



KESSLER MR100 **MAGNETIC RULER for the DCP**



USER'S MANUAL

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***DO NOT DISCONNECT THE VERTICAL SCALE
FROM THE CONTROL BOX!!!***

**PERFORM VERIFICATION
ANNUALLY**

INDEX

▶	INTRODUCTION	1
	Purpose of MagRuler	1
	Package Contents	1
	Component Identification	2
	The MagRuler Keypad	3
▶	ASSEMBLY	4
	STEP 1 – Insert Batteries	4
	STEP 2 – Attach DCP Drive Rod	4
	STEP 3 – Attach DCP Foot	4
▶	CONFIGURING THE MAGRULER	5
	Setting the Date and Time	6
	Setting the Hammer Mass	7
	Configuring the MagRuler Survey	8
	Adjusting the Hammer Blow Detector	10
▶	COLLECTING DATA WITH THE MAGRULER	12
▶	USING THE COLLECTED DATA	14
	Viewing Data	14
	Save Data to USB thumb drive	16
	Printing Data	17
	Deleting Data	18
▶	SPECIFICATIONS	19
▶	FIELD VERIFICATION OR CALIBRATION ...	19
▶	MAINTENANCE	19
▶	REFERENCES	19
▶	WARRANTY	20



**THE KESSLER MR 100 WITH
THE DCP (DYNAMIC CONE PENETROMETER)**

1. INTRODUCTION

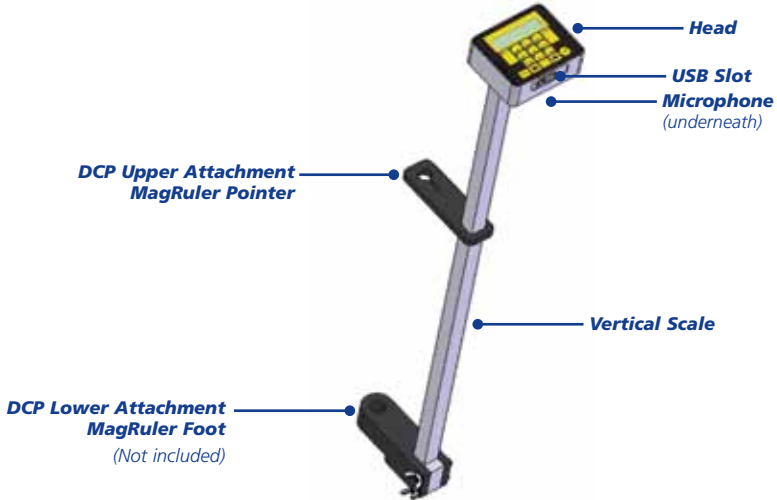
1.1. Purpose of Magnetic Ruler The Magnetic Ruler (MagRuler) is a beneficial tool for engineers, construction personnel, scientists, and anyone else interested in measuring in situ soil strength. The MagRuler automates the data collection of Dynamic Cone Penetrometer (DCP) survey work by using sophisticated microelectronics to record the penetration per DCP blow. With a MagRuler, it is no longer necessary to take measurements by hand, which drastically reduces the probabilities of human error in the measurements taken. The data allows for data to be transferred on a USB drive rather than in books, making data much easier and faster to transmit. However, it is still very simple to produce hard copies for those who may need them working in the field, with the use of the optional USB printer.

1.2. Package Contents



- 1 **MagRuler** (Qty 1)
- 2 **Upper Attachment with Magnet Pointer** (Qty 1)
- 3 **AAA Alkaline Battery** (Qty 6)
- 4 **USB Thumb Drive** (Qty 1)
- 5 **User Manual** (Qty 1)

1.3. Component Identification



Microphone

The microphone detects the sound of the hammer drop.

Head

The MagRuler head contains the microelectronics.

USB Slot

Used for save data to a thumb drive, connecting the printer, or other accessory.

Vertical Scale

Is what the pointer moves on and contains both English (tenths of an inch) and Metric (millimeters) markings.

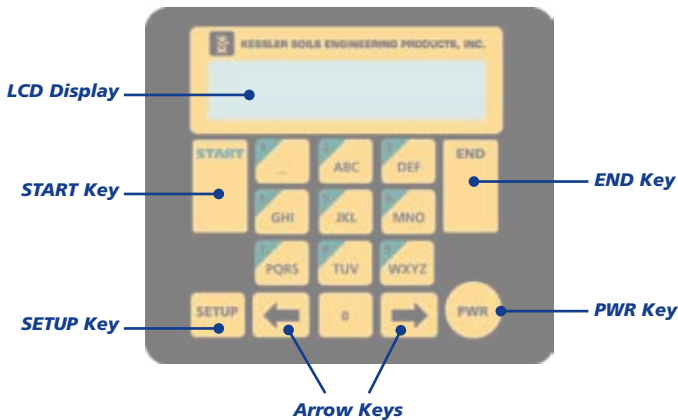
DCP Upper Attachment MagRuler Pointer

Guides the MagRuler and is the location where the distance measurement is being made.

DCP Lower Attachment MagRuler Foot (Not included with MagRuler)

Holds the MagRuler

1.4. The MagRuler Keypad The keypad includes a 2 line x 16 character LCD display, and USB port. The diagram below shows all of the features of the keypad and an overview of their functions



LCD Display

The LCD Display shows the operation status and data.

START Key

Pressing the START key will begin the data collection process. Use the START key to cycle through menu groups, and to save.

END Key

Pressing the END key will display the DATA MANAGER menu, where it is possible to view, erase, print, or save data. Use the END key to cancel a selection, go back, or to end the data collection process.

SETUP Key

Pressing the SETUP key will display the SYSTEM SETUP menu, where it is possible to configure the MagRuler such as setting the time and date.

PWR Key

Pressing and holding the PWR key for 2 seconds will toggle the MagRuler power.

Arrow Keys

Use the Arrow keys to cycle through the various menus.

2. ASSEMBLY

2.1. Step 1 — Insert Batteries

Install 6 AAA batteries in the underside of the control box. High quality, long life alkaline batteries may record up to 10,000 blows.



2.2. Step 2 — Attach DCP Drive Rod

Place the DCP Drive Rod through the DCP Pointer and tighten the bolt. Ensure the upper attachment is as close to the end cap as possible.



2.3. Step 3 — Attach DCP Foot

Slide the Drive Rod through the DCP Foot and then screw in a Hardened Point or Adapter for the Disposable cones.



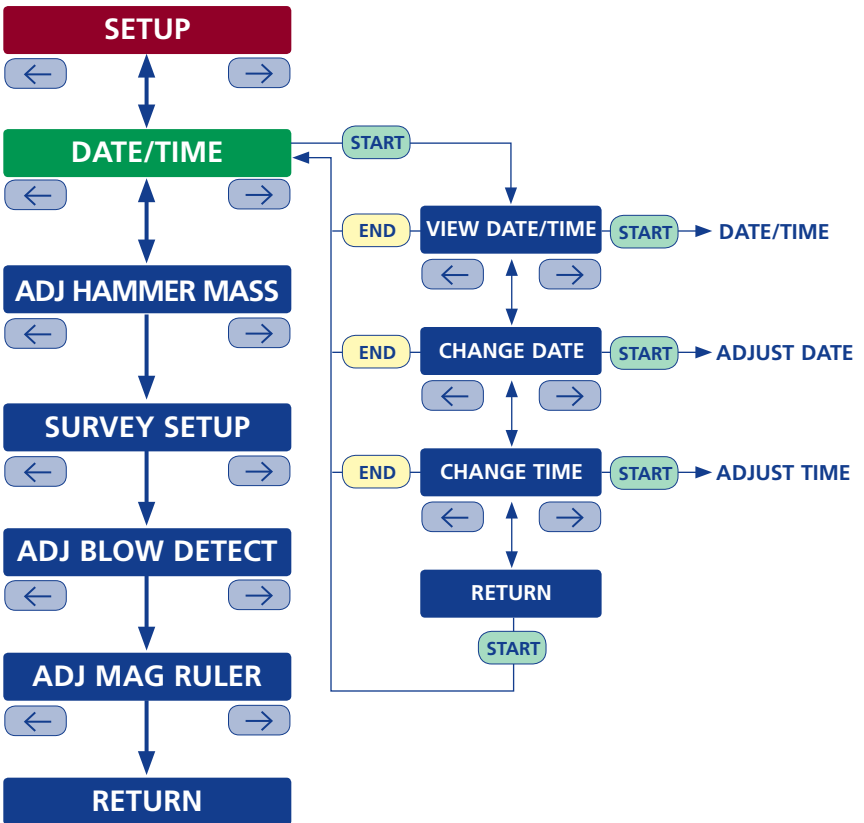
3. CONFIGURING THE MAGRULER

The MagRuler has multiple settings that can be changed at any time through the **SETUP** menu. To get to the **SETUP** menu, press the **SETUP** key from the home screen (*the screen that the MagRuler powers up to after being turned on*).

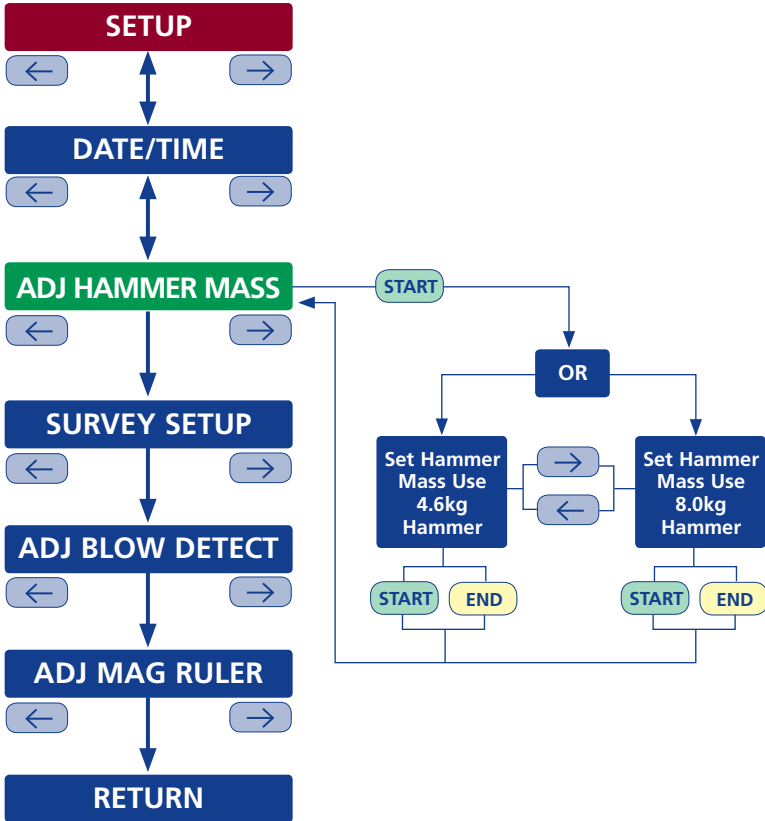


3.1 Setting the Date and Time From the home screen press **SETUP** and use the arrow key to cycle over to the **TIME/DATE** option. Press **START** and the **DATE/TIME** screen will appear. By using the arrow keys select **CHANGE DATE** and press **START**.

Using the keypad type in the date (**MM/DD/YY**), to save changes press **START**, to cancel the changes press **END**. To set the time select **CHANGE TIME** from the **DATE/TIME** screen and press **START**. Then by using the keypad type in the time (**HH:MM:SS 24HR**), to save changes press **START**, to cancel, press **END**.



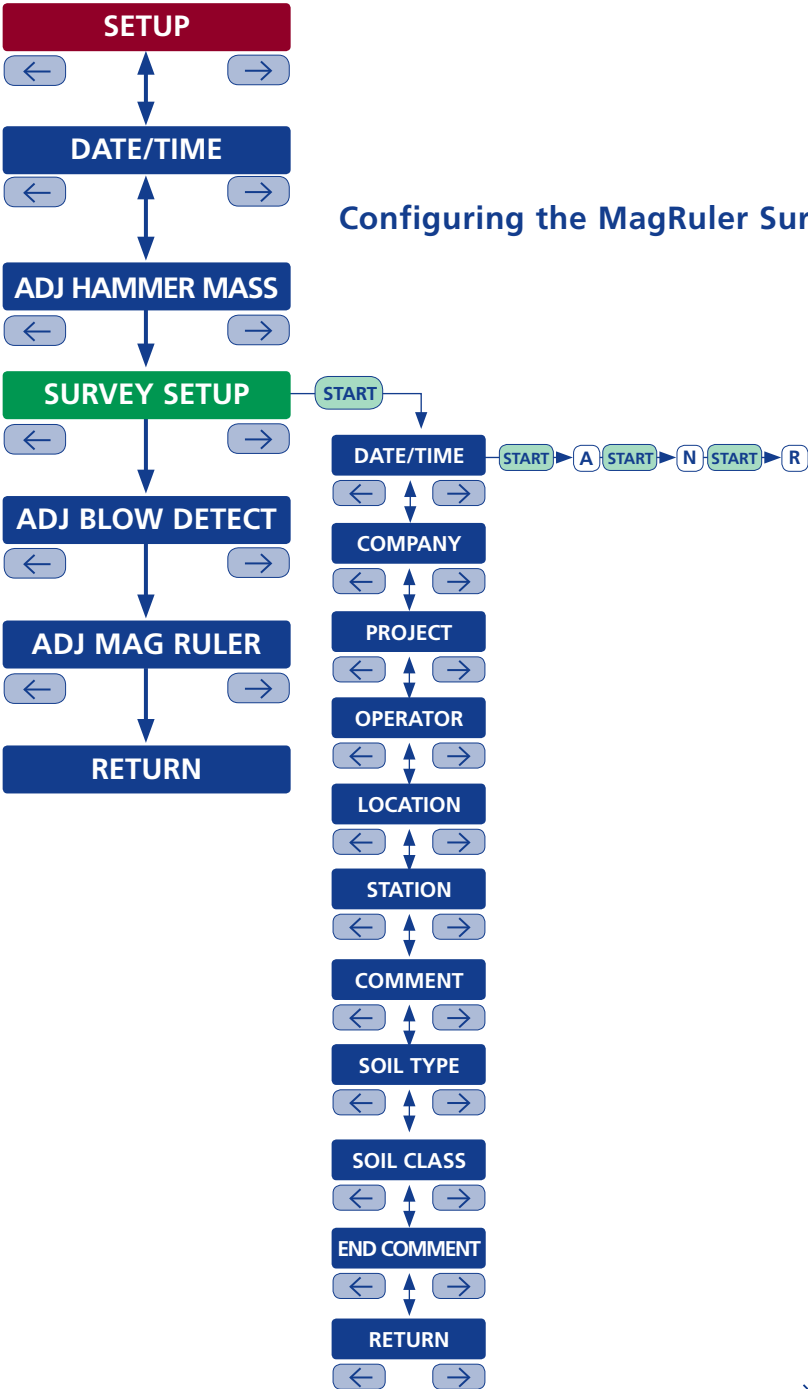
3.2 Setting the Hammer Mass From the home screen, press **SETUP** and use the arrow keys to toggle to the **ADJ HAMMER MASS** option. Press **START**. It is possible to set the hammer mass at 4.6 kg or 8.0 kg. To save changes, press **START**. To cancel, press **END**.



3.3 Configuring the MagRuler Survey At the **SETUP** menu, use the arrow keys to toggle to **SURVEY SETUP** and press **START**. **DATE/TIME** is the first parameter within the **SURVEY SETUP** menu. Three options exist for recording the time and date. *The first is to have the time and date on the LCD screen and saved in the report (All), the second is to not have the time and date on the LCD screen or saved in the report (None), and the third is to have the time and date saved in the report only (Report only).*

The first time the **DATE/TIME** parameter is accessed, it will be at the default setting of having the time and date on the LCD screen and saved in the report and an A will appear next to the parameter's name on the LCD screen. If you choose to use the (A) option for the report, simply press an arrow key to proceed to the next **SURVEY SETUP** parameter, **COMPANY**. To choose a different **DATE/TIME** option, press the **START** key. An N will appear in place of the A. If you choose to not have the time and date appear on the LCD screen or saved in the report, press an arrow key to exit the **DATE/TIME** parameter. To proceed to the R option, press the **START** key again. An R will appear on the LCD screen. To select the R option, press an arrow key to exit the **DATE/TIME** parameter. (See illustration on the opposite page.)

Configuring the MagRuler Survey

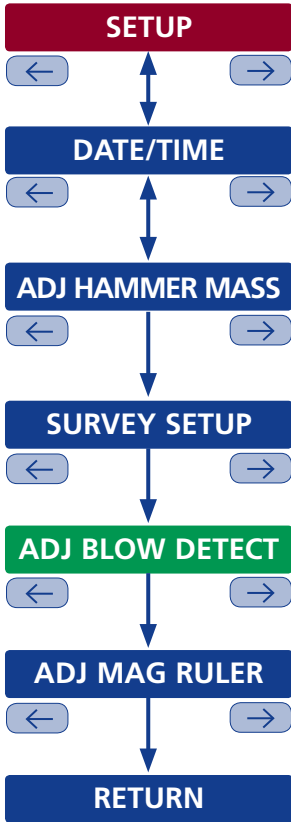


3.4 Adjusting the Hammer Blow Detector To detect when a hammer is dropped, and thus when data should be recorded, the MagRuler uses a microphone to listen for the sound of a hammer drop, or *“ping.”* The *“ping”* hammer blow detection system consists of three parts, sensitivity, short, and long. The lower the sensitivity number, the easier it will be for the MagRuler to detect a hammer drop. The MagRuler is *“listening”* for sounds between the short and long numbers to detect when a hammer is dropped. ***When a hammer drop has been recorded, the words, “GOT PING” will appear on the LCD screen.***

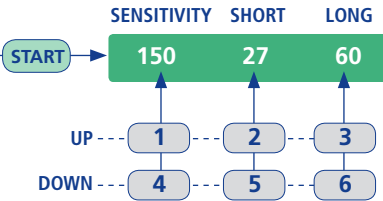
PING TOO SHORT: If this message appears, this means the sound was not long enough to be recorded.

PING TOO LONG: If this message appears, this means the sound was too long to be recorded – flying overhead.

If no message appears on the LCD screen, the sensitivity is most likely set too high. (See illustration on the opposite page.)



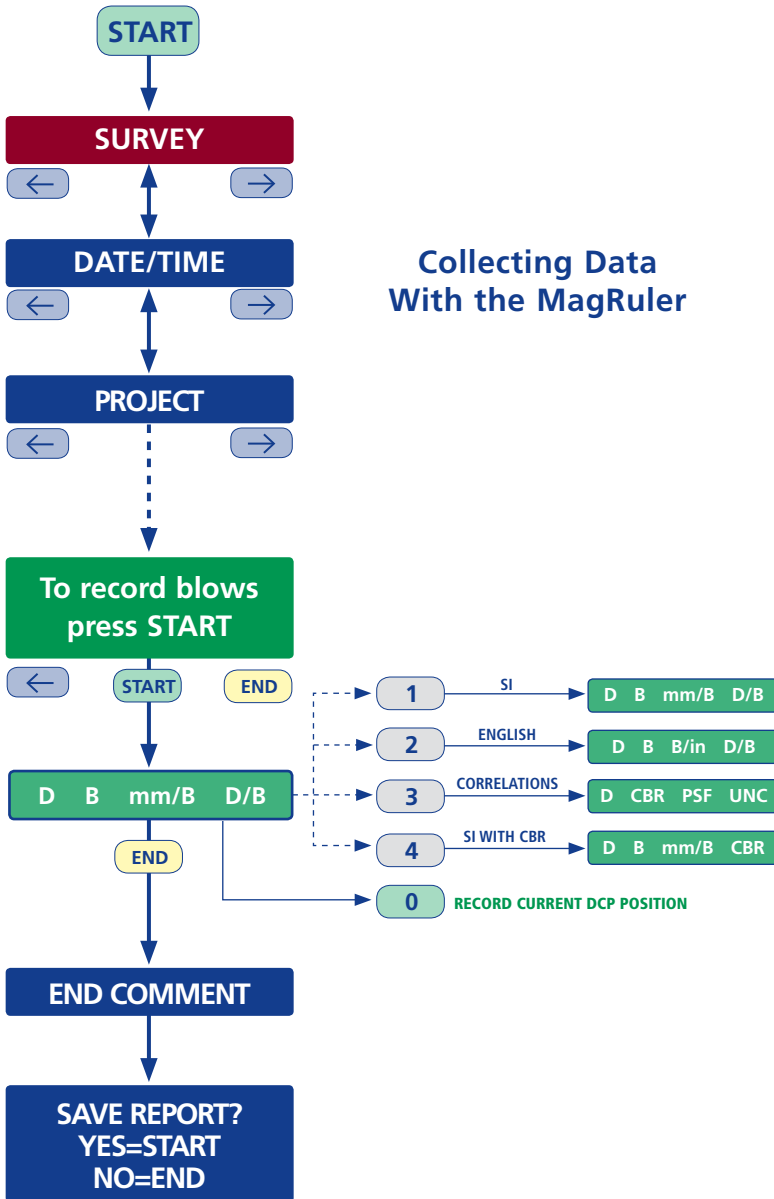
Adjusting the Hammer Blow Detector



4. COLLECTING DATA WITH THE MAGRULER

From the home screen, press **START**. The **SURVEY** screen appears, and any parameters that you have configured to be displayed on the LCD screen are available to be toggled through with the **START** and **END** keys. After entering your parameters, the screen, "To record blows, press **START**" will appear. Press **START** and the MagRuler is now ready to record your DCP hammer blows. After each drop of the hammer, the MagRuler will display ?. Between blows, one can select what is displayed on the live screen by pressing various numbers on the keypad. **See the following table for a more detailed description of these screens. Pressing the 0 key will record the position of the magnetic ruler as if a hammer had dropped.** When you reach your desired depth, press the **END** key and follow the prompts. To remove a previous blow press the left arrow key. (See illustration on the opposite page.)

MagRuler Data Collection Live Displays		
Key Press	Screen Title	Screen Data Displayed
1	SI	D = Total Depth of penetration in millimeters (mm) B = Blow count mm/B = Penetration in mm for the last blow D/B = Total penetration (mm) divided by total blows
2	ENGLISH	D = Total Depth of penetration in inches (0.1in) B = Blow count B/D = Blows/Depth in inches for last blow D/B = Total Blows divided by Total Depth for last blow
3	CORRELATIONS	D = Total Depth of penetration in inches (0.1in) CBR = California Bearing Ratio, (1 - 100%) PSF = Bearing Capacity (Ultimate) in lb/sqft
4	SI WITH CBR	D = Total Depth of penetration in millimeters (mm) B = Blow count B/D = Penetration in mm for the last blow CBR = California Bearing Ratio, (1-100%)

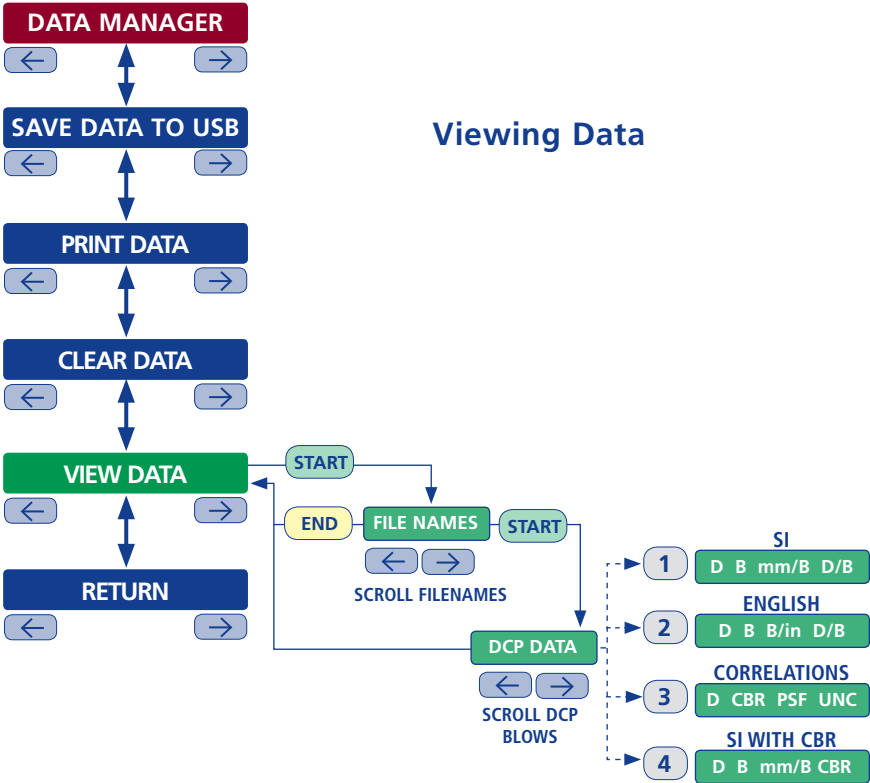


5. USING THE COLLECTED DATA

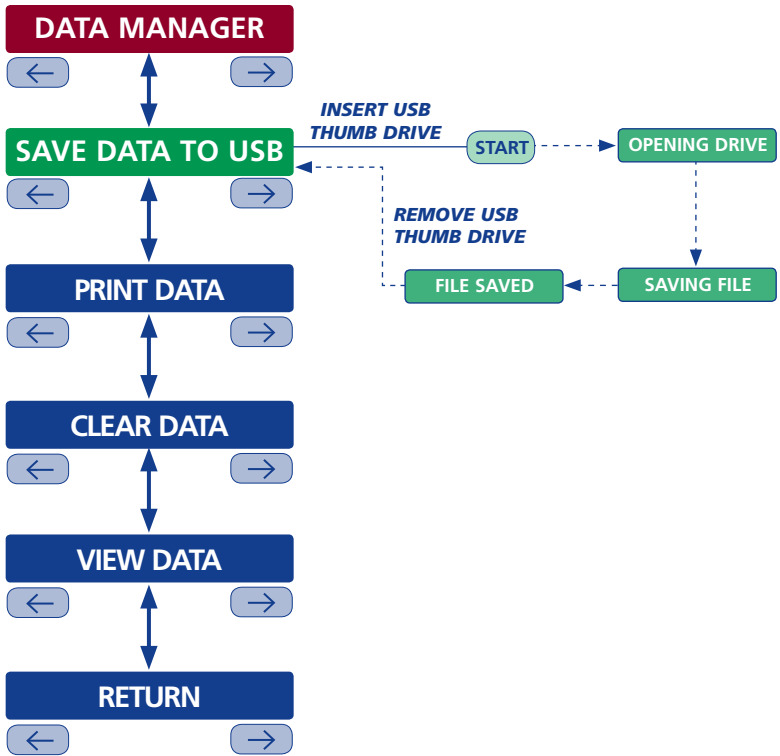
The MagRuler internally stores DCP data until you decide to delete it. Data will remain in storage in the event of accidental battery removal or failure. One can view your data on the LCD screen, save your data to a USB thumb drive, print your data to a USB printer, or delete your data from internal MagRuler storage.

5.1 Viewing Data To view data from the home screen, press **END**. This will open the **DATA MANAGER** menu. Choose the option, **VIEW DATA**. Using the arrow keys, one can scroll through the stored data files. To select the one you wish to view, press **ENTER**. You can then use the arrow keys to scroll through the data contained in that data file. Pressing the **END** key will return you to the previous menu. *(See illustration on the opposite page.)*

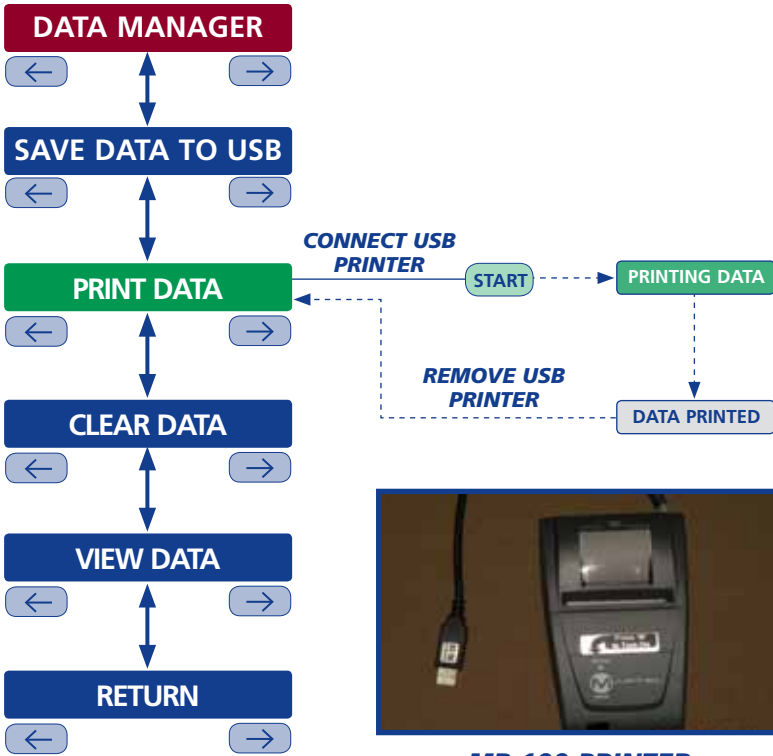
Viewing Data



5.2 Save Data to USB thumb drive From the home screen, press **END**. Use the arrow keys to scroll down to **SAVE DATA**. Insert your USB thumb drive into the MagRuler and press **START**. The light near the USB port will flash and your files will all be saved to the USB thumb drive. **Do not remove your thumb drive during this process, or data corruption can occur.** Once the data is saved, the LCD will display a message, **“DATA SAVED”** and will return you to the **DATA MANAGER** menu. At this point, you can safely remove your thumb drive. (See illustration on the opposite page.)



5.3 Printing Data From the home screen, press **END**. Use the arrow keys to scroll down to **PRINT DATA**. Connect your MagRuler printer to the USB port. Turn your printer on by firmly pressing the gray button on the printer Press **START** and your data will be printed. Once the data is printed, you will be returned to the **DATA MANAGER** menu.



MR-100 PRINTER
(Sold Separately)

6. SPECIFICATIONS

ACCURACY- Increment of distance = 1 mm.
--tolerance = 1 mm

7. FIELD VERIFICATION AND CALIBRATION

FIELD VERIFICATION & CALIBRATION - The depth of penetration displayed on the screen can be compared to readings on the vertical scale. This should be performed at least annually or sooner if the user detects a variation. If the unit fails Field Verification then it will need to be returned to Kessler Soils Engineering Products, Inc. for calibration. See www.kesslerdcp.com for contact information.

8. MAINTENANCE

Do not allow dirt particles to get in the USB slot. Keep the Magnetic Ruler in the DCP case when not in use.

9. REFERENCES

9.1. ASTM D6951 Standard Test Method for use of the Dynamic Cone Penetrometer in Shallow Pavement Applications.

9.2. Scala, A.J., (1956), Simple Methods of Flexible Pavement Design Using C(3) METHOD ST6: Measurement of the In Situ Strength of soils by the Dynamic Cone Penetrometer (DCP) (1984) Special Methods for Testing Roads, Draft TMH6, Technical Methods for Highways (TMH), ISBN 0 7988 2289 9, Pages 19 to 24, 1984.

9.3. Tingle, J.S., Jersey, S.R. (2004) US Army Engineer Research and Development Center, Evaluation of In Situ Pavement Layers with the Dynamic Cone Penetrometer (DCP) page 4

10. WARRANTY

1. KESSLER SOILS ENGINEERING PRODUCTS, Inc. guarantees this product to be manufactured in the U.S.A. to the specifications and standards developed by KESSLER SOILS ENGINEERING PRODUCTS, Inc. and ROMUS, Inc.

2. KESSLER SOILS ENGINEERING PRODUCTS, Inc. warrants this product to be free from defects in material and components for six (6) months from the date of first purchase, provided the product is used, operated and maintained in accordance with all applicable instructions. To claim under this warranty the Bill of Sale and cancelled check or credit card receipt must be presented.

3. This warranty does not apply to parts that are not in original condition because of normal wear and tear, or parts that fail or become damaged as a result of misuse, accidents, lack of proper maintenance or defects caused by improper use. Shipping costs relating to repairing a KESSLER MR-100 will be the responsibility of the purchaser.

4. To the full extent allowed by the law of the jurisdiction that governs the sale of the product, this express warranty excludes any and all other expressed warranties and limits the duration of any and all implied warranties, including warranties of merchantability and fitness for a particular purpose to six (6) months from the date of first purchase. The liability of KESSLER SOILS ENGINEERING PRODUCTS, Inc. is limited to the purchase price of the product and does not cover any other damages whatsoever including indirect, incidental or consequential damages.

5. Limitations herein do not apply in states that do not allow a limitation on how long an implied warranty lasts or an exclusion or limitation of incidental or consequential damage.