

SONO-GRADER[®] USER'S GUIDE

MODEL 2

MANUAL VERSION 4.7a
CODE VERSION 4.6

THIS PAGE FOR YOUR NOTES

TABLE OF CONTENTS

GENERAL OVERVIEW	2
THE KEYPAD	3
SONO-GRADER DATA FIELDS AND RECORDS	4
FIELD NAME ABBREVIATIONS	4
THE STARTUP SCREEN	5
ACCESSING AND INTERPRETING MAIN AND SETUP MENUS	5
FACTORY SETTINGS FOR MAIN AND SETUP MENUS	5
MAIN AND SETUP MENUS (See Flowchart #1)	6
THE IDENTIFICATION SCREEN	10
WORKING WITH THE IDENTIFICATION SCREEN	10
EDITING	11
FAT MEASUREMENT STRATEGIES AND DISPLAY MODES	11
SENSITIVITY SETTING (See Flowchart #5 for display example)	15
GENERAL TESTING PROCEDURE	15
ENTERING WEIGHT	15
MEASUREMENT TECHNIQUE	16
P1 MEASUREMENT	16
P2 MEASUREMENT	16
LOIN MEASUREMENT	18
P3 MEASUREMENT	18
PERCENT LEAN CALCULATION	18
DOCKING STATION	19
OPTICAL LINK	20
CONNECTING THE DOCKING STATION TO A COMPUTER	20
TRANSFERRING DATA TO PC USING SONO-GRADER SOFTWARE	21
DATA TRANSFER PROCESS	21
CONNECTING DIRECTLY TO A PRINTER	22
THE DATAFILE	23
THE SONO-GRADER ASCII DATAFILE FORMATS & EXAMPLES	23
9-PIN TO 25-PIN RS-232 TRANSLATION TABLE	24
ELECTRONIC SCALES	25
BACK VIEW OF SONO-GRADER	27
CHANGING BATTERIES	28
CARE AND CLEANING	28
SONO-GRADER SCALE CABLE DATA	29
PREGNANCY TESTING WITH THE SONO-GRADER	30
SETTING THE PREGNANCY WINDOW	33
SENDING DATA TO COMPUTER AND PRINTER	33
APPENDIX A	34
INITIALIZATION AND CALIBRATION (Flowchart #8)	34
SKIN, FAT, AND LOIN CALIBRATION	34
CERTIFICATION AND COMPLIANCE	37

GENERAL OVERVIEW

Please take the time to study this manual! The SONO-GRADER® is a highly versatile product, but it cannot do what you want, until you tell it what you want.

The RENCO SONO-GRADER is a microprocessor-based battery operated data acquisition device. Though its primary application is for use with swine, it can also be used with certain other mammals. It utilizes A-Mode ultrasonic technology to measure backfat and loin muscle depth and also for pregnancy detection. Data storage capacity is 2,000 animals. Data can be transferred either to a computer or printer. Provision is made to record, display, and store the following information: Animal Identification, Pen Number, User-defined Code, Weight, Loin depth at P2, Backfat depth at sites P1, P2, P3, and Pregnancy status. Sequentially incremented record numbering is provided. The operator manually enters the Animal Identification, Pen, and Code numbers. Weight can be entered either by using the keypad or automatically acquired from a supported electronic scale. Fat and Loin and pregnancy tests are determined ultrasonically. Either SI (metric) or English units can be selected.

Most features can be selected or deselected. The instrument can be programmed to:

- 1) Subtract from 0-9mm of skin thickness.
- 2) Alter the effective speed of sound factor by $\pm 50\%$ for fat and loin tissues, each independently of the other. **Therefore, if the SONO-GRADER fat/loin readings do not match those of another device you wish to use as your standard for accuracy, you can adjust the readings to match it.**
- 3) Adjust for pregnancy detection in a number of mammals other than swine.

Data can be edited both during and after entry. The user can program the instrument to detect pregnancy or to measure backfat and loin muscle depth. For fat/loin testing, the user can enable or disable all data collection except Animal Identification number, and fat measurement at site P2. User can select whether Weight data is collected before or after fat/loin measurements.

Three strategies for fat measurement are provided: 1) “**2 fat layers**”, 2) “**3 fat layers**”, and 3) “**Last fat layer**”. Two modes are available for displaying fat and loin measurements: 1) **Numerical** display, which provides numeric readings (See Flowcharts #2 and #3), and 2) **Graphical** display—a graphical analog display which also includes numeric readings (See Flowchart #5).

A high quality membrane keypad with tactile feedback is used for maximum resistance to adverse environments and for increased user friendliness. The action is initiated when a key is pressed rather than released. Key presses must be firmly made and be held slightly longer than with a typewriter—about .1-.3 secs. Use only *fingertips, never sharp, hard, or small-diameter objects.*

Backlighting can be turned on to aid in viewing the LCD display screen in low light level environments. Measurement data is displayed in large double-high digits, for easy reading from a distance.

NOTE: This User's Guide is continually updated. The manual version is on the cover. The number at the upper right corner of the display shown on page 3, indicates the Sono-Grader “firmware”, i.e. program version, to which this manual applies.



THE KEYPAD

ENTER (ON)

Turns on. Stores information displayed on the screen, and advances to next screen. Two keys are provided for convenience of both left and right handed users. In this manual, "ENTER" refers to either of these keys.

OFF

Turns instrument off. Stored data is not lost. Battery saver circuit automatically turns instrument off 10 minutes after last key press.

DISP

Turns display backlight on/off. Battery consumption with backlight on is twice that when off.

C

Correction key.

Q

Provides decimal point when entering weight manually. Enter/exit graphical display mode. Enter calibration mode.

PGM

Displays Main menu.

CURSOR

Blinking box in display.

SONO-GRADER DATA FIELDS AND RECORDS

A “**field**” is a number having one or more digits. In some cases the data is entered automatically, in other cases the operator enters it with the keypad. All of the data collected for one animal is called a “**record**”. Records are automatically numbered sequentially. A collection of records is called a “**database**”.

All SONO-GRADER fields have names. They are as follows: **Record Number**, **Animal ID Number**, **Pen Number**, **Code Number**, **Weight**, **P1**, **P2**, **P3** (refers to fat measurement sites), **Loin**, and **Status** (refers to pregnancy).

FIELD NAME ABBREVIATIONS

Due to space limitations in the display screen, the field names given above are abbreviated as shown in the first column below. These abbreviations are also defined in the flowcharts provided in this manual. This table does not include all screen abbreviations, just those that represent data fields. Other abbreviations are defined where they are discussed in the text.

FIELD NAME	DEFINITION	COMMENT
AN#, A#	Animal Identification Number	Entered by operator.
PEN#, P#	Pen Number	Entered by operator
REC#	Sequential Record Number	Increments automatically. Is not included in datafile.
Code#, Co	1 or 2 digit number	User-defined. Can be used for any purpose.
Ln, L	Loin muscle thickness	Either mm <u>or</u> inches
Wt, W	Weight	Either mm <u>or</u> inches
P1, P2, P3	Standard fat measurement sites at shoulder, 10 th rib, and ham.	

THE STARTUP SCREEN

When the SONO-GRADER is turned on by pressing ENTER, an internal diagnostic is performed. If the diagnostic test is successful, the **Startup** screen displays until the key is released. (See Flowchart #1.) This screen includes the program version number and serial number.

ACCESSING AND INTERPRETING MAIN AND SETUP MENUS

Before using the SONO-GRADER for the first time, you will probably want to customize its features to suit your needs.

Assuming instrument is off, press ENTER. When key is released, the **IDENTIFICATION** screen displays. Press **PGM** to display the **Main** menu, then press **4** to display the **Setup** menu. Press the numeric key associated with a feature to change it. “**Y**” is equal to; “Yes”, “On”, “Active”, “Enabled”. “**N**” is equal to; “No”, “Off”, “Disabled”. Flowchart #1 illustrates all customizable features. The **Main** menu can be entered only from the **IDENTIFICATION** screen, which displays at the beginning of each testing sequence.

FACTORY SETTINGS FOR MAIN AND SETUP MENUS

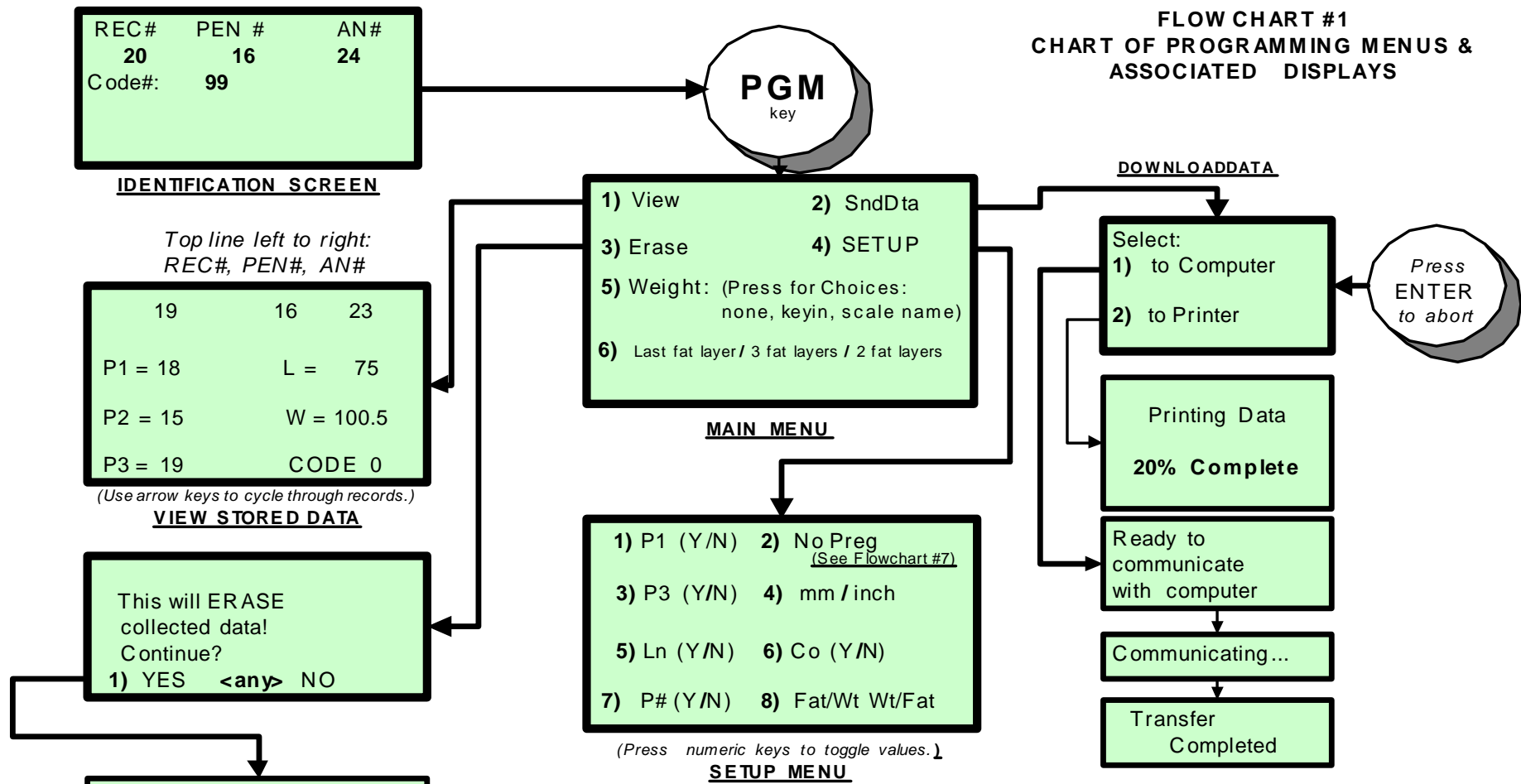
The SONO-GRADER is shipped with the features below set as indicated. The options are explained in the two tables that follow this one and in Flowchart #1. Pressing the key number selects other options.

FEATURES	FACTORY SETTINGS
Main Menu:	
5) Weight	Keyin (Manual data entry)
6) Fat measurement strategy	Last Fat Layer
Setup Menu:	
1) Enable P1 measurement	Y(es)
2) Disable Pregnancy test	NoPreg
3) Enable P3 measurement	Y(es)
4) Measurement system	mm (SI Metric)
5) Enable Loin measurement	Y(es)
6) Enable Code numbers	Y(es)
7) Enable Pen numbers	Y(es)
8) Selects whether weight is entered before or after fat/loin measurements	Wt/fat (Weight is entered before fat and loin measurements. See Flowchart #2.)

MAIN AND SETUP MENUS (See Flowchart #1)

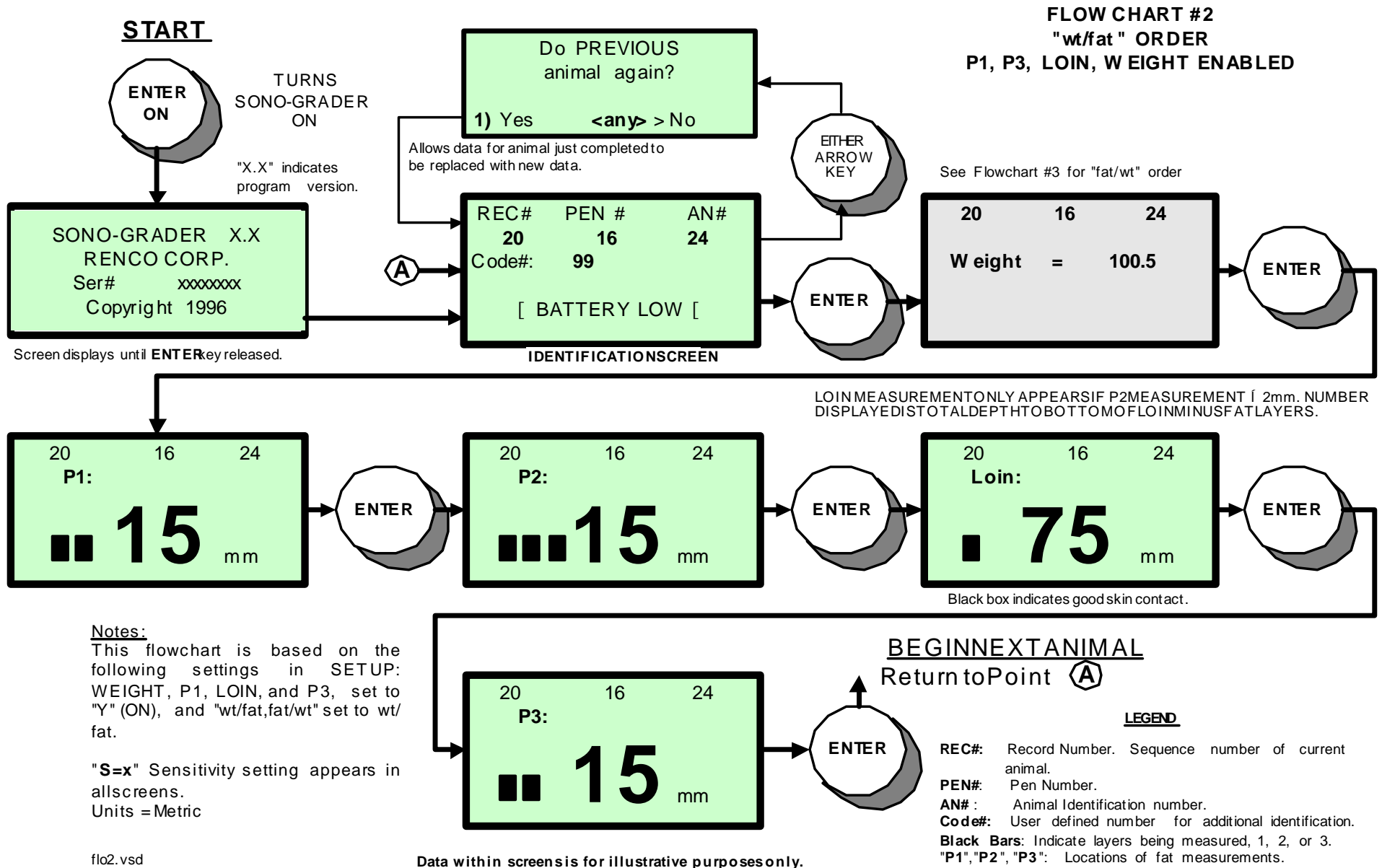
Main Menu		Functions
1	View	Displays stored records, one animal at a time. Use "ARROW" keys (↶ or ↷) to move from one record to another. When record #1 is displayed, the left arrow takes you to the highest numbered record, i.e. the most recent animal stored. ENTER returns to IDENTIFICATION screen.
2	SndDta	Sends the stored data to 1) a personal computer or 2) a printer. (This process is described in detail later in this manual.)
3	Erase	ERASES all stored records. After pressing 3 , confirmation screen appears. Press 1 to <u>confirm</u> or press any other key to retain the stored records. <u>This is the only way that all stored data is removed.</u> (Settings are not affected.)
4	Setup	Displays Setup Menu (described later).
5	Weight	Selects one of the supported electronic scales, manual weight entry ("keyin"), or disable weight recording ("none"), in which case the WEIGHT entry screen, shown on Flowcharts #1 & #2, will not appear. Pressing the "5" key repeatedly, cycles through the choices.
6	Strategy	Selects one of three strategies for determining total fat: " 3 Fat Layers ", " 2 Fat Layers ", " Last Fat Layer ". These will be described later.

Setup Menu:	Functions
1	Enable/disable P1 fat measurement.
2	Enable/disable Pregnancy testing. (Note: Weight, Fat, and Loin measurements are <u>disabled</u> during pregnancy testing.)
3	Enable/disable P3 fat measurement.
4	Selects Metric (mm), or English (inch), for fat/loin measurements.
5	Enable/disable Loin measurement.
6	Enable/disable Code number entry.
7	Enable/disable Pen number entry.
8	Selects whether Weight will be entered <u>before</u> , (wt/fat), or <u>after</u> , (fat/wt), fat and loin measurements. (See Flowcharts #2 and #3.) Also controls the order of appearance in the datafile. <i>Reminder:</i> If Weight option in Main menu is set to " none ", weight display will not appear.

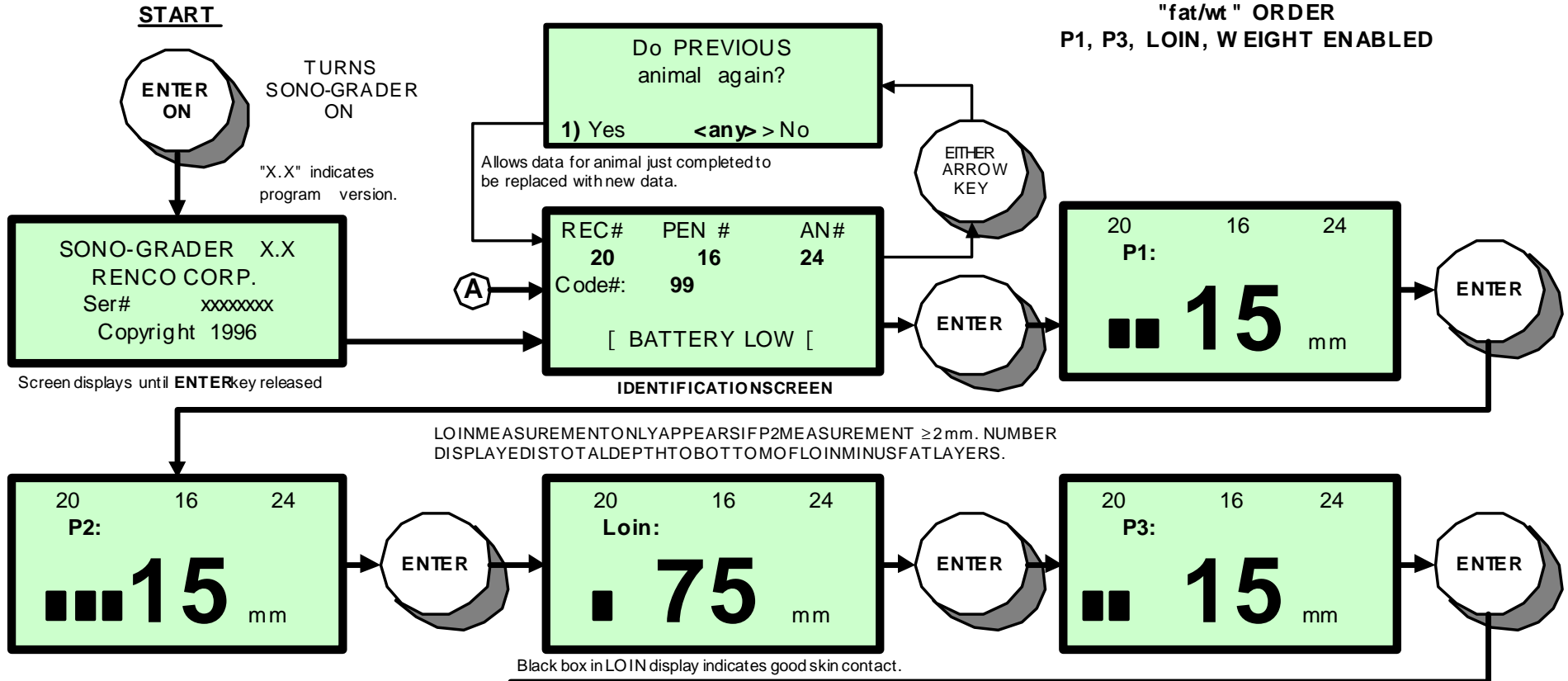


NOTES:
Main Menu Option 5, "Weight":
 "none" means no scale. No weight display is shown.
 "keyin" indicates that keyboard is used to enter weight.
Main Menu Option 6: See text.
Setup Menu:
 "Y" enables option, "N" disables option.
Option 7: Selects if displays include both PEN# and AN# or only Animal#.
Option 8: Selects if Fat and Loin measurement is done before or after Weight entry.

LEGEND
 P1, P2, P3: Fat measurement sites
 L, Ln Loin
 P# Pen Number
 A#, AN# Animal Number
 SndDta Send Data
 W, wt Weight
 CODE, Co User defined number
 flo1a.vsdRENCOCORPORATION©1997



FLOW CHART #3
"fat/wt" ORDER
P1, P3, LOIN, W EIGHT ENABLED



Notes:

This flowchart is based on the following settings in SETUP: CODE#, WEIGHT, P1, LOIN, and P3, set to "Y" (ON), and "wt/fat,fat/wt" set to fat/wt.

"S=x" Sensitivity setting appears in all loin and fat screens.

Units = Metric

flo3.vsd©2005RENCO CORPORATION

See Flowchart #2 for wt/fat order

Data within screens is for illustrative purposes only.

LEGEND

- REC#:** Record Number. Sequence number of current animal.
- PEN#:** Pen Number.
- AN#:** Animal Identification number.
- Code#:** User defined number for additional identification.
- Black Bars:** Indicate layers being measured, 1, 2, or 3.
- "P1", "P2", "P3":** Locations of fat measurement.

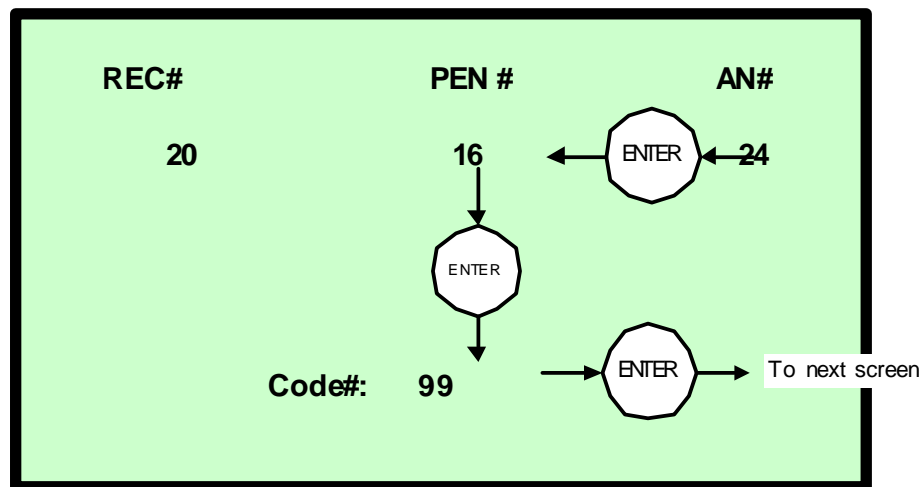
THE IDENTIFICATION SCREEN

(See Flowcharts #1 & #4.) The **IDENTIFICATION** screen follows **Startup** screen and provides for entry of the **Animal Identification Number (AN#)**, and if enabled, **Pen Number (PEN#)**, and **Code Number (Code#)**.

If power is low, “[**BATTERY LOW**] ” warning is displayed. Note that sometimes batteries may be fine, but are not making good contact. Turn instrument off and try rolling the batteries, or remove batteries and wipe contacts and battery ends with a soft cloth. If successful, warning will not reappear when instrument is turned back on. Warning is set to appear when batteries have about 15 minutes of useful life remaining, provided backlighting is off.

WORKING WITH THE IDENTIFICATION SCREEN

FLOW CHART #4 IDENTIFICATIONSCREEN



You enter numbers as you would with an adding machine or calculator—most significant digit first. When the display is first presented, the cursor is on the least significant digit of the **AN#** (Animal Number) field. The operator enters up to a 4-digit identification number. **ENTER** stores number and cursor moves to the least significant digit in **PEN#** (Pen Number) field, where up to a 4-digit number can be entered if desired.

ENTER stores number and the cursor moves to the least significant position of the **CODE#** (Code Number) field, where up to a 2-digit number may entered if desired. **ENTER** stores number and the next screen displays.

Either or both **PEN#** and **CODE#** fields can be disabled. Disabled fields do not display; so after Animal number is entered, cursor goes to next enabled field or screen.

EDITING

The “**C**” (correction key) can be used to delete the number just entered. When the cursor is at the **AN#** position, pressing the **left** arrow key will present an option to redo the previous record. (“**Do the PREVIOUS animal again?**”).

If selected, data for the previous animal, will be cleared and **IDENTIFICATION** screen will then display the Record number for previous animal. If not selected, i.e. any key other than “**1**” is pressed, the **IDENTIFICATION** screen is re-displayed.

For example: You are currently working with Record **#50**, and have entered data for **AN#** and **PEN#**. The cursor is now in **CODE#** field. You discover that you made an error in regard to the animal in Record **#49**. You must complete **ALL** of the entries for Record **#50**. The cursor is now in the **AN#** field for Record **#51**. Press the left Arrow key to delete and redo Record **#50**, and once again to delete and redo Record **#49**.

Pressing the “**C**” key after storing **P1**, **P2**, or, **P3**, takes you back to the beginning of the respective screens. But, since the **P2** reading and **Loin** reading are related, pressing the “**C**” key after doing the **Loin** measurement, takes you back to the beginning of the **P2** screen.

FAT MEASUREMENT STRATEGIES AND DISPLAY MODES

The data is presented in either of two modes: **Numerical**, illustrated in the fat and loin displays in Flowcharts #2 and #3, and **Graphical**, illustrated in Flowchart #5. The operator can quickly switch between either mode at anytime by pressing the **Q** key. Please take a moment to examine these displays now.

There are three strategies for measuring the total backfat in swine.

3 fat layers

2 fat layers

Last fat layer (Recommended)

Important: Regardless of what strategy is used, the graphical display presents ALL of the echoes received by the instrument. However, the numbers displayed for depth, will ONLY be those appropriate for the strategy in use. Likewise in the numerical display, the number of black bars will be representative of all the echoes received, but the number indicated will be restricted to the strategy being used.

To illustrate: When using the **3 fat layers** strategy, the SONO-GRADER will display a **numeric** result only if it has captured three fat layers. It will not display a numeric result if it has only captured two fat layers, (thus it cannot be used for measurements at **P1** & **P3**, which do not have the third layer). However, **all** of the echoes received will be displayed as bars. This feature enables the operators to see what they actually have. So, when using **2 fat layers** strategy, if a third layer is detected, then all three major echoes will be displayed (3 bars in the Numeric display and 3 major bars in the Graphical display), but only the depth to the bottom of the second layer will be displayed in numbers.

A hog has 3 layers of fat at **P2**, but in some thin animals, the third layer is very thin and difficult to determine. In those cases if the third layer is considered

unimportant, the **2 fat layers** strategy can be used to save time. The **Last fat layer** strategy can be used for all cases, such as with a very thin animals where it is difficult to distinguish the first layer from the hide, or when measuring the shoulder (P1) or ham (P3), but probing adequate to indicate the true depth may take longer to achieve.

Measurements at **P1** & **P3** may only be made using **2 fat layers** or **Last fat layer** strategies. (**Last fat layer** operation is described below.)

1) 2 and 3 Fat Layers Strategies with Numerical Display Mode

The total number of layers found is indicated by the number of black bars displayed. For 2 fat layers, the total depth of fat is shown to the bottom of the second layer. (If a third bar is shown, then 3 layers were detected, but only the depth to the bottom of the second layer is given.) For 3 fat layers, depth is given to the bottom of the third layer, but if only 2 black bars are shown, then there will be no depth given, since no third layer was detected. When the operator is satisfied that the best reading is being displayed, the result can be stored by pressing ENTER. Instruments are shipped configured for **3 fat layers** and **graphical** display mode.

2) 2 and 3 Fat Layers Strategies with Graphical Display Mode

When any of the fat (or loin) measurement screens are displayed, the user may press the Q key which changes the display to a graphical analog style presentation, similar to an A-Mode display on an oscilloscope. (An A-Mode display is a series of vertical “spikes”, as opposed to a “picture” presentation.) **Flowchart #5** illustrates this mode. Pressing the Q key again, returns to **numerical** display mode.

A reading is not valid until **2** or **3** echoes have been received. When only **1** echo has been received, a vertical bar will be displayed, but the numeric reading in the lower right corner of the display will be entirely blank and nothing can be stored. When **2** or **3** echoes have been received, then **2** or **3** vertical bars will be displayed and the complete numeric reading in the lower right corner will indicate the depth of the vertical bar farthest to the right. This reading can be stored.

3) Last fat layer Strategy with Graphical Display Mode

This method, unique to the SONO-GRADER, does not rely on the number of layers. Instead, it searches for and displays the distance to the bottom of the deepest fat layer found within the lower and upper limits set by the user—the “**WINDOW**”. For optimal operation, this strategy depends upon a knowledge of the range of fat to be encountered within the herd, for example 10-20mm (\approx 4-.8 in.). The **window** restriction applies only to the numeric readings at the lower right on the screen. All echoes received including those outside of the restriction range, will still appear, so that the operator can see the total picture. (Note that the use of the window is not mandatory and the strategy can be used with it set fully open, i.e. to the full range of the instrument, thus effectively eliminating it.) See “**WINDOW FEATURE**” in Flowchart #5 for additional details. As noted, the **lower** and **upper** limits are set by using the **left and right arrow** keys respectively. The window setting feature is available for all fat sites and for both **graphical** and **numerical** display modes, but only when the Last fat layer strategy is in use.

4) Last fat layer Strategy with Numerical Display Mode

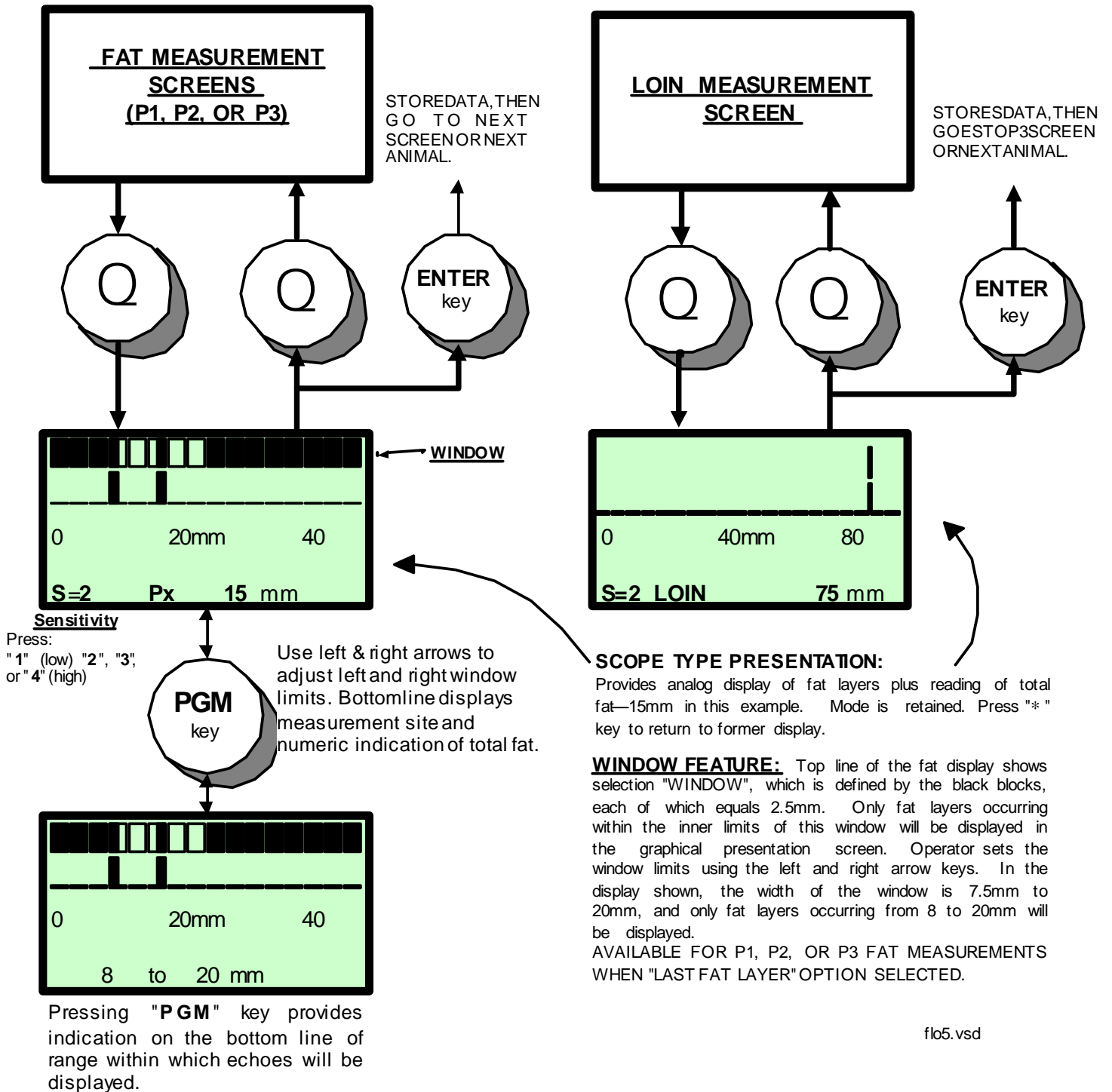
This is similar to #3 above, except that the operator needs to enter the **graphical** display mode once in order to set the window limits. After the window limits have been set, the user presses the Q key to return to the **numerical** display mode. Flowcharts #2 and #3 illustrate the **numerical** display of data. See “**WINDOW FEATURE**” in Flowchart #5 and the text in the preceding section.

Note: The **graphical** display presentation remains in effect for all measurements including Loin, *even though the instrument may be turned off*, until the operator returns to the **numeric** by pressing the Q key.

FLOW CHART #5
GRAPHICAL DISPLAY MODE AND WINDOW FEATURE

GRAPHICAL mode presentation is available for all measurements. WINDOW setting feature is available only for "Last Fat Layer" fat strategy.

LOIN APPEAR ONLY IF P2 MEASUREMENT IS > 2mm, AND LOIN MEASUREMENT ENABLED.



SENSITIVITY SETTING (See Flowchart #5 for display example)

The **Sensitivity** setting is abbreviated “S=” followed by a number from **1 to 4** in all displays. **1** is for small animals and **4** is for large animals. The **Sensitivity** settings for Fat, Loin, and Pregnancy are independent of each other. Using swine as an example, the following are probably the best places to start for average animals: **S=2 for Fat, S=3 for Loin, and S=3 for Pregnancy.** (These are the default settings.)

You can only change the Loin Sensitivity setting when in **Loin** mode, which only displays after the **P2** reading is entered. (Assuming Loin measurement is enabled in Setup.)

Use the desired number key to change the setting. Use the lowest setting that gives consistent results. The setting you choose is in effect regardless of the test site, display mode or strategy.

Sensitivity is too low when echoes are hard to find and too high when echoes run together.

GENERAL TESTING PROCEDURE

(Setup: P1, P2, Loin, P3=Y. Strategy = **3 fat layers.**)

Store animal identification information as described under “**WORKING WITH THE IDENTIFICATION SCREEN**”.

ENTERING WEIGHT

(Assumes: **Weight** set to **keyin** and **wt/fat** order. If set for **fat/wt** order, this section will take place after the **P3 Measurement** section below.)

Use the keypad to enter the weight observed from the scale. Entry may be made to one decimal place (if desired); press **Q** to enter the decimal point. Press **ENTER** to store and advance to the next display. Note: The weight entry is just a number and is not related to the measurement system (Metric or English) setting.

If **Weight** option is set to a supported electronic scale, the weight will be displayed, and keypad is not used. (See **CONNECTING TO AN ELECTRONIC SCALE.**)

Note: For all of the tests that follow, the graphical display mode can be used by pressing the **Q** key.

MEASUREMENT TECHNIQUE

The following is very important and applies to all fat and loin measurements.

Air and air bubbles stop ultrasound! The best technique is to use plenty of coupling fluid between probe and skin. Then move the probe around to displace air bubbles. If skin is very dry, allow a moment for the fluid to wet it. Without leaving the selected spot, hold the probe perpendicular to the skin and rock the probe with a small circular motion, thus causing the beam of ultrasound to scan the interior of the animal until the desired reading appears. Be sure to avoid undue downward pressure on the probe, as this will compress the tissues and yield readings that are erroneously thin.

After a reading is obtained, the operator's attention could be diverted from the animal in order to press the ENTER key to store data. In this situation contact between probe and skin could be lost. To reduce the possibility of data loss, the reading is maintained for **5** seconds. To alert the operator that contact has been lost, the echo bars will flash in **graphical** mode and will disappear in **numerical** mode.

Note: The reading made at each of the following screens, **P1**, **P2**, **Loin** and **P3** are not stored until the ENTER key has been released. The entry to be stored will be displayed until the ENTER key is released. (Though code V.4.2, the reading was stored when the key was depressed.)

P1 MEASUREMENT

The **P1** test site is at the shoulder, over the third rib, 6.3cm (2.5") from the backbone. When desired reading is obtained, press ENTER to store. The **P2** screen will then be displayed.

When the **Last fat layer** strategy is in use, the operator must set the window limits prior to making the test. Once the limits are set, they apply to **all** fat test sites until changed. Press Q to display the **graphical** mode. Use arrow keys to adjust window limits. Press, or press and hold, left arrow to cycle through low window limit. Use right arrow to select high limit. (See Flowchart #5.) It is recommended that the **graphical** display mode continue to be utilized, because more information is presented. However, if the **numerical** display mode is preferred, pressing Q will return to it. Apply probe as stated above. When the deepest reading has been achieved, press ENTER to store. The operator decides when correct reading has been displayed. Note that number of fat layers does not affect this reading. The only thing of importance is the deepest fat reading. This differs from the **2** and **3 fat layers** strategies that depend upon the presence of two or three fat layer separations.

P2 MEASUREMENT

The **P2** location is over the 10th rib, 6.3cm (2.5") from the backbone. **Find the P2 site and mark it—this exact spot must also be used for loin measurement.** Proceed as with **P1**.

Note that in order for loin measurement to be made, a fat reading of at least 2mm must be obtained. The loin measurement screen will be skipped if this minimum reading was not obtained.

After fat reading has been stored, the **Loin** screen will be displayed.

LOIN MEASUREMENT

(Reminder: The window setting feature has no effect on the loin muscle depth readings.)

Loin testing must be done at exactly the same P2 site. This is because the displayed loin measurement will be the total depth from which the SONO-GRADER will subtract the stored P2 fat measurement.

Note: Since displayed loin measurement equals total depth minus total fat, a valid reading for P2 of at least 2mm must have been stored in order for loin measurement to be made. If not, the Loin screen will not appear.

Note: Subtraction feature can be removed. See Flowchart #8. If removed, loin echo shown will be total of skin+fat+loin.

As you work the probe, observe the readings on the screen. (Note: you may need to adjust sensitivity. See section on "Setting Sensitivity") When you observe the greatest reading, press ENTER to store the measurement. The P3 screen will then be displayed.

See Appendix A for information about calibrating loin measurement.

Loin area at the P2 backfat site is often taken as 1cm of loin depth being equal to 1 square inch of loin area.

Whenever entering "LOIN MODE", instrument is automatically set to max sensitivity, s=4. Loin far side is easier to find using max sensitivity. Reduce to s=3 or possibly s=2 to get one unique reading. Going from LOIN to P3 or P2 resets sensitivity to max, s=4.

P3 MEASUREMENT

Locate and probe the P3 test site over the ham. Press ENTER to store.

The testing cycle for one animal is now complete and test data stored as one "record" in the SONO-GRADER memory.

The IDENTIFICATION screen is now displayed in preparation for next animal.

When data collection for all animals is complete, you can transfer stored data to a computer or a printer. (See OPTICAL LINK).

PERCENT LEAN CALCULATION

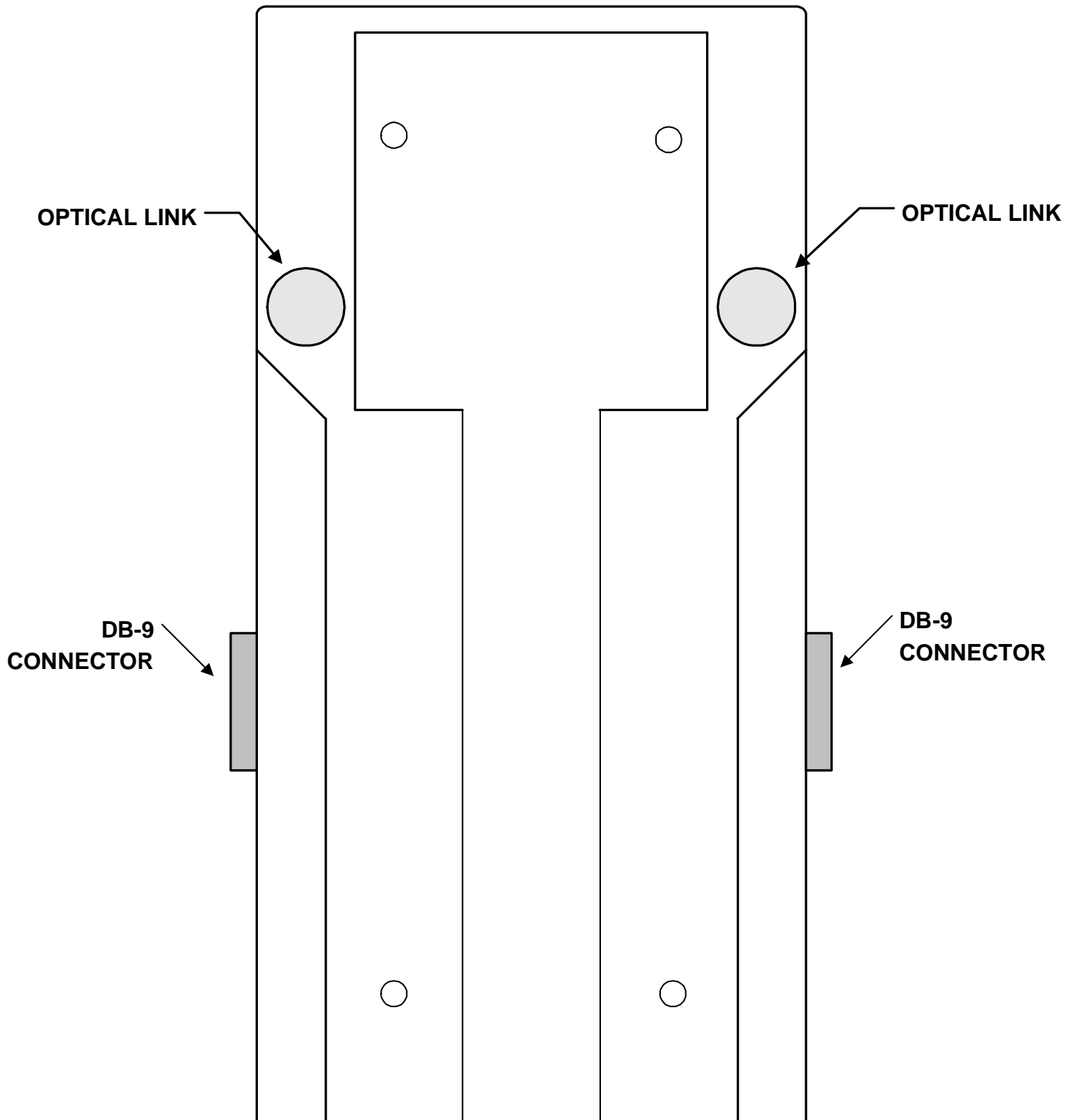
When data for **Weight, P2 and Loin** have been entered for a given animal, the percent lean will be calculated. The NSIF formula used is as follows:

$$\%YIELD = 37 - .042(\text{Weight in lbs.}) + .643(\text{Fat in mm}) + .286(\text{Loin in mm})$$

or

$$\%YIELD = 37 - .092(\text{Weight in kg.}) + .643(\text{Fat in mm}) + .286(\text{Loin in mm})$$

If all three data are present, the %Lean result appears in the 9th field in output datafile. If any are not present, the 9th field displays a 0.

DOCKING STATION**DOCKING STATION**

There are no user serviceable parts inside. Users may disassemble case (by removing 4 screws), to permit drilling such mounting holes as may be needed to mount docking station on scale, etc. Be sure that 2 optical link components mate with lenses when reassembling

OPTICAL LINK

The SONO-GRADER uses a dual optical link to communicate with peripheral equipment. One side of the dual link is located on the underside of the unit and appears as two semi-transparent lenses. The other is located on the docking stations. When the SONO-GRADER is placed in either of the two docking stations (which are identical), the four lenses in the system automatically align themselves. The lenses should be checked occasionally to be sure they are free from excessive dirt—small amounts of dirt should not affect them. Just wipe them with a soft cloth and warm—*not hot*—water.

During the data transfer process between the SONO-GRADER and any peripheral, the SONO-GRADER must remain in the docking station attached to that peripheral.

Note: The Model 2 uses infrared optical links, which is invisible to the eye. The Model 1 used visible light.

CONNECTING THE DOCKING STATION TO A COMPUTER

(Connector/cable nomenclature: DBxxy = industry standard connector style, number of pins, and pin type. y = M(ale) or F(emale). Example 1: DB25F means a DB connector with 25 Female pins. Example 2: DB9MF = a cable with a DB9F on one end and a DB9M on the other.)

In order for SONO-GRADER to communicate with a computer, scale, or printer, it must be placed in a docking station. One cable is furnished with the instrument to connect a docking station to computer, scale or printer. Only one peripheral at a time may be connected to a docking station. Each docking station has two 9-pin female connectors (type DB9F). Either connector—***but only one at a time***— can be used. The DB9M connector on the cable mates with either DB9F connector on the docking station. The DB9F connector on the cable mates with a DB9M serial port connector on a computer. An adapter is provided for adapting the DB9M to a DB25F connector, to mate with a DB25M, used on some PC serial ports. In some applications, a DB25M may be needed, and a 25-pin M-M “gender changer” is provided.

If you intend to use the instrument with both an electronic scale and a PC or printer, then you may wish to purchase an additional cable. You may either order it from the factory, or purchase it from a computer supply outlet by asking either for a “DB9MF Video Monitor Cable” or “DB9MF shielded cable”.

TRANSFERRING DATA TO PC USING SONO-GRADER SOFTWARE

The SONO-GRADER DOS-based software, is designed to run on an INTEL® compatible computer having an 80286 or higher CPU, having an RS-232 serial communications port, Microsoft® operating systems from DOS v.4.1, 5, 6, WINDOWS 3.1, 95, 98, 2000, ME, XP. It has not been tested with Linux. The program can be run from a floppy disk, but operation from a hard disk is assumed in these instructions. It is also assumed that the user has a reasonable familiarity with PCs.

Disk contents: **README.txt**, a text information file containing information not in the printed manual, **SONO.EXE**, the main data transfer program, **SCALE.EXE**, a program to load data for electronic scales, the **Data** files for various electronic scales. Installation consists only of copying the disk contents to a folder on the hard disk. The programs do not make use of the Windows® Registry or configuration files.

Be sure the SONO-GRADER docking station is connected to a serial port on the computer and the instrument is fully seated in it.

The main program, **SONO.EXE**, which is used to transfer data from the instrument to a computer or printer. The complete sequence is given in the next section, but briefly the operation is as follows: Either type the program name at a DOS prompt or click on it in Windows Explorer. For added convenience, you can also make a desktop shortcut and click on that. In the shortcut Properties, check Exit on Termination. Follow the directions and prompts on the screen: **1)** You will be directed to press certain keys on the Sono-Grader, **2)** asked for the comm port to use, **3)** to select the formula to be used; 1 if weight was entered in lbs. or 2 if weight was entered in kg, **4)** to specify a filespec. If you want to use the file in Excel, then include the .xls extension, otherwise a .txt extension will serve most purposes.

If using Excel, be sure to open the file within Excel, i.e. open Excel then the file, which will enable the text wizard—do not simply click on the file.

DATA TRANSFER PROCESS

1. Start the SONO program.
2. You can only download Fat/Loin records when the instrument is in Fat/Loin mode and likewise be in Pregnancy mode to download Pregnancy records.
2. Follow the directions on the screen, which are as follows: Place SONO-GRADER in the docking station and connect cable to PC's comm port. On the instrument, press in the following order ENTER, **PGM, 2, 1**. On the PC, type the comm port number (1-4) and press ENTER.
3. The download process begins and terminates automatically and progress is shown on the screen. The datafile will be placed in the location specified, (or the current directory if none is specified). If there is a file of the same name, you will be asked if you wish to Overwrite (Y) or Append (A). If you elect to append, the header will not be included in the file. If transfer does not commence within a short period, it terminates. Pressing **ESC** anytime during the transfer will terminate the process. The transfer process does not erase the data from the SONO-GRADER.

The program will inform you if there is any problem and the nature of the problem.

CONNECTING DIRECTLY TO A PRINTER

The SONO-GRADER can directly drive a printer having an RS-232 serial port. If it has a parallel port as many do, then a serial-to-parallel converter can be obtained from most computer supply stores.* The SONO-GRADER provides a non-adjustable formatted output designed to be printed on 8.5 x 11 continuous fanfold paper. The SONO-GRADER output contains only ASCII text characters, line feeds, carriage returns, and form feeds. There are no other "control codes". The transmission rate is fixed at 9600 bps or about 960 characters per second. There is no "protocol", and "printer reset" is not sent. Printer buffer overflow (which would result in data loss), is prevented by "line pacing", i.e. there is a pause after each line sent to the printer. The serial port on the printer (or serial side of a serial/parallel port converter), should be set for the following parameters:

Baud Rate: **9600** Databits: **8** Parity: **NONE** Stop Bits: **1**
 (Or as stated in "computer-eze": **9600,8,N,1**.)

The docking station cannot be connected to anything else when performing this procedure. The two 9-pin DB9F connectors on the docking station are electrically equivalent, but only one may be connected at any time.

- 1) Connect the docking station to the printer, prepare the printer, set paper to top of form, and place printer online. Line feeds are provided so printer should **not** be set for automatic line feeds.
- 2) Place the SONO-GRADER in the docking station and assuming it is off, press keys as follows: ENTER, **PGM**, **2**, **2**. A formatted paginated printout is provided. Printing can be aborted by turning the SONO-GRADER off and taking printer off-line. (Data in SONO-GRADER memory is not lost.)

The following is an example of the printout of the first three lines in a datafile; the header record and two data records, (fat/wt order, metric units). The data is right-justified in each field.

Pen#	AN#	P1Fat	P2Fat	Loin	P3Fat	Weight	Code	%Lean
24	4	31	30	72	12	242	22	54
3456	1111	25	25	56	14	334	18	38

%Lean only appears when P2, Weight and Loin data are present and Sono.exe is version 5.0 or later.

* The converter must be either Serial to Parallel or Bi-directional, not Parallel to Serial. One such unit Global Data Communications (800-845-8225), Serial/Parallel #GWC95391, or the Bi-directional GWC6179, Also, most printer manufacturers can provide accessory serial ports for their printers.

THE DATAFILE

The datafile is a standard plain ASCII text file where each data entry is separated by spaces and each data column is 8 spaces wide. It can be edited with any text editor and can be imported into Excel through its text wizard. (Excel can export to many types of formal data formats, so if you have a data handling program that requires a special format, Excel will likely be able to accommodate your use.)

Each line of the file is called a "record" and is terminated with a carriage return and line feed. The first record of each file is a "header" which is the title of the data for each field, e.g. Pen#, Weight, P2Fat, etc. Most database and spreadsheet programs are able to directly import this type of file as "numbers" or "numerics", if header is *not* present. If header *is* present, in most cases it can only be imported as "text", or "strings". (This is not the case with Excel's Text Wizard, which recognizes a header, so it is not necessary to remove the header when using Excel.) It is easy to remove the header with any text editor. Approximate file size for 1,000 animals is 35,000 bytes.

Each record has **nine** fields, which are 8 spaces wide. The contents of each field are right-justified. For that data which may use a decimal point, right-justification with 2-place decimal point justification is used. Each record (a single line), must end in one carriage return and one line feed character. (Prior to **Sono.exe** version **5.0**, each record had 8 fields and the %Lean was not calculated.)

Records have the same number of fields regardless of disabled options. Disabled option fields are just 8 empty spaces. The Record number is not included.

THE SONO-GRADER ASCII DATAFILE FORMATS & EXAMPLES

Examples of Fat/Loin Datafiles:

Note: Spaces, bolding and type changes have been added here for clarity. In the actual datafile, each column is 8 spaces (including data) wide and there are no special font characteristics. Though not illustrated by the examples, all data is right-justified.

(Record Format and header:

Pen# AN# P1Fat P2Fat Loin P3Fat Weight Code# %Lean)

When units = *mm* and Weight = *xxx* (rather than *xxx.x*):

21	4	22	25	67	22	105	22	50*
3456	1111	22	28	63	20	108	18	50

If Weight = **xxx.x**, the following datafile results:

21	4	22	25	67	22	104.6	22	50
3456	1111	22	28	63	20	108.2	18	50

If units = *inches* and Weight = *xxx*, the following datafile results:

21	4	0.78	0.96	2.62	0.86	231	22	50
3456	1111	0.86	1.08	2.46	0.76	237	18	50

And if Weight = **xxx.x**, the following datafile results:

21	4	0.78	0.96	2.62	0.86	231.4	22	50
3456	1111	0.86	1.08	2.46	0.76	237.8	18	50

* %Lean data shown for illustration only.

9-PIN TO 25-PIN RS-232 TRANSLATION TABLE

For reference, RS-232 9-pin and 25-pin port connections and signal designations are shown below. DB9 Pins and signals not used or supported by the SONO-GRADER are: Pin 1 (DCD) and pin 9 (RI). (These are not required for printers.)

<u>DB9, 9-pin</u>		<u>DB25, 25-pin</u>
1 -----	DCD-----	8 (Not used)
2 -----	RxD -----	3
3 -----	TxD-----	2
4 -----	DTR -----	20
5 -----	GND -----	7
6 -----	DSR-----	6
7 -----	RTS -----	4
8 -----	CTS -----	5
9 -----	RI -----	22 (Not used)

Pins 4,6,7,8 on the DB9 connector, power the docking station. There are no batteries in the docking station, unless the Osborne scale is in use.

ELECTRONIC SCALES

The SONO-GRADER can communicate directly with those scales listed on the “**SONO-GRADER SCALE CABLE DATA**” listing. Cables for supported scales can be purchased from the factory or computer parts outlets. Connect the cable to the scale and docking station. Consult the manual for your scale to determine what operations, if any, are necessary to enable the scale to output information to external devices. All you will need to do is be sure the manual switches and settings on your scale are set correctly. When used with some scales, the SONO-GRADER can perform all transfer functions. Other scales may require that each transfer occurrence be initiated by pressing a button, etc. See your scale manual.

The SONO-GRADER holds information for up to two electronic scales, but only one can be currently active. The SONO-GRADER is shipped with the information for the DIGI-STAR (JSTAR) and TRU-TEST scales installed.

The parameter information for supported scales is uploaded to the instrument from a PC using the **SCALE.EXE** program and the desired scale datafile; all contained on the SONO-GRADER software disk. The datafile names are given in the **SCALE CABLE DATA** listing. There is also a file called, “**NONE**”, which must be used if the parameter information only one scale is loaded. (Do not edit any of these data files.)

To install scale information, connect a docking station to the PC as described elsewhere. Place the SONO-GRADER in it. Turn on, press **PGM, 2**. (SndDta), **1**. The display should read, “**Ready to Communicate with computer**”.

Change to drive\directory that contains **SCALE.EXE** program and scale data files. At the DOS prompt, type **SCALE**<enter> and follow the menu instructions. You must answer each prompt, and not just press <enter> to skip it. Pressing <enter> causes the next prompt to appear. If you chose the wrong serial port, the error will not be discovered until the loading operation commences. If you chose a nonexistent filename, an error message will appear. When prompted for **Port#**, respond, **1, 2, 3, or 4**, depending on the port to which you have the docking station connected. When prompted for **Scale #1**, and **Scale #2**, you must enter either the desired scale filename, or “**NONE**” at each prompt. The loading process will proceed after the second scale prompt is answered and the SONO-GRADER will display the message, “**Communicating...**”. If successful, the message, “**Transfer Completed**” will appear on the SONO-GRADER, and “**SCALE RELOADING COMPLETED**”, will appear on the computer.

If any error messages are displayed, first try once again. If problem occurs second time, be sure you have entered the required data correctly, especially the port# to which the cable is connected, and that the unit is firmly seated and lenses are clean.

Command line operation syntax is as follows. One space between each entry:

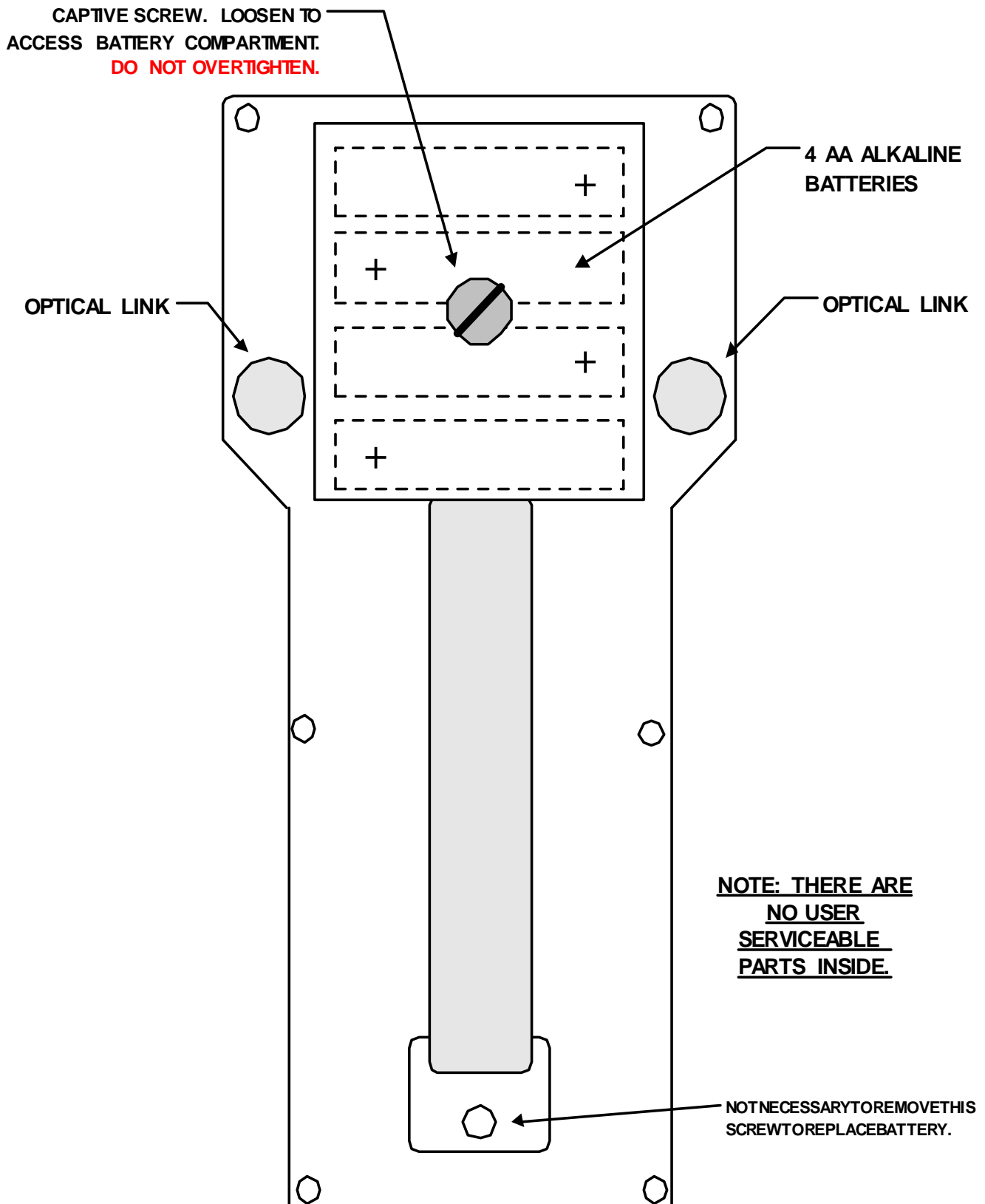
SCALE <port#> <scale#1_filename> <scale#2_filename>

<port#> must be **1, 2, 3,** or **4.**

The port number and two filenames are required with one space between each.: *If only one scale is to be loaded, the **NONE** filename must be used for the second scale.*

To select your scale, display **IDENTIFICATION** screen, press **PGM**, then **5** repeatedly until your scale appears.

BACK VIEW OF SONO-GRADER



BACKVIEW

CHANGING BATTERIES

Stored information is not lost when changing batteries due to the use of a separate internal power source having a life of approximately 10 years. Return to the dealer or factory after 10 years for replacement of lithium battery. Replacement cannot be done in the field or by the user. The **Startup** screen shows the serial number and the first two digits tell the year the instrument went into service. Ten years from that date the internal battery should be replaced.

The battery case on the back of the instrument is separate from the main case. When the batteries need changing, loosen only the large screw on the back of the battery case until you can lift off the battery case and remove the old batteries. (Do not try to remove the screw.) Replace with four size AA alkaline batteries, *observing the proper polarity*. When installing batteries it is beneficial wipe the contacts with a soft cloth, and to “roll” each battery a bit when in place. This helps to insure good contact, and is also useful from time to time as a regular maintenance procedure. New batteries will provide approximately 100 hours of use when backlight is not used. The alkaline “RAYOVAC® RENEWAL®” batteries are recommended. On balance, it is probably best to replace all four, even though some may appear to be good. Partially discharged batteries tend to discharge the others. Four AA NiCad rechargeable batteries can be used. The NiCad batteries will not give the same service length per charge as alkaline batteries and they will need to be removed for recharging.

Be sure to follow applicable laws and regulations when disposing of batteries.

CARE AND CLEANING

Do not attempt to enter the case or make internal repairs. There are no user serviceable parts inside. The SONO-GRADER is sealed to keep oil, dirt and water from entering. Circuits and components are coated to protect them from the environment. **Touching the internal parts can cause damage through static discharges and that voids warranty.** Clean the case with a soft cloth using a mild non abrasive detergent and water. Do **NOT** immerse the instrument in any fluid!

SONO-GRADER SCALE CABLE DATA

NOTE: Docking station connector is DB9M (9-PIN MALE) in all cases:

ALLFLEX MODELS #FX-11 & #FX-31, "EURO" VERSIONS ONLY (4800 BAUD)

FILENAME: **AF-FX-11, AF-FX31**

SCALE CONNECTOR

DB25M 25-PIN MALE

DOCKING STATION

12 -----+10V ----- 4
 3----- Ç DATA----- 2
 2----- DATAè ----- 3
 7----- GND----- 5

NOTE: There may not be quite enough space for some plastic DB25 connectors to fit the scale correctly. Metal types will work fine.

DIGI-STAR/J-STAR MODEL #210 WITH RS-232 PRINT OPTION (1200 BAUD)

FILENAME: **JSTAR**

SCALE CONNECTOR*

DOCKING STATION

1-----PWR (+)----- 4
 2----- DATAè ----- 3
 6----- GND----- 5

* SCALE CONNECTOR INFORMATION:

AMP 205838-1 MALE CONNECTOR BODY, 8-PIN, SERIES 1

AMP 206062-1 HOOD, SERIES 1

AMP 66504-9 FEMALE CONNECTOR PINS, SERIES 1

TRUE-TEST MODEL #703 (9600 BAUD)

FILENAME: **TRU-TEST**

SCALE CONNECTOR

DB25M 25-PIN MALE

DOCKING STATION

25 -----PWR (+)----- 4
 2----- DATAè ----- 3
 7----- GND----- 5

(DB25M-DB9M Standard Computer Cable Works.)

WEIGH-TRONIX & CENTRAL CITY MODEL #615XL (1200 BAUD)

FILENAME: **WTRX-615**

SCALE CONNECTOR

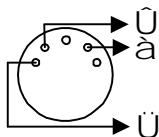
DB15M 15-PIN MALE (Standard)

DOCKING STATION

2----- DATAè ----- 3
 4-----+12V ----- 4
 7----- GND----- 5

OSBORNE MODEL E500M (9600 BAUD, 8-BIT)

FILENAME: **OSBORNE**



Front view 5-pin Male DIN connector (AMP 212440), scale end of cable. Connects to docking station end of cable, 9-pin DB9M pins 2 (Data to scale), 3 (Data to docking station), 7 (Gnd). Docking Station factory modification required. (2.2k input resistor changed to 6.8k and add battery.)

PREGNANCY TESTING WITH THE SONO-GRADER¹

Pregnancy testing and fat/loin testing can be mixed. However, a record number is used only once. For example, if data is mixed, then, records 1-5 might be fat/loin, and records 6-20 pregnancy, 21-200 fat/loin, and so on. Note that Record #'s are not included when sending data to a computer or direct printing. Only when **Viewing Stored Data**, will the Record #'s show interleaving. Be sure instrument is in pregnancy mode when downloading, or pregnancy records will not download.

To setup for Pregnancy Testing, refer to Flowchart #7. Turn instrument ON. If “**Pig preg check**” (or “**XXXmm preg check**”, if you are testing animals other than swine), appears on **IDENTIFICATION** screen you are in Pregnancy mode; skip to next paragraph. If not, press **PGM, 4, 2, ENTER**. The **IDENTIFICATION** screen will reappear with one of the above statements and pregnancy testing can proceed. To exit the pregnancy testing mode, go to **SETUP MENU** and press **2**.

Enter the Animal Identification information. (Hint: You may find it useful to use the **CODE#** to indicate days after mating.) Press **ENTER** to store and display the pregnancy test screen. Refer to Flowchart #6. Two types of displays are provided; a graphical or continuous type display, similar to that used by the RENCO PREG-ALERT®, and a discrete, “go-no-go” display in words. Either display can be selected at will by pressing the [key.

Perform pregnancy test. (See Pregnancy Testing Pictorial at end of section.) Depending upon the type of display selected, good skin contact is indicated by the appearance of two vertical bars, or the word “**CONTACT**”.

If pregnant: In the **graphical** mode display, a vertical bar (spike) will appear in the third or in rare cases the fourth zone. In the **numeric** mode display, the bottom two rows of the display will contain X's and the word YES. (This format was chosen to make the reading very obvious from all viewing angles and distances.) Press **ENTER** to store the result and continue on to the next test.

If not pregnant, the pregnancy indicators will not appear. Press **ENTER** to store the negative result.

Stored records can be viewed in the same manner as with fat/loin data. From the **IDENTIFICATION** screen, press **PGM** and select option **1**. To exit, press **ENTER**. (See Flowchart #7). *Note:* When set for pregnancy testing, only records for pregnancy can be viewed.

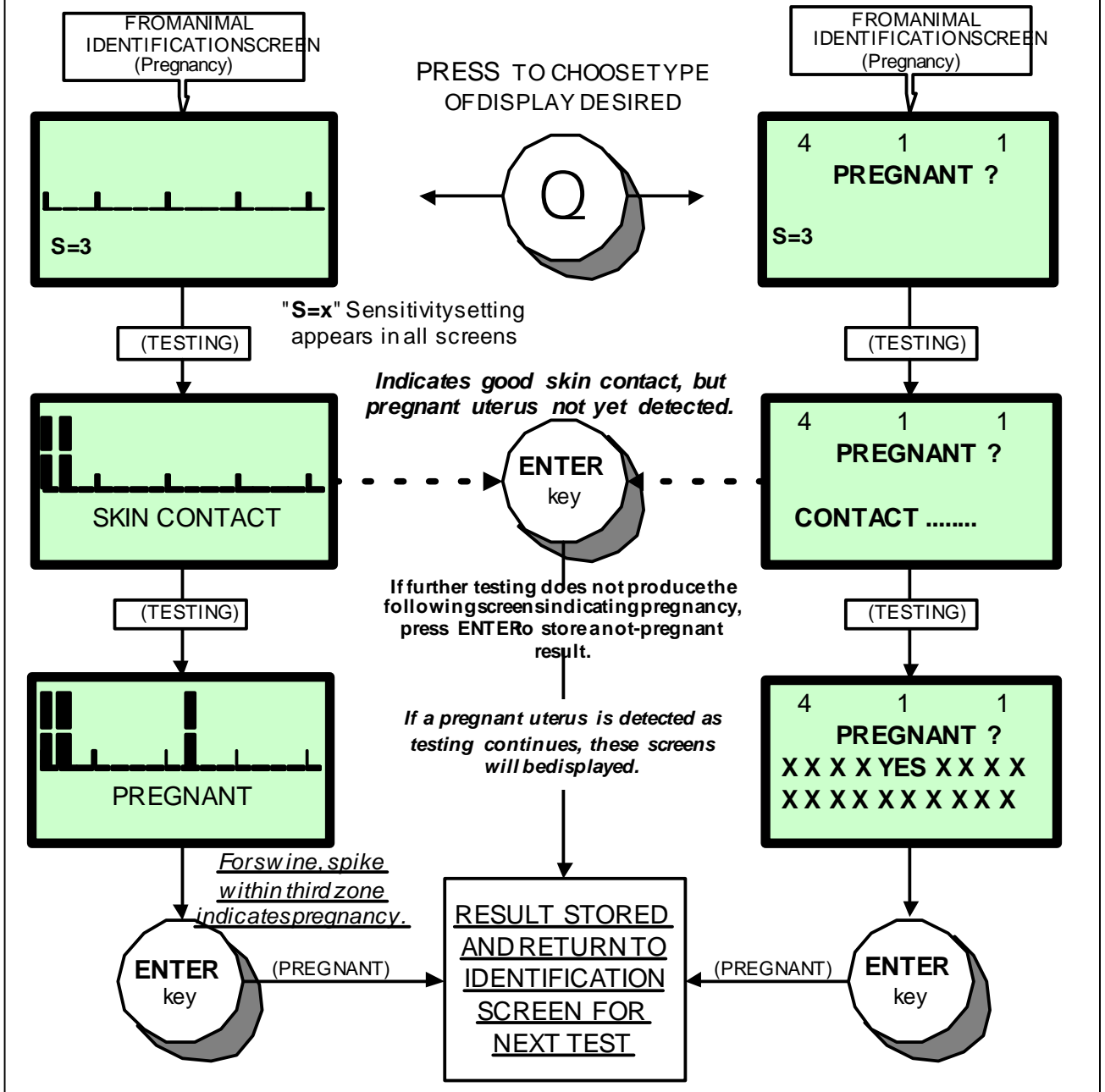
In the **graphical** display mode, the “ruler” starts at 20mm—not 0mm. The two spikes on the left edge, are only symbolic (to indicate good skin contact) and do not indicate actual echo positions. The second zone begins at 70mm, third zone at 140mm, and fourth zone at 230mm.

Erasing Stored Data

Erasing the data stored in memory is accomplished in the same manner as with fat/loin testing. **Note that the erasing procedure, Option #3 on the Main Menu, clears all stored data from memory, not just that data for the current testing mode.**

¹ The Sono-Grader cannot be used for pregnancy testing cattle at the upper SI position. It can be used at the lower EG and LG positions (100 days and longer).

SONO-GRADER® SCREEN FLOWCHART#6 PREGNANCY TEST DISPLAY SCREENS

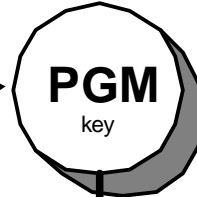


SONO-GRADER® SCREEN FLOW CHART #7

SETTING UP FOR PREGNANCY TESTING AND VIEWING STORED PREGNANCY DATA

IDENTIFICATION SCREEN (FAT/LOIN)

REC#	PEN #	AN#
1	1	1
Code#:		0



VIEWING STORED PREGNANCY DATA

(REC# PEN# AN#)

2	3	5
Pregnant (or Not pregnant)		
Code: 23		

- | | |
|--|-----------|
| 1) View | 2) SndDta |
| 3) Erase | 4) SETUP |
| 5) Weight: (Press for Choices:
none, keyin, scale name) | |
| 6) Last fat layer / 3 fat layers | |

Select #4

(Use arrow keys to cycle through records.)
Code# and Pen# only appear if selected by options 6 and 7 resp. on PREGTESTonly screen.

MAIN MENU

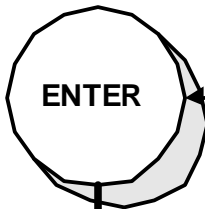
- | | |
|-------------|------------------|
| 1) P1 (Y/N) | 2) No Preg |
| 3) P3 (Y/N) | 4) mm / inch |
| 5) Ln (Y/N) | 6) Co (Y/N) |
| 7) P# (Y/N) | 8) fat/wt wt/fat |

(Press #2 to enable/disable Pregnancy Test.)

SETUP MENU

Select #2

Note: If option #2 is not displayed, then the instrument was manufactured prior to the introduction of the pregnancy feature, and does not have the necessary circuits.

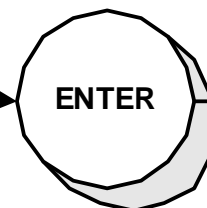


- | | |
|-----------------------|-------------|
| PREG TEST only | |
| 2) Preg test OFF | |
| 6) Co (y/n) | 7) P# (y/n) |

(Press #2 to Back Out of Pregnancy Test Mode)

IDENTIFICATION SCREEN (PREGNANCY)

REC#	PEN #	AN#
1	1	1
Code#:		0
Preg check		



TOPREGNANCY
DISPLAYSCREENS
(Flowchart #6)

Note: "Pig preg check" signifies Pregnancy Mode for swine. If pregnancy window is set for other than 139mm , "Pig" is replaced with the value selected. (*See text.)*

SETTING THE PREGNANCY WINDOW

The “Window” is the distance after which a received echo is an indication of pregnancy. For swine, the Window setting is 135mm. That is, when scanning the area of the uterus, an echo received from an internal distance greater than 135mm from the probe face is taken to indicate pregnancy. For sheep and goats, the window should be set for 93mm. However, this can vary depending upon size of the stock being tested. Thus, for sheep and goats, the pregnancy indications will be in the second zone. (Note: See Warning notice by **Initialization** Menu on Flowchart #8.)

To set the window, it is necessary to enter the special programming area. See Appendix A for details. Refer to Flowchart #6. Proceed through the displays until you reach the “**PREG WINDOW**”. Use the left and right arrow keys to set the distance for the desired animal, then press ENTER to return to **IDENTIFICATION** screen. The instrument can be used for many medium to large mammals, both ruminant and non ruminant, including midterm cattle (over 90 days), and fox. Users will need to determine the most useful window point. (Note: Observe Warning notice by **Initialization** Menu on Flowchart #8.)

SENDING DATA TO COMPUTER AND PRINTER

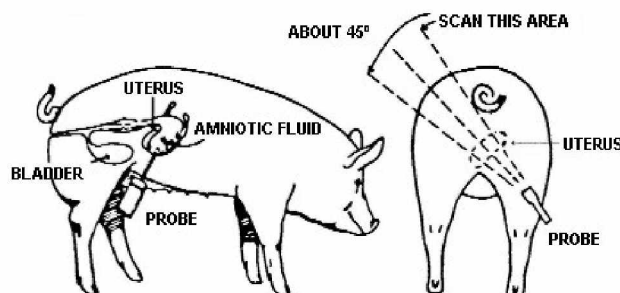
Stored data is downloaded to a computer or sent directly to a printer in the same manner as that used for fat/loin. The download program is called **SONO.EXE**, contained on the supplied software disk. (Refer to the appropriate sections of this manual for complete details.) The ASCII datafile has the format shown below, and the same characteristics as that used for fat/loin measurements: (Bold type is used only for purpose of illustration.)

Data Format and Header: Pen# AN# **Status** Code#

1	1	0	18
1	2	1	25
1	3	1	30
1	8	0	29

In the **Status** field (third column), **1** = Pregnant and **0** = Not Pregnant (The **Code#** field has been used above to indicate days after mating, but it can be used for any purpose or omitted by being disabled in the **Setup** menu.)

When the data is sent directly to a printer, the same information is presented, except that it is formatted for an 8.5 x 11 page, and the **Status** field is printed out in words; “**PREGNANT**” or “**not pregnant**”.



Pregnancy Testing Pictorial

APPENDIX A

INITIALIZATION AND CALIBRATION (Flowchart #8)

The procedures to be described greatly affect basic operating parameters. For security, it has been made a little difficult to access them. To access this area, the instrument must be off. Press and hold ENTER. While ENTER is being held, press **PGM** and hold until, the **INITIALIZATION/CALIBRATION** menu is displayed. Then release ENTER. (Pressing ENTER again, exits to **IDENTIFICATION** screen.)

“**2000 Anim. Cap.**”, is informational and cannot be altered.

RESET: Pressing **1** causes **all functions** to be reset to factory default states. It also purges **all data** in memory, clears all registers and resets the CPU. Reset must be done if a new CPU is installed. It should also be used if for some reason the SONO-GRADER should “lock up” or refuse to run when low battery is not the problem. The process completes instantly and no visual indication is provided.

SCALE RELOAD: Pressing **2**, causes the parameter information for the two default electronic scales to be loaded. There is no visual indication.

Pressing [] enters **CALIBRATION** area.

SKIN, FAT, AND LOIN CALIBRATION

There are many methods in use throughout the world for measuring fat and loin thickness. Moreover, there are many ways in which these methods have been implemented. On top of this, there are a number of factors in regard to the tissues themselves that can cause variations to occur from time to time between identical methods. There is no unvarying “absolute”. Any “standard”, is only so in terms of the individual or group that decides to adopt it. The SONO-GRADER as shipped, uses data taken from a consensus of the literature in implementing its measurement technology. It follows from the above, that the results will not always agree with the results desired by the user, in terms of whatever “standard” they may have chosen. Therefore, the SONO-GRADER contains provisions for adjusting the measurements to agree with the “standard” used by the operator.

CAUTION! The settings that follow greatly affect the data. Read all of the text that follows before making any adjustments!

The SONO-GRADER subtracts the indicated skin thickness setting from the total fat (and loin) measurements. Initial setting is **0**. Example: If set to **1mm**, and a total fat reading of **3mm** is displayed, the total fat plus skin is **4mm**. Press the number you wish to use. Press ENTER to display the Speed of Sound Factor calibration screen for **FAT**. Press ENTER again to display an identical screen for **LOIN**. For both screens, use arrow keys to make adjustments.

The speed of sound through fat tissue is typically 1480 m/sec. The SONO-GRADER is calibrated to use this speed when shipped and is indicated as 100% in the display. The range of settings is 50% to 150%. The same adjustment is available independently for loin muscle. Some research has indicated that the speed of sound through muscle is typically 1630m/sec. The instrument is set for this value when shipped and is indicated as 100%. The speed of sound through various materials is governed by the temperature, density, and elasticity of the

material. Thus, the typical speed through live fat can vary somewhat, depending upon things which affect its density and elasticity, such as breed (genetics), feed, and moisture content. This feature permits adjustment of the default **speed of sound** by a percentage factor; in order to produce more accurate readings for those animals known to have fat composition that differs from typical. Likewise for loin muscle. *These adjustments can of course also be used simply to make the SONO-GRADER agree with a "standard" the operator chooses to use.*

Setting the **Factor** percentage to lower numbers, effectively **increases** speed of sound calibration, i.e. >1480 m/sec., used by the SONO-GRADER. This produces a **smaller** fat (or loin) reading—since it takes **less time** for the echo to return. For example, a setting of 99% $\bar{\circ}$ 1495 m/sec. The opposite effect is obtained with factor percentages **greater** than 100%. The softer the tissue, i.e. **less** dense, the **slower** the speed of sound.

CERTIFICATION AND COMPLIANCE

FCC Required §15.21 Information to User: Caution! Changes or modifications not expressly approved by RENCO CORPORATION could void the user's authority to operate the equipment.

FCC §15.105 Information to User: NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instruction manual may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case, the user will be required to correct the interference at his own expense. This equipment also complies with Canadian requirements.

This equipment has been certified to be in compliance with CISPR 11, the EMC Directive 89/336/EEC, AS3548, and applicable Harmonized Standards.

CAUTION!
THE SONO-GRADER IS NOT FOR USE ON HUMAN BEINGS.

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