SM-5

Scintrex SM-5 NAVMAG Cesium Magnetometer

OPERATION MANUAL

SCINTREX

SM-5 Manual - ***part # 872700 Revision 4***

Rev	Description of change	ECO	Date of issue	App
0	Initial Release			
1	Additional Info		14/09/2005	
2	Additional Info	4413	06/12/2006	
3	Additional Info	4484	07/11/2007	
4	Additional Info	4505	08/16/2007	

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SCINTREX

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Operation Manual

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Document Part No. 872700 Revision 4

Printed and bound in Canada

Getting Started

Setting Up Your Instrument

Operating the SM-5 NAVMAG in the Field

1 Getting Started

Understanding Instrument Basics

This chapter gives an overview of the basic components, interfaces and procedures that you should become familiar with prior to taking magnetic measurements with your SM-5 NAVMAG.

Unpacking the Instrument

The SM-5 NAVMAG is packed in a padded case (with the battery disconnected to comply with transport safety regulations) in order to protect the instrument during shipment.

Figure 1-1 - SM-5 NAVMAG in Shipping Case

Important:

During shipment, the battery must be disconnected. When you receive your SM-5 NAVMAG, the battery is fully charged but disconnected.

Removing the Instrument from its Case

a. Pull up the tab of the link lock and turn the tab *counter-clockwise* to unfasten the lock from the keeper plate.

b. Repeat step a. for the other link lock.

c. Open the SM-5 NAVMAG transportation case by lifting the cover.

d. Remove the SM-5 NAVMAG from its transportation case and visually inspect for

any damage that may have occurred during transportation.

Important:

If there is any evidence of physical damage to the product or if parts are missing, immediately contact Scintrex Limited. All claims for shipping related damage are to be directed to the insurance carrier.

Damage due to shipping or missing items should be reported to Scintrex within 30 days of receiving the product.

Checking that all the parts are present

Before you assemble the SM-5 NAVMAG for the first time, please verify that you have all the parts you will need:

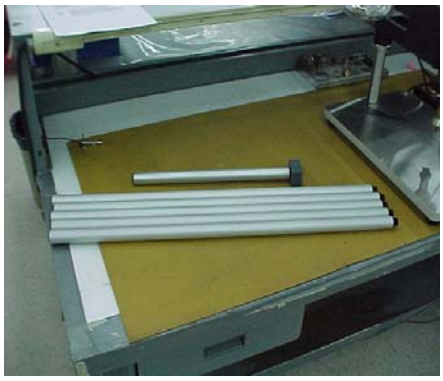


Fig. 1-2

Fig. 1-3

Fig 1-4

Fig. 1-5

Staff Segment Assembly (Long segments only)	Qty 4	Figure 1-2
and GPS Antenna Mounting Pole (14")	Qty 1	
Electronics Mounting Clamp	Qty 1	Figure 1-3
Sensor mounting Clamp	Qty 1	Figure 1-4
Velcro straps	Qty 4	Figure 1-5

Fig. 1-6

Fig. 1-7

Fig. 1-8

Fig. 1-9

Carry Strap Mounting Clamp	Qty 2	Figure 1-6
Cable Clips	As Required	Figure 1-7
Vertical Point Joint	Qty 1	Figure 1-8
Staff Cross Clamp	Qty 1	Figure 1-9

For a complete list of SM-5 Navmag parts please refer to “SM-5 Navmag Parts List” on page C-4.

Assembling your SM-5 NAVMAG - Standard Configuration

1. ***Assemble*** the sensor staff by connecting the staff sections. The unit comes with five sections: four for the sensor and one to be used as an extension for the GPS antenna. You can use up to four sections for the sensor.

2. ***Slide*** the two Carry Strap Mounting Clamps onto the staff.

3. ***Screw*** the Sensor clamp on to the threaded end of the staff.

4. ***Slide*** the Electronics Mounting Clamp onto the other end of the staff.

5. ***Attach*** the sensor and the electronics to the staff using the four Velcro straps supplied (Fig. 1-10 and Fig. 1-11). The sensor cable can then be secured to the staff using the white clamps that have been provided.

Fig. 1-10

Fig. 1-11

Hint:

In order to further secure the electronics to the mounting clamp, use a tie-wrap (not supplied) through the middle slot of the clamp.

6. ***Attach*** the shoulder strap to the two Carry Strap Mounting Clamps

assembled in Step 2

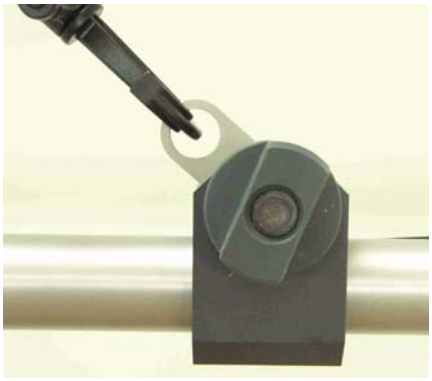


Figure 1-12 - Close-up of Carry Strap Mounting Clamps

7. ***Connect*** the coaxial cable between the sensor and the SM-5 NAVMAG Console. ***Connect*** the coaxial cable in either the S1 or S2 connector.

Fig. 1-13

Fig. 1-14

8. ***Connect*** the console to the appropriate straps located on the back-pack.

Figure 1-15 - Close-up of Console mounted on Back-pack

9. ***Connect*** the two battery leads from the Back-Pack into the P1 and P2 connectors of the SM-5 NAVMAG Console, as illustrated below:

Fig. 1-16 Close-up of the Battery leads connected in P1 and P2

The final assembled system should resemble the following:

Figure 1-17 - The NAVMAG system -Standard Configuration

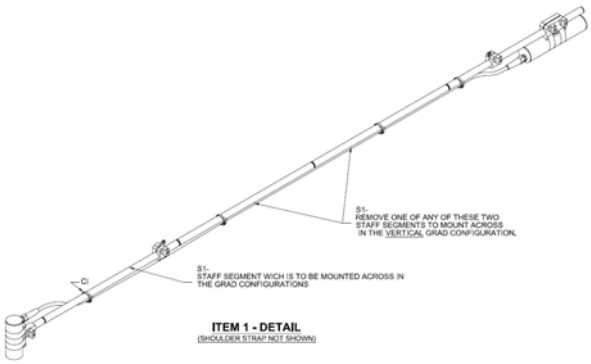


Figure 1-18 - The NAVMAG system -Standard Configuration, Staff Detail

Assembling your SM-5 NAVMAG - Hands Free Configuration

1. ***Insert*** a vertical pole joint each at the base of a staff section and at the base of the GPS Antenna Mounting Pole.

2. ***Assemble*** one staff section on the left-hand side of the backpack and the GPS Antenna Mounting pole on the right-hand side, as illustrated in figure 1-17.

Figure 1-19 - The Back-Pack with assembled poles

Note:

Should height clearance be an issue, i.e. in dense bush, you can also use another GPS Antenna Mounting Pole instead of a staff section to mount your sensor on.

3. ***Insert*** the Staff Cross Clamp into the threaded end of staff section.

Figure 1-20 - Close-up of the Staff Cross Clamp

4. ***Insert*** the Sensor clamp into the staff cross clamp.

Figure 1-21 - Close-up of the sensor clamp assembled in the sensor pole

5. ***Fasten*** the sensor to the Sensor Clamp.

Figure 1-22 - Close-up of the sensor mounted to the sensor clamp

6. ***Mount*** the sensor electronics between the battery compartment and the GPS receiver bag, as illustrated below:

Figure 1-23 - Close-up of the sensor electronics mounted on the Back-pack

Note:

Make sure that the velcro strap is tight. Otherwise, the sensor electronics will slide off. Alternatively, the sensor electronics can be inserted in the GPS receiver bag.

7. ***Connect*** the coaxial cable between the sensor and the SM-5 NAVMAG Console. ***Connect*** the coaxial cable in either the S1 or S2 connector.

Fig. 1-24

Fig. 1-25

8. ***Connect*** the console to the appropriate straps located on the back-pack.

Figure 1-26 - Close-up of Console mounted on Back-pack

9. **Connect** the two battery leads from the Back-Pack into the P1 and P2 connectors of the SM-5 NAVMAG Console, as illustrated below:

Fig. 1-27 Close-up of the Battery leads connected in P1 and P2

The final assembled system should resemble the following:

Figure 1-28 - The NAVMAG system - Hands-Free Configuration

Assembling your SM-5 NAVMAG with GPS

The SM-5 NAVMAG can be used either with an Internal GPS receiver or an external GPS receiver.

Important: The Internal GPS is not recommended for high resolution surveys, as it is a non-differential GPS and thus has a positional accuracy of no better than 5 metres.

Internal GPS

To use the Internal GPS, you must first ***connect*** the antenna to the SM-5 NAVMAG console, as illustrated below:

Figure 1-29 - Internal GPS antenna connection

Then ***mount*** the antenna on the GPS mounting pole or sensor pole (position at opposite end to the sensor to avoid magnetic interference) as illustrated below:

Figure 1-30 - Mounting the Internal GPS antenna

External GPS receiver

To use an External GPS, you must first program your GPS receiver.

The following parameters must be observed:

Sampling rate: 1Hz

GPS NMEA Sentence: GGA and ZDA.

Baud rate: 57600 or 38400

Note:

On certain external GPS receivers, you may have to manually enable PPS synchronization, in order to allow the SM-5 NAVMAG console clock to synchronize with the GPS clock.

Connect the GPS receiver to the External GPS Port "X_GPS", as illustrated below:

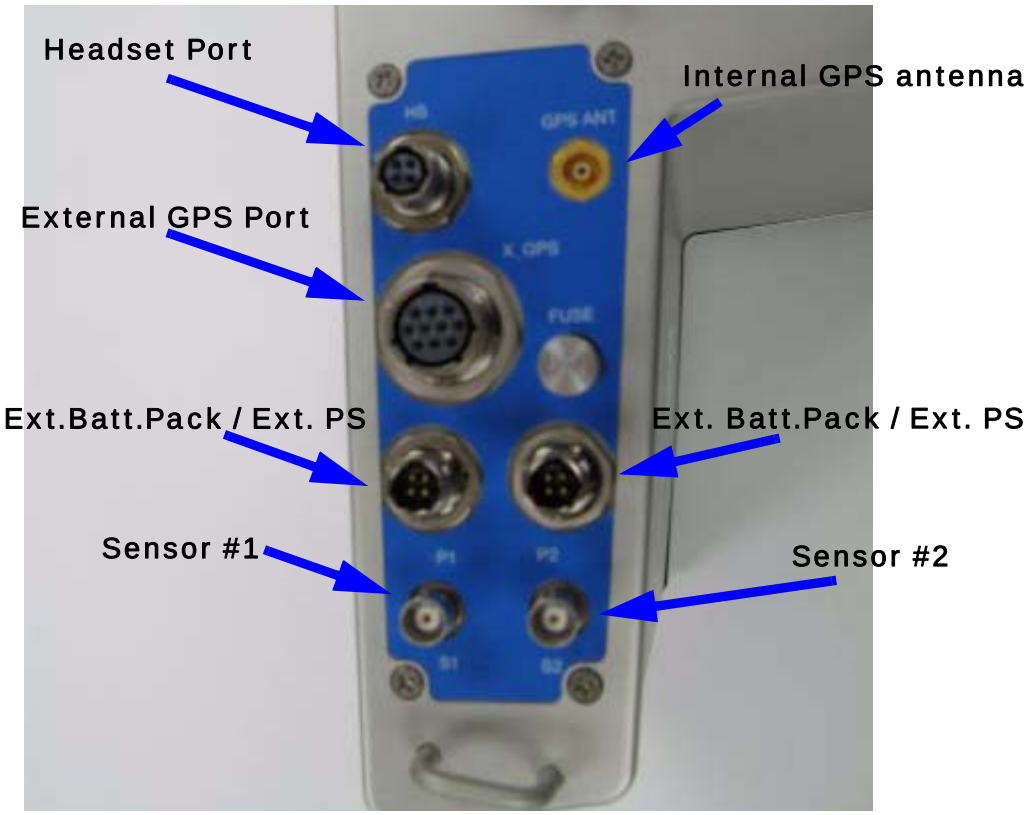


Figure 1-31 - Ancillary ports

Assembling your SM-5 NAVMAG in gradient configuration

The steps to assemble the gradient configuration are identical to those described in the section entitled “Assembling your SM-5 NAVMAG - Standard Configuration” on page 1-6. You will assemble two identical systems and join them with the staff joiners as illustrated below:

Figure 1-32 - Close-up of staff joiner

Note:

You can configure the gradient as either a horizontal or vertical gradient. Each staff measures 0.5 m in length. Furthermore, you can use two staff sections to obtain a 1.0 m separation, or three staff sections to obtain a 1.5 m separation.

Note:

For the vertical gradient configuration, please ensure that the staff section with a nib is used for the front center cross staff, and that a cross clamp with a groove is used to fasten the vertical pole holding the two sensors, as illustrated below:

Figure 1-33 - Cross Staff with Nib

Important:

Do not forget to set the number of sensors to 2. Please see “Parameter Option on page 2-10 for more details.

Your complete gradiometer system should resemble one of the following captions:

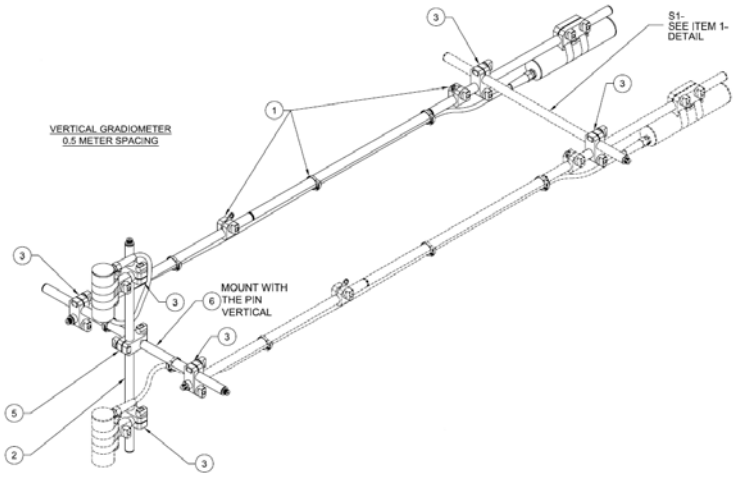


Figure 1-34 - 0.5 m Vertical Gradient Configuration

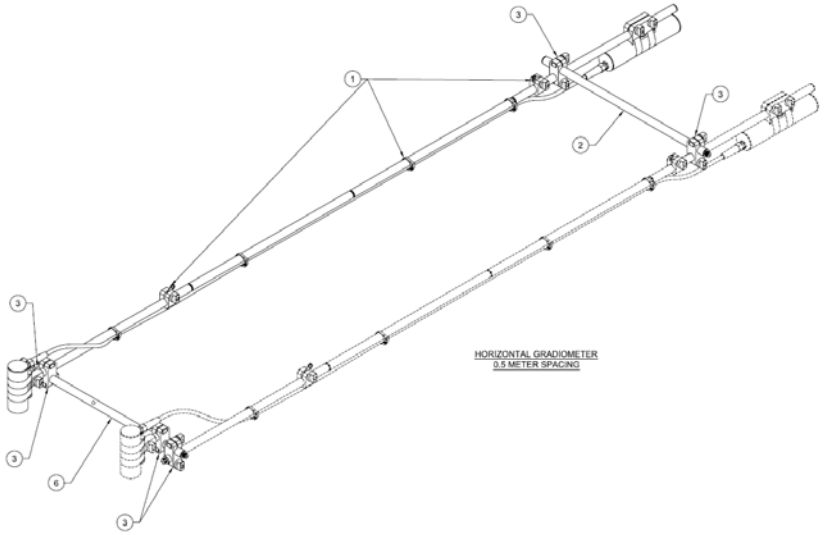


Figure 1-35 - 0.5 m Horizontal Gradient Configuration

4

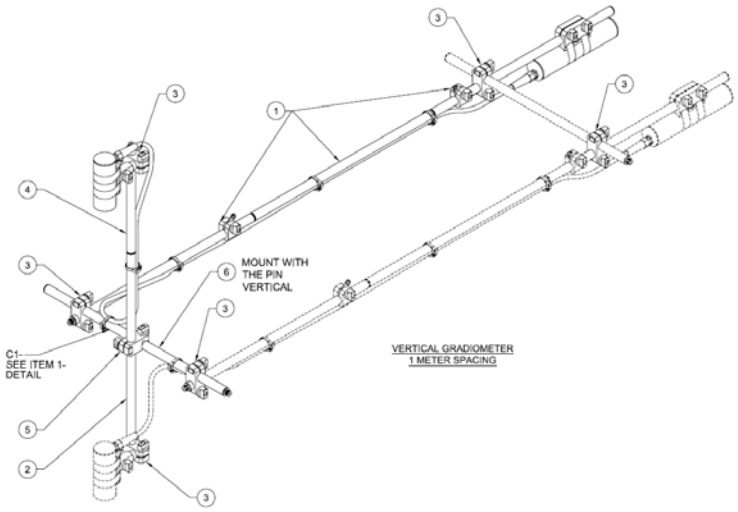


Figure 1-36 - 1.0 m Vertical Gradient Configuration

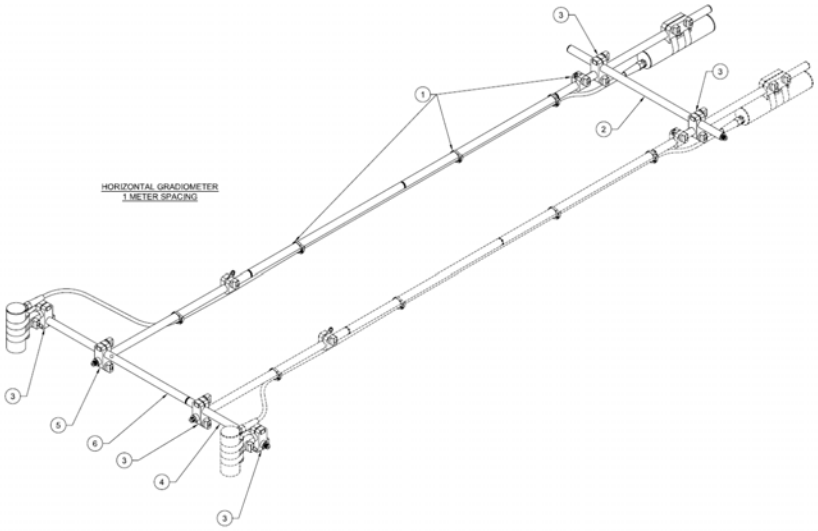


Figure 1-37 - 1.0 m Horizontal Gradient Configuration

The following figure illustrates a typical horizontal gradient set up.

Figure 1-38 - Example of Horizontal Gradient Set Up

The following figure illustrates the vertical gradient sensor set up:

Figure 1-39 - Example of Vertical Gradient Set Up

Assembling your SM-5 NAVMAG in Stop and Go configuration

The Stop and Go configuration is designed for dense vegetation, where the staff needs to be carried in a horizontal position between stations. The steps to assemble the Stop and Go configuration are somewhat identical to those described in the section entitled “Assembling your SM-5 NAVMAG - Standard Configuration” on page 1-6. However your staff will be vertical and the sensor electronics will be in your backpack.

Figure 1-40 - Stop and Go Configuration

Note:

Please ensure that the bottom staff section is capped as illustrated below.

Figure 1-41 - Bottom Staff Section

Operating the SM-5 NAVMAG for the first time

When starting up the SM-5 NAVMAG for the first time, or after it has been turned off for an extended period of time, you should observe the following:

1. **Powering up the SM-5 NAVMAG** -On initial power up of the NAVMAG, the cesium sensor will require a warm up period during which time the sensor will draw more power from the power supply. It is strongly recommended that the external supply be connected during this initial warm up in order to reduce excessive drain of the batteries.

2. **Warm-up period** - After you connect the power adapter to the SM-5 NAVMAG, the sensor requires a warm-up time to reach its operating temperature.

Note:

The warm-up time of the cesium lamp heater is 15 minutes @ 20°C. It will be longer in colder weather.

3. **Familiarization period** -If this is your first use of the instrument, this is a good time to become familiar with the keypad and software. We suggest that you examine each menu carefully.

4. **Setting up the instrument for field operations** - After completing the previous steps, you are ready to set up your SM-5 NAVMAG for field use. For more information, see Chapter 2, “Setting Up Your Instrument” and Chapter 3, “Operating the SM-5 NAVMAG in the Field”.

Powering up the SM-5 NAVMAG

The SM-5 NAVMAG is powered by the 24V external battery back-pack or an external power supply.

The instrument is also supplied with a free standing battery charger which allows the battry back-pack to be charged off-line.

Figure 1-42 - Location of External Battery Pack Connectors

The charge status of the batteries is given in the INFO screen as described later in this section.

SM-5 NAVMAG Batteries

The SM-5 NAVMAG uses four rechargeable sealed Lead-Acid Batteries located in the battery compartment of the standard back-pack.

Figure 1-43 - Location of the batteries

These batteries have the following specifications:

- Operating temperature range: -20°C to 50°C
- Storage temperature range: -20°C to 60°C. For long periods it is recommended to store below 25°C
- Charging temperature: 0°C to 45°C
- Nominal voltage: 12V
- Nominal Capacity 5.0Ah

With four fully charged batteries the SM-5 NAVMAG will operate for approximately 7 to 8 hours @ 25°C without the need for recharging. As the operating temperature drops, the battery capacity is reduced. At temperatures below -20°C it is recommended that the display heater be enabled.

When the batteries are discharged to below 10% of the total capacity an audio warning consisting of continous beeps will be heard and the SM-5 NAVMAG will not turn on. At this point at least one charged battery should be installed in the SM-5 NAVMAG Back Pack or the external supply should be connected. If this cannot be done the batteries should be removed to prevent them from being completely discharged. See the warning on next page.

Warning:

In order to prevent battery damage, do not completely discharge batteries when doing field work or storing the instrument. Batteries should not discharge through normal operation below 10 VDC. As a precaution, always back up the data before replacing any battery.

Charging the batteries

1. ***Remove*** the batteries from the battery pack.
2. ***Disconnect*** the batteries, as illustrated below.

Figure 1-44 - Disconnecting the batteries

3. ***Connect*** both batteries to the charger, as illustrated below:

Figure 1-45- Charging batteries

4. The amber light on the charger should be on, as illustrated below:

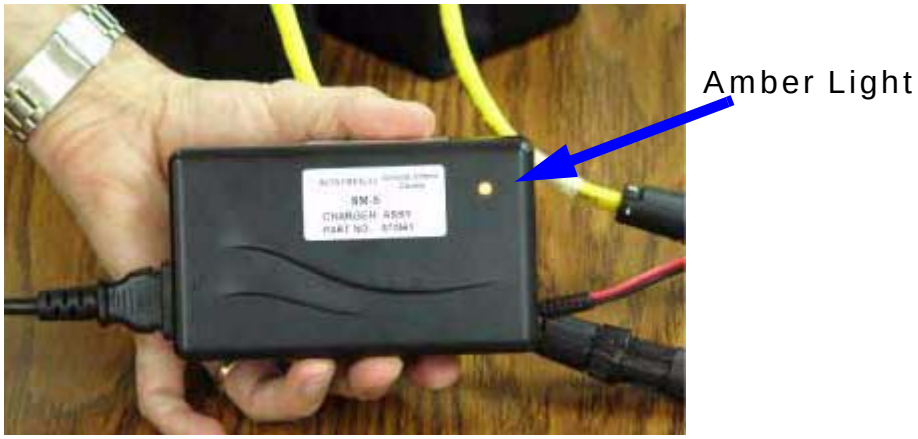


Figure 1-46- Amber light on the charger

Important:

To properly charge the batteries, charge them for at least 8 hours even after the green on the charger turns ON.

Overview of the Console and Keypad

The following picture shows the front panel of the instrument. It comprises a display for viewing menus and results; keypad for entering parameters and recording data; an active tab for scrolling between menus, dataports for transferring data to a Personal Computer or to a USB memory stick.

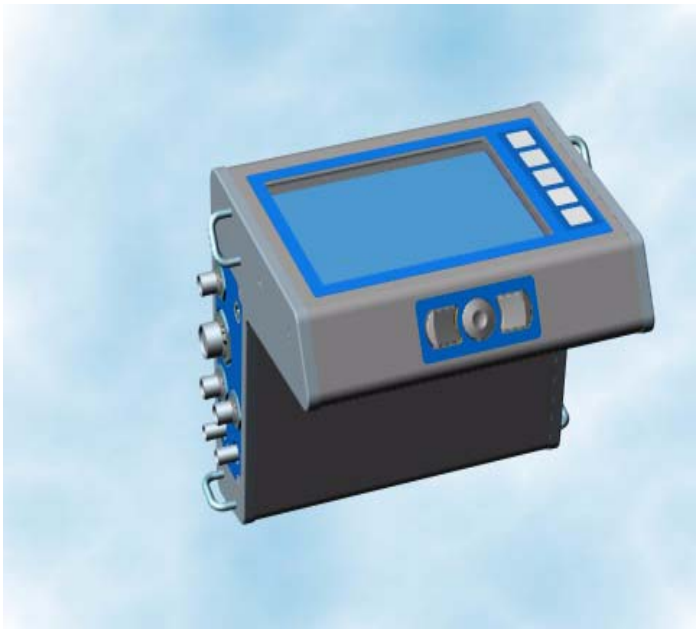


Figure 1-47 - Close Up of the SM-5 NAVMAG Console and Keypad

Navigating the Keyboard

The basic keys to navigate, select options and enter data are:

The TAB key allows you to navigate between the screens and, in the X mode, to navigate between entry fields. Please refer to “Using the hot keys (X mode)” on page 1-45 for instructions to enable the X mode.

The Measure/Stop key is used to initiate or stop a measurement of the magnetic field. In the X mode, it can be used to select a field choice by navigating Up.

The Back up/Transfer is a dual function key. The Backup function is used to archive your data from the SM-5 NAVMAG’s RAM memory to its Compact Flash memory. The transfer key allows the transferring of all data from the SM-5 NAVMAG’s Compact Flash Memory to a USB Memory Stick, if present. In the X mode, it can be used to select a field choice by navigating down.

Note: Allow at least 4 seconds following connection of USB for system recognition before proceeding with the transfer.

The optional Audio function is enabled in the measurement mode, whereas the Back Light function is the one that is enabled when not in the measurement mode.

The Backlight/Audio is a multi-function key. While not taking measurements, such as during setup or when the measurement is paused, you can toggle the backlight of the console display ON or OFF. While taking measurements you can toggle between Audio ON or OFF. In the hot key mode, this key can be used to acknowledge a field choice.

Note:

As a reminder, the optional Audio function is enabled in the measurement mode, whereas the Back Light function is the one that is enabled when not in the measurement mode.

The Sleep/Wake is a dual function key. In the Sleep mode, the SM-5 NAVMAG functions are suspended, until such time as the Sleep/Wake key is pressed to resume these functions following Wake mode. In the X mode, it can be used to erase a selection.

Important:

The Sleep/Wake function does not function in the Measure mode.

Turning the SM-5 NAVMAG Display On

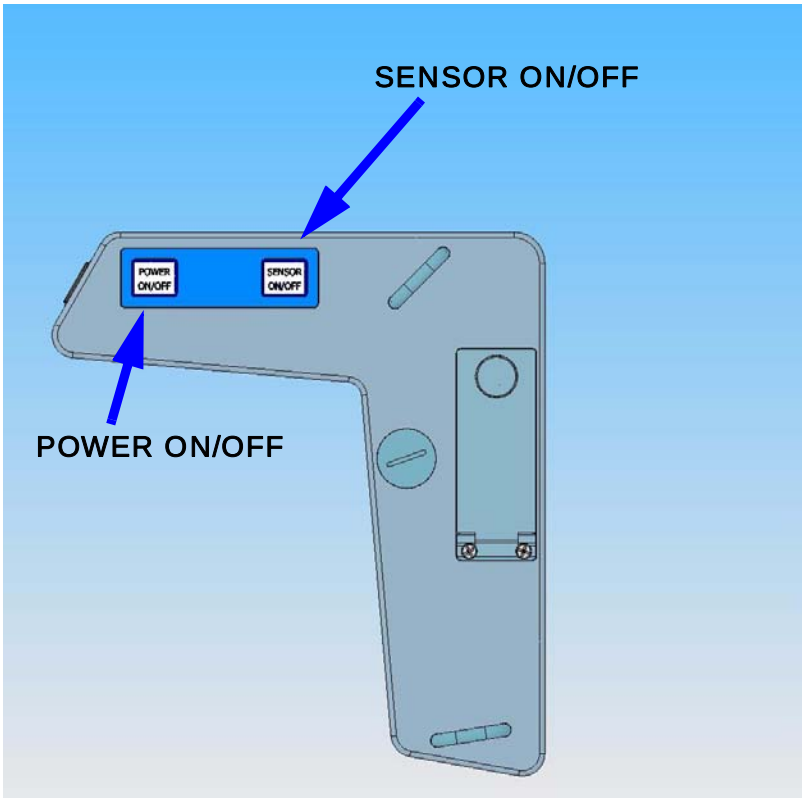


Figure 1-48 - Close Up of the left-hand side of the SM-5 NAVMAG Console

PRESS 

To turn the system on, ***press*** and ***hold*** the POWER ON/OFF key. The sensor is not controlled by the POWER ON/OFF key and must be powered up separately by using the SENSOR ON/OFF as mentioned below.

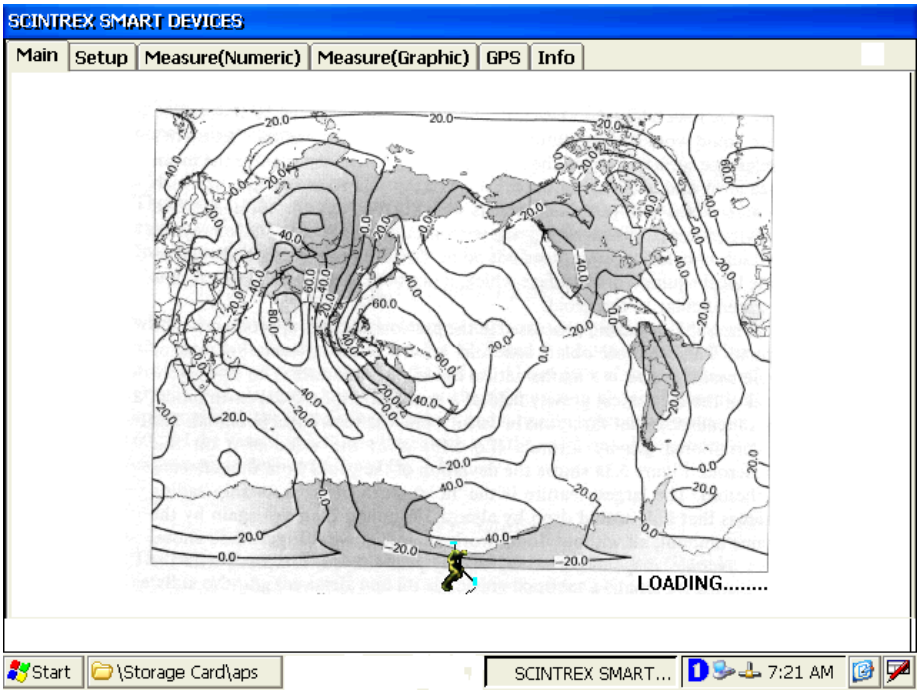
Important:

Make sure that you do not press and hold the POWER button for any length of time **during** your survey, as you your SM-5 NAVMAG will shut down and you will have to restart your SM-5 NAVMAG.

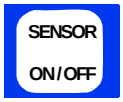
Hint:

Back up your data at the end of each line. However, if you press and hold the POWER button by mistake, you will only lose the data of the line you have just completed. You can also enable the Auto Data Backup function (see “Automatic data backup” on page 2-10.).

Once you have turned on the power, you will hear a series of faint and regular beeps and the following screen will appear on your console after 20 seconds:



Turning the SM-5 NAVMAG Sensor On

PRESS 

To turn on the cesium sensor ***press*** the SENSOR ON/OFF key. The sensor light will turn on indicating the sensor is on.

Note:

The warm-up time of the cesium lamp heater is approximately 15 minutes at an ambient air temperature of 20°C. It will be longer in colder weather.

Data Ports

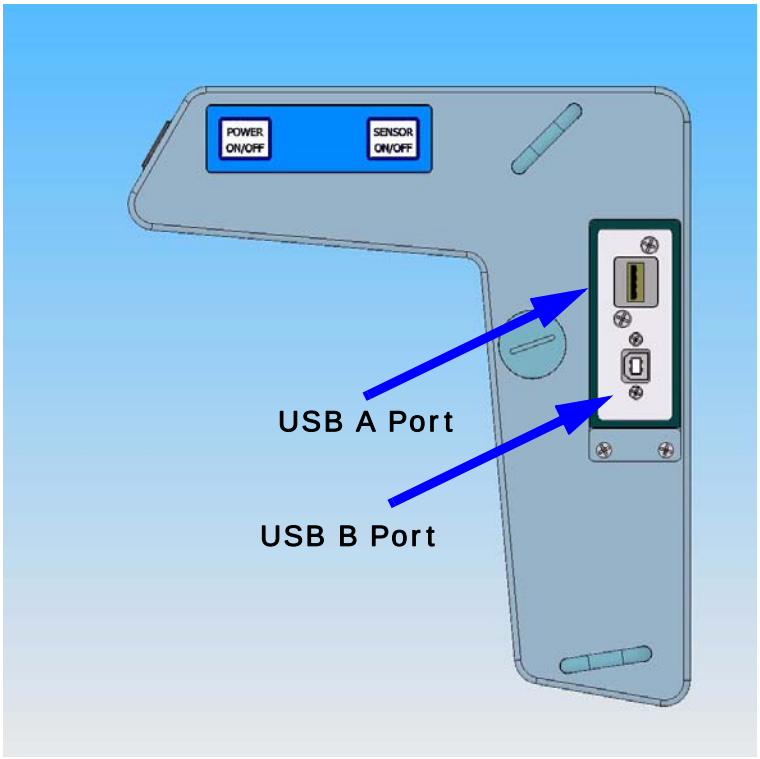


Figure 1-49 - Data Ports

The SM-5 NAVMAG has a USB A and B data ports. Data transfer through these ports will be explained in “Transferring your data” on page 3-30.

Ancillary Ports

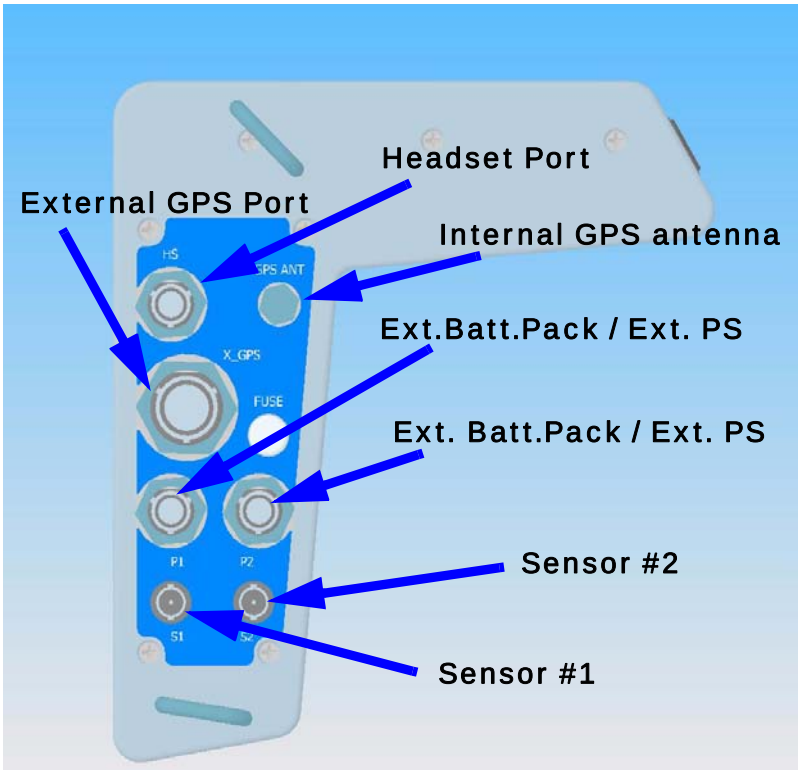


Figure 1-50 - Ancillary Ports

In addition to the internal GPS receiver, the SM-5 NAVMAG can also accommodate any external GPS receiver. As well the SM-5 NAVMAG will accommodate an external Headset hooked up to the HS port (see the explanation of the Pitch parameter starting at “Parameter Options” on page 2-7).

Using the External Power Supply

The External Power Supply (PN 872 030) also allows you to operate your SM-5 NAVMAG directly from an AC outlet, however it does not charge the batteries.

Warning:

The use of the external power supply is not recommended during a survey.

To power the SM-5 NAVMAG through the external power supply , ***connect*** the power supply to the P1 or P2 external power connectors, as illustrated below:

Figure 1-51 - Using the external power supply

Working with the Display and Menus

The SM-5 NAVMAG display is a full VGA colour 640x 480 graphics screen. Typically, each screen has a screen title, data entry or setup area, selectable options and navigation options.

You can easily navigate through the six screens by either one of the following:

PRESS 

Press the TAB key.

OR

Use the mouse to move the cursor to MAIN tab and ***press*** the button located on the left-hand side of the mouse, as illustrated below.

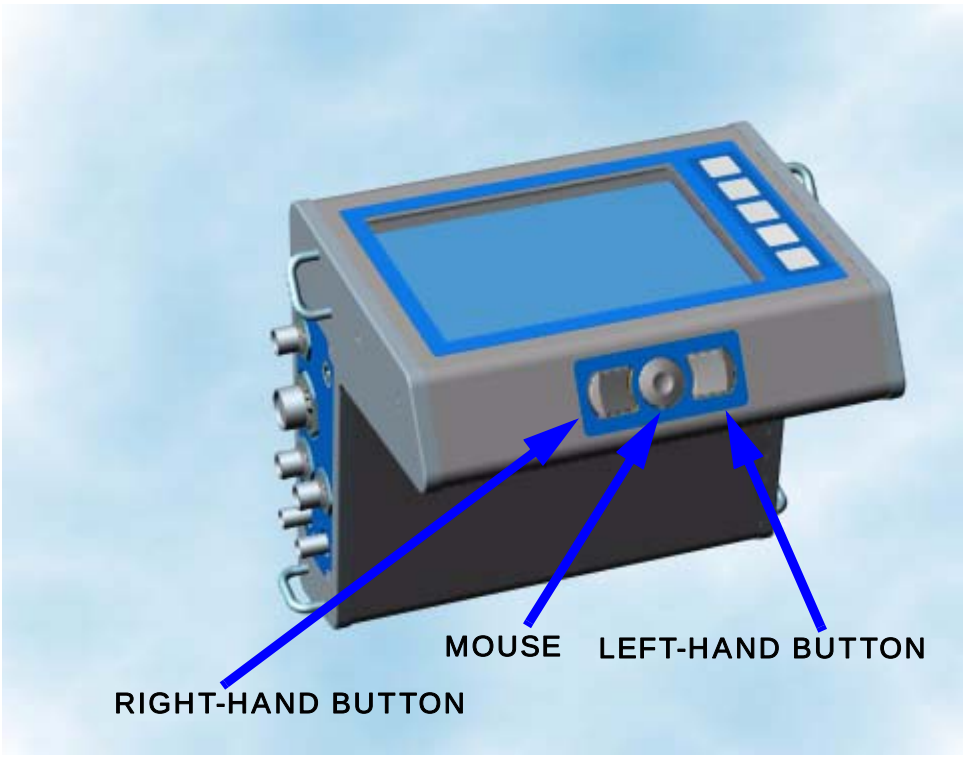
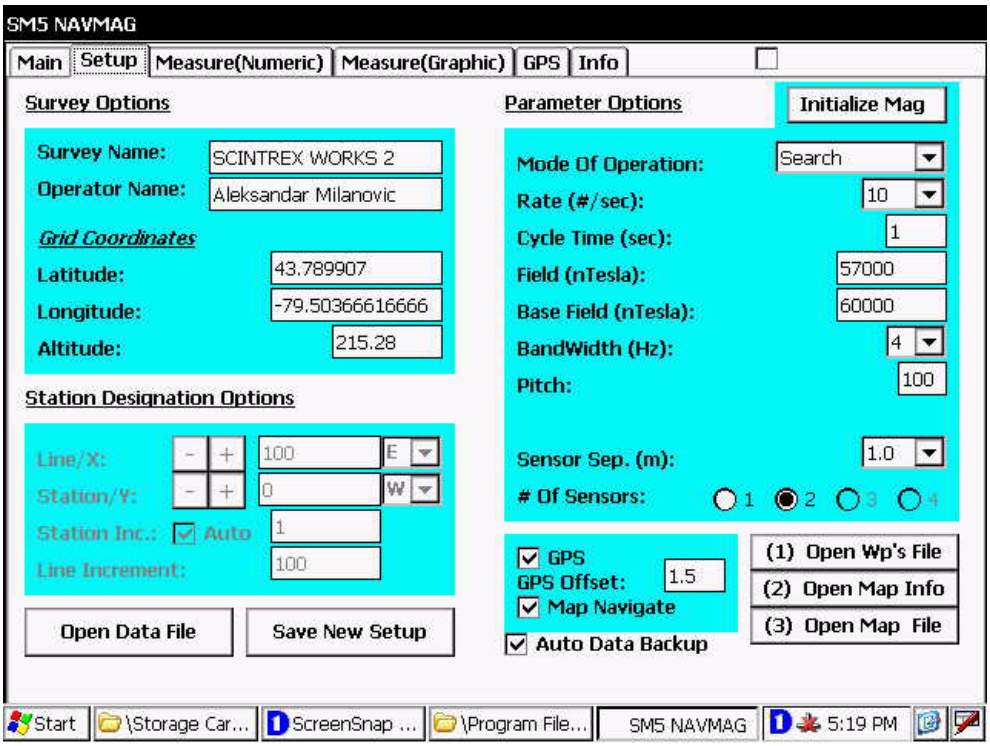


Figure 1-52 - Mouse controls

Hint:

If you loose sight of the mouse, ***press*** the TAB key to access another screen. The cursor will appear in the upper right-hand corner of the screen.

The following shows an example of the main Setup screen. In this screen, you will set the survey parameters.

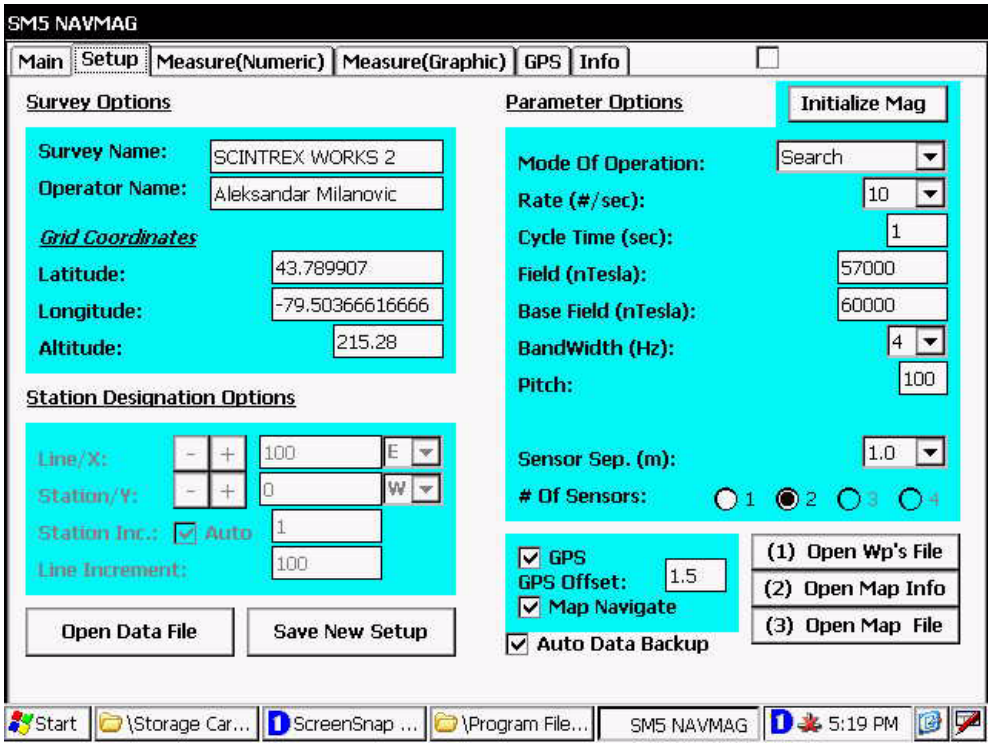


The functions in each screen will be explained in the Chapter 2, “Setting up your Instrument”.

Using the hot keys (X mode)

The SM-5 NAVMAG enables you to use hot keys which allow you to dispense with the mouse control to navigate between menus and fields.

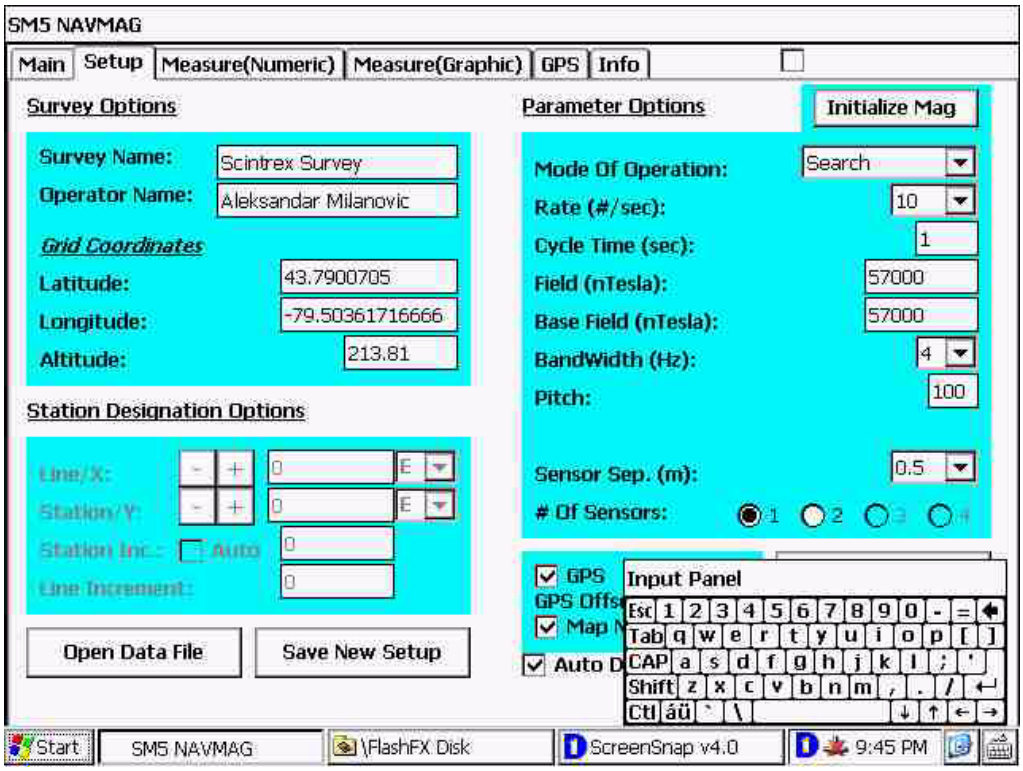
To enable the hot keys, ***check*** on the box in upper right-hand corner of the screen as illustrated below:



Entering parameters

The SM-5 NAVMAG enables you to enter various parameters in the alpha-numeric entry fields. For instance, in the above-illustrated screen, the operator name can be any alpha-numeric string.

To ***enter*** the survey name, bring the cursor using the mouse control to the survey name field. ***Press*** the left-hand button, you will notice that a keyboard will appear in the lower-right-hand part of the screen, as illustrated below:



Note:

If the keyboard does not automatically appear, ***bring*** your mouse to the keyboard icon located on the task bar, and left-click.

Transferring Data

The SM-5 NAVMAG enables you to transfer data via a standard USB port.

For information on the complete USB transfer processes, see Chapter 3, “Operating the SM-5 NAVMAG in the Field” and “Transferring your data” on page 3-30.

2

Setting Up Your Instrument

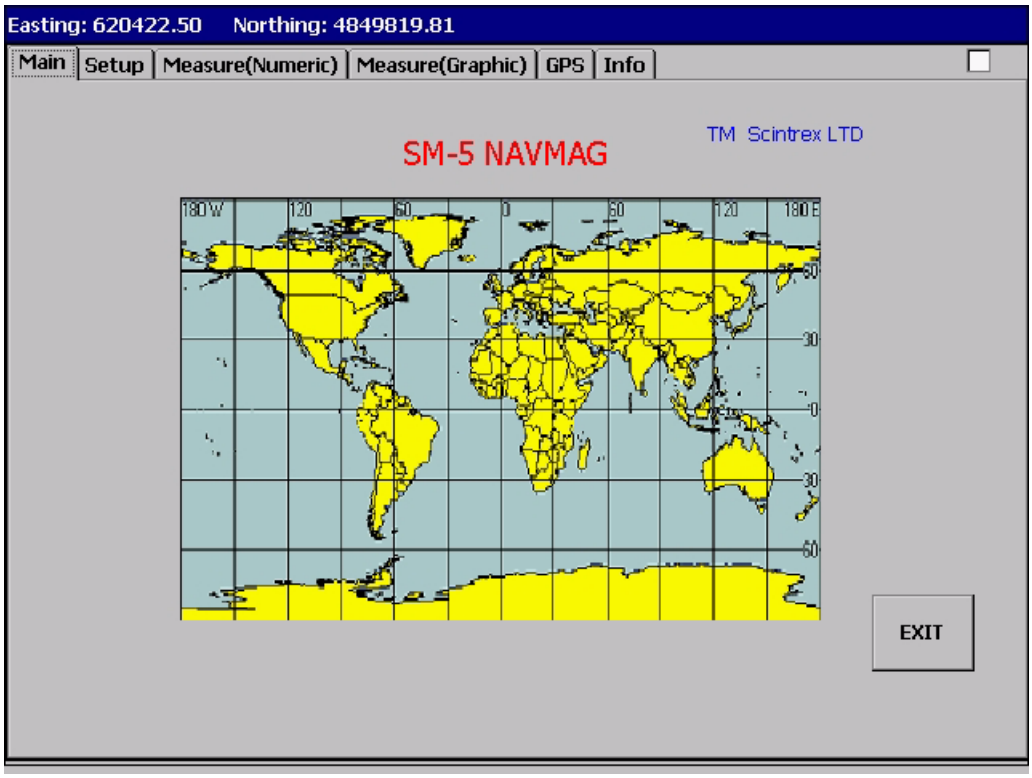
As indicated in the previous chapter, before you can initiate a magnetometer survey, you must be aware of the parameters that can be adjusted in your SM-5 NAVMAG. They include:

- Survey grid parameters
- Field and instrument parameters
- Read, cycling and base station options
- GPS setup.

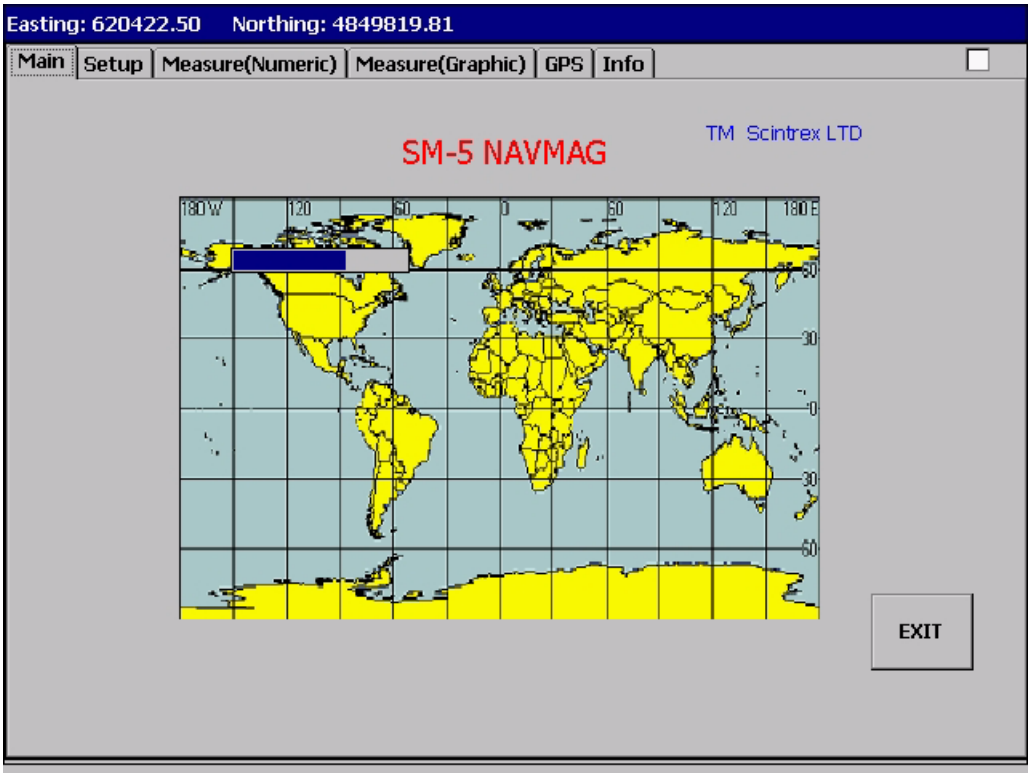
This chapter describes changes that you make to your system using the Setup screen.

Accessing the screens

Upon start-up, the Main screen, as illustrated below, is the first to appear.



Main screen Contrast adjustment



To adjust the Contrast of the main screen, ***move*** the cursor, using the mouse control, into the world map area and ***press*** the left-hand button located beside the mouse button. A green bar will then appear as illustrated above. ***Press*** the left-hand or right hand mouse buttons until you obtain the desired contrast.

Upon power-up, the Auto Contrast is enabled. For manual setting of the Contrast, ***go*** to the Info screen and disable Auto Contrast, i.e. ***set*** Auto Contrast to OFF.

Survey setup screen

The Survey Setup screen is one of the key screens of the system. It provides access to three sub-options; the Survey options, the Station Designation options and the Parameter options in order to configure your SM-5 NAVMAG.

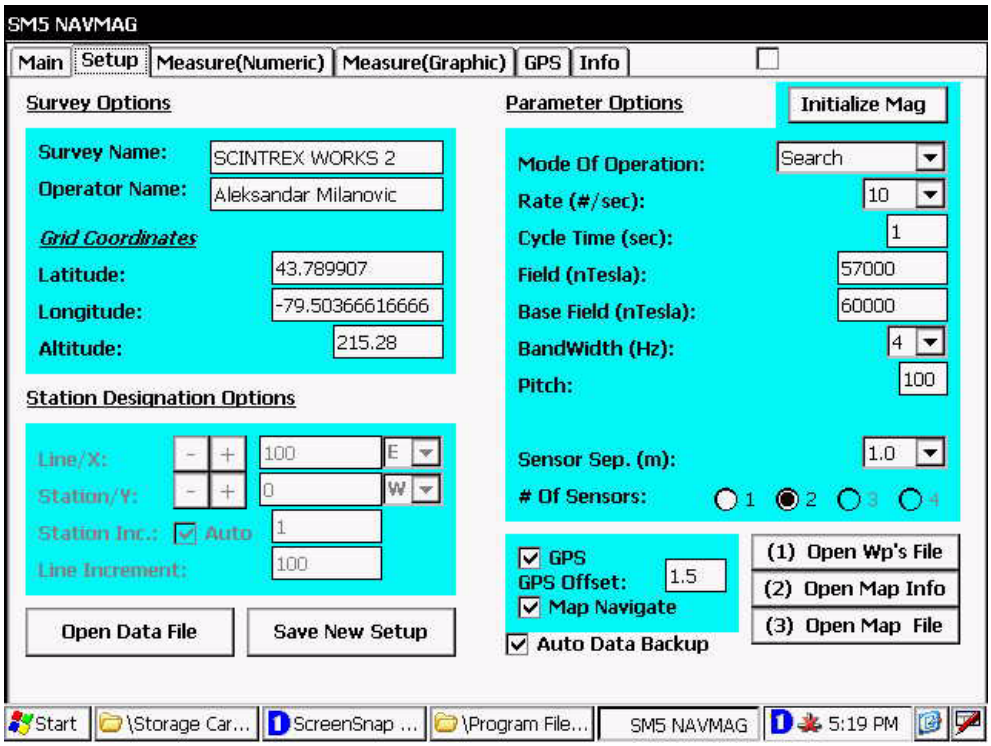
The survey Setup screen enables you to create the survey header required in the data file. This includes the:

- Survey identifier
- Name of the client
- Name of the operator
- Grid reference point
- Station designation system

PRESS 

To access the survey Setup screen:

Press the TAB key until the following screen is displayed, or use the mouse control and ***move*** the cursor to the Setup tab and click left button.



Survey Options

Using the mouse control, ***bring*** the cursor within survey name field and ***press*** the left-hand button. You will notice a keyboard appear in the lower right-hand part of the screen. Use the keyboard to enter the Survey Name.

Repeat the process for the Operator Name.

Note:

If you intend to use the GPS option, you need not enter any values for the grid coordinates, as these will be filled when you ***click*** on "Mark Grid Coordinates" and with a properly functioning GPS receiver.

Station Designation Options

The Station Designation Options are used when in presence of a grid with cut lines, e.g. when GPS navigation is not required.

Note:

The station designation option is disabled if the GPS field is enabled. Please refer to "Parameter Options" on page 2-7.

Line/X

The line number is either denoted as +/- or NSEW. You can increase or decrease your line number using the + or - keys.

Station/Y

The station number is either denoted as +/- or NSEW. You can increase or decrease your station number using the + or - keys.

Station Increment

The Station Increment allows you to automatically increment the station value without having to introduce your new station value after every reading. For this function to be enabled, you must click on the Auto box.

Note:

The station increment will be automatically applied to your first station. As an example, with a start station of 0 and a station increment of 25, you will have to reset your starting station to -25 if you want to start from station 0.

Line Increment

Along with the station incrementation function, you can also introduce a line increment. To increment the line, you must use the + or - to change the line number. The value will be changed according to the line increment value entered.

Parameter Options

The Parameter Options enable the user to configure the magnetometer survey. This is the most important sub-screen of the SM-5 NAVMAG and particular care must be taken to fully understand each parameter.

Mode of Operation

The mode of operation can be either Search, the most commonly used mode for quick location of an anomaly, Stop-and-Go mode, which is used when mapping, or Base mode when you want to configure the SM-5 NAVMAG as a base station.

To select the mode of operation, use the mouse control to ***bring*** the cursor to the pull-down arrow located on the right-hand side of the field. By clicking on the arrow, the selections will appear. ***Bring*** the cursor to the desired setting and left-click.

Rate (#/sec)

The SM-5 NAVMAG retains its accuracy of 0.01 nT even at a sampling Rate of 10 samples per second. Therefore, unless you specifically want to sample at a lower rate, we recommend you leave this parameter as is at 10. You can change it in much the same manner as the Mode of Operation.

Note:

The default rate of sampling is 10 times per second.

Cycle Time (sec)	The cycle time is used in the Base Station Mode and denotes the time interval between each base station reading. The value selected will vary with the user: some will prefer a cycle time of 30 seconds in winter, 10 seconds in summer whereas other users will prefer to cycle at 0.1s; (i.e. as fast as and synchronous with a base station used in airborne magnetometry).
Field (nTesla)	The Field Value is used as a filter value in the bandwidth calculation. Normally this would be the average magnetic field value in your area.
Base Field (nTesla)	The Base Field value is used as a datum that will be subtracted from the base station values. If used in conjunction with the field value, they should be set to the same value.
BandWidth (Hz)	The Bandwidth is related to the filter applied to the larmor precession signal. Please refer to Appendix B “Theory”. A value of 2 Hz is what is recommended for most usages.
Pitch (Optional)	The Pitch is the intensity of the audio signal as heard in the headset connected to the HS Port (See Figure 1-42 in “Ancillary Ports” on page 1-41. The higher the pitch, the higher the magnetic field value.
Sensor Sep (m)	The Sensor Separation is the distance between your sensors when your SM-5 NAVMAG is configured as a gradiometer.

# of Sensors

The SM-5 NAVMAG can accommodate up to 4 simultaneous sensors. Only 2 sensors can be accommodated at the present time. We are planning to accommodate 4 in the future.

Note:

In the gradient mode, the number of sensors will be set to 2. In the total field mode, the number of sensors must be 1.

Should you wish to use the Internal or External GPS receiver, you must enable the GPS by ***clicking*** on the GPS box.

Note:

When the GPS is enabled, you will notice that the station designation field is disabled.

Should you wish to use a background map to enhance your navigation, you can create a base map and plot your waypoints which will most likely be the Start and End points of your survey line. Please refer to the next section for more details.

Opening and saving your navigation setup

As part of the GPS-assisted navigation procedure, you must open a waypoint file, a map info file and a map file. These files are obtained by registering your map. Please refer to Appendix A “Scintrex GPS Map Registration Program” for this procedure.

Click on (1) Open Wp’s File, you will then be prompted to open the waypoint file (*.wpt) that you created during map registration. (see App. A)

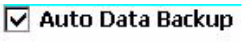
Click on (2) Open Map Info, you will then be prompted to open the map info file (*.txt) file that you created during map registration.(see App. A)

Click on (3) Open Map File, you will then be prompted to open the map file (*.bmp) that you created during map registration.(see App. A)

Important:

These three steps must be followed in their numerical order. Failure to do so will result in an error. These files are located in the Utilities/Sample Maps directory that you created during the map registration process. (see App.A)

Automatic data backup



You can also choose to have your data backed up automatically. For manual data backup and saving data, please see “Saving your data” on page 3-29.

Saving new setup

Important:

Once you have completed your setup, ***click*** on Save New Setup with the cursor. Your entire setup (GPS included) will now be stored and it will be automatically retrieved the next time you turn on your SM-5 NAVMAG.

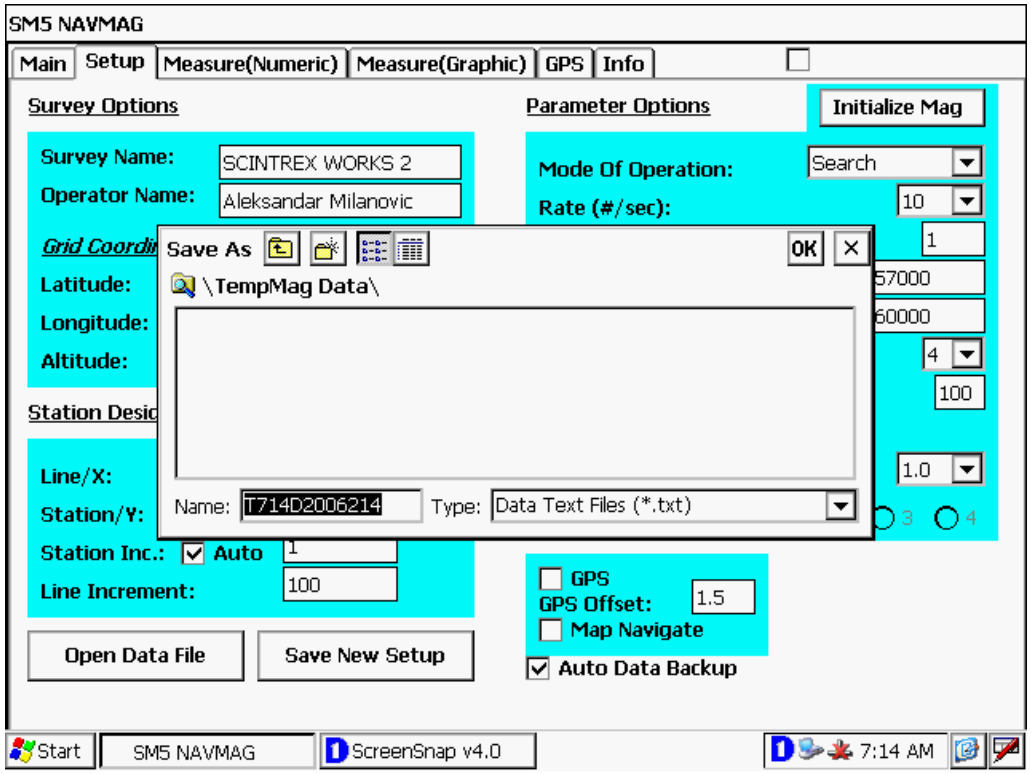
Note:

Configure all menus and then save.

Opening a data file

Important:

You must create a data file in order that the data that you are about to acquire is preserved, otherwise your data will not be recorded. Click on the Open Data File button, the following screen will appear:



Click on the file name that has been provided (hour/date based default name), or ***choose*** your own file name. Your file will then be stored in the RAM memory of your SM-5 NAVMAG.

Important:

Regardless of the file name you choose, you must keep the path as shown. Failure to do so will result in an error.

Info screen

The Info screen is the most informative of your screens. It provides you with ready diagnostics of your complete system, as well as the ability to recall your data.

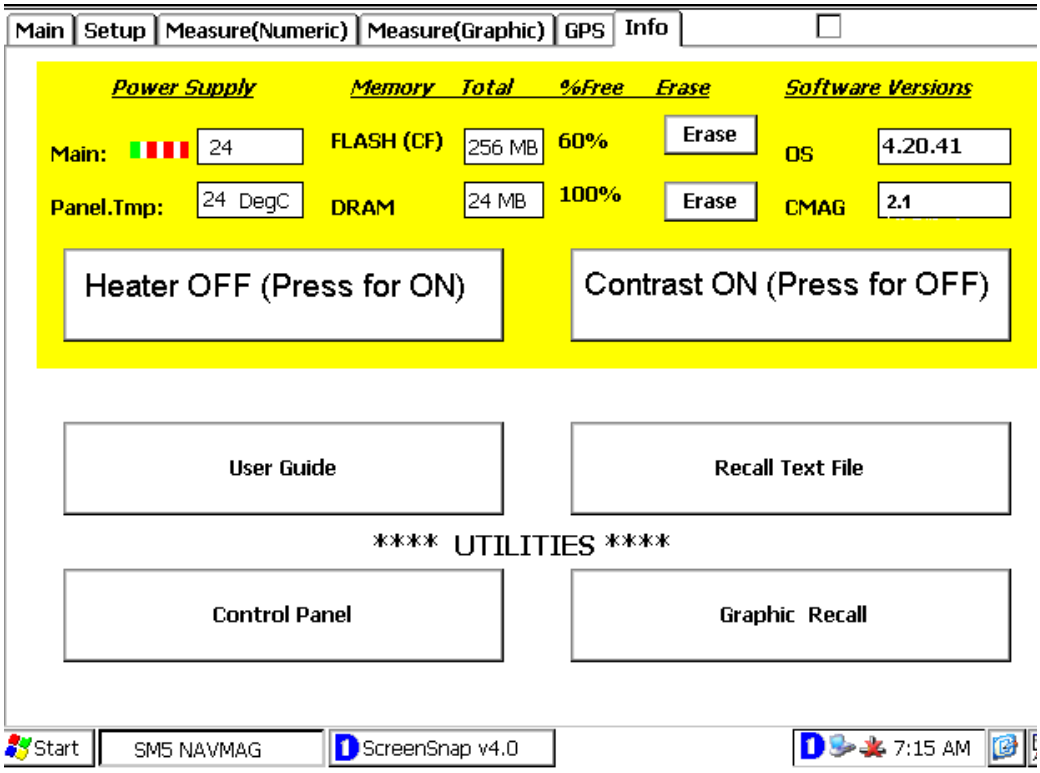
The parameters and functions that are displayed are as follows:

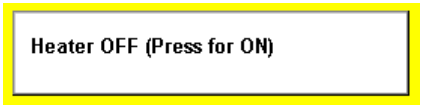
- Main power supply voltage
- Panel temperature
- Flash memory capacity
- RAM capacity
- Operating system version
- CMAG software version
- Switching on/off of display heater
- Short user guide
- Windows CE control panel
- Switching on/off of display contrast
- Recalling text files
- Recalling navigation bitmaps

PRESS 

To access the Info screen:

Press the TAB key until the following screen is displayed, or use the mouse control and ***move*** the cursor to the Info tab and click left button.





The screen heater can be toggled off and on by ***clicking*** on the heater button with your mouse.

The screen contrast can be toggled off and on by ***clicking*** on the contrast button with your mouse.

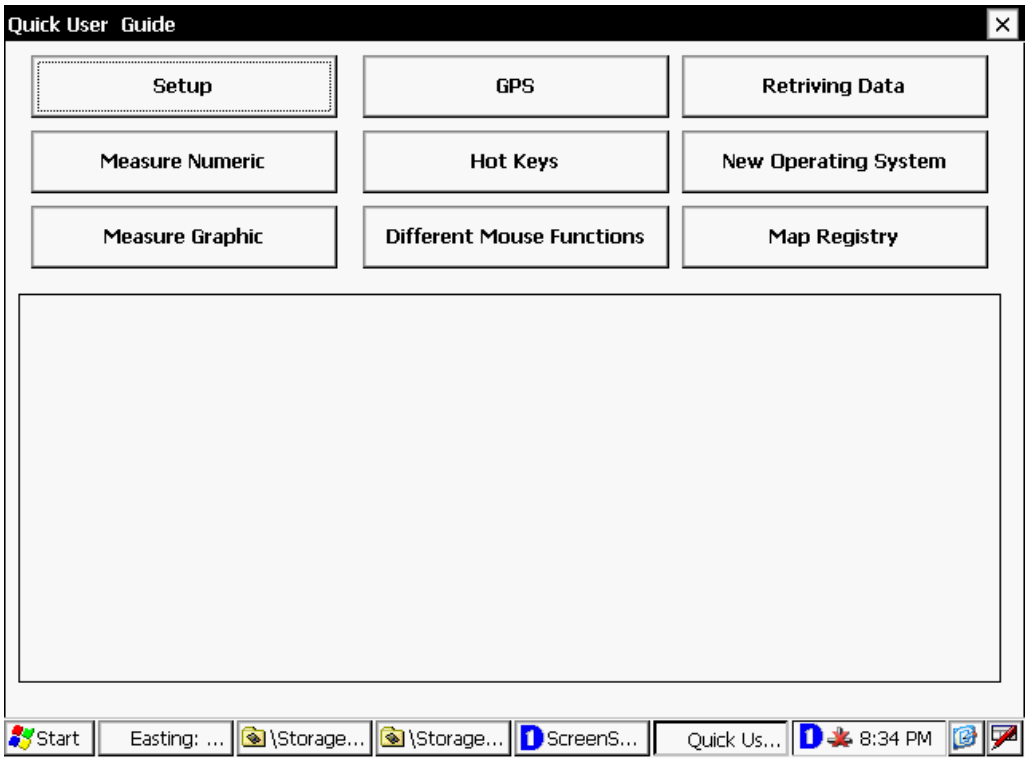
Note:

You can also adjust the screen contrast by using the main screen contrast adjustment. Please refer to “Main screen Contrast adjustment” on page 2-3 for further details.

As previously mentioned, the User Guide is similar to a summary version of the operation manual. Each screen is explained in as much detail as space allows.

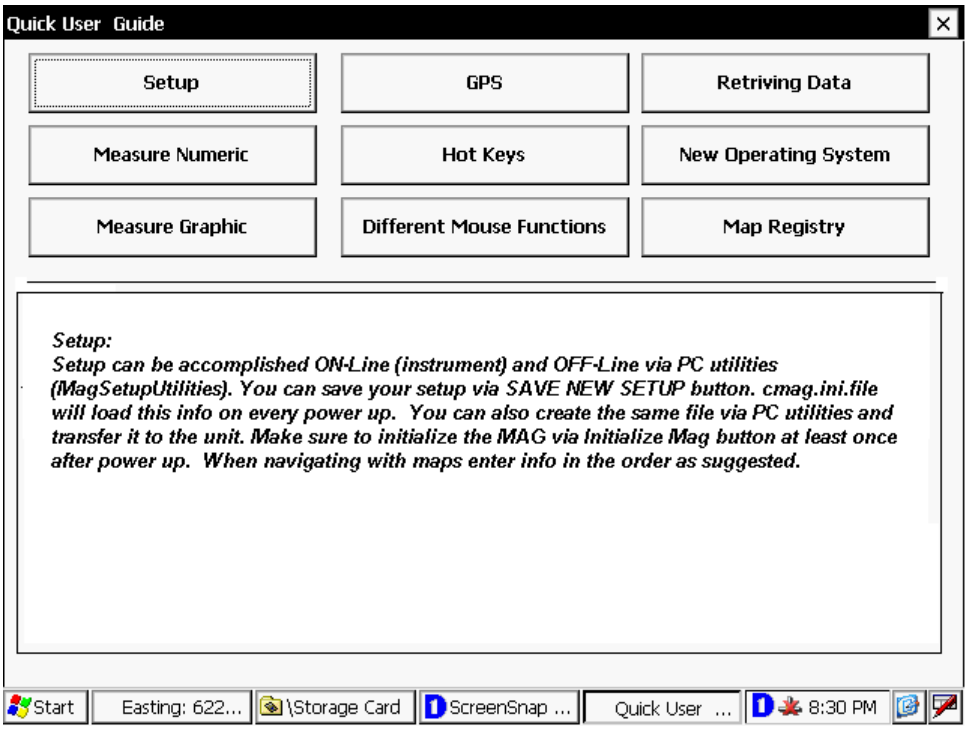
The User Guide is accessed by ***clicking*** on the User Guide button with your mouse.

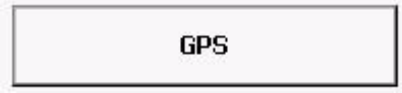
The following screen will be displayed:



The Quick User Guide for the SetUp menu is accessed by ***clicking*** on the Setup button with your mouse.

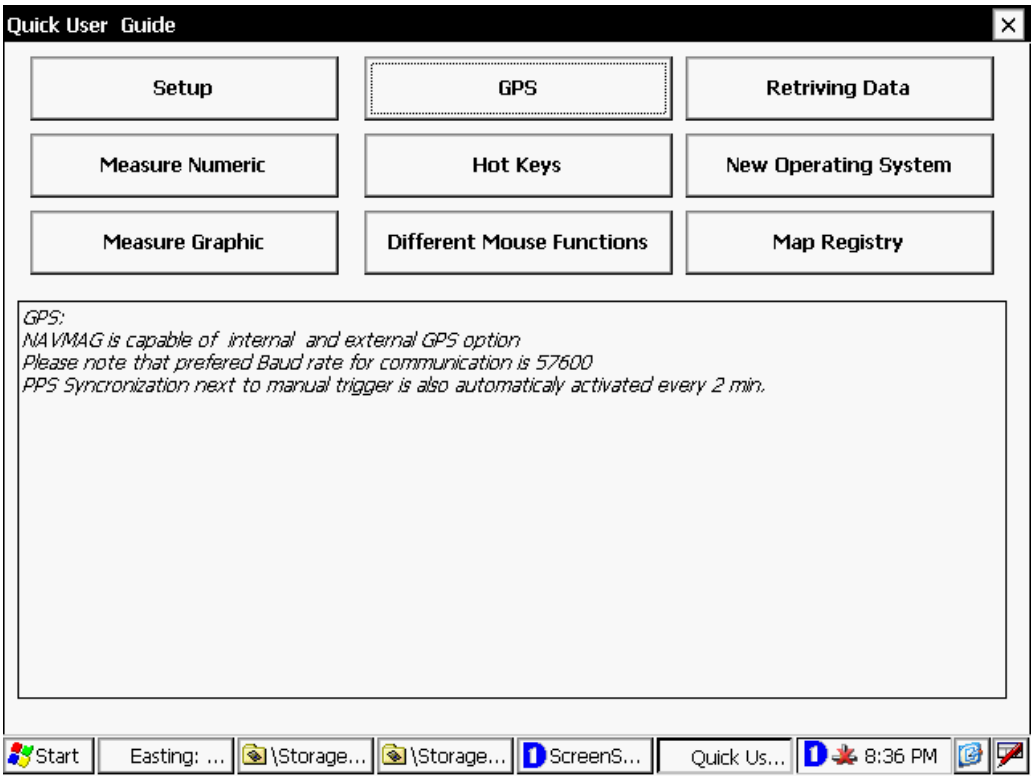
The following screen will be displayed:





The Quick User Guide for the GPS menu is accessed by ***clicking*** on the GPS button with your mouse.

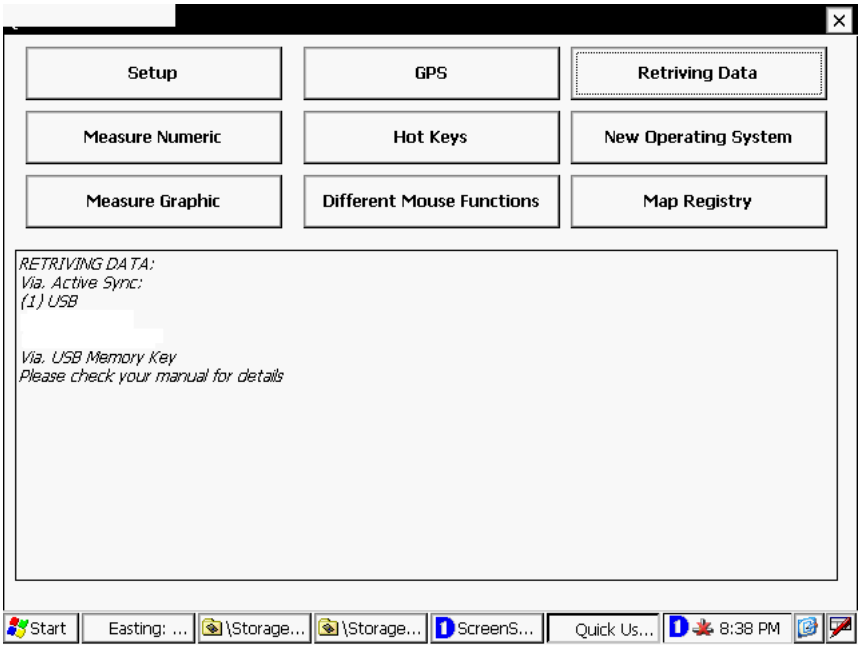
The following screen will be displayed:

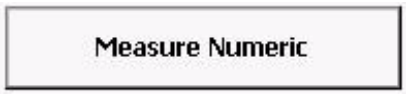


Retrieving Data

The Quick User Guide for the Retreiving Data menu is accessed by ***clicking*** on the Retreiving Data button with your mouse.

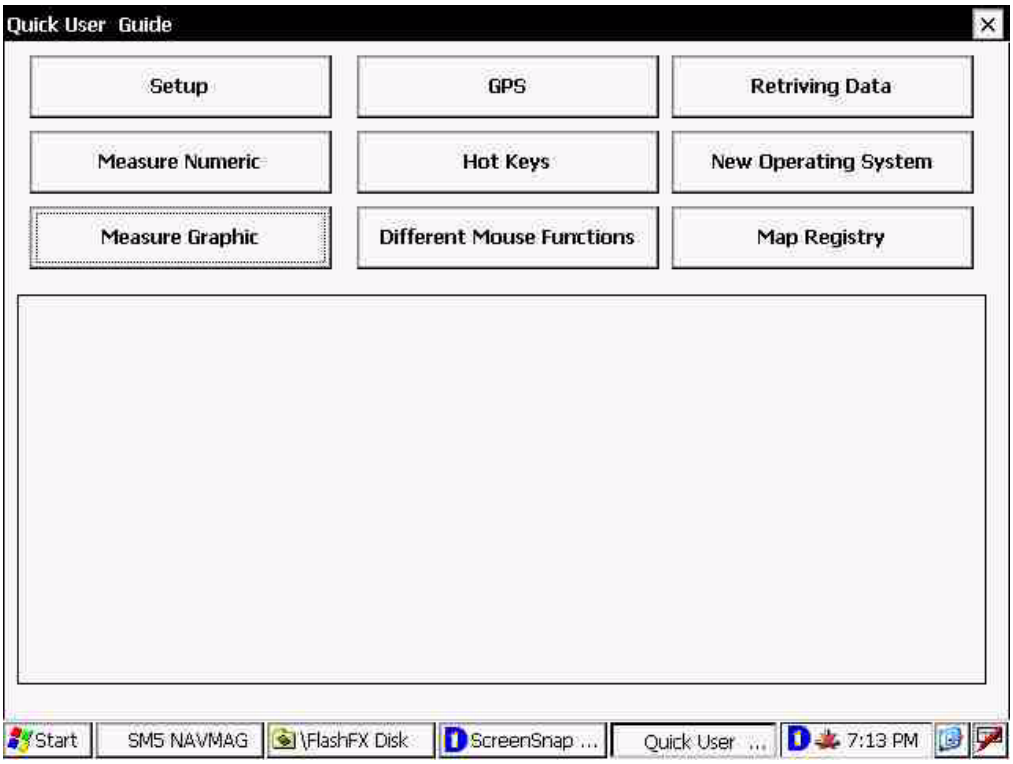
The following screen will be displayed:





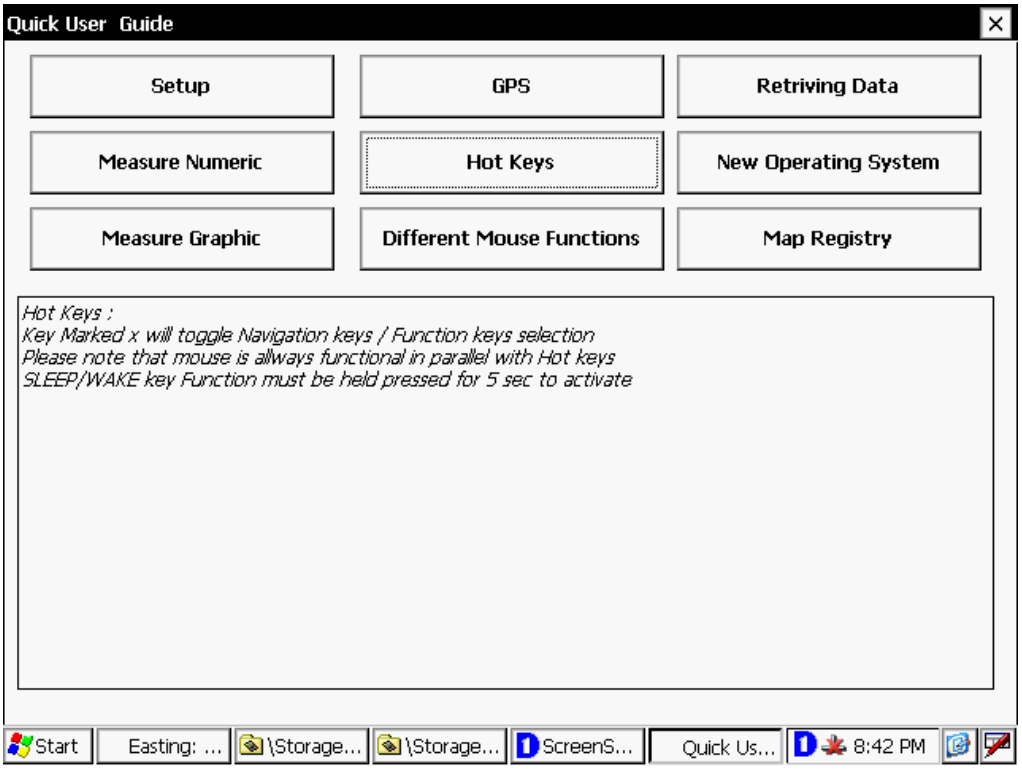
The Quick User Guide for the Measure Numeric menu is accessed by ***clicking*** on the Measure Numeric button with your mouse.

The following screen will be displayed:



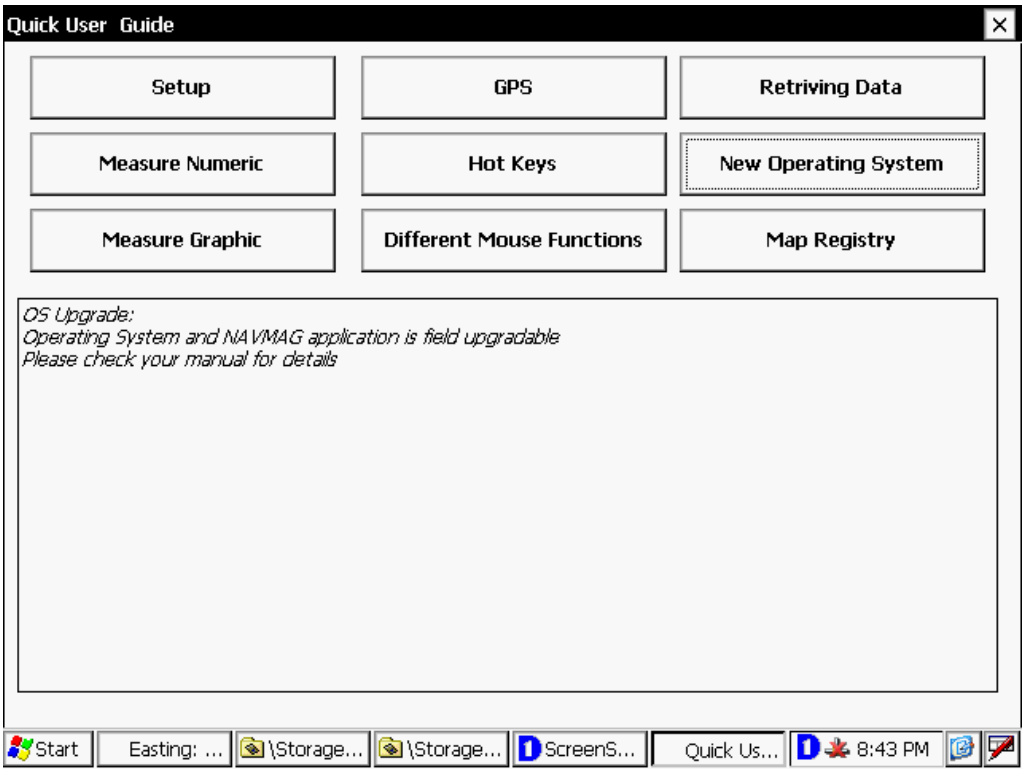
The Quick User Guide for the Hot Keys menu is accessed by ***clicking*** on the Hot Keys button with your mouse.

The following screen will be displayed:



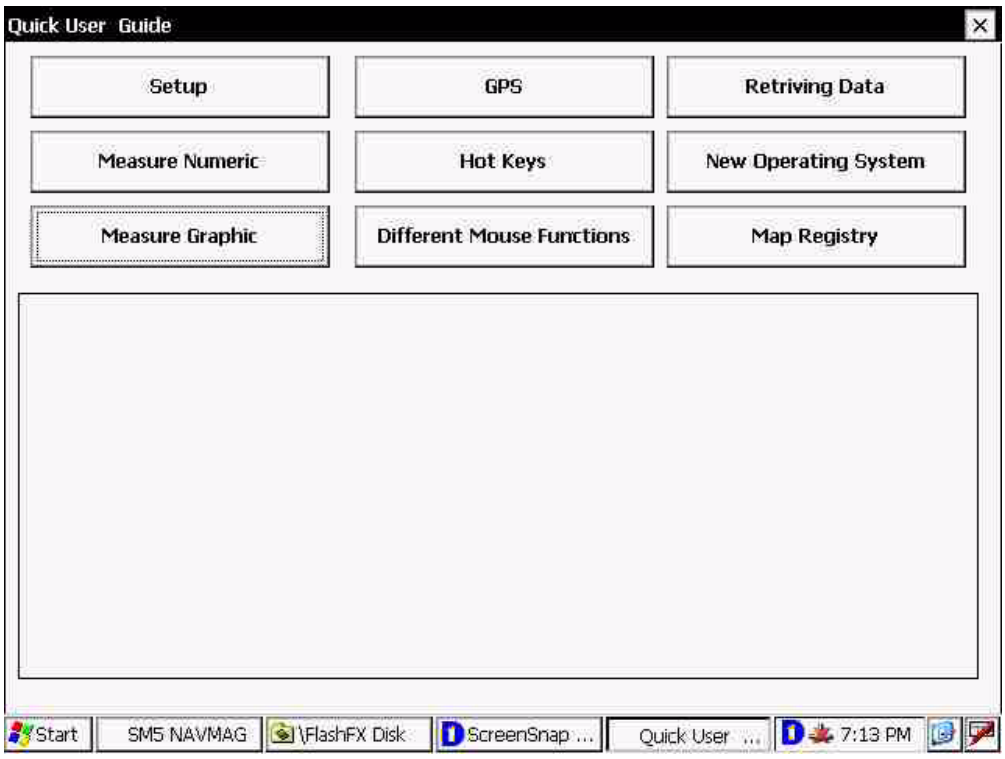
The Quick User Guide for the New Operating System menu is accessed by ***clicking*** on the New Operating System button with your mouse.

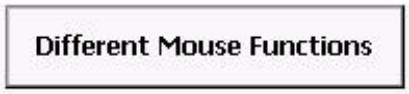
The following screen will be displayed:



The Quick User Guide for the Measure Graphic menu is accessed by ***clicking*** on the Measure Graphic button with your mouse.

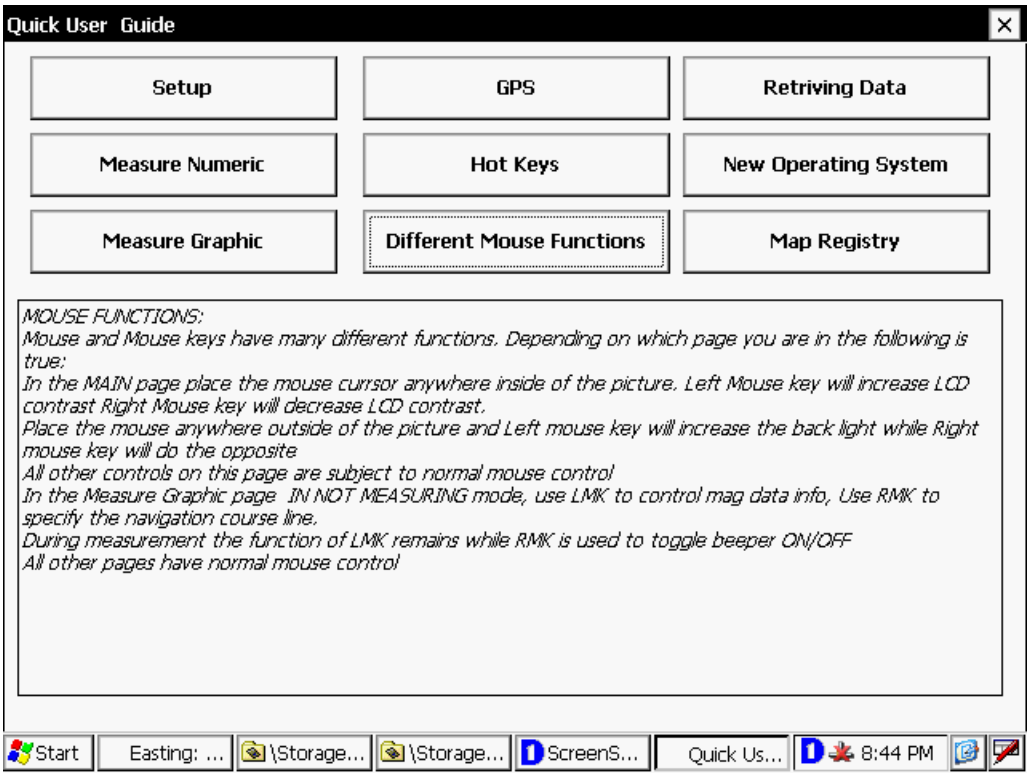
The following screen will be displayed:





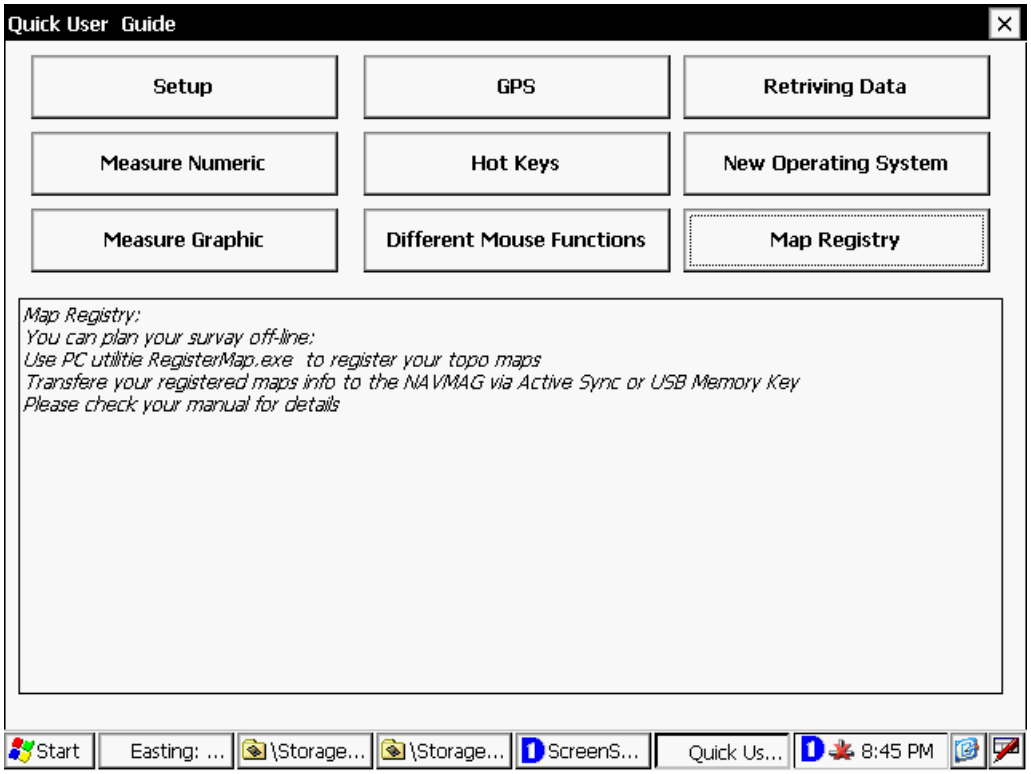
The Quick User Guide for the Mouse Functions menu is accessed by ***clicking*** on the Different Mouse Functions button with your mouse.

The following screen will be displayed:

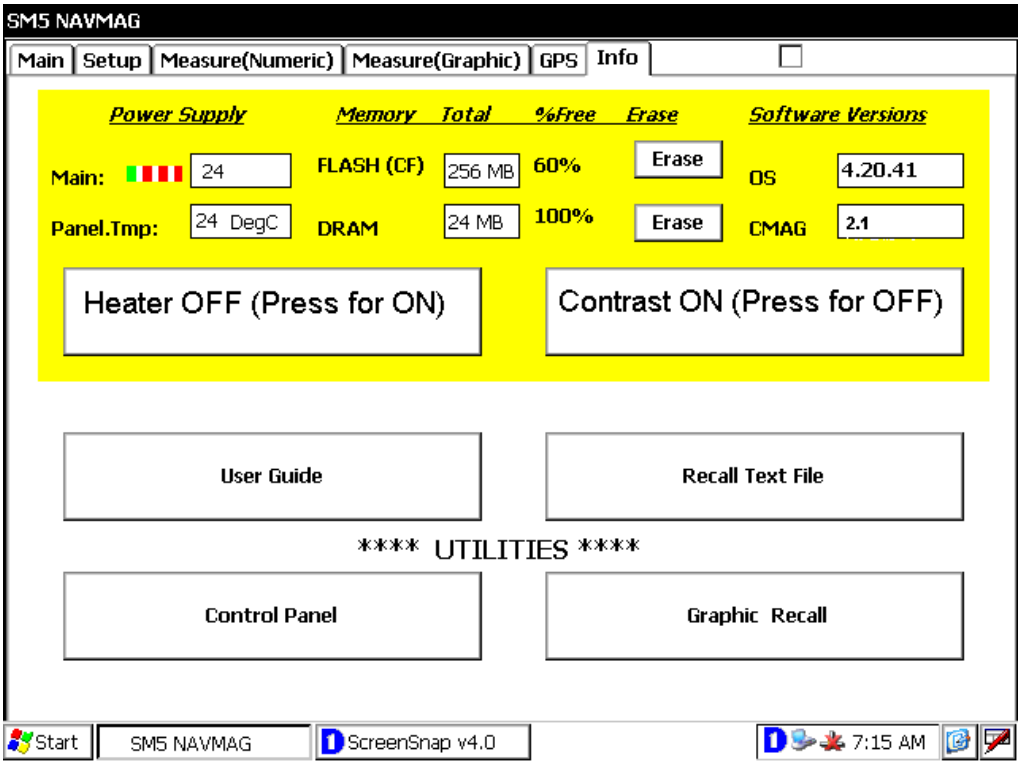


The Quick User Guide for the Map Registry menu is accessed by ***clicking*** on the Map Registry button with your mouse.

The following screen will be displayed:

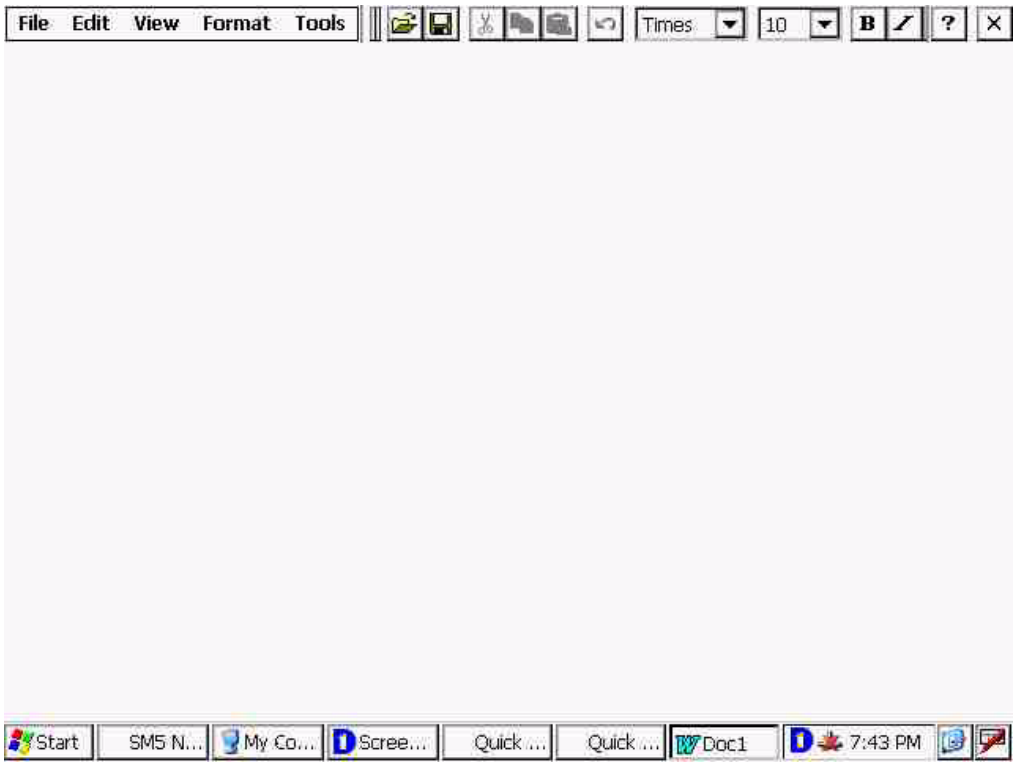


To return to the Info screen, ***click*** on the X symbol in the upper-right corner of your screen with your mouse. The following screen will appear:



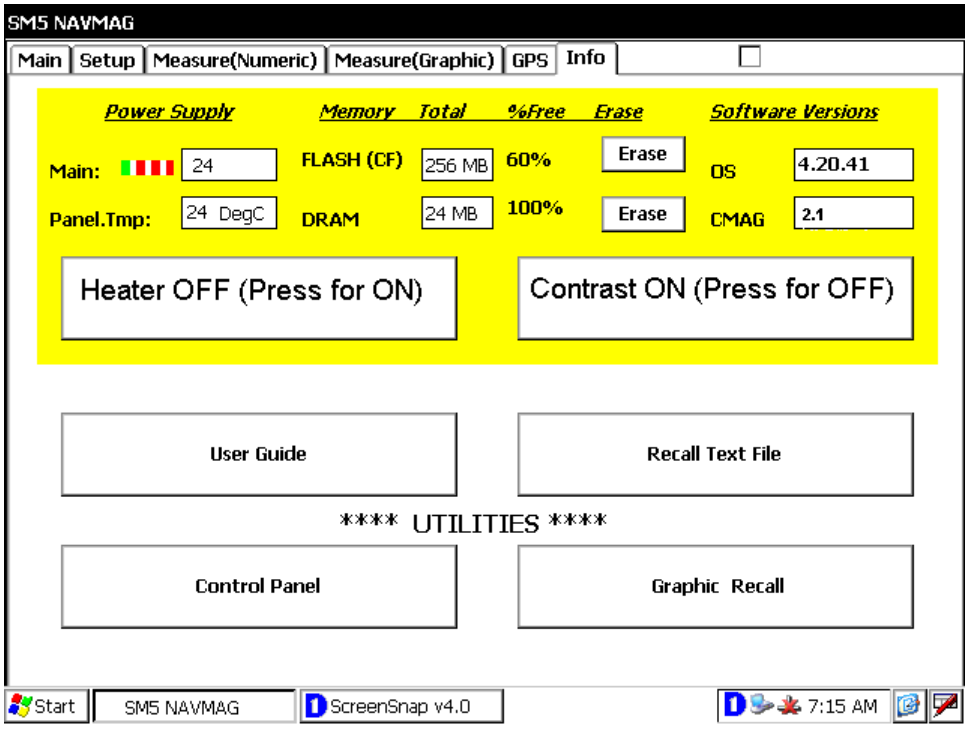
The Recall Text File allows you to edit a text file using the Microsoft Word ™ text editor.

To access the Recall Text File function, ***click*** on the Recall Text File button with your mouse. The following screen will be displayed:



The Recall Text File function allows you to edit a text file using the Microsoft Word ™ text editor. ***Bring*** your cursor to File, ***press*** the left cursor and you will edit the text file as you do in Microsoft Word ™ text editor.

To return to the Info screen, ***click*** on the X symbol in the upper-right corner of your screen with your mouse. The following screen will appear:

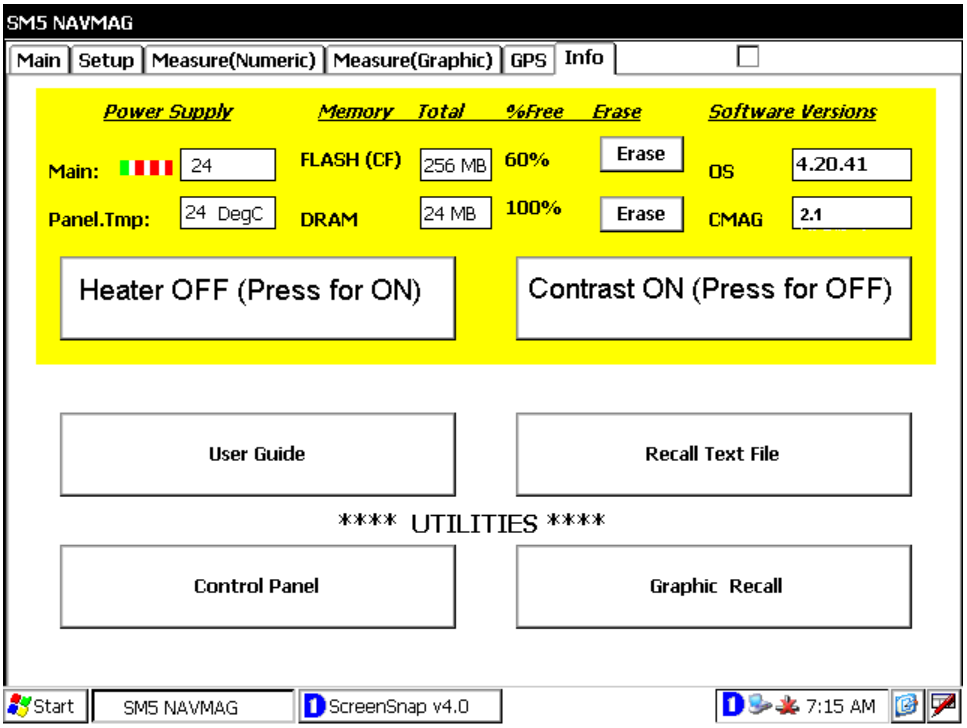


The Control Panel button allows you to access Windows control panel functions.

Control Panel

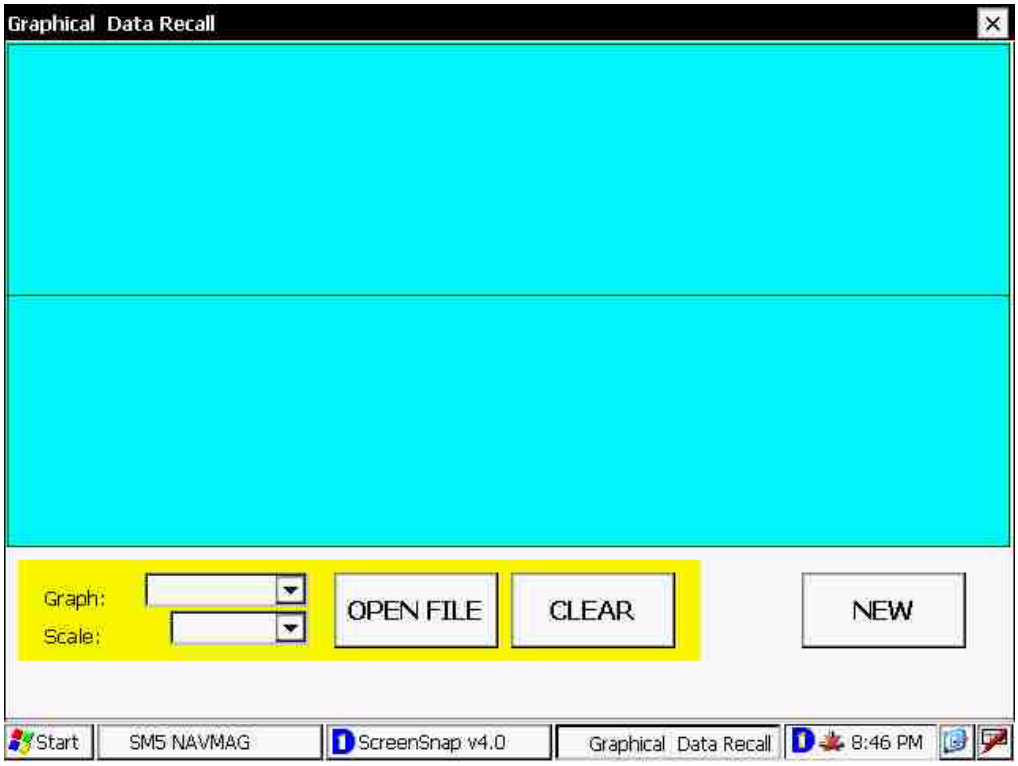
To access the Control Panel function, ***click*** on the Control Panel button with your mouse. The following screen will be displayed:

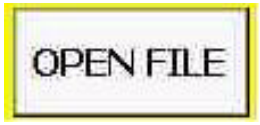
To return to the Info screen, ***click*** on the X symbol in the upper-right corner of your screen with your mouse. The following screen will appear:



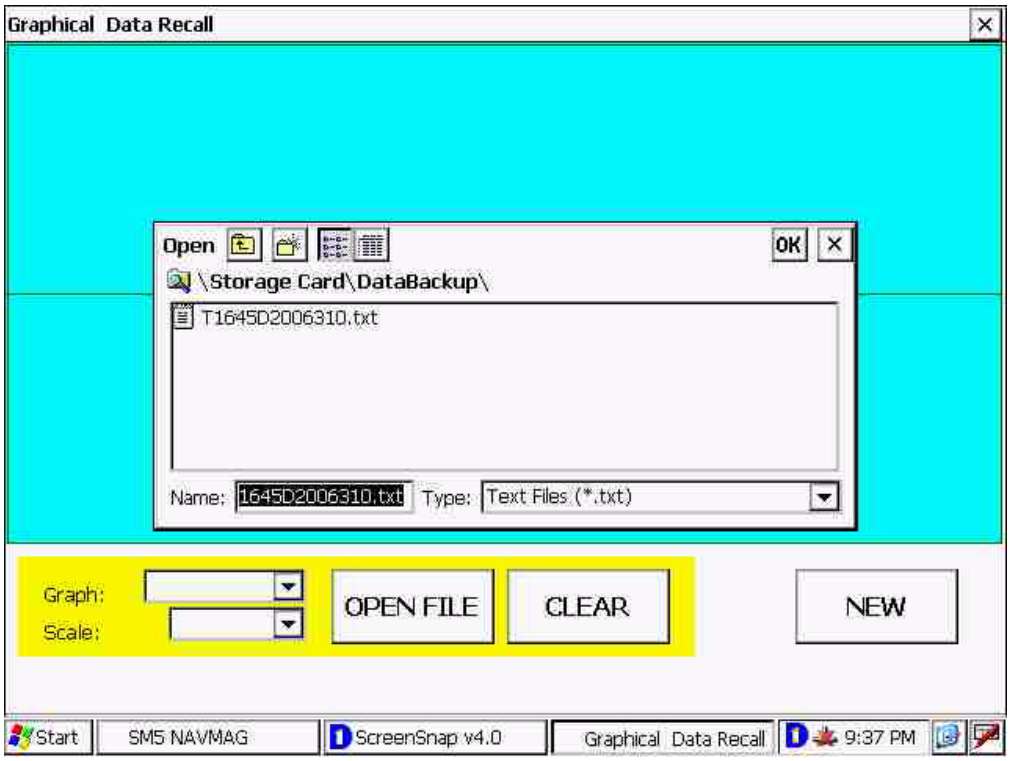
The Graphic Recall button allows you to recall and plot on your console screen any previously stored data profile.

To access the Graphic Recall function, ***click*** on the Graphic Recall button with your mouse. The following screen will be displayed:





To access a data file, ***click*** on the Open File button with your mouse. The following screen will be displayed:



Click on the OK button to access the file.

Note:

You can also choose what you want to plot by using the Graph pull down menu: either the H1, H2 or noise profile. Furthermore, you can vary the scale by using the Scale pull down menu.

3

Operating the SM-5 NAVMAG in the Field

By now you have familiarized yourself with the Setup of your SM-5 NAVMAG and have set the instrument parameters accordingly. This chapter reviews the basic steps required to carry out a field survey. Basic survey steps include:

- Initialize your magnetometer
- Initialize your GPS
- Initiate the reading
- Recall your data
- Dump your data

Initializing your magnetometer

Turn the sensor ON by ***using*** the sensor ON/OFF switch. Please also refer to “Turning the SM-5 NAVMAG Sensor On” on page 1-39. Using the mouse control, ***click*** on the “Initialize Mag” button located in the upper right-hand part of your Setup screen to intialize your magnetometer.

Important:

During the initialization process, the message “Initializing mag 1+2” will appear in the top right corner of the screen. This will last 2 to 3 seconds. Once your magnetometer has been initialized, the message “Done” will appear.

You are now ready to carry out measurements with your magnetometer and GPS.

Using GPS

If you decide not to use the GPS feature, please proceed to “Taking a measurement” on page 3-12

If your are using the GPS assisted navigational facilities, you must first initialize your GPS before you can take a measurement.

As mentioned in “Ancillary Ports” on page 1-41, the SM-5 NAVMAG can be used either with an Internal GPS receiver or an external GPS receiver.

Important: The Internal GPS is not recommended for high resolution surveys. The internal GPS operates only in the WGS-84 Ellipsod.

Using the internal GPS

To use the Internal GPS, you must first ***connect*** the antenna to the SM-5 NAVMAG console, as illustrated below:

Figure 3-1 - Internal GPS antenna connection

Then ***mount*** the antenna on the GPS mounting pole or sensor pole (position at opposite end to the sensor to avoid magnetic interference) as illustrated below:

Figure 3-2 - Mounting the Internal GPS antenna

Using an External GPS receiver

To use an External GPS, you must first program your GPS receiver.

The following parameters must be observed:

Sampling rate: 1Hz

GPS NMEA Sentence: GGA+ ZDA.

Baud rate: 57600 or 38400

Connect the GPS receiver to the External GPS Port "X_GPS", as illustrated below:

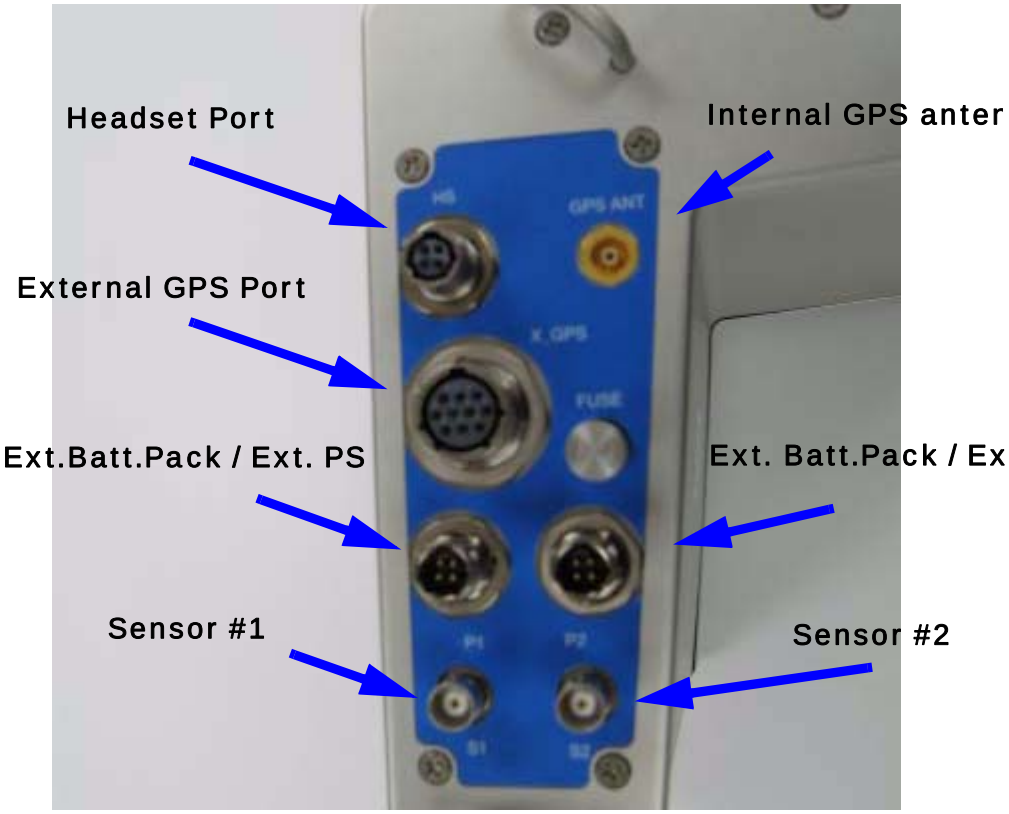


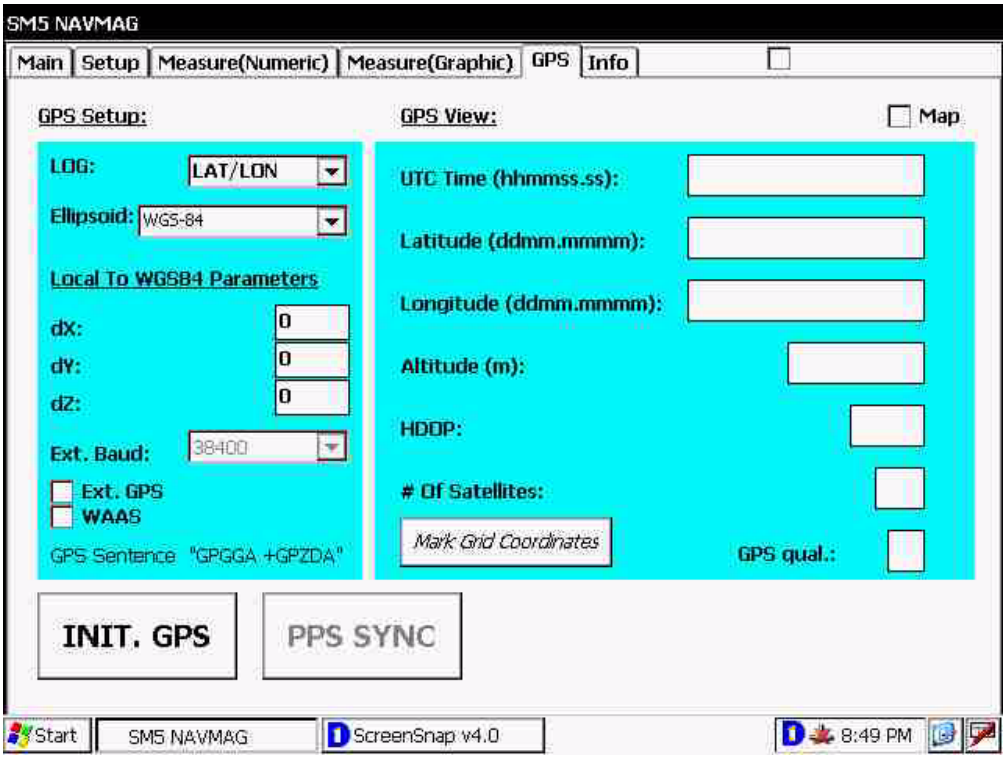
Figure 3-3 - Ancillary ports

Initializing your GPS

To access the GPS setup screen:

PRESS 

Press the TAB key until the GPS screen is displayed.



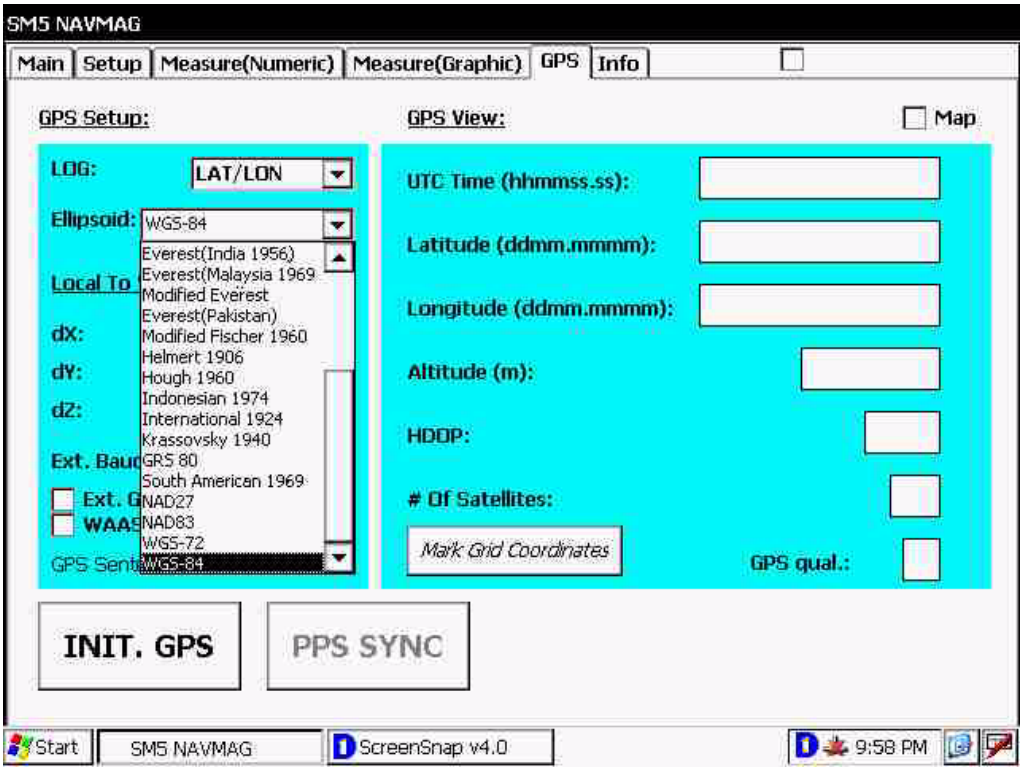
Note:

The dX, dY and dZ parameters are the deviations in meters between the WGS84 Geoid and your local Geoid. Enter the parameters to match your local map, using either the small keyboard or large keyboard, by clicking the keyboard icon. 

Important:

The internal GPS operates only in the WGS-84 Ellipsoid.

With your cursor, ***click*** on the pull-down arrow on the right-hand side of the Datum field to choose your datum. You will notice the following choices:



Use the cursor to select your datum.

If you are using an External GPS receiver, you must ***click*** on the "Ext. GPS" box and ***choose*** the appropriate baud rate. To increase the accuracy of your internal GPS ***click*** WAAS (Wide Area Augmentation System).

INIT. GPS

Using the mouse control to move the cursor, ***click*** on the Initialize GPS button. You will see the message "Acquiring Lock" appear in upper right-hand corner of the screen.

PPS SYNC.

Once Lock has been acquired, using the mouse control to move the cursor, ***click*** on the PPS Synchronisation to synchronise the console's internal clock with GPS time. The message "PPS Synchronised" will appear within a few seconds in the upper right-hand corner of the screen. Then the message "GPS Running" will appear.

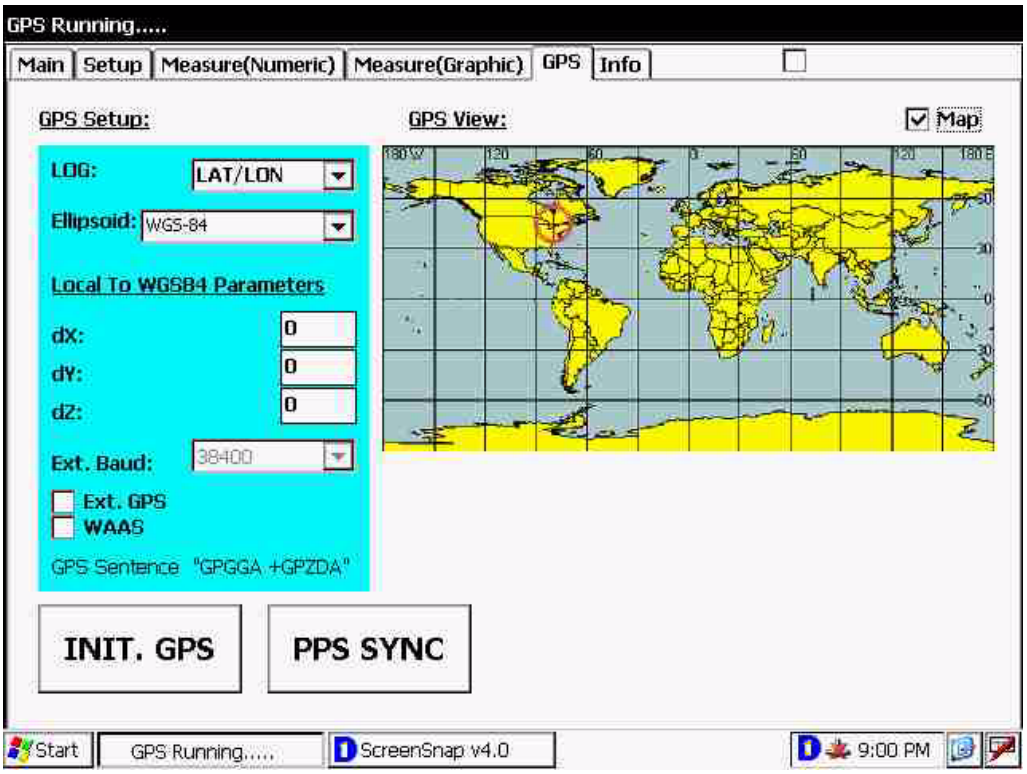
Note:

At this point, you will notice that your GPS is slowly acquiring a GPS signal and that the number of satellites is increasing. Furthermore, the real-time clock in your SM-5 NAVMAG is now synchronised with the GPS clock and you will notice that the time that is displayed is UTC (Coordinated Universal Time).

Important:

You must ***click*** on "Mark Grid Coordinates" in order for the GPS coordinates to be transferred to the Survey Setup screen.

Alternatively, you can also ***click*** on the Map box and the following screen will appear giving your location on the globe.



Now you are ready to take a magnetometer measurement.

Taking a measurement

Two screens for data acquisition are available:

1. Measure(Numeric) screen - shows the numeric value of the magnetic field as it is being acquired. If you are using GPS and have registered your map, the map will appear on the screen.
2. Measure(Graphic) screen - allows the operator to view the magnetic field values in graphical form as it is acquired at 10 samples per second

Note:

During a measurement, you will only have access to the Measure(Numeric) and Measure(Graphic) screens.

Important:

You must open a data file prior to taking a measurement, otherwise your data will not be stored.

The crossed filing cabinet icon  that may appear in the Measure (Numeric) or Measure (Graphic) screens indicates that you have not opened a file to store your data. Please refer to “Opening a data file” on page 2-11 for the proper procedures to open a data file.

Important:

You will have to power up your sensor before you can take a measurement. Please refer to “Turning the SM-5 NAVMAG Sensor On” on page 1-39 for instructions on how to power up your sensor.

Taking a Measurement - Numeric Screen without GPS navigation

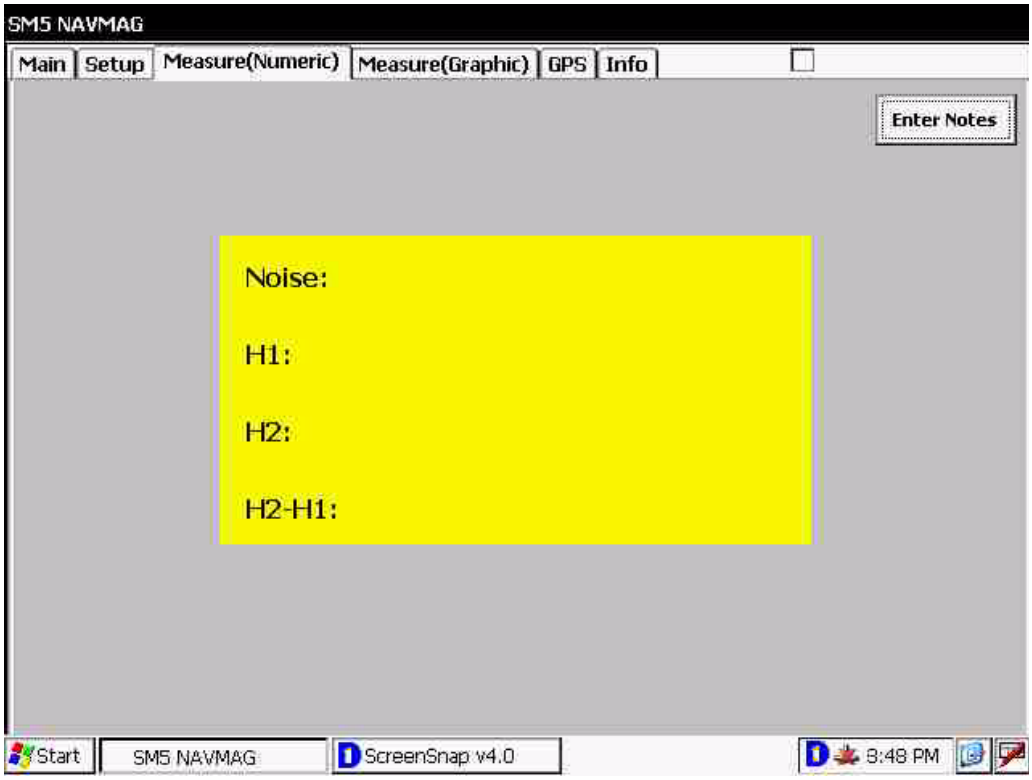
If you wish to use the GPS navigation functions, enable the GPS and Map Navigate functions (see “Survey setup screen” on page 2-4 if you are unsure on how to proceed) and see Appendix A “SM5 GPS Map Registration Program” for further instructions on map registration. Once you have done these steps, skip the following section and proceed immediately to “Taking a Measurement - Numeric Screen with GPS navigation” on page 3-16.

Note:

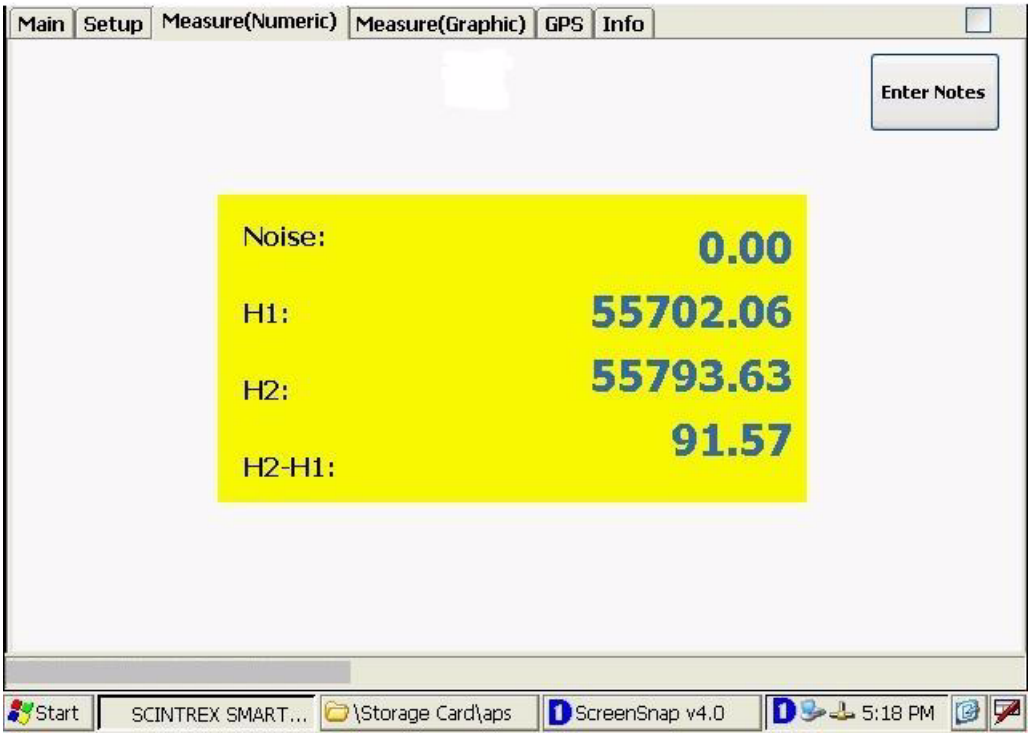
Both the GPS and Map Navigate functions in the “Survey setup screen” on page 2-4 should be disabled for the present section.

PRESS 

To access the Measure(Numeric) screen, ***press*** the TAB key, until you access the following screen:



To initiate a reading, ***press*** the Measure/Stop key, your readings will appear:



Note:

You will notice that the magnetic field values (H1 and /or H2) will vary. Furthermore, since you have disabled the GPS function, your line and station number appear in the lower left hand corner of the screen.

Taking a Measurement - Numeric Screen with GPS navigation

PRESS 

To access the Measure(Numeric) screen, ***press*** the TAB key until you access the following screen:

Note:

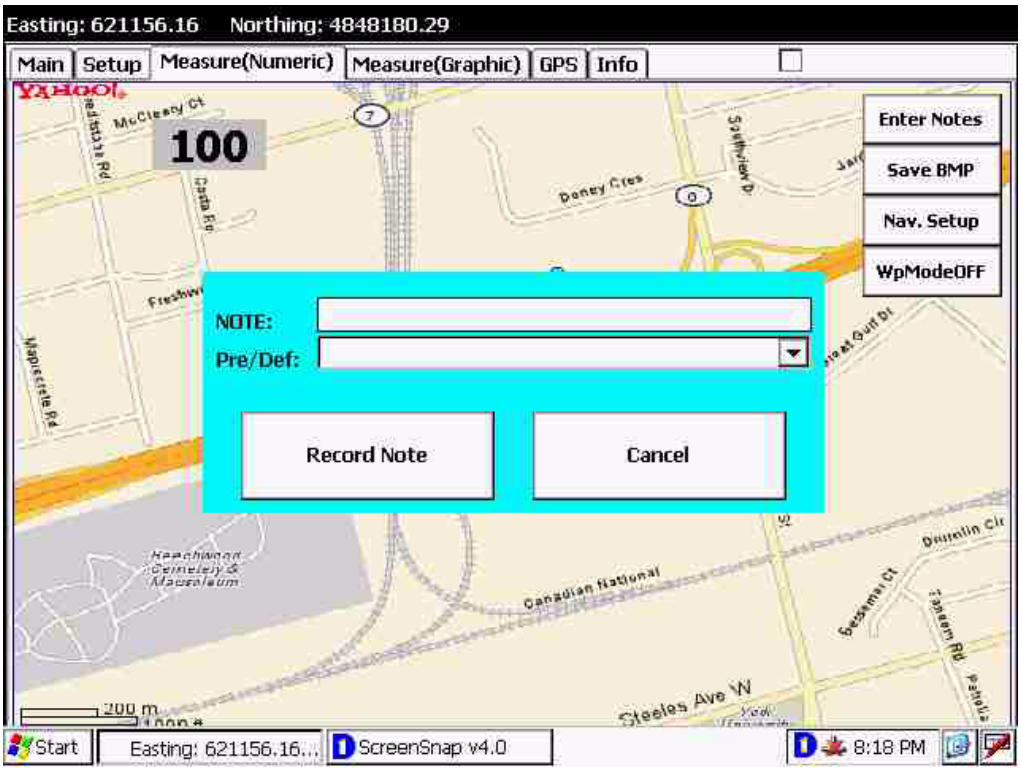
As you have enabled the Map Navigate function, and have registered your map, you will notice that your map appears in the background. This example contains waypoints which were created during the map registration process.

Entering notes

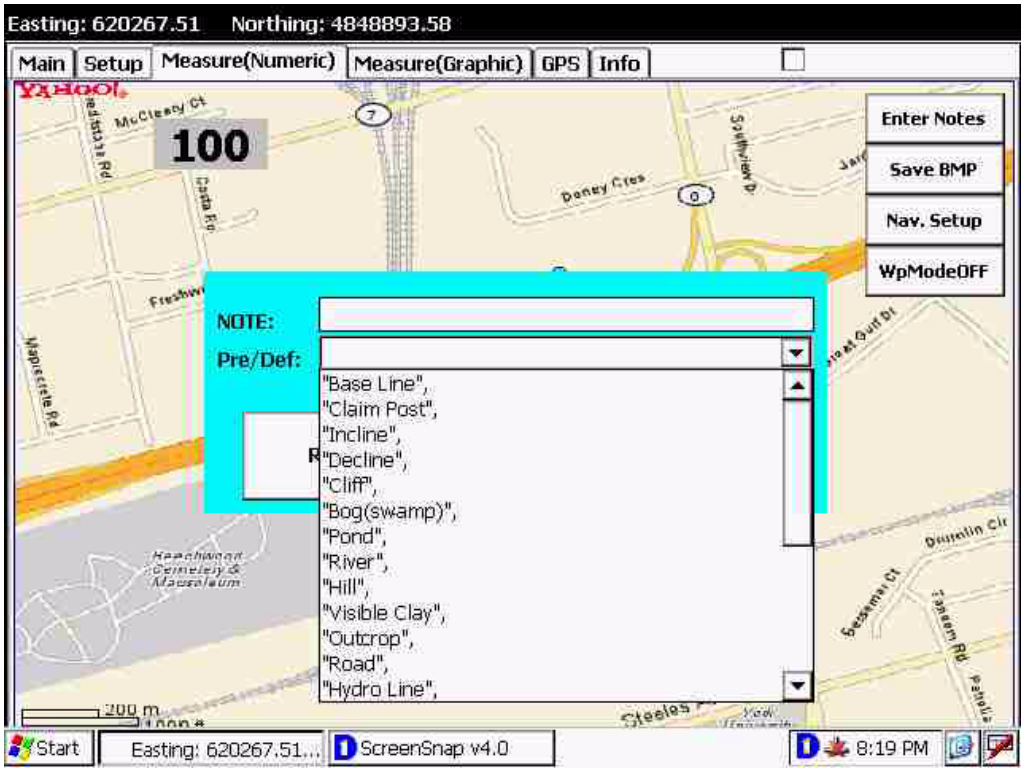
You can also enter notes that will be recorded along with your data.

Enter Notes

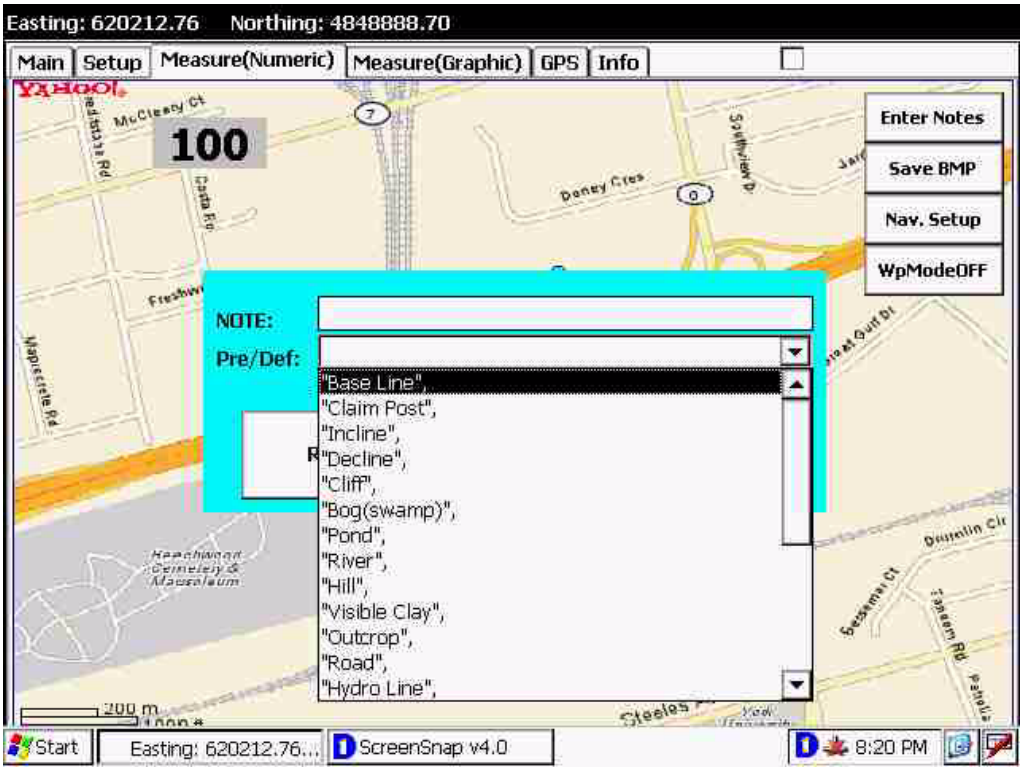
To enter notes, ***click*** on the Enter Notes tab. The following sub screen will appear:

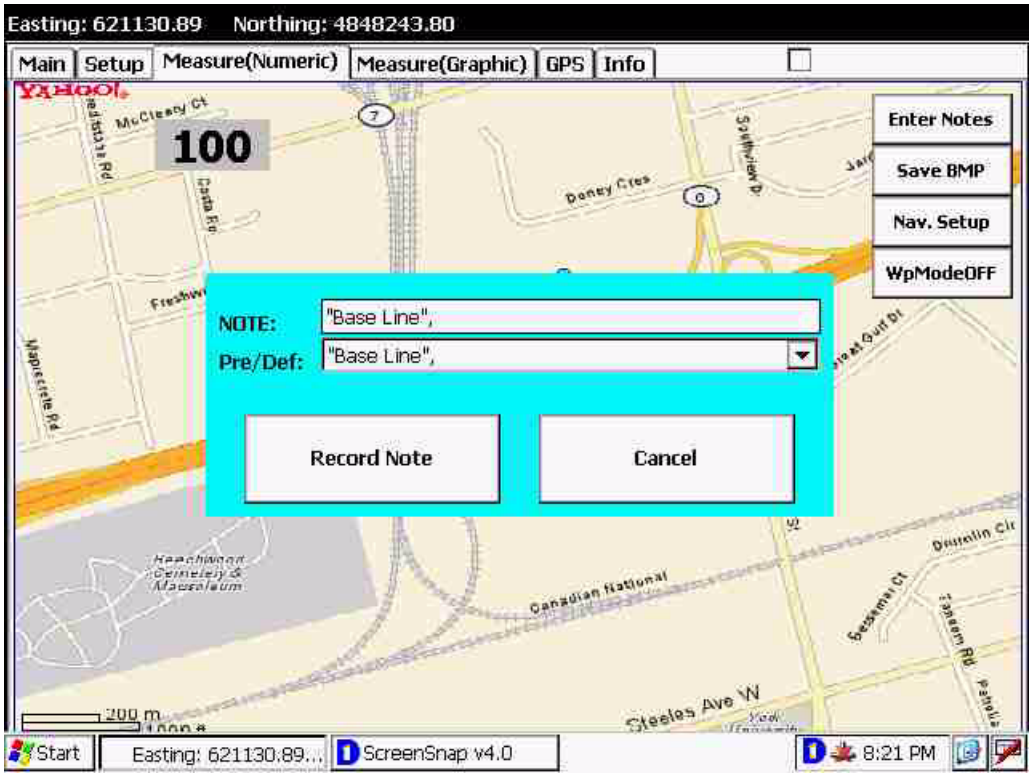


To choose pre-defined notes, ***click*** on the pull down arrow in the Pre/Def box, as illustrated below:



For instance, to ***choose*** "Base Line" as your pre-defined note, ***bring*** your cursor to "Base Line" and ***click*** with your mouse, as illustrated below:




Easting: 621130.89 Northing: 4848243.80
Main
Setup
Measure(Numeric)
Measure(Graphic)
GPS
Info
100
Enter Notes
Save BMP
Nav. Setup
WpModeOFF
NOTE:
"Base Line",
Pre/Def:
"Base Line",
Record Note
Cancel
Canadian National
Steeles Ave W
200 m
Start
Easting: 621130.89...
ScreenSnap v4.0
8:21 PM

Record Note

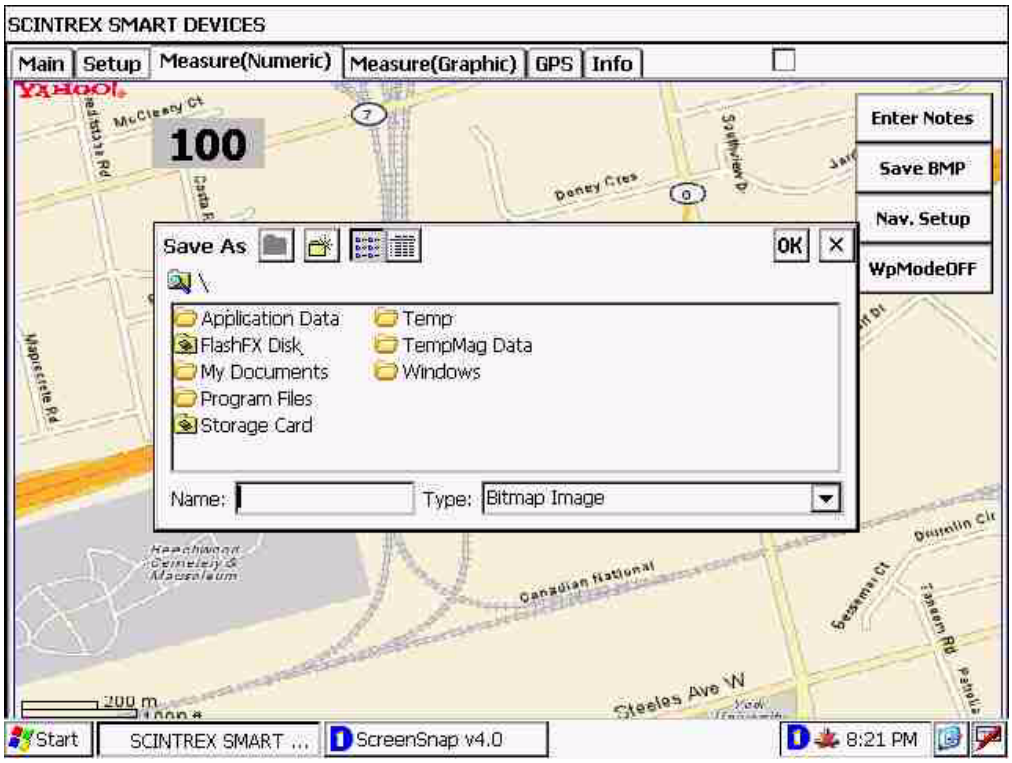
To record the note in your data file, click on the Record Note tab.

Saving your bitmap

You can also save your existing bitmap in the SM-5 NAVMAG memory for future use.

Save BMP

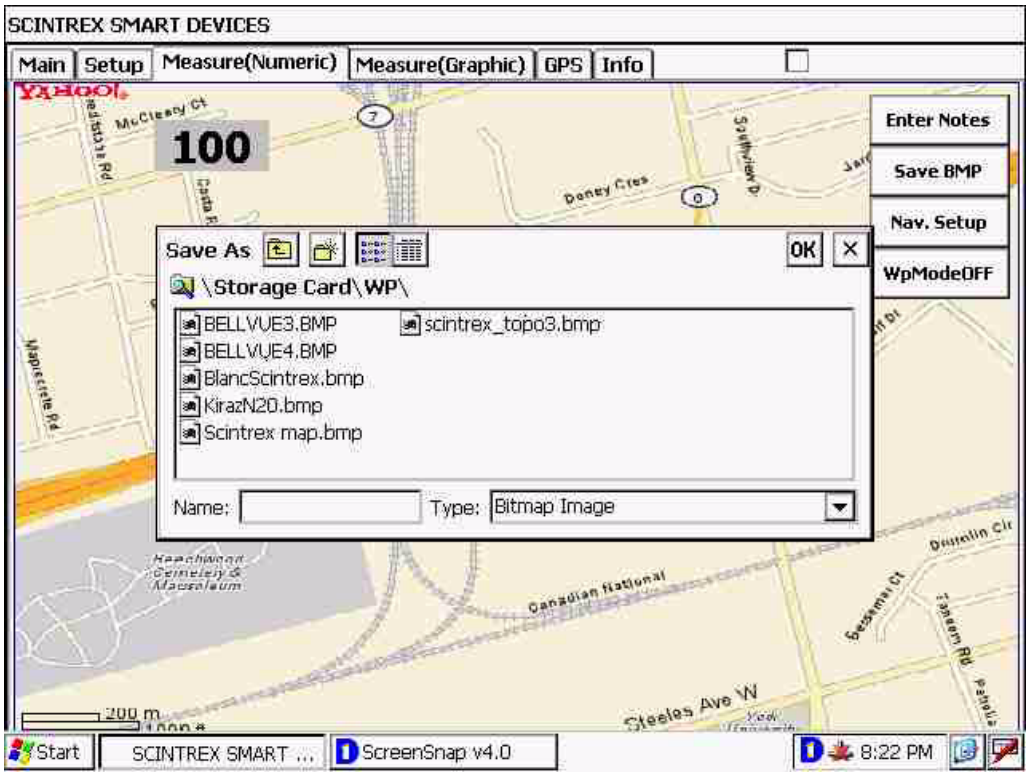
To save your Bitmap, ***click*** on the Save Bitmap tab. The following sub screen will appear:



Operations

Important:

The Bitmap should be saved in the Storage Card/WP directory, as illustrated below:

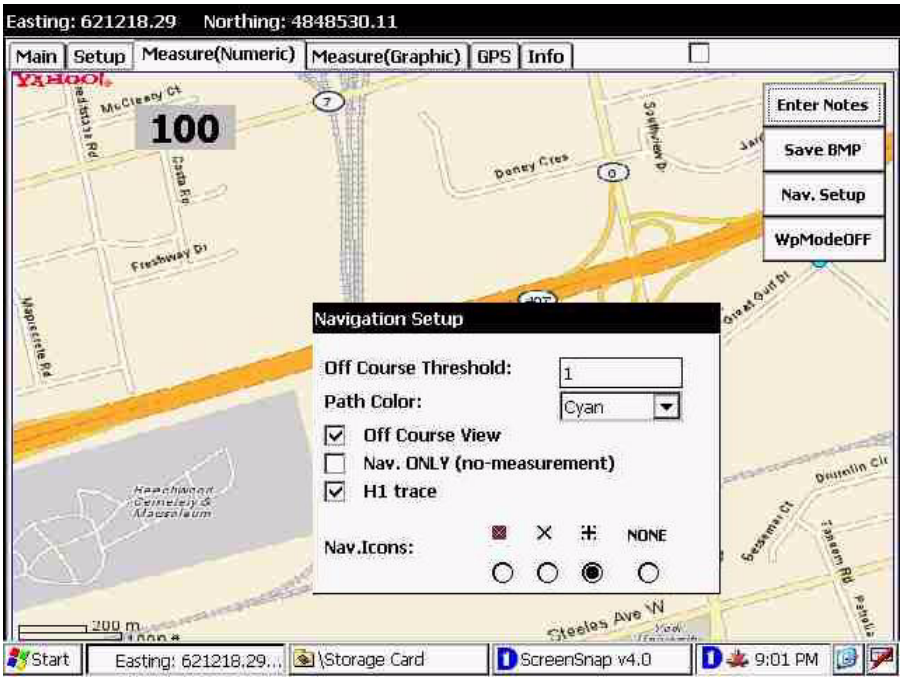


Setting a course - Numeric Screen with GPS navigation

Once you have imported your Bitmap with the waypoints, you will want to trace your survey or course lines as you navigate on the ground.

Nav Setup

To trace your lines, ***click*** on Nav. Setup. The following sub-screen will appear:



Here you can choose your Off-course threshold, i.e. what tolerance you will allow off your plotted course before the SM-5 NAVMAG warns you that you are off-course. Alternatively, if you are only trying to locate your anomaly, you can enable the

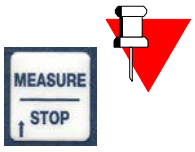
Navigation ONLY feature, by ***clicking*** on Nav. Only, where your data will not be recorded. You can also pick what color and symbols you want for your course. You can also enable the plotting of the magnetic values by ***clicking*** H1 Trace.

Note: Don't close Navigation Setup window from the taskbar. Navigation application requires this task to be open in order to operate.

Once you have completed the Navigation Setup, you are ready to navigate to your next waypoint or to any other location on your map. To choose a waypoint, ***click*** on the WpModeOFF button, this will toggle it to WpModeON, as illustrated below:

OR

To ***choose*** your waypoint, ***press*** the measure/stop button or the BK UP/XFER button. The chosen waypoint will be highlighted in red, as illustrated below:



Note:

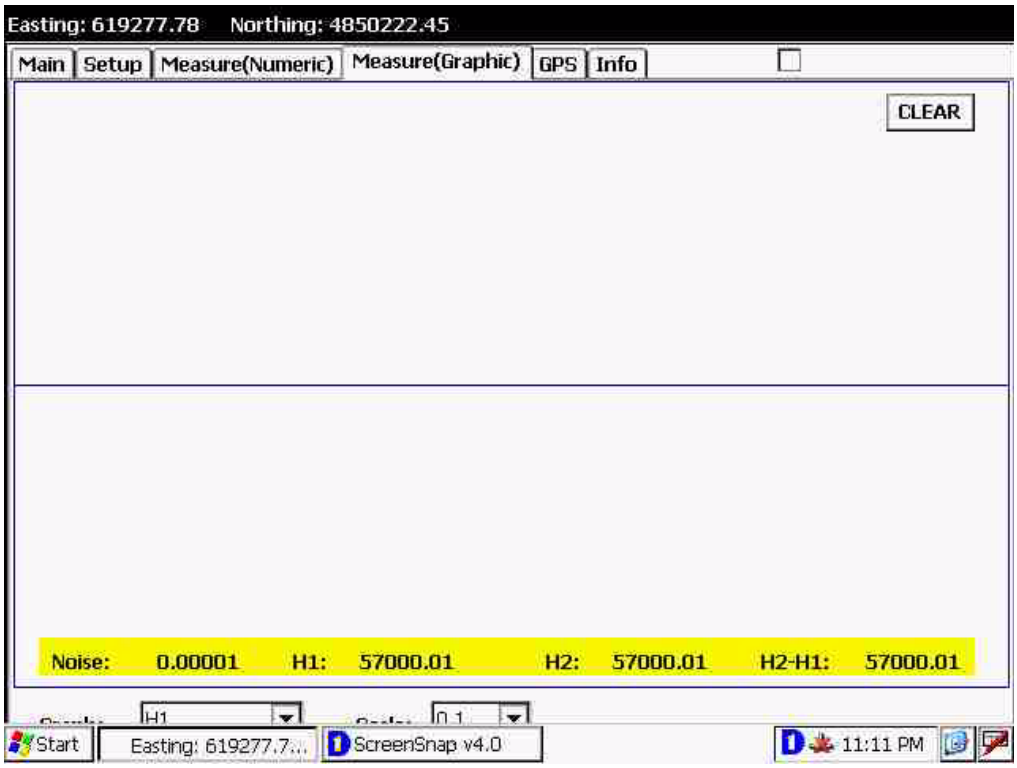
Once you have initiated a reading, by ***pressing*** the Measure/Stop key, you will notice an arrow in the upper left-hand corner. This is the direction you must follow to stay on your course line. Furthermore, the distance to the waypoint is illustrated in the top bar.

Alternatively, if you had enbled H1 trace in the Navigation setup, you would see the magnetic data appear as a profile, as illustrated below:

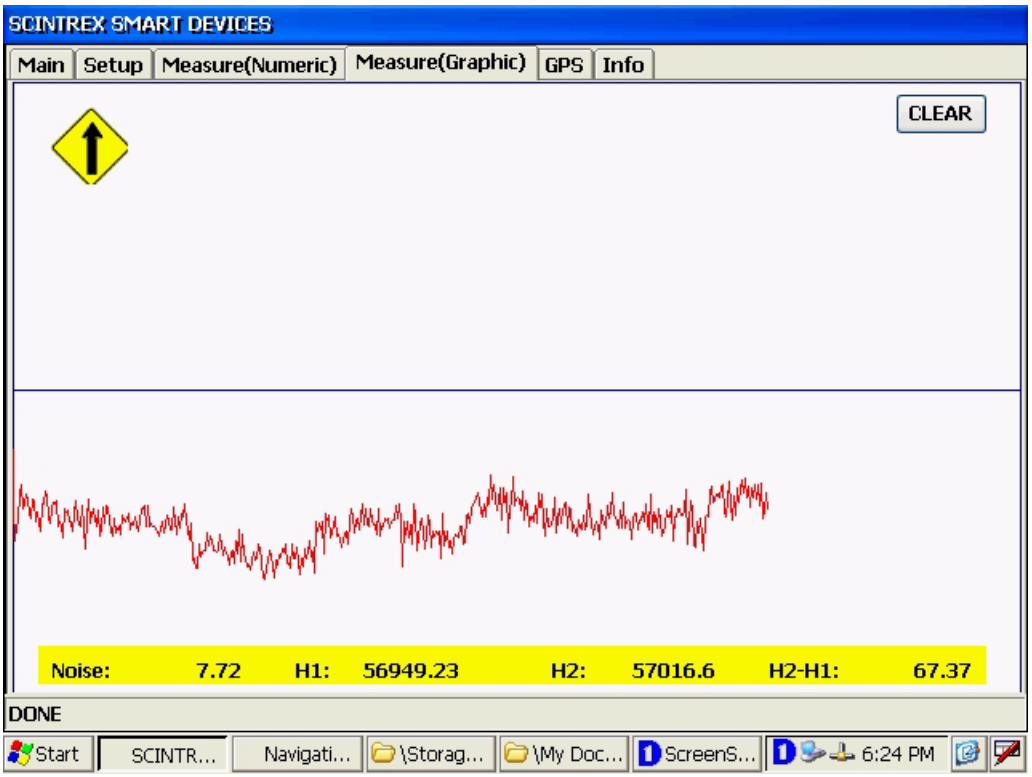
Taking a Measurement - Measure(Graphic) Screen

PRESS 

To access the Measure(Graphic) screen, ***press*** the TAB key until the following screen appears:



To initiate a reading, ***press*** the Measure/Stop key, your magnetic data will appear:



Note:

H1 denotes the magnetic field of the first sensor, H2 the second sensor and H2-H1 the gradient.

Saving your data

After you have begun to acquire data, Scintrex recommends that you back up your data to the Compact Flash memory of the SM-5 NAVMAG..

To back-up the data from the RAM memory of the SM-5 NAVMAG to its Compact Flash memory, ***press*** the BK UP/TRANSFER key. You will notice a message “Backup finished”. Your data is now stored in C: drive of the SM-5 NAVMAG’s Compact Flash memory.

Note:

You can back up your data as frequently as you like. A better procedure is to enable Auto Data Backup. Please refer to paragraph “Automatic data backup” on page 2-10.

Once you are done with the survey, you can transfer the data from the Compact Flash memory to the USB data stick supplied with your SM-5 NAVMAG or any other USB data stick.

Note:

The USB data stick is handled as any other portable storage media and appears as a separate drive in your PC’s directory. The size of the supported USB data stick is up to 1GB.

Important:

If you are operating your PC under Windows 98 and wish to use a memory stick, you will have to download the appropriate driver before you can properly use the memory stick.

Transferring your data

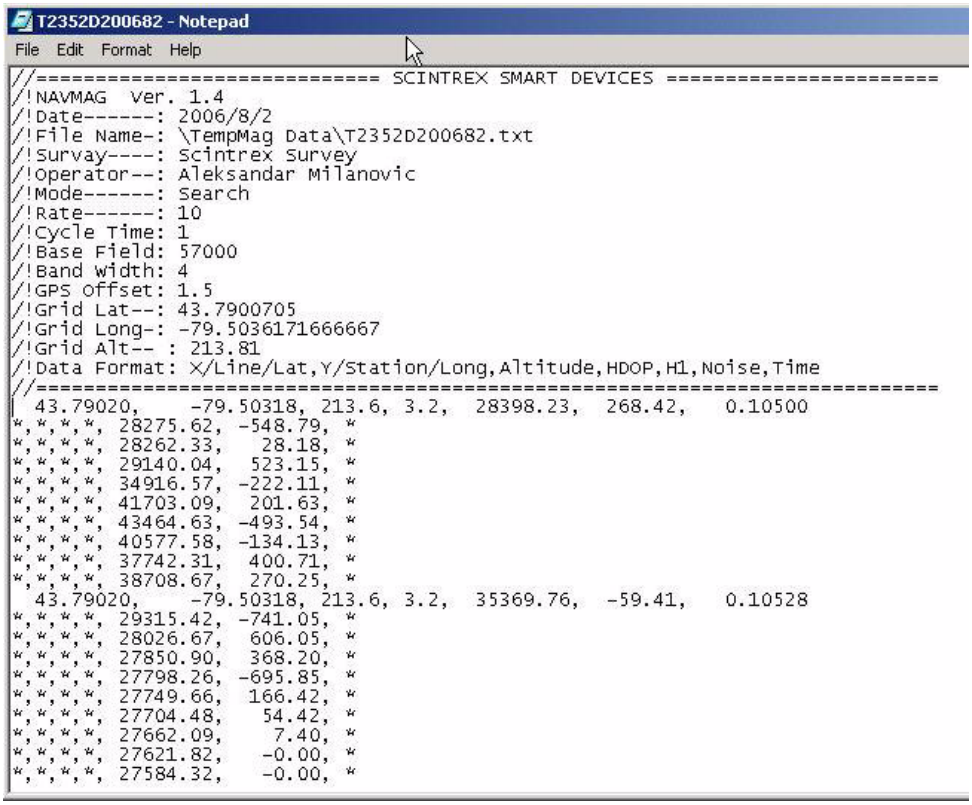
Once you have stored your data on the USB memory stick you will want to download the data to your PC.

Insert your USB Memory Stick into any of the USB slots available on your PC.

Copy the data file located in your USB memory stick onto the appropriate directory in your PC

You are now ready to process your data. There are a number of programs that can be used: Geosoft, QC Tools, EMIGMA, Surfer, etc.

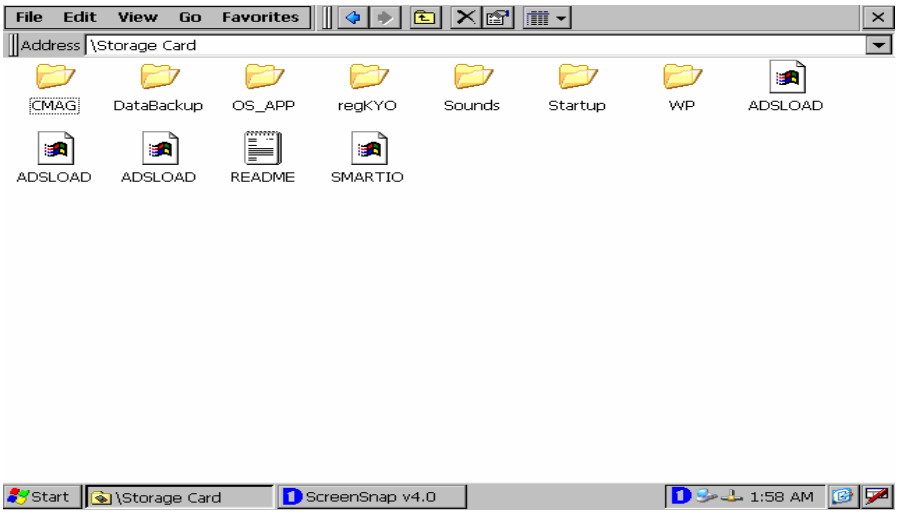
Here is a sample data file:



SM-5 NAVMAG Storage Card Folders/Files Structure

The following section describes Compact Flash (Storage Card) Navmag resident memory folders and file structure.

By ***double clicking*** on the Storage Card Icon the following screen will appear.



CMAG

This Folder contains two files:

- *Cmag.ini* This file stores all current Navmag parameters. If you set up your Navmag using PC utility, transfer this file from PC to this Folder. When setting up parameters within Navmag this file will update automatically.

- *BlankMap.bmp* This file is used when topographical maps are not available and navigation is required. Please refer to “Map Registration Program” on page A-1 for more details.

DataBackup

This Folder is used to back up all your data. It is also used during XFER (transfer) function to transfer the entire content of the memory to a USB KEY Memory. You can delete these files after storing them, by use of the MyComputer navigation tools or via Active Sync control from your PC.

OS_APP

This Folder contains one folder and 2 files:

- RX.X This folder contains the latest version of the self-extracting Navmag application. See “Scintrex SM-5 NAVMAG Utilities” on page A-1on how to install a new version.

- NavMagtest.exe This file is meant to be used for Factory testing and is not recommended for Customer use.

- NK.bin This file is the image required to reprogram the windows CE.NET operating system should this ever be required in the field.

regKYO

This Folder contains 2 files: **Please do not remove.** The files are used to configure Operating System parameters.

Sounds

This Folder contains audio files which are used during NavMag operation to signal the operator via voice.

Startup

This Folder contains two folders and 1 file:

- *CesiumMag* This folder contains the latest version of NavMag application which was created via a self-extracting .cab file. See “Scintrex SM-5 NAVMAG Utilities” on page A-1 on how to install a new version.

- *ADSCopy* This folder contains a copy of all files found in the CesiumMag folder. When the system boots up, the application files are copied from this location to the root directory for execution.

- ADSCopy.exe This file is used to perform the copy function of system files required to execute during application upgrade.

WP

This Folder contains some sample files used during navigation. You can store your own navigation files here. Please see section on RegisterMap.

Storage Card Root Directory Files

- Readme.txt This file provides some info on upgrading your NavMag to a new version of software. See “Scintrex SM-5 NAVMAG Utilities” on page A-1.

- *ADSLOAD.HWT* and *ADSLOAD.REG*

Please do not remove these files. These are System configuration files.

Trouble-shooting

Despite the fact that your SM-5 Navmag is a very reliable instrument, there can be circumstances where problems may occur. The following table lists some of these problems and their suggested solution. However, please do not hesitate to contact your nearest Scintrex office.

Problem	Possible cause	Possible solution
SM-5 Navmag will not power up. No screen	System is booting up.	Wait 25 to 30 seconds for power up.
SM-5 Navmag will not power up. A beeping sound cannot be heard after power up command	Battery is depleted.	Press the Power key for 4 to 5 seconds. Check/replace the batteries Check/replace the fuse.
Sensor problems: Field does not change, Noisy field, no signal at all. A red light can be seen on the sensor electronics	Sensor needs to warm up.	Wait at least 15 minutes for sensor electronics temperature to stabilize. Check S1 / S2 cable/plug connections.
Sensor problems: Field does not change, Noisy field, no signal at all. A red light cannot be seen on the sensor electronics	Sensor is not turned on.	Press sensor power switch for 4 to 5 seconds.
Battery capacity not to specification. Batteries have been charged	Battery are faulty or cold.	Consider low ambient temperature. Keep batteries under your coat. Replace the batteries.
Battery capacity not to specification. Batteries have not been charged	Batteries are depleted.	Charge the batteries. Charge 2 hours more once the green light on the charger comes on.

External/Internal GPS problems: - No signal - Can't synchronize	Antenna is obstructed. PPS Pulse is received. External GPS is not powered.	Remove obstructions from antenna. Check that the PPS Pulse is properly received by the SM-5 NAVMAG. Power up the external GPS.
Display contrast is not responding. Auto contrast is enabled	Auto contrast is conflicting with the proper contrast setting.	Disable Auto Contrast.
Internal mouse does not work after use of external mouse		Reboot the NAVMAG.
The application reports a system error after loading or measurement start	cmag.ini files has wrong values.	Check cmag.ini files for proper values. Use external PC NAVMAG setup utility to create a new cmag.ini file. Transfer this file to the SM-5 NAVMAG.
Topographical maps, waypoints, map registration problems	Improper parameters.	Please make sure that you are using the proper datums, xyz offsets and SM-5 NAVMAG setup.
USB Memory key does not work or is not recognized	Improper USB key.	Scintrex strongly recommends the Sandisk memory key. All other USB keys may or may not work or be detected. Memory key will be recognized as a hard disk when connected to the SM-5 NAVMAG.
My data file is lost	You never created a data file in the first place. You never backed up your data file.	You must open a data file prior to taking a measurement. You must backup the file to the flash card prior to powering down the unit or changing the batteries.

A Scintrex SM-5 NAVMAG Utilities

Map Registration Program

The GPS Registration Program allows the user to create WayPoint files, create Map Info files and Map files.

Before you start the GPS Map Registration program you must obtain a graphic file (preferably in *.bmp format) of the area you want to survey. This will serve as a background in the Numeric screen, see “Taking a Measurement - Numeric Screen with GPS navigation” on page 3-16.

Important:

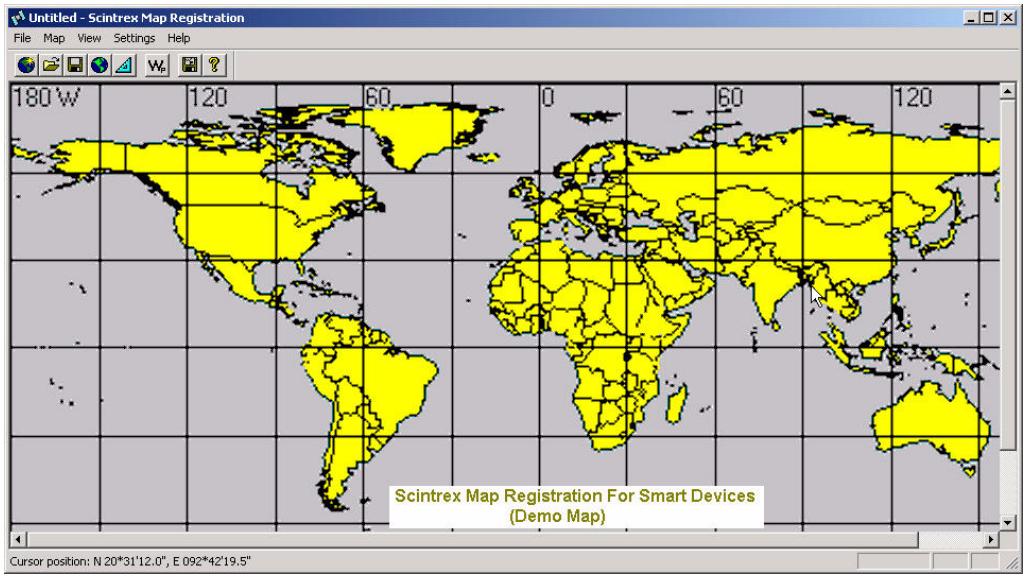
You must know the position, either in UTM or LAT/LONG of at least three points on your graphic file in order to properly register the map. Please note that blank maps can be registered as long as you know these three positions.

You will then create waypoints which you will walk towards on the ground. These are most commonly the beginning and end points of your survey lines.

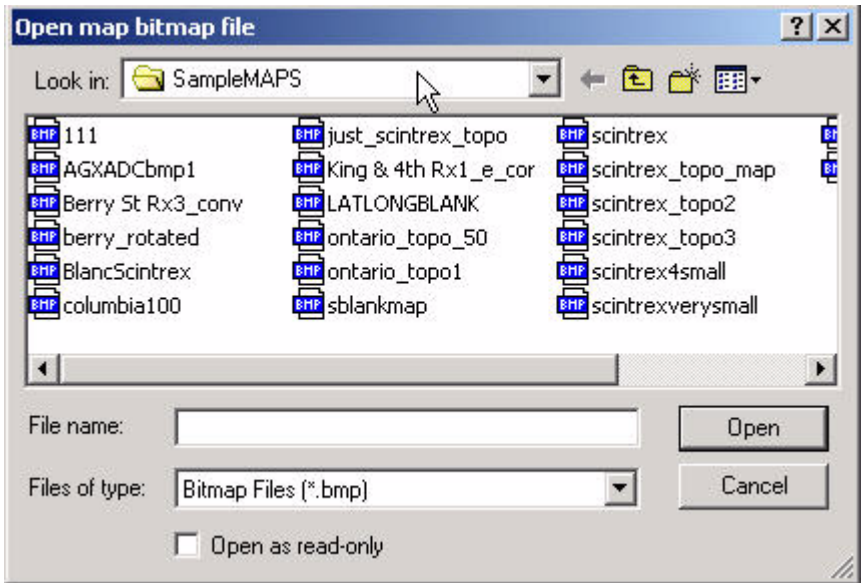
Once you have created your waypoints, you will calibrate your map and save it. The Map Registration program will then create the WayPoint file, the Map Info file and the map file all of which are necessary for GPS assisted magnetometry.

Registering your map

Click on the MapRegister.exe icon. The following screen will appear.



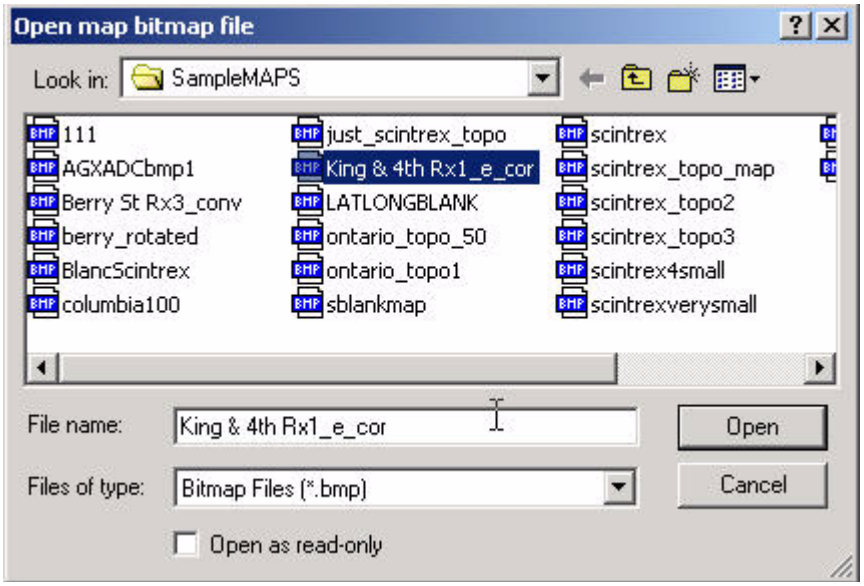
Click on Map, New Bitmap (or F2) to open your graphic map. The following screen will appear:



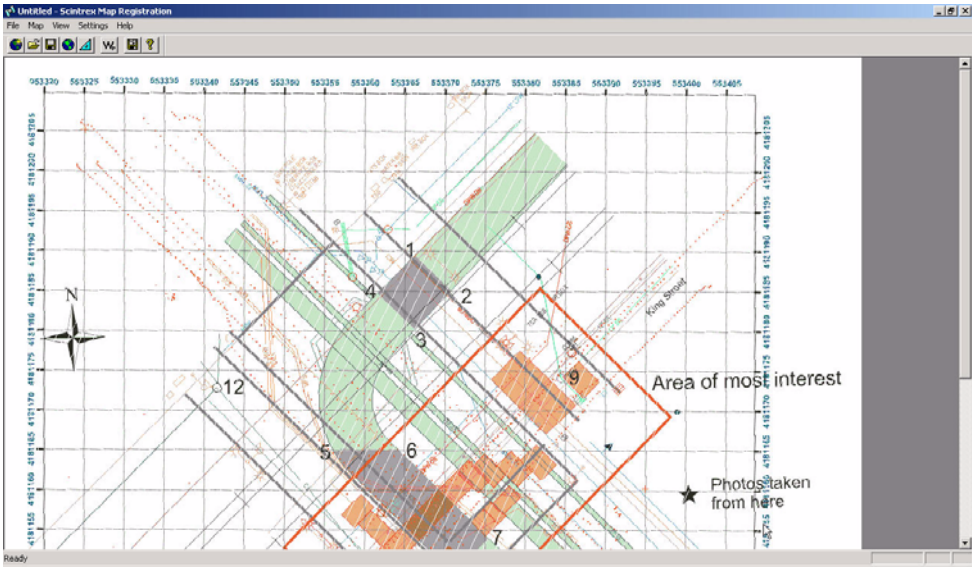
Important:

Maximum recommended bitmap size is less than **1mb.**

You will choose the map you want to use by ***clicking*** on the file name with your cursor, as illustrated below:



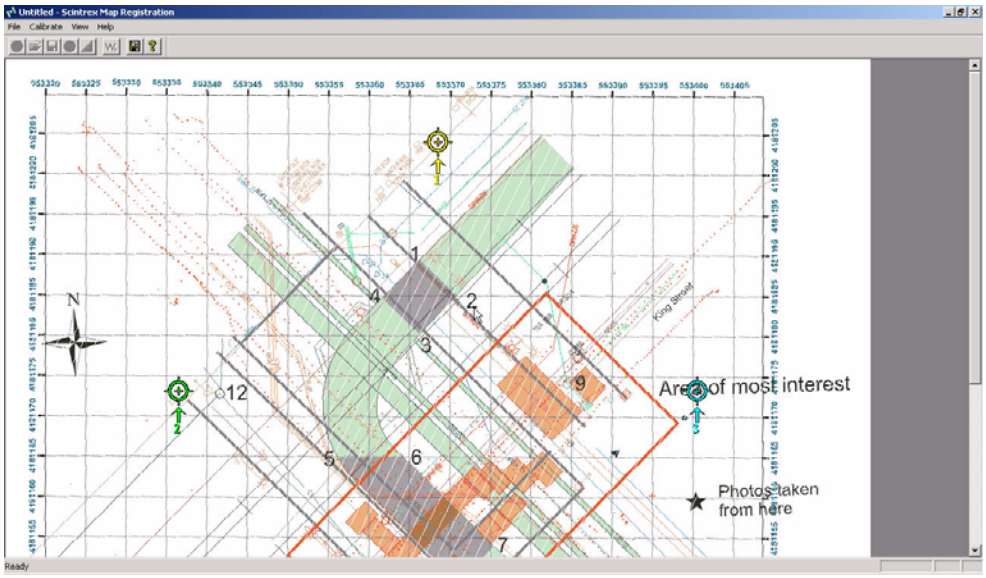
As an example, refer to the following file:



You will notice that the map has UTM Northing and Easting coordinates.

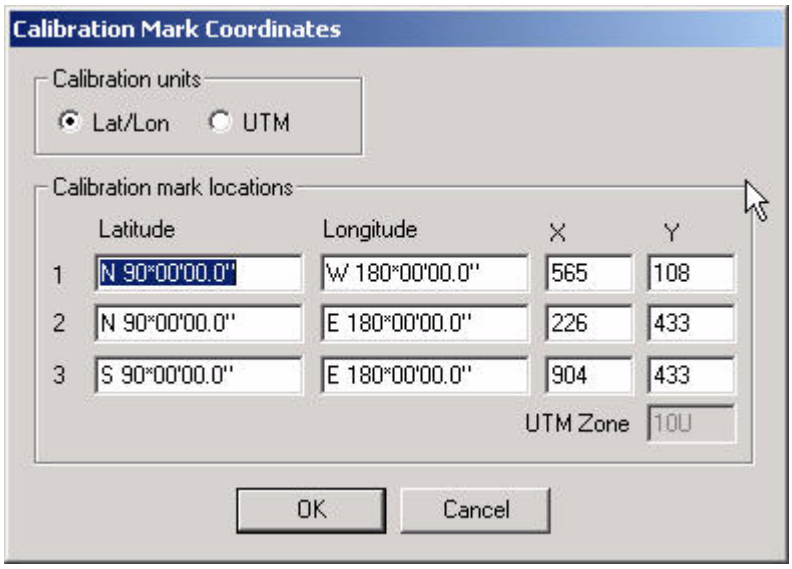
Entering waypoints

Click on the Calibrate icon, you will see three points appear on your map, as illustrated below:



Use your mouse to move the waypoints to known locations.

Click on Calibrate, Set Mark Coordinates to enter the coordinates of the waypoints, as illustrated below:



Note:

You can choose either UTM or LAT/LONG coordinates for your waypoints.

Once you have entered the waypoint coordinates, click on the Save icon and exit. You will notice that you have now created three types of files: *.wpt, *.txt and *.bmp. These will be used in the GPS setup in the Setup screen of your SM-5 NAVMAG.

Hint:

Transfer these files to your USB Key. You will then transfer them to the Compact Flash memory in your SM-5 NAVMAG.

Retrieving your GPS registration files

To retrieve your GPS Registration files from your USB memory stick, ***insert*** the USB key in the USB A data port. Using your mouse control, ***move*** the cursor to the Desktop icon and ***click*** on the icon. The following screen will appear:

You will now retrieve your GPS Registration files much like you would do on a PC. When you copy them to your SM-5 NAVMAG, they are automatically copied into the Compact Flash memory.

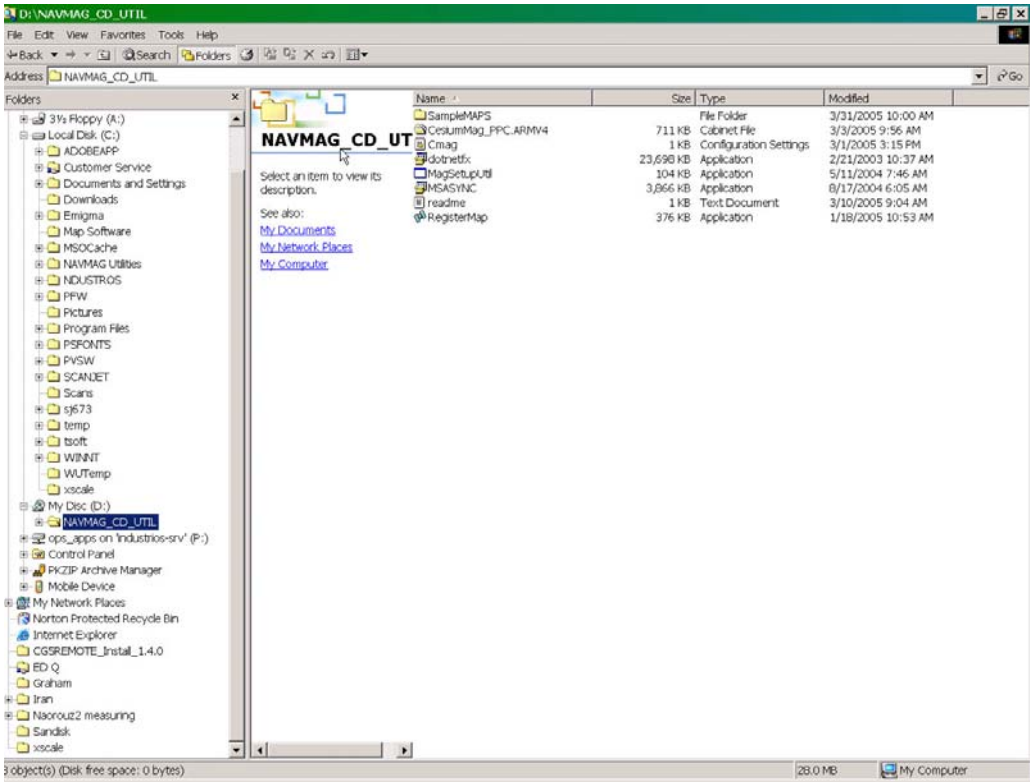
Microsoft Active Sync Program

The Microsoft Active Sync Program allows you to communicate directly with your SM-5 NAVMAG console from your PC. This will allow you to copy files back and forth between your SM-5 NAVMAG and your PC and thus allow you greater flexibility.

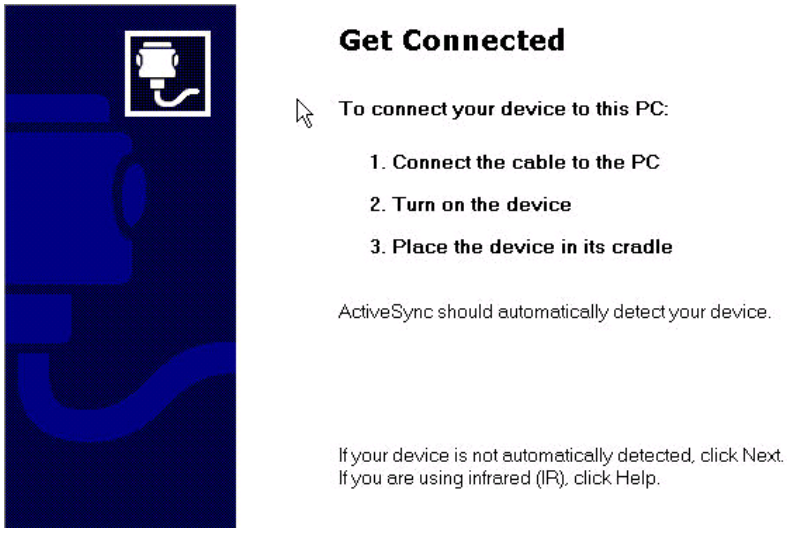
Active Sync is trademark of Microsoft Inc.

Installing Microsoft Active Sync

Insert the Utilities CD into the CD drive. In windows explorer, open the SM-5 NAVMAG_CD folder and you should see the files as listed below:

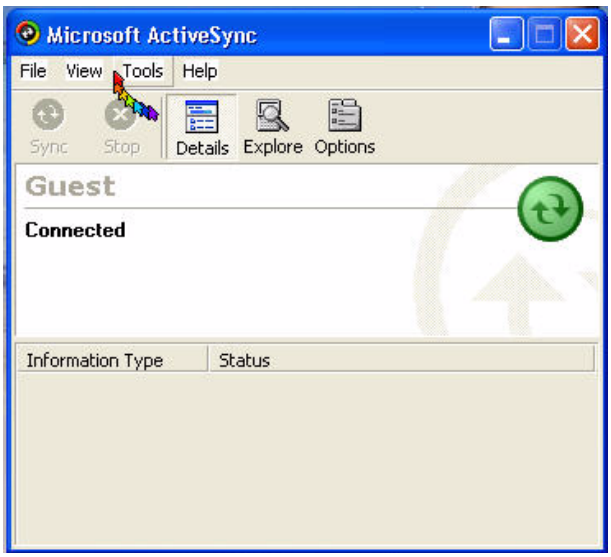


- Insert the SM5 NAVMAG UTILITIES CD #872041, you will see the following screen:



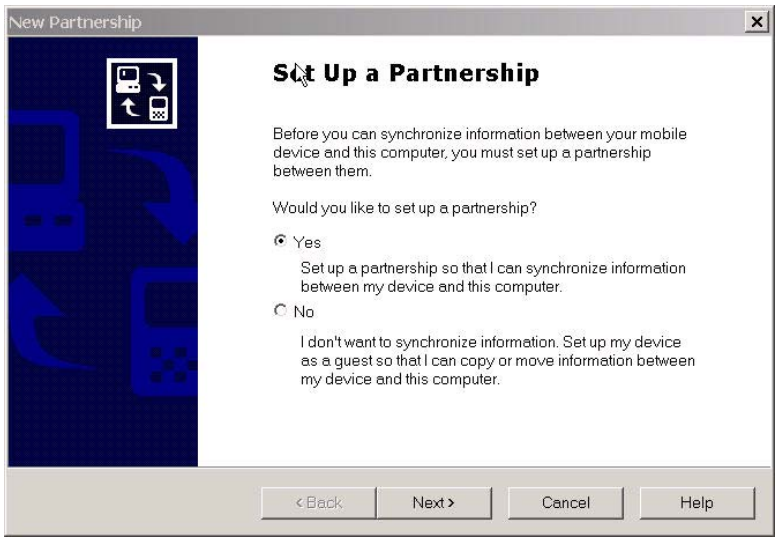
- ***Click*** on the NEXT button, the following screen will appear:

- ***Install*** Active Sync application from the NAVMAG Utility CD on your PC.
- ***Interconnect*** the USB port on the NAVMAG Console and the UDSB port on your PC using the Scintrex Cable (p/n 872545 or 200239).
- Upon connecting power, the NAVMAG Console on your PC will report “new USB device connected”. A “found new hardware” dialog wizard will appear. If not, ***go to*** System Properties on your PC.
- In the hardware update wizard ***select*** Install from the list or specify a location and then ***press*** Next.
- ***Choose*** the “Don’t Search. I will choose the driver to install” option and then ***press*** Next.
- ***Click*** on the Have Disk box.
- ***Browse*** to the location where you saved the folder.
- ***Select*** and open the WCEUSBSH.inf.file.
- ***Press*** OK.
- On the next screen ***press*** Next.
- ***Press*** Continue Anyway on the Warning screen (that the software doesn’t have Microsoft Logo testing...).
- Now your NAVMAG will connect to your PC and the Microsoft ActiveSync window will pop-up showing Guest Connected, as illustrated below:

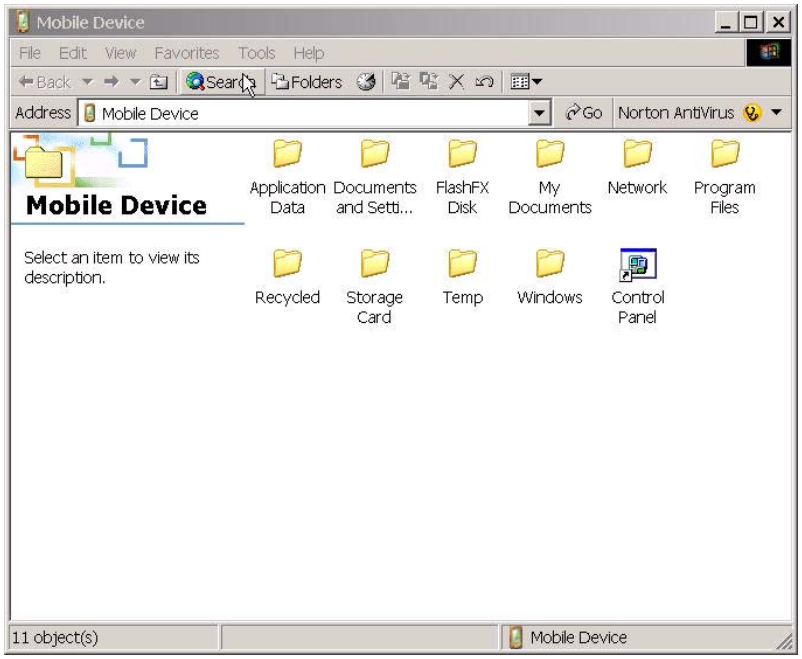


- ***Press*** Finish to close the Hardware Update Wizard.
- ***Close*** all open setup windows.
- ***Go to*** System Properties on your PC.
- ***Open*** the Device Manager.
- ***Go to*** Properties of Unknown USB Device under Other Devices Group.
- ***Go to*** the Driver tab and ***click*** on the Update Driver box.
- To verify your installation go to Properties of Intel XScale Reference Design under Windows CE USB Devices groupo to see the newly installed driver in Drive info on screen.

At this point, connect the USB cable to the SM-5 NAVMAG and ***turn*** the SM-5 NAVMAG on. Wait until you see the main screen for the SM-5 NAVMAG and then connect the end of the USB cable to your computer. Your computer will detect a new device. It will ask you for a driver, for the new device. Point to the location of the wceusbsh.sys file to install the driver. Once this is complete you will see the following screen:



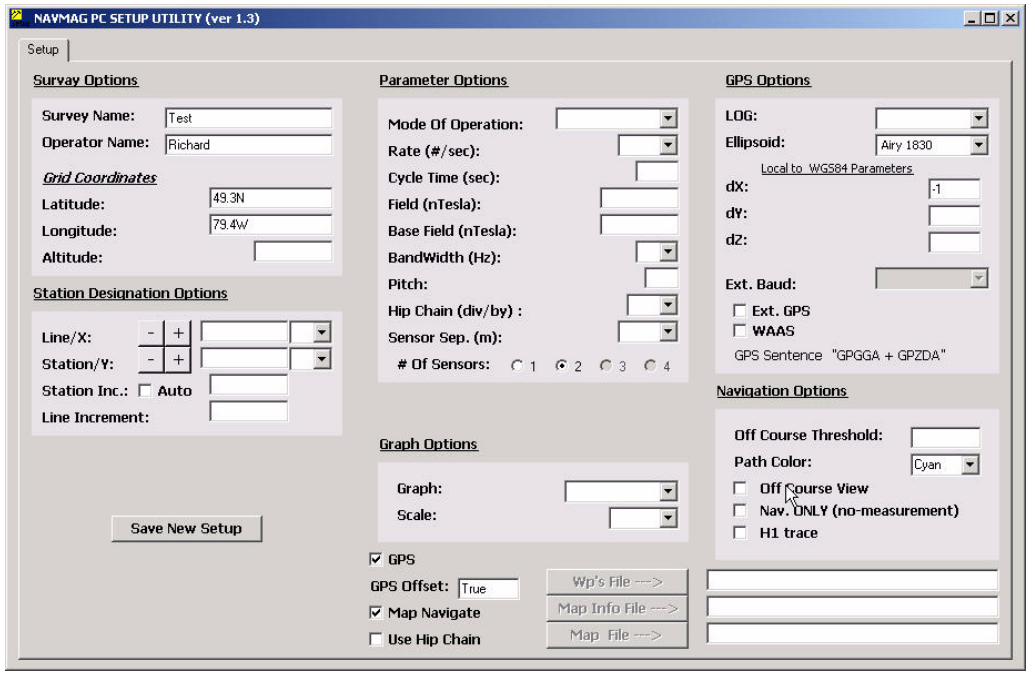
Select NO and click next. This will log you in as a guest and you will now be able to copy files back and forth between the computer and the SM-5 NAVMAG. Click the explore icon and you will see the following:



Mag Setup Utilities Program

The Mag Setup Utilities program allows you to set up all SM-5 NAVMAG parameters. Following the setup of all the parameters, a file called cmag.ini will be created. This file needs to be transferred to SM-5 NAVMAG and stored under the /Storage Card/cmag directory. Upon power up of SM-5 NAVMAG this file will be read and all parameters will be set accordingly.

Locate your Utilities directory in the SM-5 NAVMAG installation CD-ROM, and ***double-click*** on the Mag Utilities setup program icon, and the following screen will appear. Notice that all menus resemble the menus of SM-5 NAVMAG.



Installing a new version of the Cesium Mag application

The future versions of the NAVMAG application will be provided in the self extracting file form. The file name is: **CesiumMag_PPC.ARMV4.CAB**

To update your previous version of NAVMAG please follow the steps below.

Note:

To transfer the new cab file from your PC, ***use*** your USB Memory key (provided) or the Active Sync connection. (USB or Ethernet).

1 After NAVMAG power up, the Cesium Mag application will load automatically. ***Terminate*** the application by Exiting from Main page.

2 ***Use*** Windows Explorer to navigate within NavMag.

3 ***Go*** to the Storage Card Folder

4 ***Go*** to the Startup Folder

5 ***Delete*** the CesiumMag folder

6 ***Copy*** the new version of the Cesium Mag utility "CesiumMag_PPC.ARMV4.CAB" to the same path where the Windows folder is (**NOT INSIDE OF IT**)

7 ***Double click*** on CesiumMag cab file.

8 When prompted where to install, ***point*** to the \Storage Card \ Startup folder.

9 After install you should have Cesium Mag folder in the Storage Card \ Startup folder.

10 If provided (in the storage card\OS_/aPP), ***Run*** SctCopy.exe application. This will copy all of the files for your OR ***Open*** this CesiumMag folder and copy all contents to \StorageCard\Startup\ADSCopy folder overwriting the previous files.

11 ***Reboot*** the system and new Application version will be running.

B Theory

System Overview

As shown below, the SM-5 NAVMAG sensor consists of a sensor head with cable and sensor electronics.

Figure B-1 SM-5 NAVMAG Sensor Head and Electronics

The sensor head has an electrodeless discharge lamp (containing cesium vapor) and absorption cell. Electrical heaters bring the lamp and the cell to optimum operating temperatures with control and driving circuits located in the electronics console. Heating currents are supplied to the sensor head through the interconnecting cable.

When operating, an RF oscillator in the electronics console provides RF power to a lamp exciter in the sensor head and the radio frequency (RF) field produces a corresponding resonant optical radiation (light).

The light radiating from the cesium lamp is collimated by a lens. The light propagates in the direction of the sensor optical axis and passes through an interference filter which selects only the cesium D1 spectral line. The light is subsequently polarized in a split, right/left hand circular polarizer before it is allowed to optically excite cesium vapor in the absorption cell.

Theory of optical pumping

The narrow bandwidth resonant light causes momentary alignment (polarization) of the atomic magnetic moments to the direction of the ambient magnetic field. The resonant light "optically pumps" the cesium atoms to a higher energy state. (Note that the polarizing light beam has to be oriented in the general direction of the ambient field to be effective.)

Large numbers of cesium atoms can be polarized by optical pumping and then induced to precess coherently in phase around the ambient field by means of a small magnetic field, H_1. This small magnetic field is transverse to the ambient field and alternating at the Larmor frequency.

The H_1 field is produced by a coil in the SM-5 NAVMAG. The coil is coaxial with the sensor optical axis and wound around the absorption cell. Polarized resonant light perpendicular to the ambient magnetic field detects the precession. This light is alternately more or less absorbed, depending on the instantaneous orientation of the polarization.

In the SM-5 NAVMAG, this probing light is the perpendicular component of the resonant light beam. If the modulation of through-the-absorption-cell transmitted light is detected with the photosensitive detector, and the resulting Larmor signal is sufficiently amplified and phase-shifted before being fed back to the H_1 coil, then a closed loop self-oscillating circuit results.

The resonance occurs at the Larmor frequency, which in weak fields, e.g. the Earth's magnetic field, is precisely linear with the field in which the absorption cell is located. For the cesium 133 the proportionality constant (gyromagnetic constant) is 3.498577 Hz per nT.

As indicated, different components of the same resonant light beam perform two functions:

- the component parallel to the ambient field performs the optical pumping
- the perpendicular component detects the coherent precession.

Therefore, no pumping is taking place if the light beam (the optical axis) is perpendicular to the ambient field (the equatorial orientation) and consequently the sensor is not operating. Equally, no light modulation is taking place if the light beam is parallel with the ambient field (the polar orientation) and consequently the sensor is not operating.

The second reason for the sensor not operating in the polar orientation is that the H_1 field, being parallel to the ambient field, can not induce precession of the magnetic polarization.

Operating hemispheres

The plane perpendicular to the ambient field divides the sensor operating zones into two hemispheres - northern and southern operating hemisphere. In the northern operating hemisphere the sensor light beam, which propagates in the direction of the optical axis, Figure B-2, forms an angle from 0° to 90° with the direction of the ambient field. In this hemisphere, the phase shift of the Larmor signal amplifier required for the self-oscillation at the peak of the resonance is -90°.

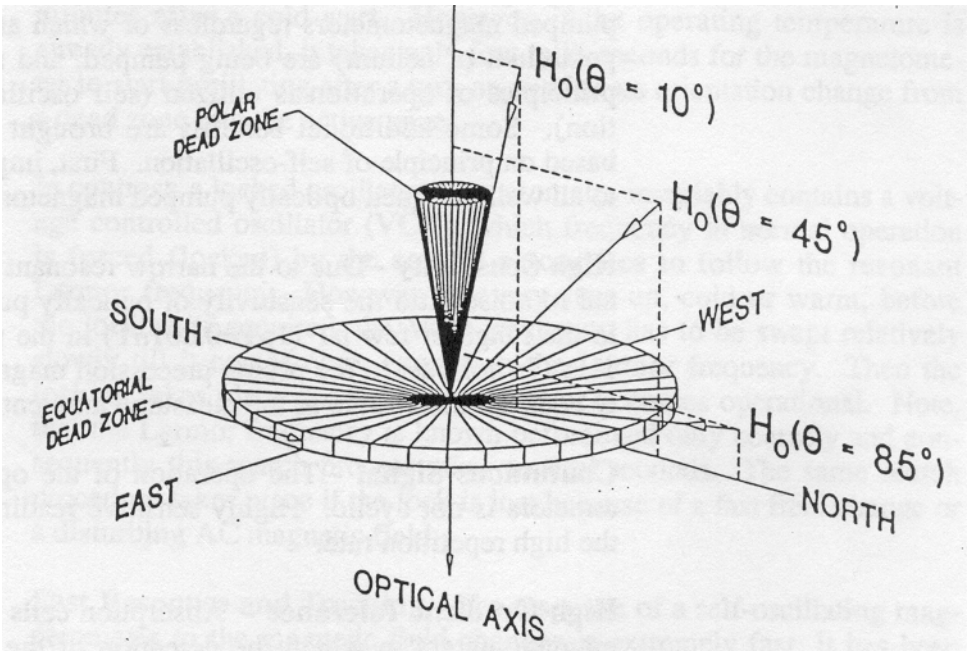


Figure B-2 Northern Operating Hemisphere

In the southern operating hemisphere the light beam forms an angle from 90° to 180° with the ambient field direction, Figure B-3. There, the phase shift of the Larmor signal amplifier required for the self-oscillation at the peak of resonance is +90°. Thus the phase change of 180° is required to make the sensor operational when the operating hemisphere is changed.

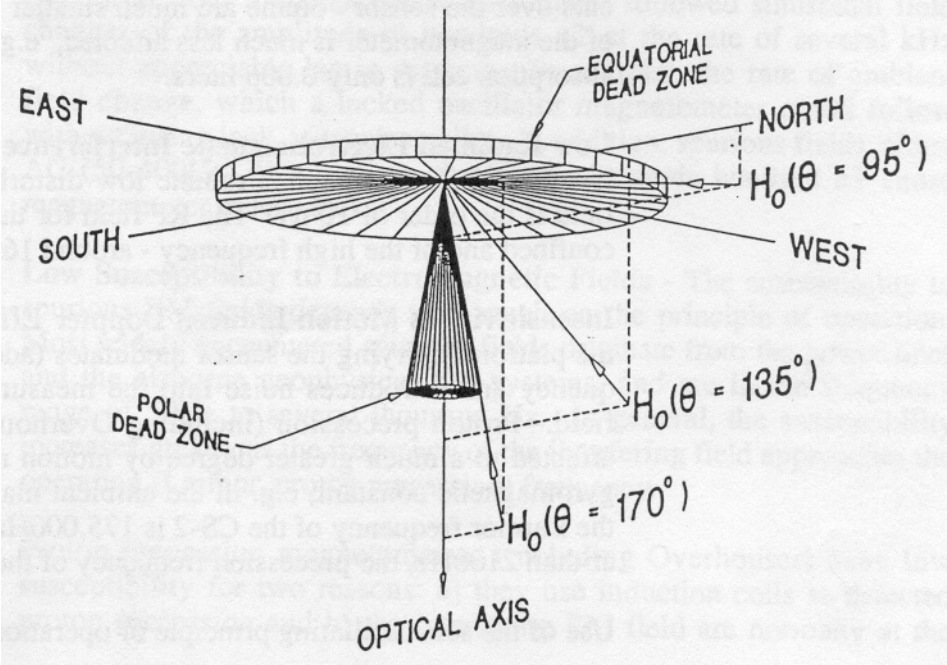


Figure B-3 Southern Operating Hemisphere

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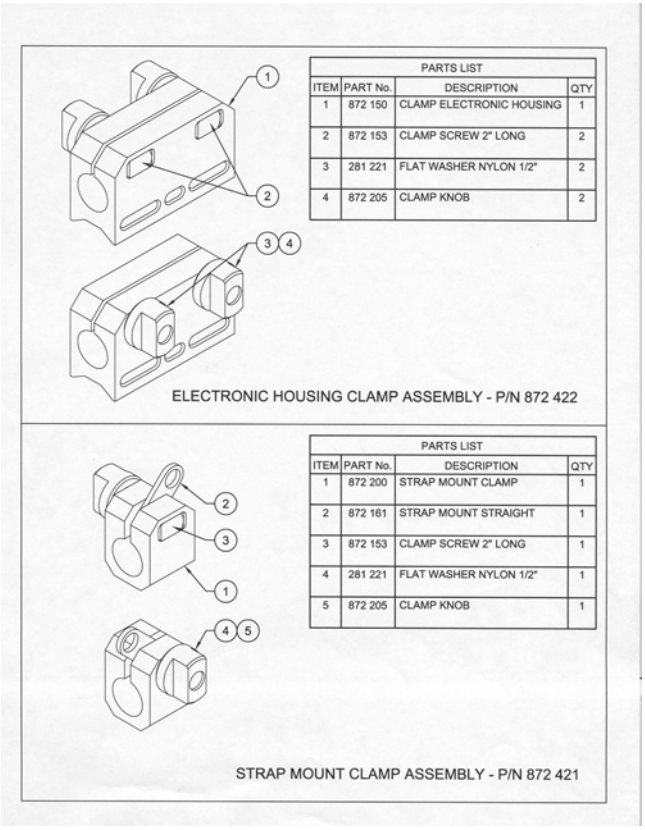
SM-5 Navmag Accessories List



PARTS LIST

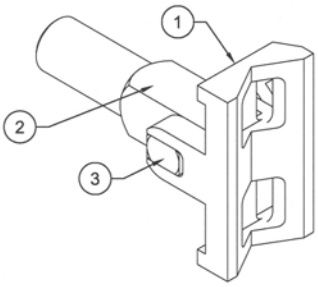
ITEM	PART No.	DESCRIPTION	QTY
1	872 150	CLAMP ELECTRONIC HOUSING	1
2	872 153	CLAMP SCREW 2" LONG	2
3	281 221	FLAT WASHER NYLON 1/2"	2
4	872 205	CLAMP KNOB	2

ELECTRONIC HOUSING CLAMP ASSEMBLY - P/N 872 422

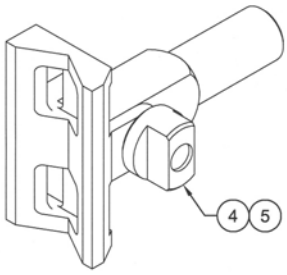
PARTS LIST

ITEM	PART No.	DESCRIPTION	QTY
1	872 200	STRAP MOUNT CLAMP	1
2	872 161	STRAP MOUNT STRAIGHT	1
3	872 153	CLAMP SCREW 2" LONG	1
4	281 221	FLAT WASHER NYLON 1/2"	1
5	872 205	CLAMP KNOB	1

STRAP MOUNT CLAMP ASSEMBLY - P/N 872 421



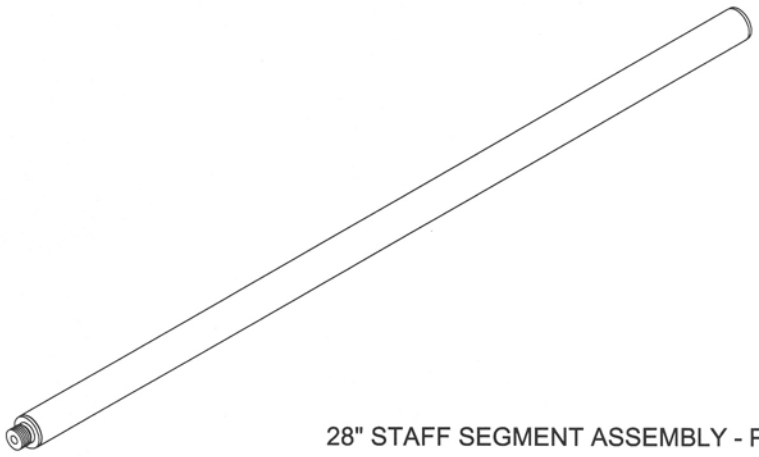
PARTS LIST			
ITEM	PART No.	DESCRIPTION	QTY
1	872 159	CLAMP SENSOR	1
2	872 160	CLAMP SENSOR WAND	1
3	872 153	CLAMP SCREW 2" LONG	1
4	281 221	FLAT WASHER NYLON 1/2"	1
5	872 205	CLAMP KNOB	1



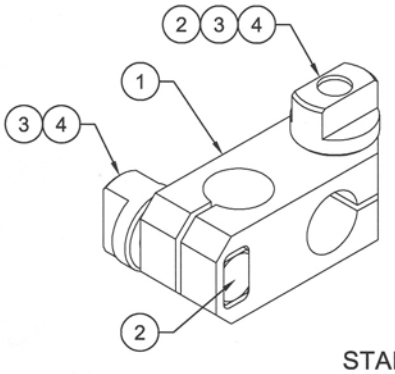
SENSOR CLAMP ASSEMBLY - P/N 872 423

HOSE CLAMP - P/N 600 668

VELSTRAP FASTENER - P/N 540 171

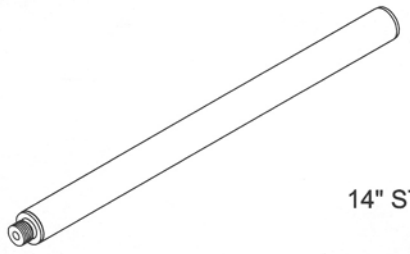


28" STAFF SEGMENT ASSEMBLY - P/N 872 410



PARTS LIST			
ITEM	PART No.	DESCRIPTION	QTY
1	872 179	STAFF CROSS CLAMP	1
2	872 153	CLAMP SCREW 2" LONG	2
3	281 221	FLAT WASHER NYLON 1/2"	2
4	872 205	CLAMP KNOB	2

STAFF CROSS CLAMP ASSEMBLY - P/N 872 420
(GRADIOMETER OPTION)



14" STAFF SEGMENT ASSEMBLY - P/N 872 412
(GRADIOMETER OPTION)

SM-5 Navmag Parts List

Part Number	Description	Qty
200252	Flash Drive USB	1
400078	Battery Lead Acid, 2,3 AH, 12 Volt	4
861324	QC Tools Software	1
872010	SM-5 Navmag Console	1
872011	Sensor/Staff Assembly	1
872014	Transit Case Assembly	1
872016	Spare Parts Kit	1
872019	GPS Battery/Backpack Assembly	1
872561	Battery Charger Assembly	1
872029	Coax Cable Assembly	1
872030	External Power Supply	1
872039	Internal GPS Antenna Assembly	1
872041	Navmag Utilities	1
872700	SM-5 Navmag Operation Manual	1

SM-5 Navmag Spare Parts List

Part Number	Description	Qty
281221	Washer Flat Nylon	3
512012	Fuse Quick, 5A, Fast Acting	3
540171	Velstrap Fastener	4
600668	Clamp Hose Nylon	4
872153	Clamp Screw 2” long	3
872198	Battery Door Gasket	2
872205	Clamp Knob	3

SM-5 Navmag Gradiometer Parts List

Part Number	Description	Qty
872011	Sensor/Staff Assembly	1
872029	Coax Cable Assembly	1
872410	Staff Segment Assembly	2
872412	Staff Segment Assembly 14”	2
872420	Staff Cross Clamp Assembly	7

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