**RIMIK
ELECTRONICS**

**RIMIK CP 40 CONE
PENETROMETER**

**HARDWARE
INSTRUCTION MANUAL**

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INTRODUCTION

The Rimik CP40 is a cone penetrometer for use in soil density, trafficability and compaction studies. The instrument measures and records cone index values, as well as the time, date and optionally the GPS (Global Positioning System) coordinates received from an external GPS receiver. Up to 2047 insertions may be recorded and subsequently downloaded via the RS232 interface. Cone index measurements can be made to depths of 600mm in soils with cone index values of up to 5500 kPa. The CP40 uses an ultrasonic transducer to measure the depth of the insertion. An LCD (Liquid Crystal Display) is used to display the results of insertions in a graphical format for easy comparison of readings at different depths. All functions are carried out using the menu driven interface.

Front Panel
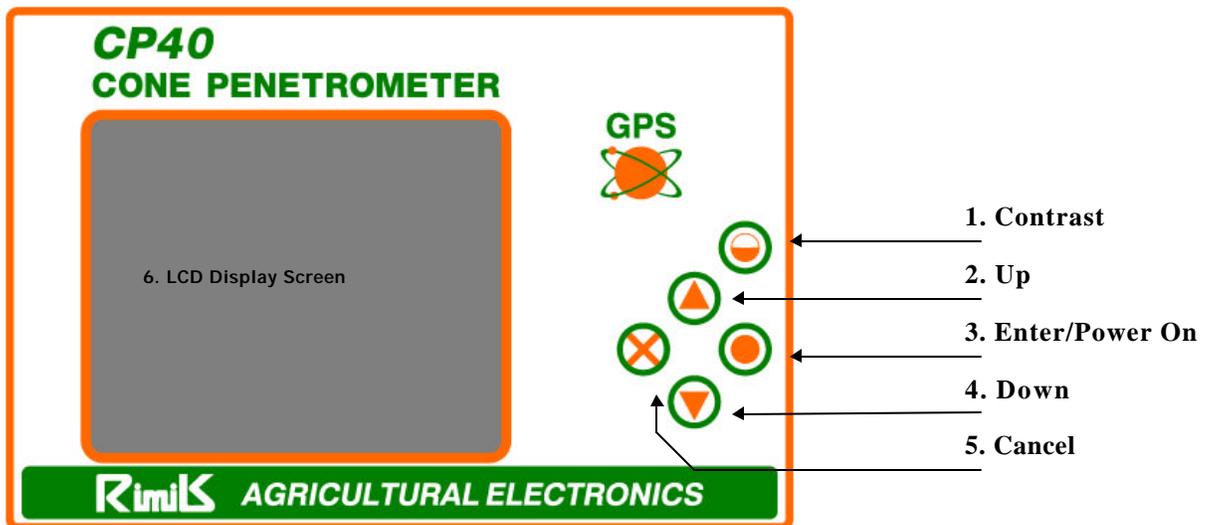
Figure 1

Figure 1 shows the front panel of the penetrometer. There are five pushbuttons used to operate the instrument. Four of the buttons are used to select options from a menu driven display.

1. **Contrast Button.** The CONTRAST button is used to control the contrast of the display. By pushing and holding down this button the display will vary its contrast from a very feint image to a very dark one. If the button is released for more than 2 seconds and then pushed again, the contrast will move in the opposite direction to which it was previously. The contrast setting is retained after powering off the instrument.

2. **Up Button.** The UP button is used to move the cursor up the menu or increment a value on the display.

3. **Enter / Power On Button.** To power on the instrument press and hold down this button until a tone is heard from the internal buzzer. The alternative function of this button is to ENTER or OK a change from the main menu.

4. **Down Button.** The DOWN button is used to move the cursor down the menu or decrement a value on the display.

5. **Cancel Button.** The CANCEL button is used to cancel a function or to move back in the menu system.

6. **LCD Screen.** The LCD screen is a 160 x 128 pixel unit. All menu items are displayed on it.

Back Panel

1. DC Power
2. Transducer
3. PC Connector
4. GPS Connector
5. Reset Switch
6. Load Cell Connector
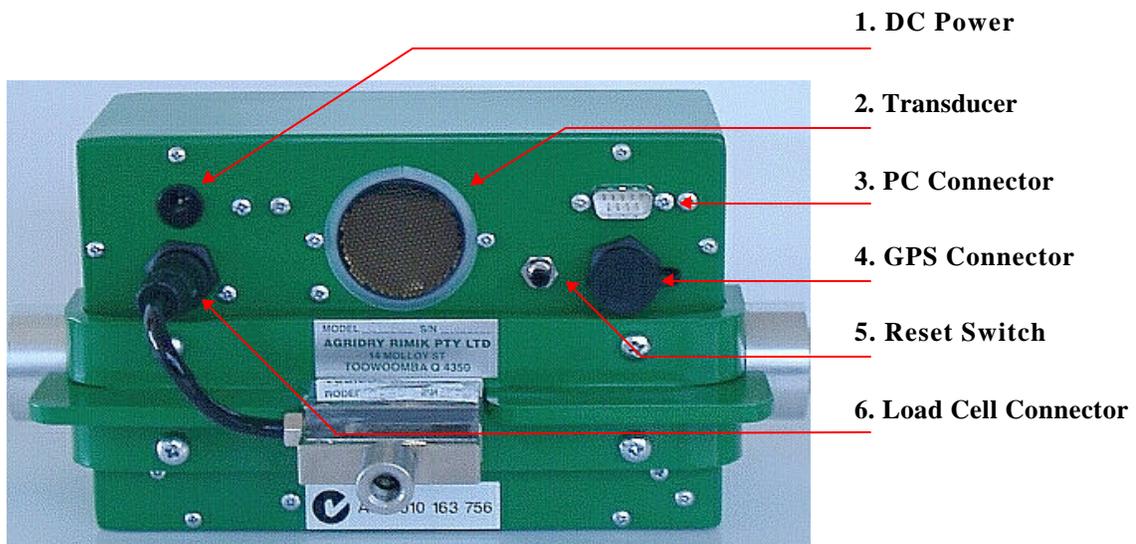
Figure 2

The underside of the CP40 constitutes the back panel. It has several features that are marked in Figure 2 and detailed below.

1. **DC Power Connector.** This connector is used to connect the unit to an external battery charger. The battery charger recharges the internal 6V battery.

2. **Ultrasonic Transducer.** The ultrasonic transducer is used to measure distance to the target by the use of ultrasonic waves sent from and reflected back to it.

3. **RS232 Connector -PC .** The DB9 connector is used to connect the penetrometer to a PC for downloading insertion data.

4. **GPS Connector.** This 6 pin connector is used for connection to an external GPS receiver. The GPS receiver can be powered from this connector and will send navigation information to the CP40 through it.

5. **Reset Button.** This pushbutton is used to force the CP40 into the power off state. Normally the CP40 is powered off using the main menu selection. However due to the fact that the unit is powered on by a push button switch and kept on by the CPU (as opposed to a physical switch) , there is a remote possibility that should the unit experience a fault , the user would not be able to turn off the unit by the menu system. Hence this push button is provided to allow the user to force the CP40 to power off.

6. **Load Cell Connector.** This 4 pin connector is used for connection to the load cell which measures the force exerted by the shaft attached to it.

Penetrometer Concepts.

The CP40 is designed to allow the user some choice of various parameters. These parameters should only be changed after reading this section that deals with various concepts associated with the use of the CP40.

Files & Insertions

The CP40 is capable of recording up to 2047 insertions. An insertion is the act of using the penetrometer to record a profile of soil cone index values. As far as the CP40 is concerned an insertion is the group of data (kPa readings, date, time etc) relating to a physical insertion performed by the user. A file can contain from 1 to 9 insertions. The purpose of grouping insertions into files is that the insertions belonging to a file should all be taken in the same physical location , so that the data from the insertions can be averaged by the retrieval software to produce an averaged result for the particular file number. If the user is content to take only one reading per location then the insertions per file parameter should be set to 1. Obviously the number of files the CP40 can store is dependent on the number of insertions per file. If for example the insertions per file parameter was set to 5 then 409 files of 5 insertions each could be recorded.

Interval

When the user is performing an insertion, the penetrometer is taking readings from the load cell (force) and from the ultrasonic transducer (depth) at the rate of 40 readings per second. All these readings are not recorded individually. Instead the load cell readings are grouped into intervals, an average is calculated for each interval and then stored. If the interval was set to 15mm for instance then the penetrometer would take all the load cell readings from a depth of 0mm to 15mm and average them and then store the result as the cone index reading for interval No. 1 . It would then take all the readings from a depth of 15mm to 30mm, average them and store the result as the cone index reading for interval No 2 etc. until the maximum depth is reached. The reason for this is that the soil profile will contain small air pockets, stones, sticks, roots etc which cause the cone

index value to 'jitter' about the true reading for the soil. Grouping the data into intervals helps minimise this error. The user may select intervals of 15, 20 or 25mm . The ASAE standard recommends using an interval of 25mm. The interval setting must be the same for all the insertions grouped into a particular file for the purpose of the retrieval software averaging the data between the insertions. For this reason the interval parameter may not be changed until the penetrometer is ready to start a new file number.

Maximum Depth

The maximum depth of penetration default value is 600mm. When this depth is reached the insertion is terminated. The user may set the maximum depth to a value less than this. The resolution of the maximum depth parameter is dependent on the setting of the interval parameter. For example if the interval parameter was set to 20mm then the maximum depth parameter can only be incremented or decremented by lots of 20mm. In this case the maximum depth parameter could be 20,40,60 etc up to 600mm. The maximum depth setting must be the same for all the insertions grouped into a particular file for the purpose of the retrieval software averaging the data between insertions. For this reason the maximum depth parameter may not be changed until the penetrometer is ready to start a new file number.

OPERATION

Power On

To power on the CP40 push the ENTER button and hold it down until a tone is heard. A brief message will appear on the screen detailing the units model No. , software version, serial number and current date. The screen will then display the main menu selection with a flashing cursor indicating the current selection. Displayed at the bottom of the screen are the current battery voltage and the time.

Power Off

To power off the CP40 from the main menu screen , use the UP or DOWN keys to move the cursor to the '# Power Off ' item and then push ENTER. The unit may also be powered off by simply pushing the CANCEL key when in the main menu, regardless of which menu item the cursor is on.

Set Up Menu

The set up menu is entered from the main menu by pushing the UP or DOWN keys until the cursor is located on the ' # Set Up' item, then push ENTER. The set up menu will then be displayed with several options available. Push the CANCEL key to return to the main menu selection.

Site Name

The site name is an 18 character text message which is tagged to each insertion. This feature allows the user to determine upon download to the retrieval software the name of the location where insertions were made.

Move the cursor to the '# Site Name ' menu item and push ENTER. The screen will display the current site name with a flashing cursor located at the first position. Use the UP or DOWN button to change the character the cursor is currently located on. When the desired character is selected push the ENTER button. The flashing cursor will now move to the next character position. Using the UP and DOWN keys change the character to the desired one and repeat this process in a similar manner until the desired site name is displayed on the screen. Once the site name is correct push the CANCEL button. The site name will now be tagged to each insertion. The site name is retained after powering off the unit.

Time

The time is read each time an insertion is performed and retained with the insertion data for download. This feature allows the user to determine the time the insertion was made. The CP40 uses the 24 hour clock format only . For example 3:00 PM will be displayed and stored as 15:00 hours.

Move the cursor to the '# Time ' menu item and push the ENTER button. The screen will display the time with the flashing cursor over the hours. Use the UP or DOWN button to change the hours value and then push ENTER. The cursor will now move to the minutes value. In a similar manner use the UP or DOWN button to change the minutes value to the correct figure, push ENTER. In the same way change the value of the seconds setting and then push ENTER.

Date

The date is read each time an insertion is performed and retained with the insertion data for download. This feature allows the user to determine the date the insertion was made. The user can choose either to display the date as D/M/Y format or M/D/Y format.

Move the cursor to the '# Date' menu item and push the ENTER button. The screen will display two lines. The first line indicates the date format . Use the UP or DOWN button to change this if desired and then push ENTER. The cursor will then move to the second line. The cursor will then

be on the day of the month or the month of the year depending on the date format previously selected. Use the UP or DOWN button to change this value and then push ENTER. The cursor will then move to the next position. In a similar manner use the UP, DOWN and ENTER buttons to change the remaining values.

The time and date information are updated by an internal RTC (Real Time Clock) which will keep time for several days after the CP40 is powered off. If the CP40 has been powered off for an extended period it will be necessary to reset the time and date information.

Parameters

The parameters menu allows the operator to change several operating parameters of the instrument. An explanation of the terms file No. , insertion No. , interval, and maximum depth was presented previously. To enter the parameters menu use the UP or DOWN keys to move the cursor to the '# Parameters' menu item and push ENTER. The screen will show several parameters that can be selected by using the UP and DOWN keys to move the cursor to the desired parameter and then push the ENTER key. When all the desired parameters have been set push the CANCEL key to return to the set up menu.

Inserts/File

The number of insertions per file can be set from 1 to a maximum of 9 by using the UP or DOWN keys followed by the ENTER key.

Speed Abort

The speed abort can be either turned ON or OFF . If it is set to on when an insertion exceeds the maximum speed setting the insertion will be aborted and the data not recorded. If it is set to off when an insertion exceeds the maximum speed setting the buzzer will emit an alarm sound but not abort the insertion. Use the UP or DOWN keys to change the setting and then push ENTER.

Max Depth

The maximum depth setting can be set up to 600mm. The CP40 will complete an insertion when the maximum depth is reached. Use the UP and DOWN keys to alter the maximum depth setting. Push ENTER when the desired setting is present. The CP40 will not allow the maximum depth setting to be changed unless the unit is ready to start the first insertion of a new file number i.e. the current insertion number must be 1 .

Interval

The Interval can be set at 15, 20 or 25mm . Use the UP and DOWN keys to set the interval and then push ENTER. The CP40 will not allow the interval setting to be changed unless the unit is ready to start the first insertion of a new file number i.e. the current insertion number must be 1.

Max Speed

The maximum speed value is the maximum speed in metres per minute that the insertion can occur before either it is aborted or an alarm is sounded depending on the setting of the speed abort parameter. The ASAE standard recommends an insertion speed of 2 metres/minute to avoid the data being inaccurate due to inertia effects. In soils where soft layers underlie hard layers it can be very difficult to avoid exceeding 2 metres/minute as the hard/soft interface is penetrated. For this reason the user may set this parameter up to a maximum value of 8 metres/minute. Use the UP or DOWN keys to set this parameter to the desired value and then push ENTER.

Max Load

The maximum load parameter is the the maximum load in kg's that the load cell can be subjected to before an insertion is aborted. The default and maximum value is 75 kg's. Use the UP or DOWN keys to change this value and then push ENTER.

Calibrations

For the CP40 to record dependable data it must be calibrated accurately. There are two calibrations required, the load calibration and the distance calibration. When the CP40 is manufactured it will already have had these two calibrations performed. It is advisable to periodically check these calibrations and recalibrate the instrument if necessary. To enter the calibrations menu use the UP or DOWN keys to move the cursor onto the '# Calibrations' menu item and press ENTER. The screen will display the calibrations menu. Use the UP or DOWN key to move the cursor to the desired function and press ENTER. When the desired calibrations or checks have been performed use the CANCEL key to return to the set up menu.

Calibrate Load

This function allows the user to calibrate the readings taken from the load cell. To enter this mode use the UP or DOWN key to move the cursor to the '# Calibrate Load' menu item and push ENTER. The screen will display " Set Load to zero Push Enter when Ready… " . It will also display a number representing the reading from the load cell, this number should be a small positive value of approximately 50. Hold the penetrometer by its handles and allow the load cell to point toward the ground (ensure the shaft is not attached to the load cell) . Push the ENTER button. The penetrometer will now record the reading for zero load.
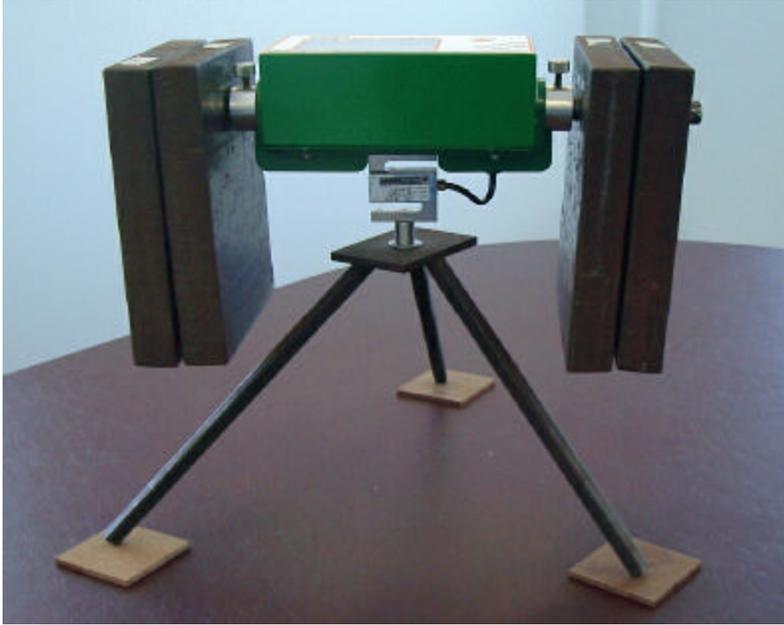
Figure 3

 The screen will now display "Add Test Weights Push Enter when Ready… " followed by the reading from the load cell. Mount the CP40 on a test stand as indicated by figure 3 with the 3/8 bolt supplied. The test stand should consist of a piece of flat plate with an 8mm hole in the middle and attached to a suitable support. Add the test weights. These should be hung from the handles- an equal weight each side. The total weight added should be no less than 50kg and no more than 70kg ,the exact weight should be known. The total weight should be made up of several smaller weights (at least 2 per side) to avoid excessive strain on the user. When loading and unloading the weights the total out-of-balance moment should be kept as low as possible. Once the weights have been added the reading from the load cell on the screen should have increased considerably. Ensure the CP40 is balanced properly on the stand with no movement or oscillation present. Push the ENTER key. The screen will display " Enter Weight " followed by a reading in kg's. The cursor will be flashing on the tens column. It is now required to enter the total weight on the load cell. This will be the known added weight + the weight of the penetrometer which is 2.85kg's. For example if 55kg weight was added the user should now enter the value of 57.85kg. Use the UP and DOWN keys to alter the value in the tens column followed by ENTER. The cursor will now be in the units column. Use the UP and DOWN keys to alter the value followed by ENTER. In a similar manner set the tenth's and hundredth's columns. The load calibration procedure is now complete. The CP40 will now automatically enter the 'Check Load' mode. Remove the test weights and the penetrometer from its stand.

Check Load

This function allows the user to check the load applied to the load cell. To enter this mode press the UP or DOWN key until the cursor appears over the '# Check Load ' menu item then push the ENTER key. The CP40 will display the load measured by the load cell and display it in kg's. To return to the calibrations menu press the CANCEL key.

Cal Distance

The Calibrate Distance function is entered by pushing the UP or DOWN key until the cursor is on the '# Cal Distance' menu item, then push the ENTER key. The screen will show a cursor on a value for the target height. Use the UP or DOWN keys to set this to the

correct value then push ENTER. If a standard CP40 target is being used this value should be 85mm. The cursor will then be on a value for the distance from the base of the cone to the transducer. In a similar manner set this number to the correct value and push ENTER. If a standard CP40 shaft and target are used this value should be 886mm. The ultrasonic transducer will now be working and a value indicating the time of flight (i.e. time for the ultrasonic wave to be reflected back) in milliseconds will be displayed on the screen. Allow the target to rest on the base of the cone and support the instrument with the cone well above the ground as illustrated in figure 4. Ensure the top surface of the target is horizontal and then push the ENTER key. The screen will now indicate a distance to be entered. Use the UP , DOWN and ENTER keys to enter the distance from the transducer to the top surface of the target. If a standard CP40 shaft and target are being used this value should be 880mm. The distance calibration procedure is now complete. The CP40 will now automatically enter the 'Check Distance' mode.

Figure 4

Check Distance

The Check Distance function allows the user to check the distance being measured by the ultrasonic transducer. To enter this mode push the UP or DOWN key until the cursor appears over the '# Check Distance' menu item and push the ENTER key. The ultrasonic transducer will begin working and the time of flight (for the ultrasonic wave), the measured distance(from the transducer to an object-usually the target) as well as the calculated depth of insertion will be displayed. The depth of insertion is calculated by taking the known distance from the transducer to the base of the cone, subtracting the height of the target and then subtracting the measured distance. To return to the calibrations menu press the CANCEL button.

GPS

The CP40 is capable of recording position information from an external GPS receiver and tagging the insertion data with it. The specifications for the GPS connector are provided in appendix A . The CP40 features the ability for the user to set a local origin point and to record the local latitude and longitude departure from the origin (in metres) with the insertion data. The absolute latitude (degrees minutes and seconds north or south of the equator) and the absolute longitude (degrees

minutes and seconds east or west of Greenwich) are also recorded with the insertion data. If an external GPS receiver is not used the user may choose to deselect the option.

From the set up menu use the UP or DOWN key to move the cursor to the '# GPS' option and press the ENTER key. The screen will display either "GPS Selected" or "GPS Not Selected". Use the UP or DOWN key to change the setting if desired and push ENTER. If the GPS is not selected the screen will return to the set up menu. IF the GPS was selected the screen will display 1 of 3 messages. These are detailed below.

Navigating GPS is displayed at the top of the screen . The absolute latitude and longitude are displayed (in degrees minutes seconds format) next followed by the local latitude and longitude in metres. The bottom of the screen indicates that if ENTER is pushed the local origin will be set to the same coordinates as the current absolute latitude and longitude. If this is done it will be seen that the local latitude and longitude will become 0.0 metres. Push CANCEL to return to the set up menu. The local origin is not retained after power off.

Not Navigating! is displayed at the top of the screen. This indicates that the GPS receiver is not able to get a valid navigational fix. This can occur if the the receiver has only been recently power on as it can take several minutes after power on for the receiver to get a good navigational fix. This message can also occur if the GPS receiver is receiving weak signals from the satellites which could be due to dense foliage or cloud cover above the receiver etc.

No Valid Data! is displayed at the top of the screen. This message indicates that the CP40 is not receiving any data of a valid format. This will occur if there is no GPS receiver connected or if the GPS receiver has been configured wrongly by the user (incorrect BAUD rate , non NMEA data format etc) or if the receiver has been wired incorrectly to the 6 pin connector. Refer to appendix A for the details for connecting and configuring the GPS receiver.

If the receiver is having problems getting a valid navigational fix or there is no receiver being used it is advisable to set the the setting to GPS not selected. This will prevent the CP40 from attempting to read the GPS receiver when an insertion is made.

RECORDING INSERTIONS

Before recording insertion data the target needs to be resting on the ground and the penetrometer held up so that the cone is off the ground. Ensure that no foliage is between the CP40 and the target and that no clods of mud are stuck to the shaft or the reading from the ultrasonic transducer will be erroneous. Once an insertion is started the cone is to be pushed into the ground smoothly and at a constant speed (aim for 2 metres / minute) until the insertion is finished.

To record an insertion from the main menu move the cursor (using UP or DOWN) to the '# Start ' item. Adjacent to this will be displayed the next file number and insertion number to be recorded, push the ENTER key. The CP40 will now execute one of several options depending on the GPS select setting and the response from the GPS receiver.

If the GPS receiver was selected in the set up menu and the receiver has a valid navigational fix then '**Navigating GPS'** is displayed at the top of the screen . The absolute latitude and longitude are displayed (in degrees minutes seconds format) next followed by the local latitude and longitude in metres. The bottom of the screen indicates that if ENTER is pushed the insertion will be initiated. The ENTER button needs to be held down until the insertion is initiated, this may take up to 1 second. The reason for this is that the CP40 takes time to read the GPS receiver before beginning the insertion. Valid GPS data will be recorded with the insertion data.

If the GPS receiver was selected in the set up menu and the receiver has failed to get a valid navigational fix then '**Not Navigating !'** is displayed at the top of the screen. The bottom of the screen indicates that if ENTER is pushed the insertion will be initiated. The ENTER button may need to be held down for up to 1 second. No valid GPS data will be recorded with the insertion data, the absolute and local latitudes and longitudes will be recorded as 0.

If the GPS receiver was selected in the set up menu and the receiver is not sending valid data then '**No Valid Data !'** is displayed at the top of the screen. The bottom of the screen indicates that if ENTER is pushed the insertion will be initiated. The ENTER key may need to be held down for several seconds for the insertion to be initiated. No valid GPS data will be recorded with the insertion data, the absolute and local latitudes and longitudes will be recorded as 0. If no GPS receiver is being used it is advisable to change the setting to GPS not selected from the set up menu.

If the GPS receiver was not selected in the set up menu the insertion will be initiated immediately. No valid GPS data will be recorded with the insertion data, the absolute and local latitudes and longitudes will be recorded as 0.

Once an insertion is initiated the ultrasonic transducer will be heard operating (emitting clicking sounds) and the screen will display several parameters. The first line will display the depth of the cone below ground level. This will be a negative number until the cone is pushed into the ground. The next line indicates the current cone index reading in kPa. The next line indicates the speed of the insertion in metres/minute. Try to maintain this number at or below 2m/min . The last line

indicates which interval the penetrometer is currently recording data for. This number will start at 1 and will increase until the insertion is completed. If the user wishes to terminate the insertion the CANCEL button is to be pushed. The screen will show "Insertion Aborted   Data Not Recorded !" and will return to the main menu. The data will not be recorded and the insertion number and or file number will not be incremented.

Insertion Errors

If an attempt is made to initiate an insertion while the cone is in the ground the screen will show " Too Close ! Data Not Recorded ! " and will return to the main menu. The data will not be recorded and the insertion number and or file number will not be incremented.

If the speed of insertion drops below 0.2 metres/minute the insertion will be terminated and a message on the screen will show " Too Slow! Data Not Recorded ! " and will return to the main menu. The data will not be recorded and the insertion number and or file number will not be incremented.

If the speed of insertion exceeds the maximum speed parameter (set from the set up menu) then the penetrometer will either sound an alarm (if the speed abort parameter is set to off) or will terminate the insertion (if the speed abort parameter is set to on). If the insertion is terminated the screen will show " Too Fast ! Data Not Recorded !" and will return to the main menu. The data will not be recorded and the insertion number and or file number will not be incremented.

If the load experienced by the load cell is greater than the maximum load parameter (set from the set up menu) then the penetrometer will terminate the insertion. The screen will show " Max Load Exceeded! Data Not Recorded! " and will return to the main menu. The data will not be recorded and the insertion number and or file number will not be incremented.

Once an insertion is completed the ultrasonic transducer will stop working and the CP40 will automatically enter the 'Review Data' mode displaying the insertion just completed. The UP and DOWN buttons may be used to review other insertions in the CP40's memory. Push ENTER or CANCEL to return to the main menu.

REVIEWING DATA

The CP40 provides the user the ability to review insertions currently stored in memory. To review previous insertions from the main menu use the UP or DOWN key to move the cursor to the '# Review Data' item and push ENTER. The screen will show the most recently recorded file number with a flashing cursor over it. Use the UP or DOWN keys to change the file number if required then push ENTER. The screen will then show a two axis graph with the horizontal axis indicating depth , 0 at the origin and the maximum depth achieved at the right hand end. Each graticule indicates one interval of depth. This axis is dynamically adjusted to suit the maximum depth and interval setting used at the time of the insertion. If for example a maximum depth of

600mm and an interval of 15mm was chosen then the graticule dots will be 'bunched up' across the axis with 40 of them present. If a maximum depth of 200mm and an interval of 25mm was chosen these graticule dots will be a lot further apart, as it is only required to fit 8 of them across the axis. The vertical axis indicates cone index readings, 0 kPa at the origin. This axis shows a graticule dot for each 500kPa, the furthest up the axis being for 5500kPa. The file number and insertion number of the data currently displayed is indicated at the top of the screen. Use the UP or DOWN button to review other insertions stored in the memory. Push ENTER or CANCEL to return to the main menu.

DOWNLOADING DATA

The CP40 provides the user the ability to download stored data via the RS232 serial cable to a PC. From the main menu use the UP or DOWN keys to move the cursor to the '# Download Data' item and push ENTER. The CP40 now requires the user to enter a file number to start downloading from and one to finish downloading from. Use the UP, DOWN and ENTER keys to select the block of files to be downloaded. Once the ENTER key is pushed after indicating the finish file number the CP40 will proceed to download all the insertions of the files between the start file number and the finish file number inclusive. The file currently being downloaded will be displayed on the screen. Once the data has been downloaded the screen will return to the main menu.

CLEARING MEMORY

The clear memory function deletes all insertion data from the CP40. The user should be certain of having any valuable data saved on a PC system before clearing the memory. To clear the memory from the main menu use the UP or DOWN key to position the cursor on the '# Clear Memory' item and push ENTER. The screen will indicate " Clear Data ?" if the CANCEL key is pushed then the memory will not be cleared. If the ENTER key is pushed the memory will be erased. When the memory has been erased the screen will return to the main menu. The site name and all other parameters are not altered after the memory has been erased.

BATTERY

The internal battery is a 6V rechargeable gel cell type. It is of sufficient capacity to provide more than a full days use with no external GPS receiver powered from the penetrometer. If an external receiver is powered from the CP40 it will naturally reduce the usable operating time of the unit dependent on the current drawn by the receiver. The battery voltage is indicated at the bottom of the screen on the main menu. If the battery voltage falls below 5.6 volts the CP40 will flash the battery voltage on and off on the screen . Do not attempt an insertion after the battery has reached this state. If the battery voltage drops below 5.5 volts the unit will automatically power off. Charge the battery with the charger provided for at least 8 hours before attempting to use the unit again. None of the parameters or previously recorded insertion data will be affected if the CP40 experiences a low battery condition.

APPENDIX A

GPS Receiver

The CP40 penetrometer is designed to use the data from any compatible GPS receiver provided it is configured and connected correctly. Connecting and configuring a GPS receiver should not be attempted by the inexperienced. If the task appears onerous use the services of a competent local electronics workshop to ensure a professional standard is maintained. Ensure data on the receiver being used (wiring diagram, power supply required, current drawn etc.) is obtained from the manufacturer and used to connect the GPS receiver correctly. The CP40 is warranted for a period of 12 months from the date of purchase. If the penetrometer or GPS receiver is damaged during the process of connecting and configuring the GPS receiver then Agridry Rimik or its agents cannot be held responsible.

 Essentially there are two types of GPS receivers available. The non-differential type obtain their navigational fix directly from the satellites orbiting the earth. These units are generally accurate to within 15 metres (selective availability turned off). They are moderately priced and generally are powered by a low voltage (+6V or less) and draw a small current (less than 150mA). The other type of receiver is the differential type (DGPS) . These receivers obtain a more accurate position fix (less than 5 metres error) by using the orbiting satellites as well as a ground (or sea) based transmitter to correct the error. They are larger, more expensive and are often powered by +12V. They generally draw more current than the non differential type. As technology continues to advance it is expected differential receivers will become smaller, cheaper and use less power.

The GPS receiver should be configured to output positional data in the NMEA-0183 ASCII format updated once per second. The CP40 requires the receiver to send the $GPRMC sentence to obtain position information. The receiver shall operate through a true level **(not logic level)** RS232 interface at a data rate of 4800bps with a format of 8 data bits, no parity bits, 1 stop bit with no hardware handshaking required. This is the standard format used by most GPS receivers. Many GPS receivers allow the operator to configure these parameters by connecting them to a PC and using configuration software provided by the GPS receiver vendor.

 A typical connection to a GPS receiver is illustrated in figure A-1. Many GPS receivers use an enable line to activate them and will not work unless the enable line is set to the correct state. A high level enable state is supplied at pin 5. If the receiver used is enabled by a low level then connect the receivers enable line directly to pin 1 as illustrated in figure A-2. The CP40 provides a +5V rail to power an external receiver. It is important the receiver draws no more than 150mA current from this pin. If the GPS receiver used does not run from +5V (some are +3.3V, others 6V or 12 V, others have their own internal batteries) or requires more than 150mA current then the user must make provision for the receiver to be independently powered by other means as illustrated in figure A-3. It should be noted that the GPS receiver is connected in a cross connect fashion (null modem) i.e. data out of the receiver connected to RXD of the penetrometer and data in connected to TXD. As mentioned previously it is desirable to be able to connect a GPS

receiver directly to a PC for the purpose of setting it up correctly. Use the wiring configuration shown in figure A-4 to do this.

GPS RECEIVER

CP40 6 way GPS Connector

1 GROUND	GROUND
2 RXD	DATA OUT
3 TXD	DATA IN
4 +5V	+5V
5 ENABLE(+)	ENABLE(+)
6 N.C.	

Figure A-1

GPS RECEIVER

CP40 6 way GPS Connector

	ENABLE(-)
1 GROUND	GROUND
2 RXD	DATA OUT
3 TXD	DATA IN
4 +5V	+5V
5 ENABLE(+)	
6 N.C.	
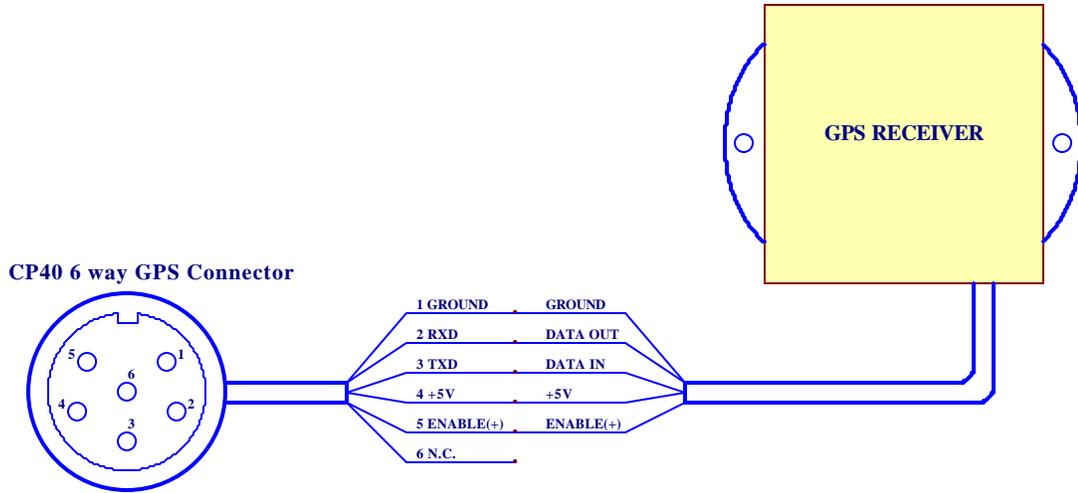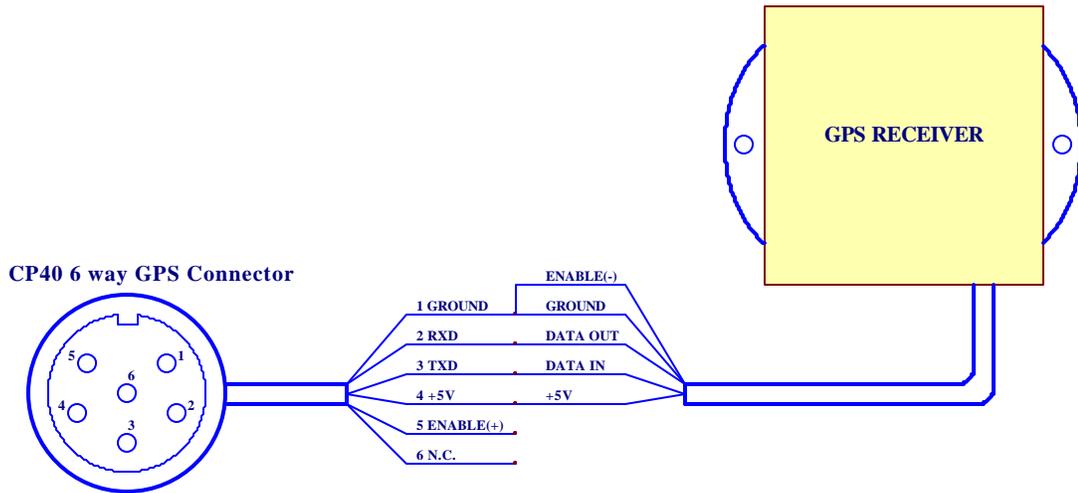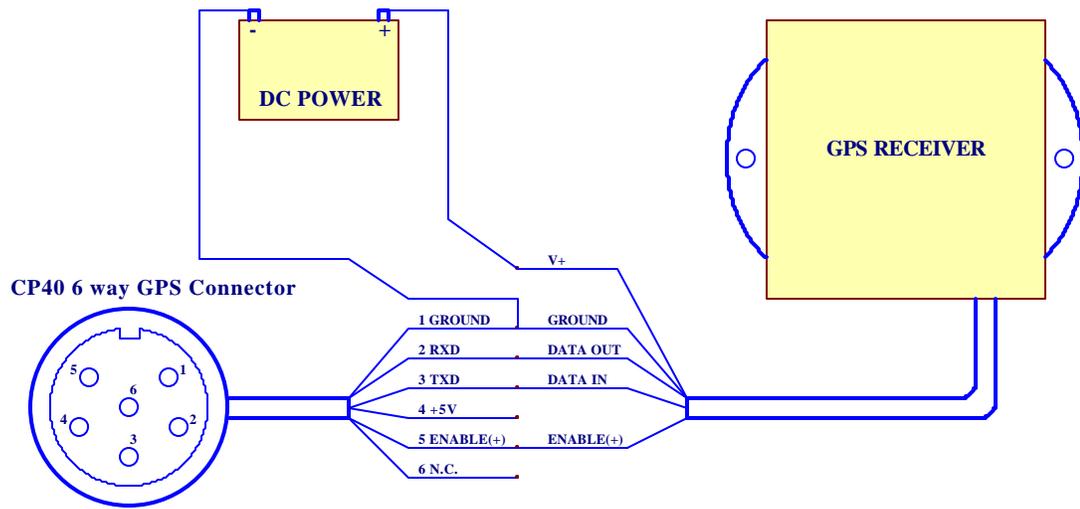
Figure A-2

Figure A-3

Figure A-4

APPENDIX B

Replacement Battery

134mm

34.5mm

60.5mm

Battery Charger Connector

+ -

6V 3AH
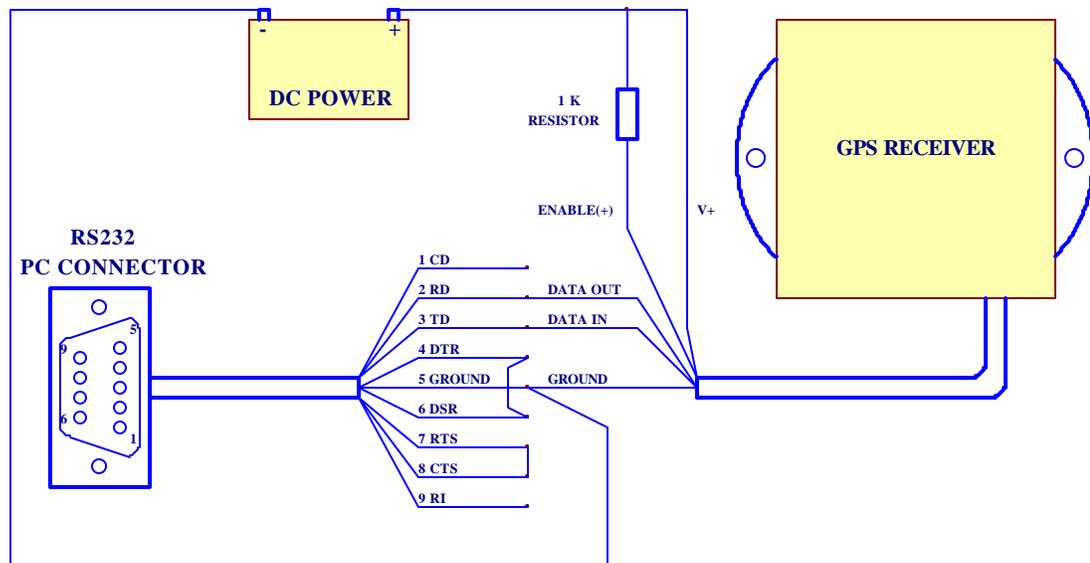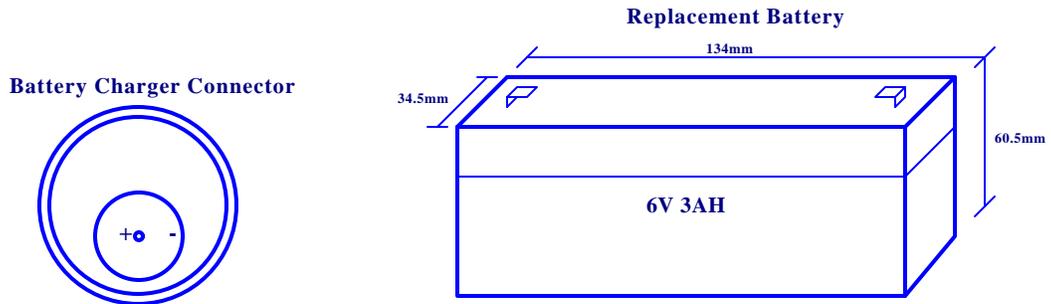
The battery charger connector's central pin diameter is 2.1mm. The internal rechargeable battery is of standard dimensions and rating. Several manufacturers produce this type.

CP40 4 way Load Cell Connector

Load Cell

4 1

3 2

1 V+ RED
2 LS+ WHITE
3 LS- GREEN
4 GROUND BLACK

DOWNLOAD CABLE

9 WAY RS232
CONNECTOR

1 CD	1 CD
2 RD	2 RD
3 TD	3 TD
4 DTR	4 DTR
5 GROUND	5 GROUND
6 DSR	6 DSR
7 RTS	7 RTS
8 CTS	8 CTS
9 RI	9 RI

9 WAY RS232
CONNECTOR
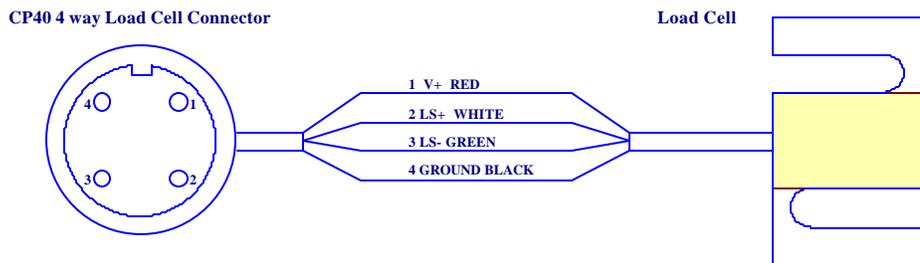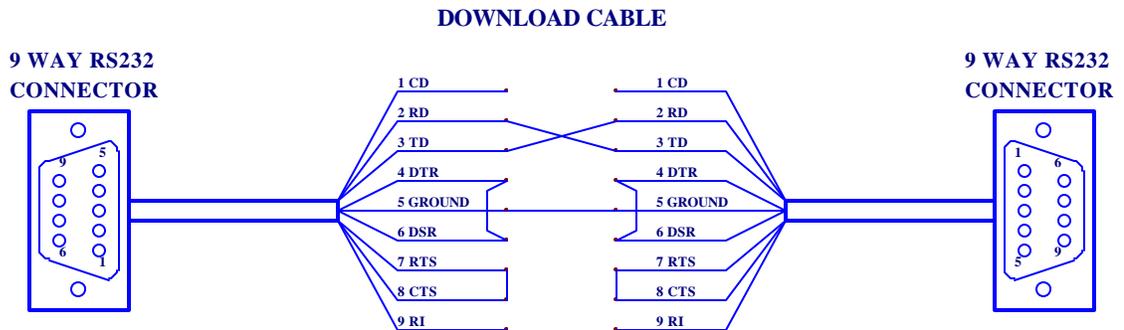
The serial data download cable is a standard cross connect null modem arrangement. Note RD connects to TD of the other connector and vice versa. Also note at each connector DTR is connected to DSR and RTS is connected to CTS. Data is downloaded from the CP40 at 9600Bps, 8 data bits, 1 stop bit , no parity bit format.