LIMITED WARRANTY

JAMAR Technologies, Inc. warrants the DB-400 against defects in material and workmanship for a period of one (1) year limited warranty on parts and one (1) year limited warranty on labor from the date of purchase. For information on extended warranty call 1-800-776-0940.

JAMAR Technologies, Inc. warrants each new instrument manufactured by the company to be free from defective material and workmanship and agrees to remedy any such defect. At its option, it may furnish a new part in exchange for any part of any instrument of its manufacture which, under normal use and service discloses such defect. The instrument must be returned to the JAMAR factory or authorized service agent intact, for examination, with all transportation charges prepaid.

This warranty does not extend to any products which have been subject to misuse, neglect, accident or vandalism. This warranty does not extend to products which have been repaired or altered outside the JAMAR factory or authorized service agent.

In no event shall JAMAR Technologies, Inc. be liable for any damages arising from the use of this product including damages arising from the loss of information.

This warranty is in lieu of all other warranties expressed or implied and no representative or person is authorized to assume for JAMAR Technologies, Inc. any other liability in connection with the sale or use of JAMAR products.

JAMAR Technologies, Inc. reserves the right to make improvements on the product and/or specifications at any time without notice.

Questions concerning this warranty or any JAMAR Technologies, Inc. product should be directed by e-mail, mail or telephone to:

<div align="center">

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044
215-491-4899
sales@jamartech.com

</div>

If you have any questions about the use of the DB-400, please call the following number:

1-215-491-4899
Monday — Friday 8:00 AM to 5:00 PM Eastern time

You may also contact us by e-mail at:

sales@jamartech.com

For more information on our products, or for the latest news in product development, visit our web site at:

www.jamartech.com

Address any correspondence to:

JAMAR Technologies, Inc.
151 Keith Valley Road
Horsham, PA 19044-1411

Table of Contents

Quick Start Guide for the DB-400

1. Turn the DB-400 ON. Once the start-up process is complete, the main menu will be displayed. Press DO while Count is flashing.

> COUNT   REVIEW   DUMP
>   CLEAR   UTILITIES
> Do Turning Movement
> count.   -bat: OK

2. On the next screen, to start a new count, press the TAB until New is flashing then press the DO key.

> NEW   STATUS   EXIT
>
>   Start a new Turning
>   movement count.

3. You are then given the option to enter a site code for the study. This can be an 8-digit number or the street names of the intersection being counted (Alpha).

> 8-DIGIT   ALPHA   EXIT
>
>   Select 8-digit site
>   code mode.

4. Once a site code has been entered, you are prompted to select an interval length. The most commonly used interval is 15 minutes. Press the TAB key to highlight the interval desired then press the DO key.

> 1   5   15   30   60   EXIT
>   Select interval
>   duration (minutes).
>   Press DO to accept

5. When starting a new count, always try to begin as close to an interval boundary as possible, such as xx:00, xx:15, xx:30, or xx:45.

> Count # : 001
> Interval #: 001
>   --Any Key to Start--
> 07:59:37

6. Press any of the grey keys to begin counting and the DB-400 will start recording data.

7. Once you have finished your count, turn the DB-400 off and the data will be stored internally.

Chapter 1

Introduction to the DB-400

What is the DB-400?

The DB-400 is an electronic hand-held device that enables you to do the most common of all manual data collection studies: intersection turning movement counts.

Multiple studies can be stored in the DB-400, using up to a total of 312 intervals of data. For each count, the unit stores the date and time, the number of intervals used, a site code, and the data. While collecting data you can record up to 48 distinct movements per intersection.

While the data that has been collected with the DB-400 can be manually extracted from its display, the device is designed to be downloaded to a computer. At any convenient time, you can transfer the data to your computer through the RS-232 serial port. The PETRAPro software allows you to easily read, edit and store the data, as well as print a variety of reports and graphs.

Maintaining Your DB-400

The DB-400 is a complex electronic device. Like other electronic devices (televisions, VCRs, computers) a certain amount of care should be taken to ensure it has a long, productive life. While the DB-400 is a very rugged and durable instrument, some precautions should be taken.

Like other electronic devices, the DB-400 can be affected by static electric discharge. When using the device, be careful to properly ground or discharge yourself, especially in cold weather when static electric build-up is more prevalent.

The DB-400 is not waterproof. Like other electronic devices, the DB-400 can be damaged or otherwise adversely affected by getting wet. Be sure to protect the unit properly during inclement weather. Be careful not to spill any liquids into the unit.

How is the DB-400 powered?

The DB-400 is powered by four AA batteries. The electronics of the unit are designed to draw as little power as necessary, so (depending on use) a fresh set of batteries may last several months before they need to be replaced.

The Main Menu shows the current battery voltage. Fresh batteries should read around 6.4 volts. Batteries should be replaced when this voltage falls around 5.5.

An optional power supply can also be used with the unit to further extend the life of the batteries. This unit, which plugs into a wall socket, is recommend for use when downloading the DB-400 to a computer. When in the field, an optional cigarette lighter adapter can be used with the unit. This item draws power from the car's battery and is required for DB-400s equipped with backlit displays.

Note: When using either the cigarette lighter adapter or external power supply, the On/Off switch of the DB-400 does not need to be turned on. We recommend that the switch be left in the OFF position as this will prevent the DB-400 from drawing power from the internal AA batteries, and extend their life.

Programming the DB-400

The DB-400 is simple to use. An OFF/ON switch on top of the unit panel is used to turn the unit on and off. A 4-line by 20-character display helps you select the proper entries. All options are clearly displayed, with the currently selected option shown with a blinking highlight. The bottom lines of the display are used to explain the option that is highlighted.

Two buttons are all that are used to move from menu to menu, and to select from the various options shown on the display. The TAB key is used to cycle through the options while the DO key is used to select an option. If you move the highlight too far and over-shoot the desired option, just keep pressing the TAB key until it is re-selected.

Using the Count Keys

The DB-400 is designed to make turning movement counts simple and accurate. The buttons are arranged to simulate a standard intersection. There are 16 buttons, with 12 normally used for the left, thru, and right movements from each of the four approach directions. The additional four buttons are user-defined; they can be used for buses, trucks, bicycles, pedestrians, or whatever you want.

Since the DB-400 looks like an intersection, doing a count is very intuitive. If a car makes a left turn from an approach, you simply push the button that shows a left turn from that direction. The DB-400 keeps track of everything else for you.

The DB-400 can also double or triple the number of movements counted from 16 to 32 or 48 by using the unit's two BANK keys in conjunction with the regular movement keys. If a movement key is pressed, the count is registered in the "primary" movements (1-16). If the BANK1 key is held down while a movement key is pressed, the count is registered in the "secondary" movements (17-32). If the BANK2 key is held down while a movement key is pressed, the count is registered in the "tertiary" movements (33-48). Normally, the turning movements of less common events are counted with the secondary and tertiary (BANK1 and BANK2) keys.

The secondary and tertiary keys are often assigned to truck movements. For example, if a car makes a right turn from the north approach, then you press button #2. If a light truck makes the same movement, you press and

hold down the BANK 1 key while pressing button #2, which is counted in the secondary movements. If a heavy truck makes the same movement, you press and hold down the BANK 2 key while pressing button #2, which is counted in the tertiary movements. Since it takes a little more work to press the BANK 1 and BANK 2 keys, the less common truck volumes are assigned to the secondary movements.

This is just one example of how the Bank keys can be used. They can also be used for counting additional approaches if you have more than the standard four at an intersection.

Doing a Count

Before you start a turning movement count, you must ask yourself the following questions.

> • What are the user defined buttons (1,5,9,13) going to be used for, if at all?
> • Are the secondary and tertiary (Bank 1 and Bank 2) keys going to be used?
> • Can one person do the study, or will it require two or more, using separate counters?
> • How is the DB-400 going to be oriented?

The answer to these questions depends upon the experience of the people doing the counts; there are no simple rules of thumb we can give you to help you decide. The important thing is to use your knowledge of the people counting, along with your experience with the traffic they are likely to see in the field, to decide in advance what the best strategy would be.

Deciding on how the DB-400 will be oriented during the study depends on where you will actually be located while doing the count. When the data from the unit is downloaded to our software, the program assumes that the 1 through 4 keys were for the from north (southbound) approach, and the rest of the keys are assigned accordingly.

The DB-400's front panel has a symbol with compass points showing north, south, east and west. This symbol is included to suggest that you align the counter so that buttons 1 though 4 faces north while you are doing the count. It is not necessary to always conform to this practice. Sometimes it

is more convenient for you to face another direction when you do the count, especially if you want to be able to read the display.

The analysis software allows you to select which button was facing north during the count; it just defaults to button #3. We recommend that (if possible) you use the default direction, since it eliminates one source of error when you do the analysis. If you don't use the default direction, it is important to note this. The last page of this manual contains a Field Worksheet that can be used when performing counts. This worksheet, or a similar one, will help to keep track of what was done during a count. If you keep good notes in the field, you won't have any problems, no matter which way the DB-400 is aligned.

Once you have determined how to conduct the count, you are ready to begin. However, before going to the site you should prepare a checklist, like the one below, to prevent potential problems.

1. Is the equipment in good working condition? Can it collect, store and download data properly?   **Yes   No**

2. Have all decisions been made regarding how the data is to be collected?   **Yes   No**

3. Are the people doing the study familiar with how to collect the data?   **Yes   No**

4. Are the people doing the study familiar with the equipment they will be using?   **Yes   No**

5. Are the people doing the study equipped with all needed accessories (spare batteries, watches, pens & paper, etc.)?   **Yes   No**

During the data collection itself, the first priority of those doing the study should be safety. Data collection personnel should stay a safe distance from the traffic, and distract drivers as little as possible. Whenever possible, data collection personnel should work in pairs to minimize the threat of crime, stray dogs, etc.

An excellent source for more detailed information on collecting traffic data is the *Manual of Transportation Engineering Studies*, published by the Institute of Transportation Engineers. The following is excerpted from the manual:

> *Safe, efficient, and effective data collection requires skill, attention to detail, and common sense. The importance of "good" data cannot be overstated. Important conclusions are drawn from field data that form the basis for decisions that affect the expenditure of large amounts of money and can have a significant effect on the safety of the public at large. Data collection demands the same level of professionalism as any other task undertaken by an engineer or engineering technician.*

Chapter 2

Operation of the DB-400

Start-up Screens

To turn on the DB-400, use the power switch that is mounted on the top panel of the unit. When the unit first comes on the sign-on screen is shown. This screen shows the current version number of the firmware in the DB-400.

<div style="text-align:center; border:1px solid;">

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DB-400
Version 4.00
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</div>

After a few seconds, this screen is replaced by the status screen.

<div style="text-align:center; border:1px solid;">

DB-400 Status
Counts Stored: 002
Intervals Used: 032
Intervals Left: 280

</div>
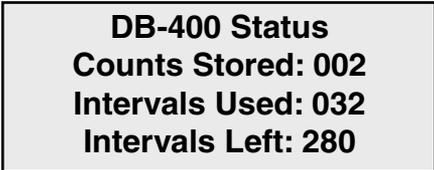
This screen shows the number of counts stored in memory, and the amount of memory (in number of intervals) used and left for new studies. Make a note of the amount of memory left. If you are not sure if it is enough for the study you want to do, then you should download the data to your computer, and then clear the memory in the DB-400 before proceeding.

After a few seconds, the status screen clears and the Main Menu is displayed.

Main Menu

```
COUNT   REVIEW   DUMP
   CLEAR    UTILITIES
Do Turning Movement
count.            -bat: OK
```

The Main Menu screen is the starting point for all of the options in the DB-400. The options on this screen are:

COUNT   Start a New count or Continue the previous count in memory. You can also check the amount of memory left for new counts.

REVIEW   Display on the screen the data in memory for any of the counts. This process is described in chapter 3.

DUMP   Download all of the data in the DB-400 to a computer through the serial port. This process is described in chapter 3.

CLEAR   Clear the memory of all count data.

UTILITIES Perform miscellaneous operations that include a variety of hardware tests, set the time and date, and beeper control.

Battery Status

The Main Menu also displays the battery voltage of the AA batteries used in the unit. Fresh batteries should read around 6.4 volts. You should begin planning to replace the batteries once they fall to 5.5 volts. The unit will shut down once the voltage falls to approaximately 4.5 volts.

For best results, always replace all batteries when changing the batteries. Do not mix and match new and old batteries

Count Menu

```
┌─────────────────────────────┐
│ NEW      STATUS             │
│ CONTINUE          EXIT      │
│    Start a new Turning      │
│      movement count.        │
└─────────────────────────────┘
```

When you select Count from the Main Menu, the screen shown above is displayed. There are several options that may be available on this menu.

New

Select New from the Count menu whenever you want to start a new count. The DB-400 will then step you through a series of menus to further define the parameters of the count, starting with the Site Code.

Site Code

The data in the DB-400 includes the *date and time* that the count was done, but no direct information on *where* the count was done. Correct use of the Site Code is a way for you to guarantee that the data you think was collected at a particular site was indeed collected there.

The DB-400 has two different types of site codes that you can use to identify your counts. The first is simply an 8-digit number that you assign to a particular count so that you can uniquely identify the location of the count when you download the data from the DB-400 to your computer. The second allows you to enter two lines of twenty alpha-numeric characters, typically used to show the North/South street name and the East/West street name at the intersection where the count is done.

After you select NEW from the COUNT menu, the site code selection screen is shown.

```
┌─────────────────────────────┐
│ 8-DIGIT   ALPHA    EXIT     │
│                             │
│  Select 8-digit site code   │
│          mode.              │
└─────────────────────────────┘
```

Select 8-DIGIT to use a simple 8 digit site number to identify the location of the count, or select ALPHA and enter the actual names of the streets where the count is being done.

If you select 8-DIGIT the display changes to:

> **Site code:**
> **Enter up to 8 digits**
> **Press DO to accept,**
> **BANK1-TAB to cancel.**

It is simple to enter the Site Code. Use the keys 1-10 like a keyboard (10=0). Enter the number you want. The display shows the numbers as you type them in. If you make a mistake, press BANK1-TAB and start over. When the number on the display is correct, press DO and you will go to the interval menu.

If you select ALPHA from the Site Code Type Select Menu, the display shows the screen shown below.

> **North/South Street:**
> **A**
> **use↑/↓, TAB=advance**
> **^TAB=cancel,   DO=done**

The top line of the display shows the title North/South Street, with the cursor flashing on the letter A. You enter the street names one letter at a time, using the Change keys (14 & 15) to scroll through the alphabet until the display shows the letter you want. You then press the TAB key to select that letter and advance to the next letter. The display now shows a blank character, which is the default character to start with each time. You can use the up arrow key to move to the letter A, or you can use the down arrow key to go to the number 9. In this way you can quickly select each letter you need. You have 20 characters for each street address, and you can use any letter from A-Z, and any number from 0-9. You can also use spaces. No other characters are available.

You continue in this manner until the entire street address is visible on the display. If you make a mistake, press BANK1-TAB to cancel the operation. When the display is correct, press the DO key. The display then shows a similar screen for the East/West street. Repeat the procedure explained above. When you are done with the second street address, press DO and the DB-400 goes on to the interval menu.

The titles say North/South Street and East/West Street, but that isn't necessarily what you have to enter. You have two lines of characters you can use any way you want. Which of the two types of site codes you use is a matter of preference.

The ALPHA input is more precise, with the actual names of the streets entered with the data, but some people don't like to enter the names one letter at a time. The 8-Digit site code is certainly easier to use, but then you have to have some sort of system to link the site code entered into the DB-400 with the names of the streets. This can be done by using the Field Worksheet located in the back of this manual. Have the people who do the counts fill out the information on the worksheet, along with any other information you think is important (a sketch of the location is usually a good idea). This worksheet should then be brought back to the office and used as a reference when the data is transferred to the computer.

This is a simple system that has worked well for many different agencies. It avoids the occasional problem of trying to remember exactly where a particular count was done, especially if the person who did the count is not available for one reason or another.

What Site Code scheme you use is entirely up to you. Some agencies have developed elaborate coding schemes to uniquely identify every possible counting location in their area, usually using a map reference system (123 456 7 8 might mean location at grid point 123,456 facing direction 7, counted by tech # 8), others simply start at 1 each day and add one for each count. As long as you are consistent with your scheme, and keep a separate worksheet record, you won't have any trouble.

Once you have entered the site code, you will be taken to the Interval menu

Interval

Once you have programmed a site code for the study, you are prompted to choose the interval length that will be used.

```
1   5   15   30   60   EXIT
       Select interval
     duration (minutes).
    Press DO to accept
```

You are given the choice of 1, 5, 15, 30, or 60 minute intervals. An Interval is the amount of time the DB-400 collects data before it stores the accumulated totals in memory. You are barely aware of intervals changing when you do a count with the DB-400 (the counter beeps at the end of each interval to let you know it may be time to go home). The counter automatically keeps track of the time and stores the data at the end of the interval. You only have to concentrate on collecting the data. This is one of the major features of the DB-400.

The default value is 15 minutes, as this is the most common interval length used for Turning Movement studies. We recommend that you use 15 minutes unless you have special requirements.

Press DO once you have selected the interval length you wish to use.

Start Count

After you have selected an interval to use, you are ready to start the count. The display shows the current count number and the interval number. In

```
Count #  : 001
Interval #: 001
    --Any Key to Start--
07:59:37
```

the example shown, this is the first count done, and it is at the first interval.

The DB-400 is waiting for you to push any movement button, which starts the count. The display in the lower left corner shows the current time, so it is easy to synchronize the start of the count to the beginning of the desired interval. You do not have to push the first button exactly when the seconds roll over to zero. The analysis software rounds the start of the count to the nearest minute automatically. However, when starting a new count, always try to begin as close to an interval boundary as possible, such as xx:00, xx:15, xx:30, or xx:45.

Press any of the gray keys to begin counting and the DB-400 will start recording data.

When you push the first button to start the count, the display changes to show the amount of time left in the present interval. In this case, it starts at 15:
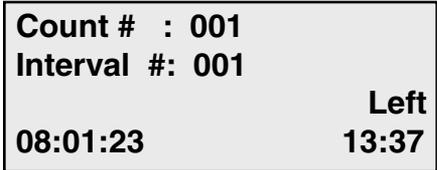
```
Count #  : 001
Interval #: 001
                      Left
08:01:23            13:37
```

00 minutes and counts down to zero. At the end of each interval, the DB-400 beeps three times. Normally you are not watching the display, you are watching the traffic. The beeps remind you that the interval is over. This is only important if this is the last interval and you are ready to quit; otherwise, just ignore the beeps and keep counting vehicles.

********IMPORTANT********
Once you start the count, the only way to quit the count is to turn the DB-400 off. Always wait for the end of interval beeps before turning the unit off.

There is no data stored in the counter until after the first interval. If, after starting a count, you realize that you set one of the parameters wrong, you can turn off the counter and restart the count correctly. However, once an interval has finished, the count is stored in memory. So, if you realize after the first interval that you have made a mistake, you need to either make a note to the person downloading the data to ignore that count, or clear the DB-400's memory, as described on page 2-11.

You have two display options while you are doing the count. The status screen shows the current time and the amount of time left in the interval, among other things. Normally you do not look at the screen while you are doing a count, you are busy looking at the traffic. All you really need to know is the time so that you know when the count is over.

However, some people like to be able to see the counts accumulate in memory, especially if they have done counts for years with mechanical counters that show the count totals change as the buttons are pushed. Some people just don't believe the count is registered if they can't see any evidence for themselves.

If you press the TAB key while counting, the display changes to show the totals for each of the primary movements, buttons 1-16. Each row shows one approach.

1N :	000	000	000	000
1E :	000	000	000	000
1S :	000	000	000	000
1W :	000	000	000	000

Note that this display assumes buttons 1-4 are the North direction.

If you press the TAB key a second time, the display changes to show the totals for each of the secondary movements, BANK1 1-16. *This is designated by the number before the direction changing to a 2.* If you press the TAB key a third time, the display changes to show the totals for each of the tertiary movements, BANK2 1-16, with the number before the direction changing to a 3.

Press the TAB key a fourth time, and the display changes back to the default status screen showing the time. You can continually press the TAB key to cycle through the four screens (time, primary keys, secondary keys, tertiary keys).

At the end of each interval, the display automatically changes back to the default screen, so you can check to see if it is time to end the count. As soon as you press one of the movement keys, the display goes back to the screen you were using when the interval ended. If you know that you are not near the end of the count yet, you don't have to look at the display, just keep counting.

When you get to the last interval, keep counting until the interval ends, signaled by the triple beep. Once you hear this, turn the DB-400 off. **Remember, the only way to stop a count is to turn the power off.**

Continue

It is often necessary to do a study at the same location at different times of the same day. For example, you might do a count in the morning to count the morning peak, and then return later in the day to count the afternoon peak. You can choose NEW and just do two separate counts and treat them separately, or you can choose to CONTINUE the first count.

When selecting the Continue option, the DB-400 automatically selects the same counting interval and site code you used for the previous count. When the information is downloaded, the analysis software combines the data from the two sessions into one count, and puts zeros in all of the data points between the two counts. An option in the software lets you print just the collected data, so that all of the zeros are not printed on the report.

The Continue option is not always available as an option, and as a result is not always shown on the display. The DB-400 checks the count in memory to determine if it is a count that you can continue.

The rules for being able to continue a count are as follows:

1. You cannot Continue a count unless it is on the same day as the previous count. All studies with the DB-400 are confined to a single day.

2. You can only Continue the last count performed. Previous counts cannot be continued.

With the exceptions noted above, you can CONTINUE any count, any number of times, when you use the DB-400.

Status

Before starting a New count or Continuing a previous count, the Status menu can be used to determine whether or not there is enough memory in the DB-400 to conduct the next count.

```
Counts stored: XXX
Intervals used: XXX
Intervals left: XXX
   Press DO to return
```

The status screen (shown above) tells you information about the memory in the counter. The most important number is on the third line, the number of intervals left. You want to make sure you have enough memory to do the counts you want to do **before** you bring the counter out to the field. If you are not sure, you should download the data in the counter to your computer for processing, and then clear the counter to free up the memory.

The status information is always shown when you turn on the DB-400 counter, but you can also re-display it from the Count menu if you didn't notice it the first time.

Clearing the Memory

The DB-400 stores the count data in low power solid state memory, and retains the data even if the counter is turned off. Once the data has been transferred successfully to the computer, however, there is no

```
COUNT   REVIEW   DUMP
   CLEAR    UTILITIES
Clear memory of all
count data.      -bat: OK
```

need to keep the data in the DB-400. The only way to clear the data, and make room for new counts, is to use the Clear option. Select Clear from the Main Menu.

The first level of protection checks to make sure you pressed the correct key in the Main Menu. Assuming you did, move the highlight to CLEAR and press the DO key.

```
CLEAR         EXIT

Clear memory of all
count data.
```

The second (and final) level of protection asks you to confirm that you really want to clear the memory. Again, assuming you do, move the highlight to Confirm and press the DO key *(If you clear the memory by accident, after all this, don't blame us).*

```
CONFIRM        EXIT

Yes, I really want to clear
memory.
```

The memory is cleared and the screen shown here is displayed. Press DO and you will then be returned to the Main Menu.

```
- - Memory Cleared - -

   Press DO to return
     to Main Menu.
```

Utilities Menu

The Utilities Menu contains a miscellaneous assortment of operations that are necessary and/or helpful to the operation of the DB-400. When you select Utilities from the main menu, the following screen is displayed.

```
COUNT  REVIEW  DUMP
   CLEAR   UTILITIES
Tests, time/date,
set options      -bat: OK
```

```
TESTS      TIME/DATE
    OPTIONS       EXIT
  Test memory, keys,
     display, s.port
```

You have three sub-menus from which to choose: Tests, Time/Date and Options.

Tests

The DB-400 is designed to be a very reliable instrument. It is manufactured with high quality components, and is designed to withstand rugged use in the field. It is also a very sophisticated product with a microprocessor "brain". One feature of this brain is that it can perform a series of diagnostic self-tests to help you verify the correct operation of the DB-400, even in the field.

To perform one or more diagnostic tests, select Tests from the Utilities menu. The screen shown below is then displayed.

> **MEMORY   DISPLAY**
> **KEYS   S.PORT   EXIT**
> **Test memory, keys,**
> **display, s.port**

The display shows the four types of tests that can be performed, which are Memory, Display, Keys and Serial Port. Use the TAB key to move the highlight to the test you want to do, and then press DO.

Memory Test

The DB-400 contains low-power solid state memory that is used to store the data from the various counts. Solid state memory is extremely reliable. However, like any electronic element, it can go bad. If you suspect there may be a problem with the memory you can easily test it. To test the memory, select MEMORY from the TESTS menu. The screen shown below is then displayed.

> **- - - MEMORY TEST - - -**
> **TESTING**
> **Please wait**
> *** * * ***

The DB-400 automatically starts testing the memory. It takes only a few seconds to complete the test. Every few seconds a star "*" is displayed on the screen so that you'll know that something is happening. The test does not affect any data that is stored in the DB-400. If the test is successful, the word PASSED is displayed, as shown below.

> **- - - MEMORY TEST - - -**
> **PASSED**
> **Press DO to return**
> **to TESTS Menu**

If the test is not successful, an error message is printed. There is not much you can do, except check the main batteries to see if they are low. It is possible (but very unlikely) that if the batteries are low, the microprocessor is not executing the test properly. If the memory test fails, contact us using the information in the front of this manual to arrange to ship the DB-400 back for repair.

Display Test

The liquid crystal display used in the DB-400 displays four lines of 20 characters. Each character is made up of 35 dots, in a 5 x 7 matrix. That's a lot of dots! The display test lets you check the display to make sure it is showing what it should be showing.

To test the display, select Display from the Tests menu, and the screen shown below is displayed. Press DO to start the test.

```
- - - DISPLAY TEST - - -

   Press DO after each
      test screen...
```
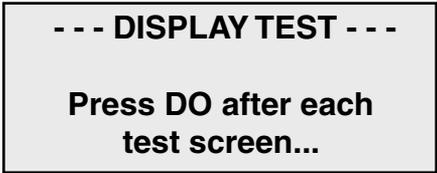
The display should look like the screen shown below. Each character should be an asterisk "*", and there should not be any other dots displayed.

```
* * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * *
* * * * * * * * * * * * * * * * * * * *
```

Press DO three times. You should see a full screen of "8", then full screen of "=", and finally a full screen of "|". If any of the screens do not display correctly, then something is wrong with the display of the DB-400. Contact us using the information in the front of this manual to arrange to ship the DB-400 back for repair.

Keys Test

There are 20 push-button keys (or switches) on the front panel of the DB-400, each of which performs a vital function. It is very important that the keys work reliably. The keys are the only components in the DB-400 that are susceptible to "wear & tear".

Our experience suggests that some customers think that the harder they push the keys, the more "important" the DB-400 will consider the count. This is not true. Actually, the counter prefers gentle pressing of the keys. Please keep it in mind.

To test the switches, select KEYS from the TESTS menu. The screen shown below is then displayed.

> **- - - SWITCH TEST - - -**
> **Press any one key...**
> **You pressed: #1**
> **Bank1-DO to exit**

Each time you press a key, the DB-400 displays the number of the key on the display. The BANK1, BANK2, TAB, & DO keys are spelled out. Press each of the keys until the all of the switches have been tested. Press BANK1 - DO to return to the TESTS menu.

If any of the switches won't register on the display, contact us using the information in the front of this manual to arrange to ship the DB-400 back for repair.

Serial Port

The DB-400 has an RS-232 serial port that is used to transfer its data to your computer for analysis. The serial port has bi-directional capability, meaning that data can be sent *out* to the computer and commands can be received *in* from the computer.

To test the serial port, select S. PORT from the TESTS menu. The screen shown here is then displayed.

> **- SERIAL PORT TEST -**
> **Short pins 2 & 3.**
> **Press DO to begin**
> **test procedure.**

```
┌──────────────────── ******IMPORTANT****** ────────────────────┐
│  In order for the serial port test to work correctly, you must use a  │
│  test connector to connect pins 2 (the output) to pin 3 (the input).  │
│  The test will fail if a connector is not used properly.              │
└───────────────────────────────────────────────────────────────┘
```

The easiest way to connect pins 2
& 3 is to use a paper clip that has
been straightened out. Note that
the cable used to download data
to your computer **cannot** be used
as a test connector. Refer to the
diagram shown here to determine
which pins 2 and 3 are on the serial
port. The port itself also has small
numbered labels for each pin.

Pin 3   Pin 2
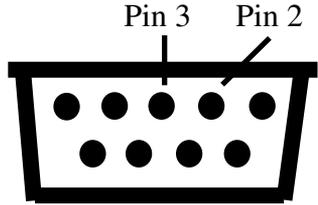
The DB-400 sends a series of known messages out of the serial
port, and at the same time reads the messages coming into the serial
port. Since they are the same messages, the DB-400 can tell if it
is sending and receiving correctly. This tests the entire serial port
section of the DB-400 circuitry.

Once you have connected pins 2 & 3 properly, press the DO key and
the test will begin. The following screen will then be displayed.

```
┌───────────────────────────────────┐
│        - SERIAL PORT TEST -        │
│                                    │
│        -------TESTING -------      │
└───────────────────────────────────┘
```

The DB-400 performs the test, and if the test is successful, displays
the following screen.

```
┌───────────────────────────────────┐
│        - SERIAL PORT TEST -        │
│   Test: PASSED                     │
│          Press DO to return        │
│             to TESTS Menu          │
└───────────────────────────────────┘
```

You can now remove the test connector and press DO to return to the TESTS menu.

If the test fails, then the DB-400 displays a screen similar to the one above, except the word "FAILED" is displayed instead of the word "PASSED". You should then contact us using the information in the front of this manual to arrange to ship the DB-400 back for repair.

Note: You can also perform this test to determine if the download cable you are using is working. First, connect the plug of the download cable to the serial port connector of the DB-400. Next, use a test connector to connect the 2 and 3 pins on the plug on the other end of the cable. Then, perform the serial port test. This will test the serial port of the DB-400 as well as the continuity of the cable.

Time/Date

The DB-400 has a built-in real time clock that is powered by the same lithium battery that is used to store the count data in the solid state memory. The clock normally keeps excellent time, but occasionally needs to have the date or time corrected.

To change the date or time, select TIME/DATE from the UTILITIES menu. The screen shown here is then displayed.

```
HR  MIN    MON DAY YR
  12:25       02/ 13/ 01
Change↑/↓ to modify
DO to set time/date
```

The display shows the current hours, minutes, month, day, and year. Use the TAB key to move the highlight to the parameter that you need to adjust. Then:

Use the Change (#15) key to add one to the current value,

or

Use the Change (#14) to subtract one from the current value.

Continue using the Tab and Change keys until all of the parameters are correct, then press DO to set the new date and time.

Note: The time is not set until you press the DO key. To synchronize the time to the second, set the time one minute ahead then wait until your watch shows the seconds equal zero, and then press the DO key.

Options

The Options menu lets you select two different operating characteristics of the DB-400. The first controls the use of the Beeper. The second controls the

```
 BEEPER    #TIERS   EXIT

Turn beeper on
  or off.
```

number of tiers (or banks) of memory you can use when you do Turning Movement counts.

Beeper

The DB-400 has a built-in beeper that beeps when most keys are pressed. Some people like the beep. It is a positive indication that the key pressed was detected by the microprocessor. In the field, while you are busy watching the traffic, the beep can be reassuring. Other people don't like the beep, especially in a quiet car.

You can easily change the current mode of the beeper, from on to off, or from off to on. Select Beeper from the Utilities menu. The screen shown here is then displayed.

```
- - -  BEEPER  MODE  - - -
 ON        OFF        EXIT

Turn Beeper ON
```
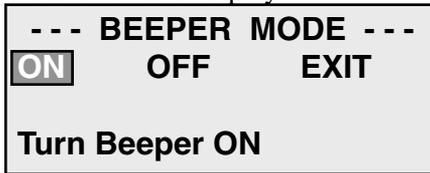
Use the TAB key to move the highlight to the mode you want, then press DO. The new mode is installed immediately, and you are returned to the Options menu.

The DB-400 remembers the mode you have selected even after it is turned off. If you change the beeper mode to off, then it will stay off unless you change the mode again.

Tiers

There are three banks of memory available in the DB-400. The earliest generation of turning movement counters and software available from us (called IMC) were limited to two banks of memory. Since some customers still use this equipment, the DB-400 has an option to set the number of memory banks to two, to be compatible with

the IMC software. The PETRA or newer PETRAPro software allows you to take full advantage of the three banks of memory in the DB-400.

──────********IMPORTANT********──────

Unless you have a specific reason for changing the Teir setting, we suggest leaving it at the default setting of 3-Tiers.

To change the Tier setting in the DB-400, select #TIERS from the OPTIONS menu. The screen shown here is then displayed.

```
┌─────────────────────────────┐
│  2-TIERS      3-TIERS        │
│                   EXIT       │
│  Extended: BANK1 and         │
│  BANK2 both active.          │
└─────────────────────────────┘
```

Press the TAB key to select the option you want, then press DO. The option is stored in memory, and you are returned to the Options menu. Note that if the 2-Tier mode is used, then the BANK 2 switch on the DB-400 is disabled. You are then limited to 32 movements, with the primary movements counted with keys 1-16 and the secondary movements counted with the BANK1 key in conjunction with keys 1-16.

The Tier mode is stored in permanent memory and will be the active mode until you change it again at a later date. You don't have to set it each time you turn on the counter.

Chapter 3

Retrieving Data from the DB-400

There are two ways in which to retrieve data from the DB-400: by downloading it to a computer or by manually retrieving it using the Review menu. Downloading the data is the easier (and much more commonly used) of the two options.

Downloading to the computer

The DB-400 is specifically designed to allow the data to be transferred to a computer for analysis. Although it is certainly possible to use the Review option to read and remove the data by hand, it is not really practical if you use even a small number of the 312 intervals available in the DB-400. A much better method is to do the counts you need to do and then transfer all of the data to a computer at one time for further analysis.

Our PETRAPro software is the program most commonly used for download and analysis. This section of the manual assumes that you are using this software.

The DB-400 has a built-in RS-232 serial port that is used to transfer the data to any computer with a corresponding serial port. To start the download process, connect the plug of the JAMAR universal cable into the computer and then connect the cable to the DB-400.

*******IMPORTANT*******

Always turn the DB-400 ON **before** connecting it to the computer.

Always use a JAMAR universal download cable when transferring data from the DB-400 to a computer. Use of a generic cable can cause data to be lost or damage to occur to the DB-400.

Use the optional external power supply during the download process whenever possible. The download process draws a significant amount of power, so use of the external power supply will prolong the life of your AA batteries.

The universal cable must be plugged into a serial (COM) port on the computer. Some computers have one serial port, some have two. The ports may be labeled on the computer itself with COM 1 listed as 1 or A and COM 2 listed as 2 or B. The following tips should help you to avoid problems when download through a computer's serial port.

1) You must correctly identify what port you are plugging the cable into. Just because your cable fits into a connector on your PC does not

mean it is a serial port. Consult your computer manual if you have any questions on which ports are serial ports on your computer.

2) Many computers have more than one serial port. You will need to know which serial port you are plugging the universal cable into. Serial ports are designated as COMx where x is a number from 1 to 4. You will need to know this number to download the DB-400.

3) Some devices that are plugged into a computer's serial port will not allow the DB-400 to download its data properly. These devices require a **device driver** to be running in the computer at all times. Mice, digitizer boards, PDAs, light pens, digital cameras and scanners are all devices that require these device drivers to be running. If you have to unplug a device from the serial port to plug your DB-400 in, be sure that the device does not have a driver running in memory.

4) Currently all JAMAR equipment that interface with a computer use a serial port to do so. However, if you do not have a serial port on your computer (or there is a conflict with another device), you can use a USB port by using a USB to Serial Adapter. These devices allow serial peripherals, like JAMAR equipment, to interface with a USB port.

Run the analysis software on your computer, and prepare it to read the counter. Turn on the DB-400. Once the Main Menu appears, use the TAB key to select DUMP. The screen shown below is then displayed.

```
┌─────────────────────────────┐
│ LOCAL   MODEM   BAUD        │
│   PHONE#        EXIT        │
│   Begin local transfer      │
│      at 9600 baud           │
└─────────────────────────────┘
```

LOCAL   Download data to a local computer through a JAMAR universal cable.

MODEM   Transfer data to a remote computer through a portable modem.

BAUD   Set the Baud Rate at which the data is transmitted.

PHONE #   Set the phone number of the remote computer (used with Modem option).

Local Download to a Computer

In most cases, the Local mode is the one you will use to download the data to your computer. Select Local and press DO. The screen shown below is then displayed.

```
BEGIN      EXIT
      Press DO to start
          local dump.
Baud Rate = 9600
```
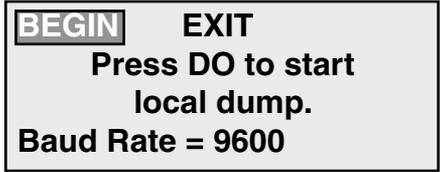
Note that the baud rate that the DB-400 is currently set for is shown on the last line. The baud rate is the speed at which the data will be sent from the unit to the computer. The Baud Rate set in the DB-400 **must** match the baud rate that has been selected in the software. Refer to the Baud Rate Selection section on page 3-5 for information on how to set the baud rate in the DB-400.

At this point, the DB-400 is ready to download. Make sure your software is properly setup (refer to the software manual if you have any questions on this), then press the DO key. The display screen will then show the following:

```
TRANSFER IN PROGRESS

       count#:001
       interval#:001
```

The DB-400 starts sending the data to the computer, beginning with the first interval of the first count. The screen shows the count number and interval number that is being transferred. When all of the data has been transferred, the screen returns to the Dump. Assuming the transfer is successful, you can then select EXIT to return to the Main Menu.

Note: The DB-400 has no way of knowing if the transfer is successful (for technical types, there is no handshaking). The data is sent out the serial port and hopefully something is there to catch it. If the data has been successfully sent to the computer, you should see a window for each file appear in the software. Check the data in the software to

make sure the download has been successful. If everything looks okay, you may clear the memory of the unit using the process described on page 2-11.

Baud Rate Selection

The Baud Rate selection controls the speed at which the data is transmitted from the DB-400. You normally only have to set the Baud Rate once, to match the setting in the software. To set the Baud Rate, use the following steps.

Select Baud from the Dump menu. The screen shown below is then displayed.

300	**1200**	**4800**
	9600 EXIT	
	Select Baud rate,	
	then press DO.	

Use the TAB key to move the highlight to the baud rate you want. Most computers will allow transfer at the fastest baud rate of 9600. Once you have set the baud, press DO.

The new Baud Rate is then selected and will be used every time for the download, unless you change it.

Modem Transfer to a Computer

The DB-400 has a special option that allows you to transfer the data to your office computer using a portable modem. This feature is useful if it is difficult or inconvenient for the field people to bring the DB-400 to the office to dump the data. **Note, however, that the modem option is not supported by the PETRAPro software.** You must use a communications program (such as Windows Hyperterminal) or your own custom program to use this option.

To transfer data using the Modem option, select Modem from the Dump screen, and press DO. The screen shown here is then displayed.

BEGIN   EXIT
Press DO to begin
transfer via modem
Baud Rate = 9600

Connect the pocket modem to the DB-400, plug the phone cable on the modem into a phone jack, and then press DO. The DB-400 dials the phone number stored in the DB-400 (refer to the following section on how to setup the phone number) and attempts to connect to the office computer. Once the connection is made, a signal must be sent back to the DB-400 to tell it to begin the download. This signal is one character, a capital 'S'. After this signal is sent back to the DB-400, the data transfer will begin and the screen shown below is displayed.

```
TRANSFER IN PROGRESS

      count#:001
      interval#:001
```

When all of the data has been transferred, the DB-400 returns to the Main Menu. The communications program can then be disconnected.

Phone Number Selection

When using the Modem option, the DB-400 dials the phone number that has been entered into its memory.

To enter, change, or just check the current phone number, select Phone# from the Dump menu. The screen shown here is then displayed.

```
CHANGE      EXIT
  Change phone # used
    in modem transfer
# = 555-1212
```

The current phone number is shown at the bottom of the screen. If you want to change it, then select Change and press DO.

Type in the new number, just as you would dial a phone. The table provided here gives the characters that can be entered by using the keys on the DB-400.

Key	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Symbol	1	2	3	4	5	6	7	8	9	0	P	-	,	*	#

The TAB Key backspaces, the DO key accepts the entry

Press DO when you are done. The new number is stored in memory and will be used whenever the Modem option is selected.

Retrieving Data Using the Review Menu

Although the DB-400 is designed to be downloaded to a computer, the data that is stored in memory can be manually viewed and transcribed using the Review Menu. This options is especially useful if you do not have software to download the data or if you are having trouble getting data to download.

To access the Review menu, select Review from the Main Menu. The following screen is then displayed.

```
COUNT: 001       02/13/01
    INT: 001           07:00
   BINS: 01-04        EXIT
TOT: 001   008   040  010
```

The first line of the display list the number of the count that is currently being displayed, along with the start date of the count. The second line lists the interval number of the interval being shown, along with the interval time. The Bins entry on the third line lists the key numbers for the totals that are currently being shown on the fourth line.

When the highlight is on Count, Int or Bins you can go to the next value or previous value by pressing the Change (#14 and #15) keys. You can move the highlight from Count to Int to Bins to Exit and back with the TAB key, just like with the other menus.

Next to TOT are the number of counts for the four bins. You are shown four keys at a time, each set being one approach. It is easy to scan through the data and check to see if it seems reasonable.

The procedure to examine data for a count is very simple.

Move the highlight to Count. Press Change until the desired count number is displayed. The date and time can be used to find a particular count if you are not sure of its count number.

If you want to look at all of the data, then move the highlight to Bins and press the change button while reading the data displayed next to Tot. The Bins increments each time you press a change key. After the last data point in the interval is displayed, the Int number increments by one and Bins automatically goes back to 01-04. You can go through all of the data by continuously pressing the Change keys.

If you want to look at a specific interval of data, then move the highlight to Int and press a Change key until the required interval is displayed. Then, follow the procedure outlined above to display the data.

If you always use the analysis software to download and analyze the data (and we certainly hope you do), then you probably will never need to use the Review option.

Chapter 4

Battery Care

Installing Batteries

The DB-400 is powered by four AA cell batteries. Use of low power electronics in the DB-400 makes it possible for the batteries to last for several months, depending on use.

The Main Menu shows the current battery voltage. Fresh batteries should read around 6.4 volts. Batteries should be replaced when this voltage falls around 5.5. The unit will shut down once the voltage falls to approximately 4.5 volts.

The back of the DB-400 contains the battery compartment. The batteries can easily be popped out and replaced. You should use high quality alkaline batteries, which you can get at any convenience store.

> *********IMPORTANT********
>
> Be very careful to observe the proper polarity when installing new batteries. Prolonged use of the DB-400 with incorrectly installed batteries can cause batteries to burst, damaging the unit.
>
> Do not mix old batteries with new batteries, or mix brands of batteries, when replacing the batteries. This can cause batteries to burst, damaging the unit.

You should be able to replace the batteries without disturbing the data in the DB-400. The memory of the unit is backed by an internal lithium battery, and is retained even when the AA batteries are removed. Just to be safe, however, we suggest that you download the data to your computer before you replace the batteries, then clear the memory after the new batteries are installed to reset everything properly.

We recommend that you keep track of when you have changed the batteries in the DB-400, and establish a regular routine for changing them. This should help to avoid having to change the batteries in the middle of a count.

Chapter 5

Troubleshooting

TROUBLESHOOTING

The following are some common questions/problems that can be encountered when using the DB-400. The possible answers that are stated with them are not necessarily the only answer, but should be checked first before contacting us. If you cannot find the answer to your problem/question, do not hesitate to contact us. Contact information is listed on the first page of this manual.

The DB-400 will not turn on.
Check that the unit has enough power to operate. Replace the AA batteries with fresh ones, or plug in the external power supply.

The DB-400 will not download.
Perform the following checks:

• Check your cable connection between the unit and the computer.
• Check that the baud rate selected in the unit matches that in the software.
• Make sure there is enough power for the download. Either plug in the external power supply or try a new set of batteries.

Refer to Chapter 3, *Retrieving Data From the DB-400*, for other items to check.

Data is not being recorded properly on Bank 1 or Bank 2.
When recording a count on one of the bank keys, you must **hold down** the Bank key **while** pressing one of the 1 through 16 keys.

Serial Port test failed.
Make sure that you are using a **test connector** with the proper pin configuration. The test will fail if a test connector is not used to connect pins 2 and 3. The universal cable used for downloading **cannot** be used as a test connector.

The DB-400 beeps (or does not beep) every time I press a key. Can this be changed?
Yes. The beeper can be turned on or off by using the Utilities menu. Refer to page 2-18 for more detailed information.

A Real-Time Clock error appears when I turn the DB-400 on.
There are several possible causes for this. The unit may have been affected by static electric discharge, the internal lithium battery my be failing, or some other internal component may have been damaged. If you encounter this error, perform the following:
1. Clear the memory
2. Reset the Date and Time
3. Perform a short test count by programming the unit to start counting and letting it sit for 1 hour.
4. Turn the unit off, then back on to see if the error occurs again.
If the error occurs again, contact us using the information in the front of this manual.

Additional troubleshooting information can be found on our web site at www.jamartech.com.

If you are unable to find a solution to your problem or question, contact us using the information located on the first page of this manual.

Appendix

Computer Interface Notes

The following information is not normally needed to use the DB-400. It is provided for those who are interested in some of the technical aspects of the DB-400. It is also provided for those customers who do not plan to use the analysis software, or who are interested in interfacing the DB-400 to their own computer hardware and/or software systems.

Serial Port Parameters

The DB-400 has a built-in serial port. The serial port fully conforms to the RS-232 voltage conventions.

The format is fixed as: **8 Data Bits**, **1 Stop Bit**, **No Parity**

Interface Cable

The DB-400 is normally supplied with a JAMAR universal interface cable to connect the DB-400 to your computer. This is a customized cable that works with a variety of products sold by JAMAR. The cable has two 9 pin connectors. The male plug connects to the JAMAR equipment while the female plug connects to a serial (COM) port on your computer.

The universal cable uses only three wires. There is no handshaking required, or implemented. When the data is downloaded, the DB-400 assumes that something is out there to receive it.
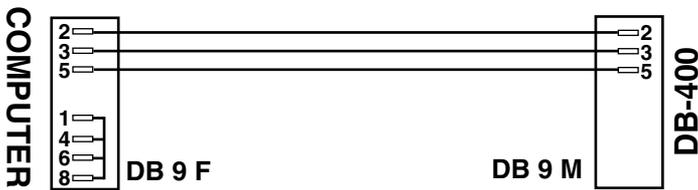

```
*******IMPORTANT*******
```
Use of a generic serial cable for downloading data can cause data to be lost or damage to occur to the DB-400. Generic serial cables do not block the pins that are blocked by the JAMAR universal cable, and potentially damaging voltage can be sent from the computer to the DB-400 on these pins.

Data Output Format

The data that is sent out of the DB-400 is in standard ASCII (text) format. Any communications program, such as Windows Hyperterminal, can be used to capture the data. It is also easy to write software that can read the raw data, if you are familiar with a programming language. (Doing something with the data is another matter.)

Each interval of data is sent separately. The general format of the data is as follows:

^^^^^^^^^^^^^^^^^^^^	leader characters (20)
001	count number
001	interval number
01	interval length
nnnnnnnn	site code
hhmm	start time
mmddyy	start date
nnnn,nnnn,...nnnn	data, 10 per line
...	
ccc	checksum

Notes:
• Checksum is mod 256 of all characters in interval
• All lines are followed by CR, LF characters
• Last line of data followed by 20 colons ":" (end of data character)

```
Status ─┬─ Count ──┬── New ───── Site Code ──────────────
        │          │
        │          ├── Continue ── Start
        │          │
        │          └── Status ───── ▉▉▉▉▉
        │
        ├─ Review ──────────────── ▉▉▉▉▉
        │
        ├─ Dump ───┬── Local ───── ▉▉▉▉▉
        │          │
        │          ├── Modem ───── ▉▉▉▉▉
        │          │
        │          ├── Baud ────── ▉▉▉▉▉
        │          │
        │          └── Phone# ──── ▉▉▉▉▉
        │
        ├─ Clear ─── Confirm ───── ▉▉▉▉▉
        │
        └─ Utilities ─┬── Tests ──┬── Memory ──────────
                      │           │
                      │           ├── Display ─────────
                      │           │
                      │           ├── Keys ────────────
                      │           │
                      │           └── S. Port ─────────
                      │
                      ├── Time/Date ── ▉▉▉▉▉
                      │
                      └── Options ──┬── Beeper ─────────
                                    │
                                    └── #Tiers ─────────
```
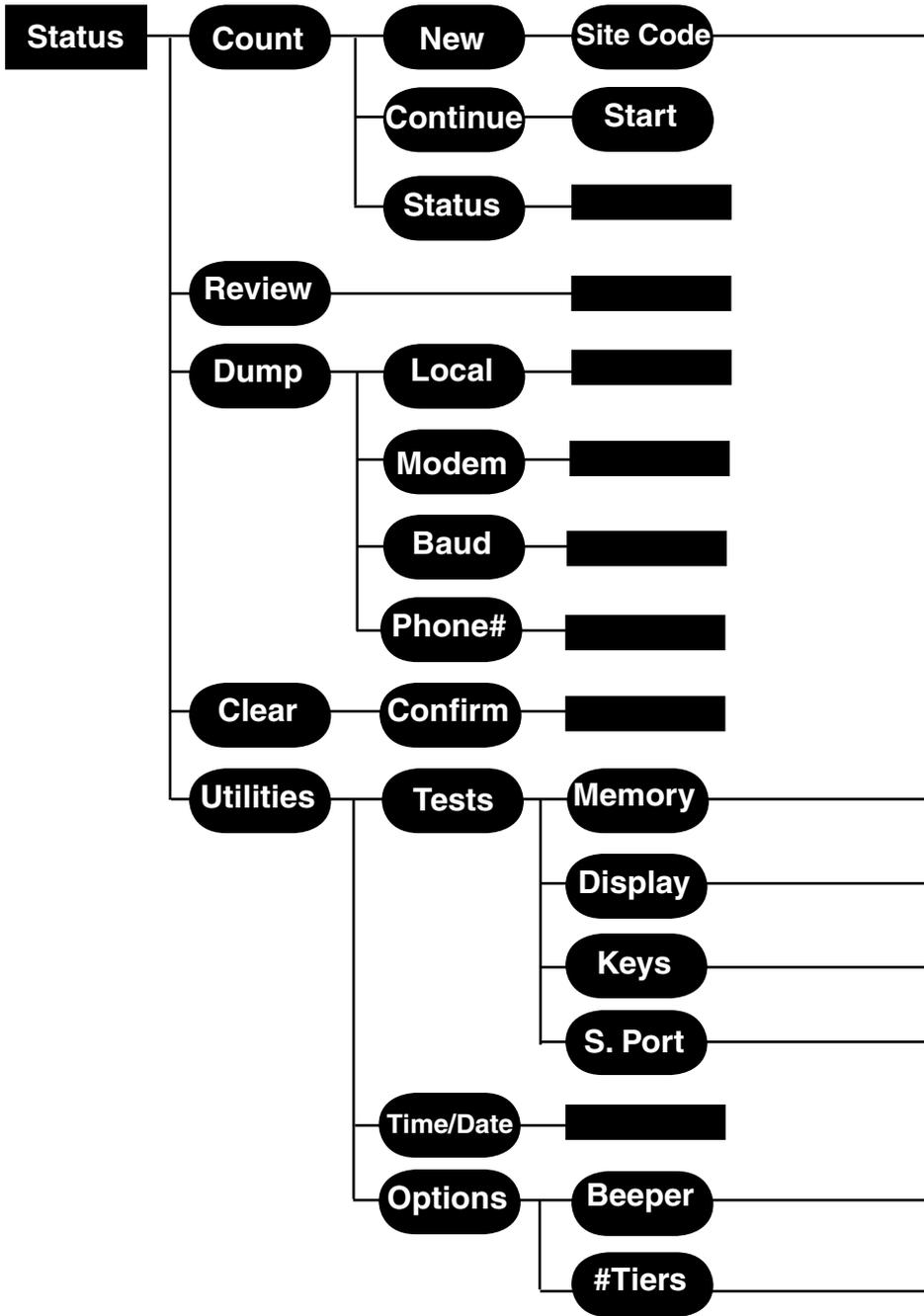
Interval — Start —

Menu Tree

Specifications

Size — 7.5" x 7" x 1.5"

Weight — approximately 1.5 lbs.

Memory — 32K, CMOS RAM. Lithium battery backup

Power — 4 AA alkaline batteries or 6-18 volts, DC, 200 ma through external jack

Interface — RS-232 serial communications port, 9 pin DBS socket

Display — wide temperature, 16-character LCD display

Output — ASCII format capable of being read by JAMAR software or other communications program

Data Collection — Intersection Turning Movements, 48 possible movements

Clock — always active real-time clock

We are pleased that you have chosen the DB-400 for your traffic data collection needs. We have strived to develop a unit that is easy to use and has the options that our customers require. The DB-400 has undergone extensive testing to verify the accuracy of its operations, and each unit is extensively tested before it leaves our facility. Should you detect any problems with this unit, or any of our products, please notify us immediately and discontinue use of the unit until we have verified its operation.

Field Worksheet

Location:

Site Code: _____ **DB-400 Serial #:** _____

Date: _____ **Times Counted:** _____

_____

Check keys pointed to
From North approach: _____

Check approaches counted:
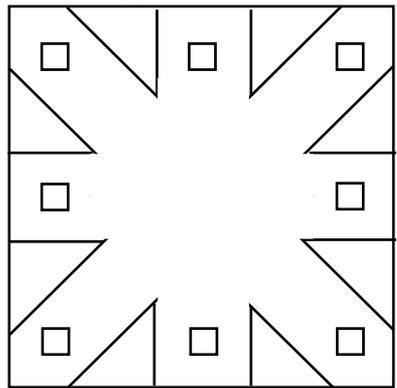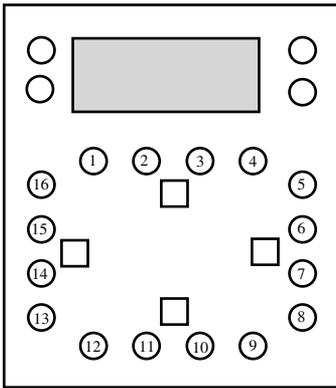
Approach Names

North — South: _____

East — West: _____

Northeast — Southwest: _____

Northwest — Southeast: _____

Groups Counted

Unshifted: _____

Bank 1: _____

Bank 2: _____

☐ **See Reverse for Additional Notes**

Counted By: _____

Notes: