-out data on the previous page.

The minimum and maximum borders of the graph are indicated at the top. The maximum border will be .3" Hg above the maximum obtained vacuum level. If the minimum goes to 0.00 then the minimum border will be 0.00. Otherwise, the minimum will be .3"Hg lower than the minimum obtained vacuum level.



Tick marks are indicated each 250 milliseconds with each second indicated by a numeral.

Note: The numeric data at the top of the print-out, Ratio, Milk% etc. is calculated from the last complete waveform which appears on the graph. This means that if part of the last pulsation waveform is cut-off then the numbers represent the complete waveform preceding it.

Since there is no Fluctuation time frame in the Milk/Rest Ratio function it is not necessary to match the Fluctuation time frame from the Vacuum Level function with the graph period desired for Milk/Rest Ratio graphs.

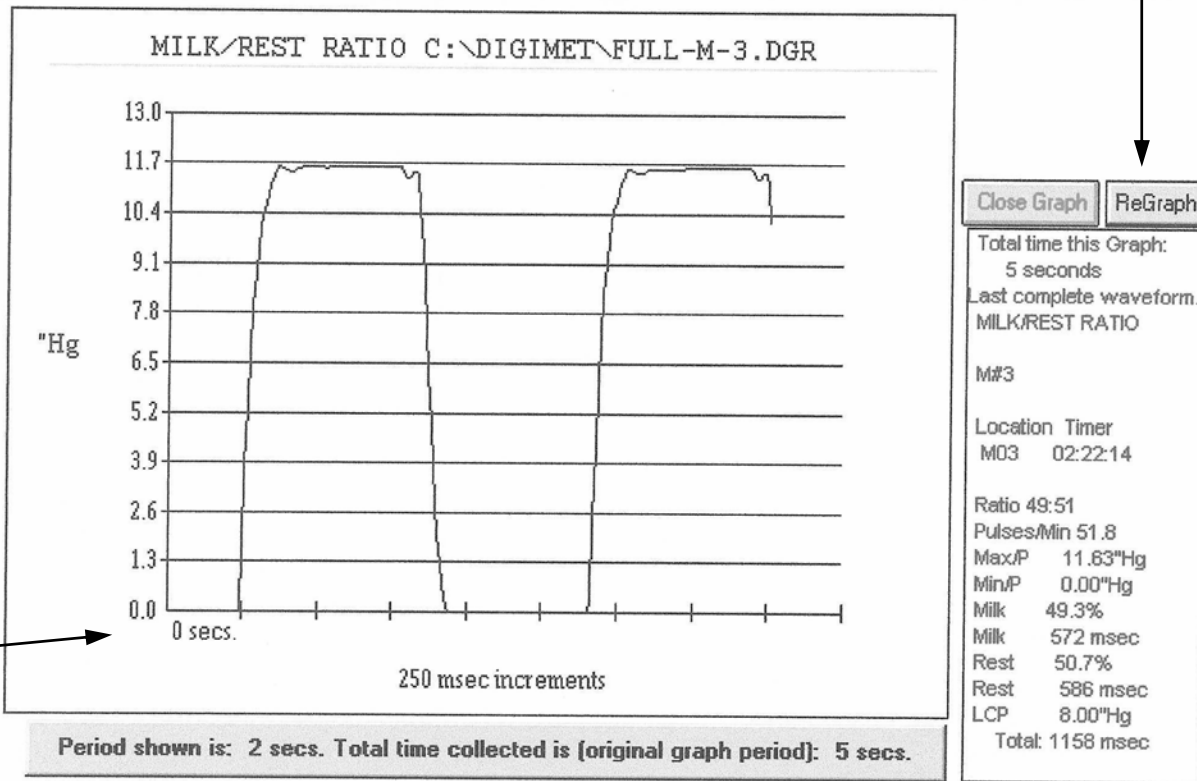
Graphs - computer

Graphs can be saved and/or printed from the DigiData Windows program in a couple of ways. Use Print Graph, which is a menu item under the File heading, to print viewed graphs, or save a graph as a bitmap file (.bmp) to view in other programs or print from other programs.

The graph below is a representation of a viewed and/or printed graph in the DigiData computer program:

Heading consists of the function and the saved file name.

If graph parameters are changed, **Regraph** will show the new look of the graph.



Start time is indicated and increments are 250 milliseconds.

Period of graph shown and original recorded graph period are indicated.

Associated data calculations are printed here.

Quick Reference Guide for the Digimet 3000

1. **View data real-time** - Press On/Off key, then use arrow keys to choose function, press the Enter key at the desired function, view all data by scrolling with arrow keys.

2. **STORE (numeric data)** - From function, press Menu key to enter OPTION MENU. Use arrow keys to choose the Store choice in the Menu. Press the Enter key and STORE screen will appear. Choose desired storage slot by using arrow keys. Press the Enter key. Choose a label or don't choose a label, then press the Menu key. Item is stored.

3. **PRINT (numeric data) - Printing single item:** From OPTION MENU use arrow keys to choose Print/Upload choice and press Enter. The PRINT screen will appear. Use arrow keys to choose item to print. Press the Enter key. Next screen indicates which slot will be sent to the printer. Make sure the Digimet Printer is hooked up and ON. Press the Enter key. Item will Print. **Printing all numeric data:** Use arrow keys to go to item 5 in the Function Menu - the Utility Menu and press Enter. You will be at item 1 Upload-Print all Data. Make sure the Digimet Printer is hooked up and ON. Press the Enter key. All items will Print.

4. **STORE (graph)** - In any pneumatic function go to OPTION MENU by pressing the Menu key when in the function. Use arrow keys to choose the Store Graph choice in the Menu and press Enter. The GRAPH storage screen will appear. Use arrow keys to choose slot. Press the Enter key and choose label or don't choose a label. Press the Menu key. Next screen will indicate number of seconds to graph. Use arrow keys to choose seconds. Press the Enter key. Storage for the amount of seconds chosen will begin. When blinking R disappears, storage is complete.

5. **PRINT (graph)** - Use arrow keys to go to item 5 in the Function Menu - the Utility Menu. Press the Enter key then use arrow keys to choose item 3 Print Graph. Press the Enter key and choose item to graph with arrow keys. Press the Enter key. Screen will appear indicating "Press Enter to start graphing. Menu to exit." Be sure Digimet Printer is ON. Then, press the Enter key. Printing of the graph will begin.

6. **UPLOAD (numeric data - single item)** - Go to the OPTION MENU in any of the functions and use the arrow keys to choose the Print/Upload choice in the Menu. Press the Enter key and the PRINT screen will appear. Choose the item to Upload. Press the Enter key and the next screen will indicate the slot that will be

uploaded. Make sure the DIGIMET DigiData WINDOWS program is running and the Digimet is hooked up via the 6 foot computer cable to the computers serial port. On the computer display, click on the Upload Item command button upper right corner. This prepares the computer to accept the transmission from the Digimet. The Digimet still indicates the Send Slot screen. Press the Enter key on the Digimet. When the OPTIONS MENU reappears the transmission is Done. Click the Done Upload Item command button in the upper right corner of the computer screen. Item has been uploaded. To save data in a computer file, click File - Save As, then click Save As (data, archive files), then choose file name. Remember to save Digimet data files with a .dm3 ending. Then click OK. File is saved.

7. **UPLOAD (numeric data - all)** - Go to item 1 Upload-Print all Data in the UTILITY MENU. Make sure the DIGIMET DigiData WINDOWS program is running and the Digimet is hooked up via the 6 foot computer cable to the computers serial port. On the computer screen, click on the Upload All command button upper right corner. The caption on the button will change to **Press Enter-Digimet**. Press the Enter key on the Digimet. The caption on the button on the DigiData screen will change to **Uploading**. When the computer and Digimet are done uploading, the computer program will beep and the caption on the button will change to **Press here-Done**. Press the button and the Digimet 3000 data will appear in its respective slots in the DigiData computer program.

Note: If you are uploading just a few items, for example, 2 Vacuum Level items, you may need to press the Enter key a few times to get the button to change from **Press Enter-Digimet** to **Uploading**.

To save data in a computer file, click File - Save As, then click Save As (data, archive files), then choose file name. Remember to save Digimet data files with a .dm3 ending. Then click OK. File is saved.

8. **UPLOAD (graph)** - Connect the 6 foot serial cable to the Digimet and the computers serial port and open the Digidata program.

Go to the UTILITY MENU item 2 Upload Graphic Data on the Digimet. Press Enter on the Digimet. Choose your Graph to upload on the Digimet. Press Enter on the Digimet, one time. Press the Upload Graph button on the Digidata computer screen, the button will change to "Press Digi then Here". Press Enter on the Digimet one more time. Then press the "Press Digi then Here" button on computer screen. The button changes to "*****Uploading." As uploading is taking place this button will change to "*****Still Uploading". When uploading is completed the button will say "**Done Uploading".

The Save Graphic file window will then appear. Choose a name for your graph file and be sure it ends with .dgr. Press the OK button in the Save Graphic files window. Your graphic file has been uploaded from the Digimet and saved as a computer file.

Digimet Printer to be used with the Digimet 3000

The Digimet Printer unit consists of the printer and power supply. The paper roll and printer ribbon are stored within the printer enclosure.

The printer must be connected to a power source (120 VAC) to function.

To turn the printer on – press the ON button (ON button blinks **green**).

To turn the printer off – press and hold the OFF button until the FEED button blinks **red**. (the button blinks once, quickly)

When printing, the ON button appears solid **green**.

After printing, the FEED button will need to be pressed to see all that has printed.

Note: If, when initiating printing, nothing happens, do one or all of the following: 1) Make sure there is saved data in the Digimet 2) Make sure the Digimet Printer is ON 3) Make sure the connector at the Digimet and at the Digimet Printer are snug 4) Turn off the Digimet Printer and the Digimet and start over.

To open the printer to change paper or to change the print ribbon, lift the top cover up. To close, lower the top cover and press slightly forward to close completely.

Paper rolls are 2 ¼ inch (57 mm) wide and are adding machine paper rolls. If the roll is too tight in the printer compartment it might be necessary to remove some of the paper from the roll.

The print ribbon is an Epson HX-20 cartridge ribbon. These can be obtained from LJE or a local stationary/computer store.

To run a printer test, turn off the printer then press the FEED button and the ON button at the same time. When the printer stops printing the first time while running the printer test, press the FEED button, again. The instructions to do so appear below the tear edge of the printer.

Note: When the unit is plugged into a power source the Mode button will be **green** whether or not the unit is ON or OFF. To determine whether or not the unit is on, press the FEED button. If the printer feeds paper, unit is ON, if not, the unit is OFF.



1. LIMITED WARRANTY: Seller warrants that the goods delivered shall be free from defects in material and workmanship for a period of one (1) year from the date of Seller's shipment. Seller's sole obligation and Buyer's exclusive remedy for defects in the goods shall be limited, at Seller's option, to either repair or replacement of goods determined to be defective. Transportation and any other delivery costs to return defective goods to Seller for repair or replacement shall be the responsibility of Buyer. Any claim by Buyer must be made by Buyer to Seller in writing within five (5) days of the discovery of the claimed defect but in no event after the expiration of one (1) year from the date of Seller's shipment, whichever is less. Buyer's failure to so notify Seller of such defects within the above time periods shall bar Buyer from any remedy under this Warranty, or for recovery of damages or losses due to defects in the goods. Any return of goods shall be subject to the prior written approval of Seller.

THIS WARRANTY IS THE SOLE WARRANTY COVERING THE GOODS AND SELLER MAKES NO OTHER WARRANTY OF ANY KIND, WHETHER EXPRESS, IMPLIED OR STATUTORY, AND ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE ARE HEREBY DISCLAIMED BY SELLER AND EXCLUDED FROM THIS WARRANTY. IN NO EVENT SHALL SELLER BE LIABLE FOR CONSEQUENTIAL, COMPENSATORY, PUNITIVE OR INCIDENTAL DAMAGES HOWSOEVER ARISING FROM SELLER'S PERFORMANCE OF THIS CONTRACT OR THE PERFORMANCE OF THE GOODS.

This Warranty shall not apply to goods which have been repaired or altered by other than authorized representatives of Seller or to damage or defects caused by accident, vandalism, Acts of God, erosion, normal wear and tear, improper selection by Buyer or others, and other causes beyond Seller's control. This Warranty shall not apply to the misapplication, improper installation, or misuse of the goods caused by variations in environment, the inappropriate extrapolation of data provided, the failure of Buyer or others to adhere to pertinent specifications or industry practices, or otherwise.

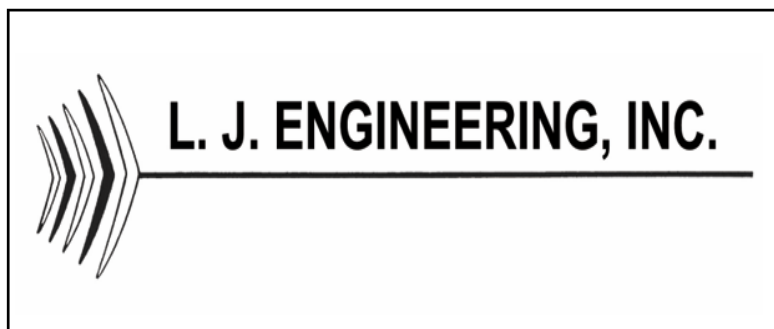
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