G-877 MARINE
MAGNETOMETER
25165-OM Rev. A

# *Operation Manual*



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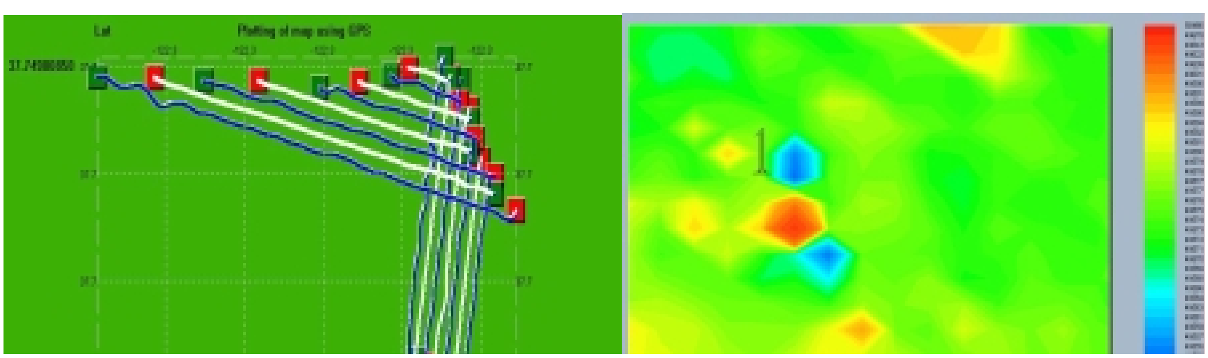
## 1.0 INTRODUCTION TO THE G–877 MARINE MAGNETOMETER

Congratulations on your purchase of the newest member of our Marine Magnetometer family! This document describes the basic operation of the G–877 Marine Magnetometer hardware and software systems. We have divided the manual into sections on theory, installation, operation and software configuration. In order to get the best performance from your new magnetometer, it is important that you read sections 1.0 through 3.0 material in its entirety.

The G–877 Proton Precession Magnetometer is a digital device and requires that a customer or Geometrics supplied portable laptop or desktop computer be used for recording and display of the data. To facilitate the use of the system by those individuals new to computer use, we have written logging/display software with a special Configuration Wizard that simplifies and automates the setup of the computer, magnetometer and associated hardware (GPS positioning for example). If you purchased **MagLogLite**™ or **MagLogNT™** software (sometimes supplied with the system) it is important that you read the **MagLogNT™** manual as well as section 3.0 in this manual on the use of the MagLog Configuration Wizard. If you are not using our software to communicate with the magnetometer, we have included section 4.0 which discusses the technical details of communicating with the magnetometer system.

Each of our magnetometer systems is supplied with our **MagMap2000™** analysis and display software. This program allows the user to upload the logged data files (from our logging software or others') and apply a variety of analytical and display features. For instance MagMap2000 allows the user to plot out his GPS position tracks *as well as plot profiles and color contour maps* of the survey data. Anomalies in the analog style profile plots can be flagged and their latitude - longitude positions noted in the GPS track plot *and* contour maps to enable the surveyor to accurately return to the site for pinpointing locations or for additional target analysis.



The following provides a basic introduction to magnetics in general and to recording proton precession magnetometers specifically.

### *1.1 WHAT IS A MAGNETOMETER?*

A magnetometer is an instrument used to measure the value of the earth's total magnetic field at a particular location. Many objects including man-made items and geologic structures perturb or distort the normally smooth earth's magnetic field due to properties of the material from which they are made. The measurement of the distortion or bending of the background field is used to identify the physical characteristics of objects or structures. For example, a marine search team could use a magnetometer to locate a sunken ship, since shipwrecks produce magnetic "signatures" that appear as "anomalies" or noticeable deviations from the usual background intensity of the earth's magnetic field.

Sometimes simple natural materials cause variations that can be used to detect non-magnetic objects such wooden galleons. Ballast stones that are not native to the particular wreck site can be detected due to their chemical composition (ferrous materials) or their orientation. Sometimes these anomalies are subtle and therefore typically the end result of a survey is to produce a map that shows the GPS locations (track plot) and the shape of the anomaly on a contour map. From this the user can often determine the shape and location of the source body even if the "signal" is very small. A map contains significantly more information than that which can be gleaned from an audio alarm type system or even a line profile plot of the data.

The unit of measurement used to express the intensity of the earth's magnetic field is the **gamma** (1 gamma [γ] equals $10^{-5}$ gauss or $10^{-9}$ Tesla or 1 nanoTesla, nT). Depending upon where the field is measured, the intensity can range from 20,000 to 70,000 gammas (nT)

Magnetometers can be hand-carried, vehicle mounted, fixed as base stations, or operated aboard aircraft, marine vessels, or even spacecraft. Data collected from magnetometers can be used to describe characteristics of the geologic structure of specific areas of the earth and thereby locate and characterize mineral and petroleum deposits. Magnetometers can also provide valuable assistance in locating buried pipelines, electrical cables, cultural artifacts, unexploded ordnance, buried waste containers or archeological sites. In some cases the magnetometer is the only device that will detect a given type of target at the range required. In addition, non-magnetic items are "invisible" allowing the magnetometer to see through water, sand or other non-magnetic materials to the source of the anomalous field distortion.

The basic rule of thumb is that one ton of iron gives a one gamma anomaly at one hundred feet. The effect is linear with mass (two tons = 2 gammas) but falls off with the cube with distance from a point object. This means we can "see" a 250 lb object at 50 ft, or a 30 lb object at 25 ft. More information is available from our excellent free text Applications Manual for Portable Magnetometers included with every magnetometer system.

The G–877 is one of several different types of magnetometers, all of which are named by the way that they measure the strength of the earth's magnetic field. The G–877 uses 'proton precession' to make this measurement. Other magnetometers are 'flux gate', Overhauser or optically pumped (Cesium Vapor) devices that use operating principles that differ from that used by a proton precession magnetometer. (See Technical Report TR-120 for more information on different technologies and their performance). The following discussion will be limited to the proton precession principle.

## 1.2 MAGNETOMETER THEORY

In order to understand the proton precession principle in a magnetometer, one needs to understand what happens inside the sensor of the proton magnetometer. Sensors come in many shapes and sizes, but for the proton precession magnetometer, sensors share the same operational design: A non-magnetic container is filled with a liquid (typically water or hydrocarbon fluids like kerosene, white mineral spirits) in which a coil of wire is immersed. Free protons in the fluids have spin and small magnetic fields, and therefore the protons will align themselves with the flux lines of the earth's magnetic field. However, as soon as "polarizing" current is applied to the coil the protons will align themselves with the electromagnetic field of the energized coil.

When the current is removed from the coil, the protons will "turn away" from their alignment with the electromagnetic field of the coil to become realigned with the earth's magnetic field. As they "turn away", the protons do not directly turn to align themselves with the earth's field, but because of their inherent spin, "precess" like a spinning top. As they precess, the protons behave like tiny magnets inside the sensor coil , inducing a small AC signal in the coil. This signal is amplified and its frequency counted to produce a highly accurate and repeatable measurement of the total intensity of the magnetic field at the sensor. The frequency of the measured signal is proportional to the absolute value of the ambient earth's magnetic field. Thus, a proton precession magnetometer is an instrument that measures the absolute value of the earth's magnetic field by measuring the proton precession frequency and converts that frequency into the units that are used to quantitatively represent the earth's magnetic field in gammas or nanoTeslas (nT).

You may want to obtain more information on the operation, application of magnetometers and data processing procedures for magnetic data. This information can be found in the Geometrics publication, Applications Manual for Portable Magnetometers, by Sheldon Breiner available from our web site www.geometrics.com under Downloads or included in your equipment documentation.

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# 2.0 G–877 SYSTEM DESCRIPTION, INSTALLATION AND COMMISSIONING

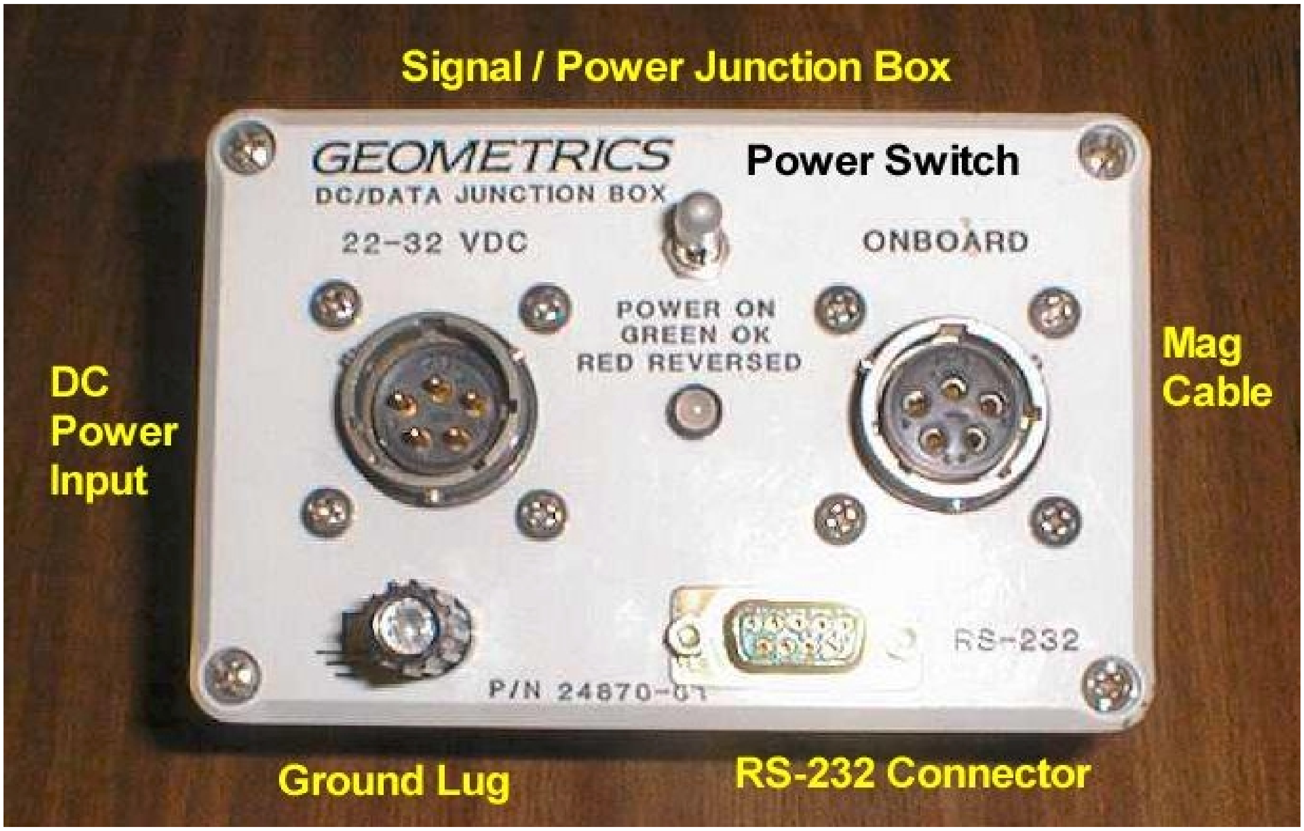
## 2.1 SYSTEM OVERVIEW

The G–877 Magnetometer consists of 4 main assemblies. These are the Magnetometer Fish, the Tow Cable, the Junction Box/Power Supply and MagLogLite™ Logging and Display Software.

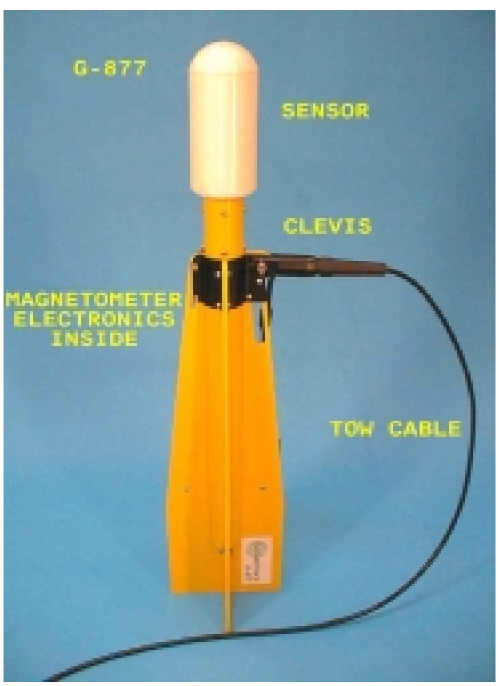
## 2.2 DETAILED SYSTEM DESCRIPTION

The G–877 is a digital magnetometer. This means that it communicates via an RS-232 from the magnetometer fish to the computer serial port (i.e., Com 1) via the tow cable, junction box and RS-232 cable. The tow cable employs 5 wire cable (5 conductors), two for power and three for RS-232 communications. On the deck the G–877 is supplied with an AC/DC Junction Box which provides connections for tow cable, RS-232 and power (see photo below). Power is supplied from either an AC Power supply or user supplied DC battery power with supplied clamp cable. The AC Power Supply is a 120/240 VAC to 28volt DC supply which connects to the ship's AC mains. The DC input cable provides for operation from a 24 - 32 volt DC source such as 2 car batteries wired in series. Software to log and display digital magnetic data is available from Geometrics and may be included in your purchase.

The G–877 Marine Proton Magnetometer system may include the following assemblies/modules: Logging and Display Computer (optional, may be customer supplied), Dot Matrix or Printrex Thermal Printer (optional), AC Power Supply, Junction Box, On-board cable (optional - runs from the instrument room to the stern mounted winch if required), G–877 Sensor Tow cable and Magnetometer Fish. The Logging and Display Computer should provide two communication ports, one for the Magnetometer input and one for the customer or Geometrics supplied GPS unit. It should be noted that the positional accuracy of the survey data will be determined to a large part on the accuracy of the GPS employed. The use of a Dot Matrix graphics printer is optional but does afford the user a permanent record of the survey. The system requires 115 or 220 VAC, 50/60 Hz at 150 watts or 24-32 VDC at 2 amps




2.2.1 Magnetometer Fish




The Magnetometer Fish is a center of gravity tow body meaning that it is supported underwater from a tow point mid-way down the fish. This affords better depth and control at slow speeds. There is a front nose piece of tough plastic that contains the sensor with its permanently installed sensor fluid. The sensor may be replaced if it is damaged, but this is unlikely as the potting material is extremely strong. The electronics module is internal to the fish body. . This module produces the polarize signal to the sensor, reads the precession frequency and converts it to RS-232 for transmission up the tow cable. The tow cable is attached to the fish using the third assembly, the Clevis CG tow point as shown.

There is a water-tight 8 pin Subconn marine connector which exits the rear of the fish and which attaches to a mating connector on the tow cable. The tow cable contains a clevis assembly that mates to the clevis attachment point on the fish for secure towing. The entire body is encased in fins for hydrodynamic stability at all speeds.

### 2.2.2 Tow Cable

The tow cable is a polyurethane jacked Kevlar reinforced 5 conductor cable with a breaking strength of 6,000 lbs and an operating load of 1000 lbs. The clevis and Subconn connector on the fish end has been described above. There is a male Bendix type connector on the other end of the tow cable for attachment to the Junction Box. (Note that for long cables, an On-Board Cable may be supplied, see below).

The cable is perhaps the most vulnerable part of the system and that part subjected to the greatest physical abuse. Geometrics offers retermination kits for those instances when the cable has been damaged due to contact with obstructions, coral or the sea floor.

### 2.2.3 Junction Box

There is a 9 pin RS-232 connector on the Junction Box for a standard serial cable (supplied) which connects to the Logging Computer serial port. In addition there are connections to power and to the tow cable. It is IMPORTANT that the grounding lug be attached to a wire that will then be grounded to sea water using a lead or steel weight to make sure the system is grounded at this single point only. The ground is islolated for direct current.

An On/Off switch applies power to the magnetometer. If the DC power cable is connected to reversed DC power, the LED will light Red. Normal operation is with the Green light lit.

*It is imperative that you read the introductory and operation parts of this manual in their entirety prior to system assembly and initialization.* Also, it is important to read the **MagLogLite**™ Software Manual.

### 2.2.4 Logging Software and Hardware

The system is typically shipped with a logging, display and communications logging software package called **MagLogLite™**. High-speed playback of the survey data on the computer screen is available using **MagLogLite™** (see software manual). Alternately, such software packages as Coastal Oceanographics Hypack or Triton Elics ISIS or EIVA's NaviPak offer logging and display capabilities. However, any terminal emulator program such as Windows Hyperterminal may be used for direct communication with the G–877, though not for logging of GPS simultaneously or displaying the data or running real-time diagnostics. Hyperterminal is handy when troubleshooting computer serial port or communications difficulties.

The Logging Computer may be customer or Geometrics supplied. In general it should be a high performance Desktop or Laptop computer (PII 500MHz or better) with either Windows 98, ME or NT, 2000 or latest Microsoft offering installed. Note that the Logging Computer should have two serial communication ports (one for magnetometer and one for GPS). This is not an issue with Desktop computers which come with 2 com ports as standard issue. However, with Notebooks or Laptops, a second port must be added. This may be either PCMCIA or USB serial port add-on made by Socket I/O or Entrega. Contact Geometrics for more information if you are unclear about how to increase your computer port capacity.

## *2.3 SYSTEM INSTALLATION*

Begin by installing the Logging and Display Computer (which may include printer) and G–877 AC Power Supply in the instrument room and connect them to 115/220VAC 50/60 Hz power. If DC power is used, connect the Junction Box to a source of 24-32 VDC (such as two 12 Volt batteries in series) with the supplied DC power cable. If you are using DC power be sure to connect the Red Clamp to positive and the Black Clamp to negative terminals on the batteries. If used, connect the printer to the computer with a printer cable (that comes with the printer) and load the paper. Connect the computer to the Junction Box with the Serial 9 pin cable. Mount the GPS antenna in an appropriate position and run the serial cable from the GPS console to one of the serial ports on the computer. Note the X and Y position of the GPS antenna relative to the G–877 tow cable tow point on the rear of the ship. This information will be needed later when we input the offset of the antenna to the Magnetometer Fish into **MagLogLite™**.

Unpack the tow cable and magnetometer fish and connect the tow cable clevis assembly to the fish with the clevis pin and lock with the cotter pin. Connect the tow cable connector to the fish connector. For testing purposes, place the fish on a cardboard box or other non-magnetic surface (watch out for nails in wooden crates, at close distances they will interfere with mag operation). Connect the other end of the tow system to the Junction Box or to On-Board as noted below.

The basic G–877 system uses a single tow cable from Fish to Junction Box because the standard tow cable (60m or 200 ft) is easily managed by hand. However if longer cables are used (up to a maximum of 400m or 1312 ft), a winch will probably be required. In this case, Geometrics can supply an optional waterproof On-Board Cable (100 or 200 ft – 30m or 60m) that runs from the winch to the Junction Box. Since the winch is in a wet environment, we supply the G–877 Tow Cable and the On-Board Cable with rubber marine connectors (8 pin Subconn) for water environment connection similar to the connectors used on the tow cable to magnetometer fish connection. If the on-board cable is used, on the Junction Box end we supply an 8 pin Subconn to 5 pin Bendix adaptor cable to connect the On-Board Cable to the Junction Box. Contact the factory for more information if you wish to use longer tow cables.

Connect either the Tow Cable or On-Board Cable to the Junction Box. Connect the On-Board cable to the tow system if On-Board is used. Tie off the or otherwise secure the tow system to the vessel structure and set the Magnetometer Fish on a non-magnetic surface for testing purposes. It must be several meters from steel objects like deck, winch, engines etc., and preferably farther.

Later we will deploy the tow system with Magnetometer Fish into the water. Know in advance the depth of water into which you are deploying the tow system as catastrophic loss may occur if the fish is snagged on the bottom or coral head. Typical tow depths at 5 or 6 knots are 10 % of the deployed cable. Therefore, a 60 meter cable will tow the fish at approximately 6 meters at 6 knots.

***ATTENTION !***

*BEFORE CONNECTING ANY OF THE CONNECTORS TO THE G–877 MAGNETOMETER, MAKE SURE THE CONNECTORS ARE DRY AND SALT FREE. USE A SMALL AMOUNT THE SUPPLIED SILICONE GREASE LUBRICANT OR SPRAY ON ALL MALE CONNECTOR PINS BEFORE ATTEMPTING TO MATE THEM. DO NOT PACK THE FEMALE RECEPTACLES WITH GREASE, THEY ARE NOT VENTED.*

Sensor cables up to 200 feet (60m) in length may be deployed from the tow vessel by hand. Deployment of cables exceeding 200 feet in length should be accomplished with a winch. If a hand deployed cable is used, it should be securely tied off to the vessel structure or well secured with a Kellems grip to prevent damage to the tow system connector or the Junction Box in the event the fish impacts the bottom.

After installing the system as described above, turn on the power via the On/Off switch on the Junction Box and boot up the Logging Computer. Turn on and configure the GPS for GGA NMEA 0183 transmission. A differentially corrected GPS will give much more accurate positions (0.6 meters) than non-differentially corrected GPS data (10 meters).

After a short period the G–877 will automatically start to send data to the Logging Computer over the RS-232 serial interface. Start **MagLogLite™** or other logging software. Follow instructions in **MagLogLite™** Software Manual for setting up proper communications. In general, using **MagLogLite™** Configuration Wizard will result in a quick and flawless system setup of the G-877 and GPS communications and display.

## 2.4 G–877 Installation Hints.

The G–877 Magnetometer Fish, as in other magnetometer systems, is sensitive to interference from A.C. or pulsed sources. Normally the sensor is deployed far from any electromagnetic source, i.e. many meters behind the tow vessel. Even though the communication from the magnetometer is essentially immune to shipborne interference, it is always good practice to minimize the possibility of interference. Sources to avoid with magnetometer cabling include motors in winches, tuggers and capstans, hydraulic pump power packs and engines with spark plugs.

The power to operate the magnetometer system must be isolated from all ground connections **except one ground connection to the hull or to sea water** (or no connection as may be appropriate, trial and error is the best procedure here. However our experience shows that a wire from the grounding lug to Sea Water is the best procedure). This one connection should be to the grounding post on the Junction Box. Note that the RS-232 ground which is connected to the Logging Computer is opto-isolated in the Magnetometer fish and thus presents no opportunity to create a ground loop situation.

Magnetometer systems which are run from DC voltage, such as batteries, should be grounded by a connection from the lowest negative battery terminal to the hull or sea water. A fuse should be wired in series with the battery bank. Place the battery in a well-ventilated space away from any source of ignition. Any lead-acid battery is a possible source of hydrogen gas emission.

Note that the magnetometer will not operate very close to large steel objects and that it must be deployed some distance perhaps 20 or 30 feet at a minimum from a small vessel or much further from large steel vessels to operate correctly and get good signal strength. To get proper low noise data, the sensor should be approximately 5 times the length of the ship *behind* the ship.

If the connectors get salt water in them, rinse with fresh water and then use compressed air to blow the water out. When dry, use the supplied silicone grease or silicone spray to lubricate the connectors. *This procedure is necessary for all marine type Subconn connectors on the G–877 Magnetometer*.

## 2.5 STARTING UP A SURVEY

Configure the logging software in the following section as described. Make sure that the magnetometer and GPS are powered up and sending data during the configuration. It is important that you set the tuning of the magnetometer to the field value for the location of the survey. This field value for your location will be found in the supplied Applications Manual for Portable Magnetometers on page 6 (for instance San Francisco is 50,000 nT). Alternately, you may wish to set the G-877 Tuning Control to AutoTuning. This will afford a quick and easy automatic tuning sequence.

Deploy the sensor from the back of the vessel making a few knots headway. Take care that the sensor cable is properly affixed to a sturdy tie point using a Kellems grip or rope. Also note the water depth and the amount of cable that you are going to deploy to make sure that you will not be dragging the sensor on the bottom.

Once in sufficiently deep water, deploy some 20 meters of cable and observe the signal levels and analog field traces in the MagLog software displays. You should be see a smooth curve associated with slowly varying magnetic field variations. If the trace seems noisy at this time you may want to reconfirm that the sensor is not close to any large steel object (like the tow vessel) and that the tuning value for your location is set correctly in MagLog. Read the MagLog and MagMap2000 manuals for more information on how to analyze the data.

Conduct a grid pattern type survey with lines 500m long and separated by 50m for locating an anchor for instance. Make the grid approximately square (11 lines all tolled). If you are searching for smaller objects then the line spacing must be smaller as described in the Applications Manual for Portable Magnetometers. Enjoy your new search and survey tool!

Contact the factory by email or fax or phone with any comments or questions.

support@mail.geometrics.com or sales@geometrics.com

or TEL 408-954-0522 or FAX 408-954-0902

NOTES

## 3.0 Configuring Input Devices and Displays with MagLog Wizard.

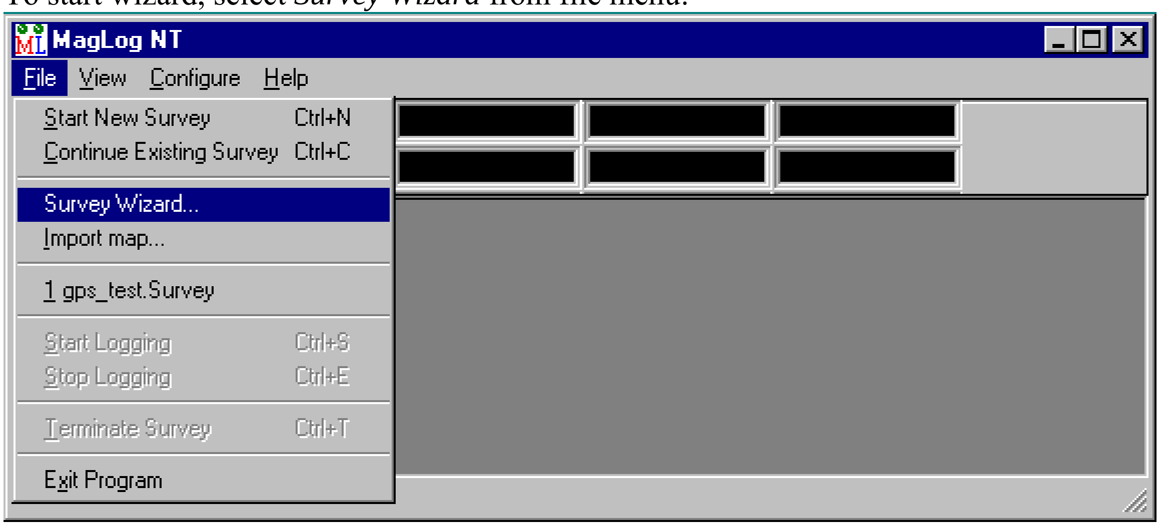
To work with a particular hardware configuration MagLogLite™ or MagLogNT™ should be configured accordingly. It is a highly customizable program that allows a variety of different data presentations. However, flexibility always comes at the cost of complexity and therefore we have endeavored to minimize configuration confusion. For this reason, we have created the *Maglog Configuration Wizard* which is provided to make it easy to configure a survey. It should be pointed out here that the wizard covers only limited number of hardware configurations that include:

- GPS device sending NMEA $GPGGA strings to one of PC's serial ports
- *Geometrics* magnetometers connected to another serial ports. The models supported are:
  - G-880/881 magnetometers with up to two magnetic sensors and optional pressure transducer and altimeter.
  - G-886 / G877 family

Other devices for logging and display may be configured manually (see below). It is possible to configure basic devices (such as the GPS and magnetometer) with the wizard and then append more devices by hand later.

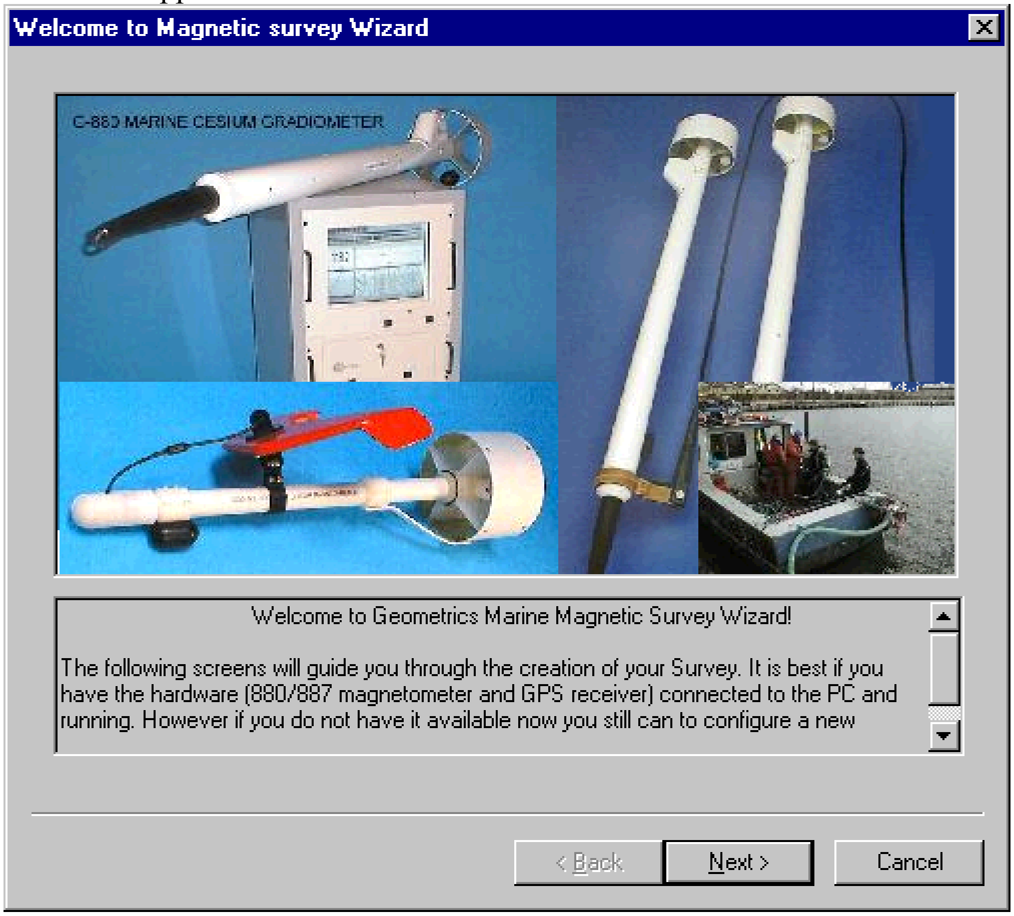
***Starting Maglog Wizard.***

To start wizard, select *Survey Wizard* from file menu:




It is recommended that you have your hardware (magnetometer and GPS) connected to the computer and running at this time. GPS should be outputing real positions, and magnetometer also should be running although it may not be producing real measurements at this time (it can be on the ship's deck). If these requirements are not met you still can proceed with *Wizard*, but there is some chance that you may encounter problems in future and have to rerun the wizard when you are under actual survey.

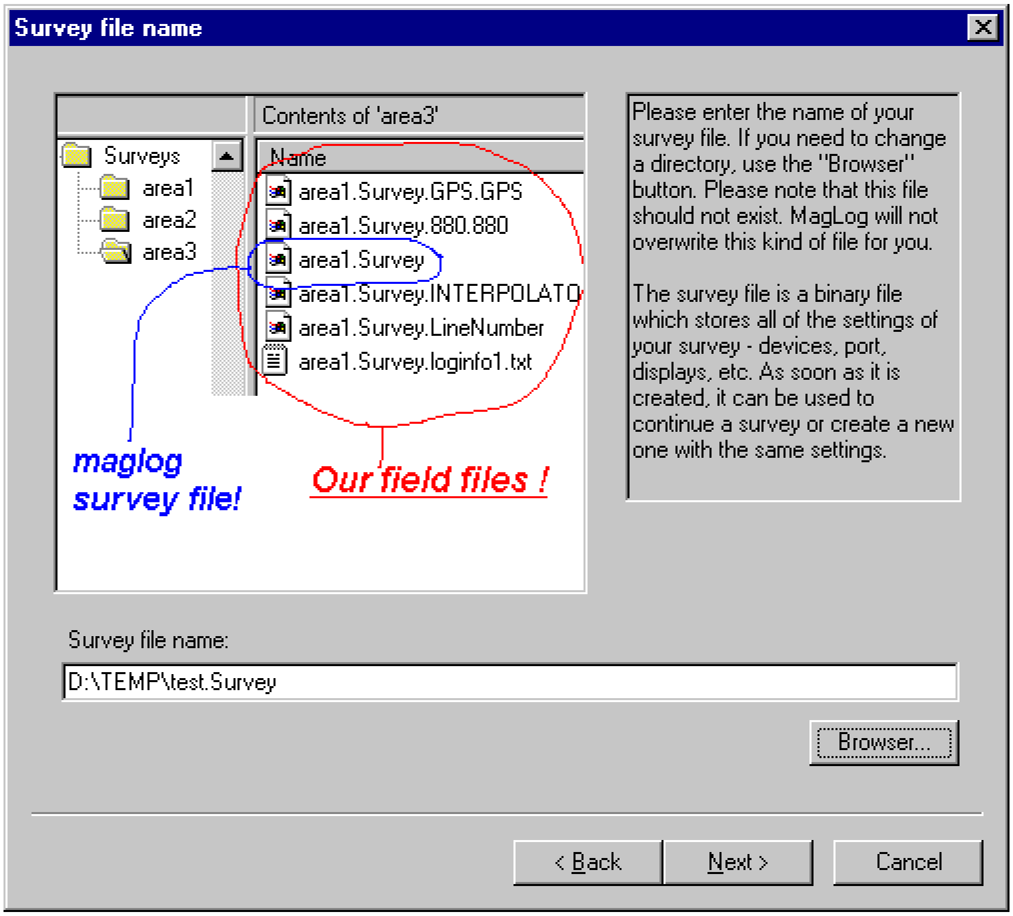
Next there appears the *Welcome* screen:




All *Wizard* screens have a short help file associated with them (duplicated in this document).

Next you must specify *survey* file name. It is recommended if you press *Browse* button and select the appropriate folder and name (don't place your survey files in the same folder where maglog.exe executable files reside but in another folder such as C:\DATA\SURVEY1). Please note that the new file name should not previously exist in the folder. MagLog will not overwrite previous survey files.

The survey file is a binary file that stores all of the settings of your survey - devices, ports, display configurations, etc. As soon as it is created, it can be used to continue a survey or create a new one with the same settings.




***Configuring GPS and its display.***

The next screen will allow you to configure the GPS. It will work best if the GPS is connected to one of your serial ports now. If this is the case, press "Autoset communication parameters" and MagLog will scan your serial ports to find the GPS port and its baud rate. It may take a few minutes; therefore if you know (or you think you know) these com port parameters, set them and press "Autoset Communication Parameter" to check if they are correct.

MagLog can generate a warning if the GPS signal deteriorates. To enable this feature, you should check "Differential GPS fix required" and set the minimum number of satellites. If one of these conditions is not met, an Alarm Window with a warning appears on the screen.

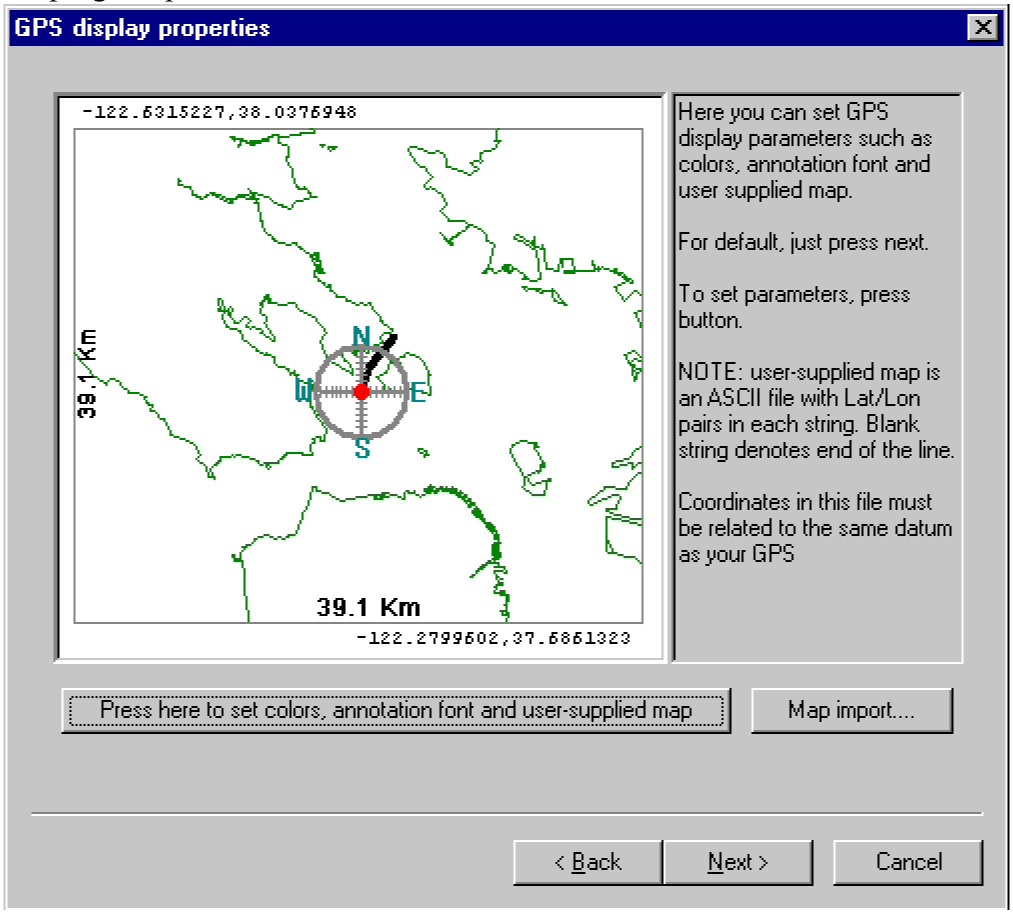
A note on real time lay back calculations. MagLog provides a feature that calculates where the fish is at all times. It does this by noting the position of the GPS antenna and then taking input from you regarding the antenna position relative to the tow point on the back of the ship and the amount of cable deployed. If you plan to use real time layback calculations you will need the *central UTM meridian of your location.* If you are located at the same area where you plan to make a survey (or at least in vicinity of few hundreds kilometers) and your GPS is getting real positions, the *Wizard* will analyze the GPS messages, find corresponding central meridian and enter them into the proper part of the program. This makes it very easy to configure Maglog

Interpolator in one of the next screens and why we recommend that you have a good GPS data transmission as you set up the survey.


The GPS display can be configured with user selectable background colors and annotation fonts. Also, MagLog has the capability to import ArcInfo shape file maps (more on this in the MagLog Manual). If there is a map available (presented in *ArcInfo* Shape file format) it is possible to combine GPS display with that map. The screen below shows a typical view of the *MagLog* GPS screen and allows the user to set parameters such as:

- *Press here to set annotation font and user-supplied map*. An additional dialog appears which allows user to set all these parameters. It is assumed that user map (if any) is presented in MagLog format already and user can simply import it up. If map has not yet been transformed into Maglog format, use the next button:
- *Map Import*. This allows user to select set of ArcInfo shape files (both .shp and .shx set of files must be available) to be converted into MagLog format. During conversion geometry information can be clipped against rectangular clip region and *user marks* and *user lines* added to the view. Note that ArcInfo shape files are available for most regions of the world on several internet sights at no charge.

Only linear features (such as coastlines, roads, etc) are taken from shape files. Point features as well as names in any associated .dbf file are ignored. The user should take care in employing this Maglog feature as large numbers of shape file elements can slow down the program performance.



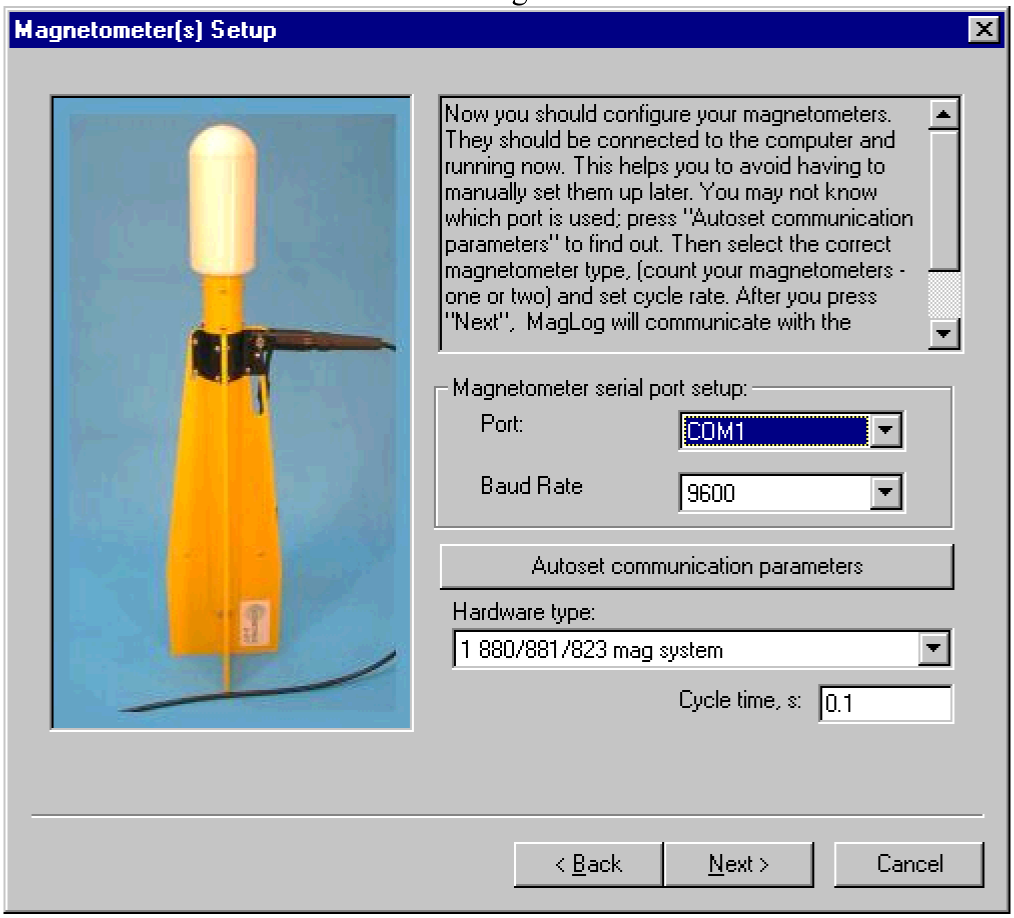

***Configuring magnetometer hardware.***

Next is the magnetometer configuration section. It is recommended that the magnetometer be connected to one of the computer serial ports and sending data. If you know the port and baud rate, set it and *press Autoset communication parameters* . MagLog scans all available ports and baud rates trying to find the magnetometer data. It starts the search with parameters you have set; therefore if the port and baud rate are set correctly, the magnetometer will be found very quickly.

Next set *Hardware Type* . The following configurations are available:

1. **1 880/881/823 mag system**. This system consists of one magnetic sensor with its signal strength channel. It outputs two numbers per reading – total field and signal strength.
2. **1 880/881/823 mag with depth sensor**. The same as above, but with pressure transducer. It outputs 3 numbers per reading: total field, signal and a depth reading that needs to be calibrated.
3. **1 880/881/823 mag with depth & altimeter.** The same as (2) but altimeter data has been added. The system outputs 4 numbers: total field, signal, depth and altitude. Depth and altitude data need to be calibrated.

4. **2 880/881/823 mag system.** Same as (1) but two magnetometer sensors connected into the chain. System outputs 4 numbers: Total field for first sensor, its signal level, total field for second sensor and its signal




5. **2 880/881/823 mag with depth sensors** Identical to (2) but has two magnetic sensors connected into the chain. Outputs 6 numbers: total field for 1st sensor, its signal, depth, and the same for second sensor.
6. **2 880/881/823 mag with depth & altimeter.** Identical (3) but has two magnetic sensors connected into the chain, each with its own depth transducer and altimeter. System outputs 8 numbers which are total field, signal, depth, altitude and the same 4 values for second sensors. Depth and attitude sensors have to be calibrated.
7. **886 / 877 Proton Magnetometer.** This device may have additional channels (depth) and they are normally factory pre-configured.

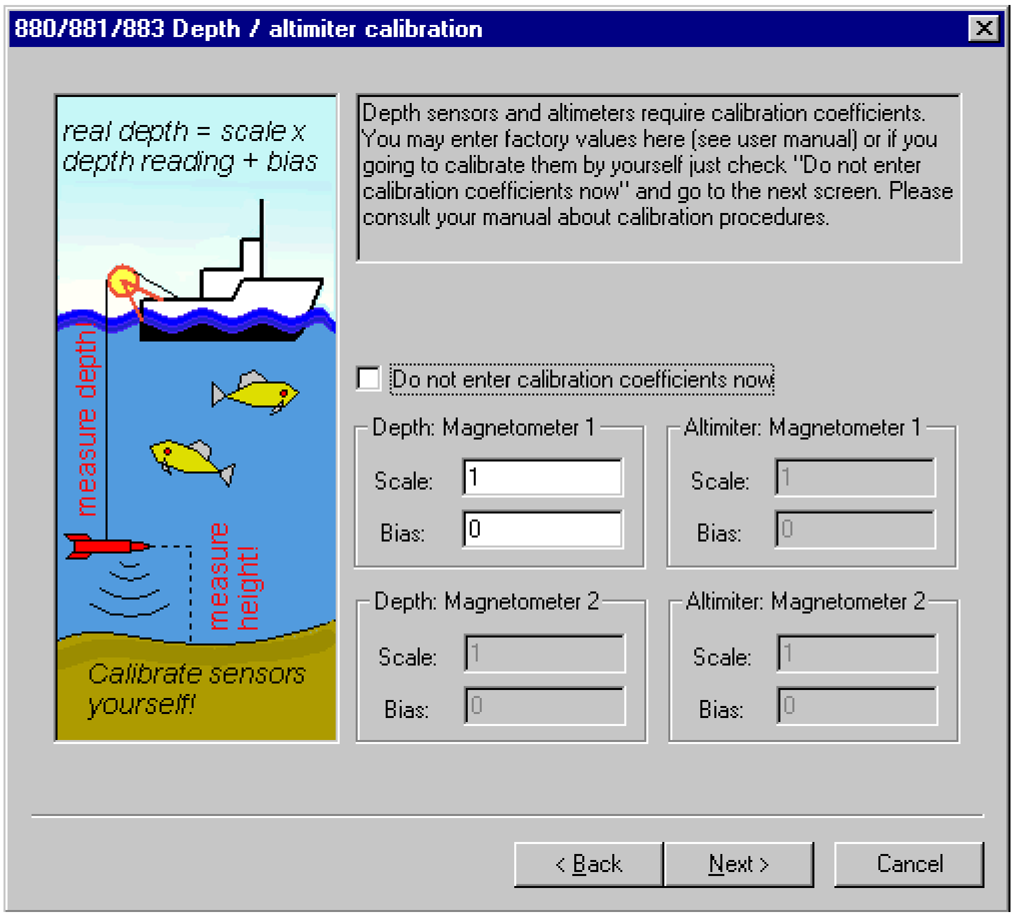
If your hardware configuration does not match exactly one of these 7 pre-defined sets, it is usually not be a problem. For example if you have 2 each 880 magnetometers with depth sensor and altimeter on one of them; then you can use configuration (6). In this case the depth transducer and altimeter for the second magnetic sensor will output zero values and that is ok for most data processing programs. However if your hardware consists of 3 magnetic sensors you will not be able to use Wizard to set up the gradiometer (multi-sensor) array.

At the same screen you should now set the desired cycle rate for magnetometer. Typical values for 880 family would be 0.1 seconds (10 HZ) and typical value for proton magnetometer is 2.0 seconds (0.5 Hz).

After all parameters are set and the auto detection sequence has completed you can press the *Next* button. Before goings to the next Wizard screen, the program will try to communicate with magnetometer to configure it accordingly. If magnetometer is not connected, the program will fail to converse with the mag and you will have to press the Cancel button. However, after this cancellation you can still proceed to the next dialog boxes but we recommend that you use the Wizard only when all devices to be logged are connected and sending data.

The communication program may fail due to other reasons as well, such as a wrong number of magnetic sensors entered into the dialog box. For example, if your system has only one sensor and you are trying to configure it as 2-sensor system this will occur.

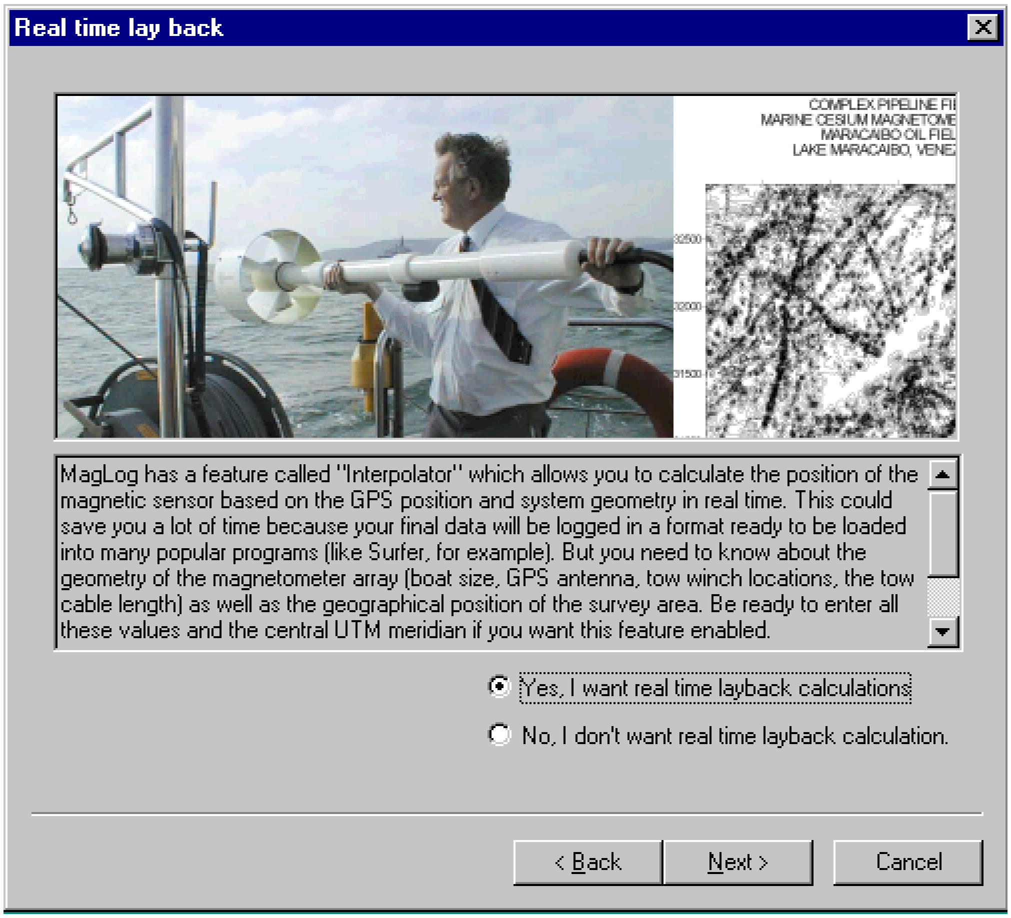
***Magnetometer calibration.***




If your hardware includes depth or altimeter sensors, they need to be calibrated. The Wizard does not provide full calibration capabilities (see below how to do depth / altimeter calibration) however it allows entering of the calibration coefficients if you know them. These values might be obtained from the factory or the results of previous calibration procedures. You also can check the *Do not enter calibration coefficients now* button and the scale will be set as 1 and bias as 0. Do this if you don't know calibration coefficients at this time.

Note that this screen will not appear if you do not have depth or altimeter sensors in your system.

***Real time lay back calculations.***



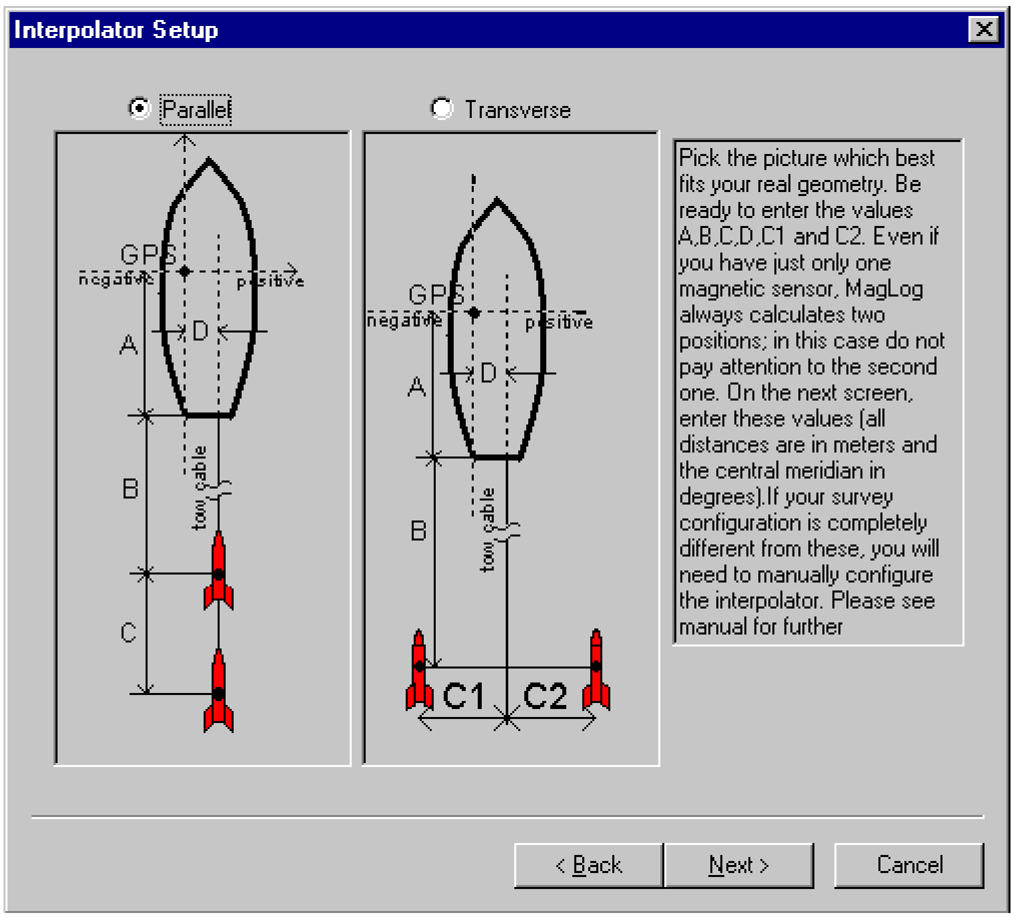

MagLog has a feature called "Interpolator" which allows you to calculate the position of the magnetic sensor based on the GPS position and the system geometry in real time. This function saves time and effort because the final data will be logged in a format ready to be loaded into many popular programs (like Surfer, for example) with the position of the fish (not the boat) in the file.  In order to use this feature, you will need to know the geometry of the magnetometer array (boat size, GPS antenna, tow winch locations, the tow cable length) as well as the geographical position of the survey area. Be ready to enter all these values and the central UTM meridian if you want this feature enabled.

Hint: If your GPS is reporting correct positions and you "auto detected" it during the GPS configuration step, the central meridian will be computed and entered automatically.

To enable the "Interpolator" function, just "Yes" and fill in the subsequent information. If you answer "No", then the set of subsequent screens are skipped and the feature is disabled. If you answer "Yes", be ready to answer questions about your boat and cable geometry.

The Wizard does not cover all possible aspects of the *Interpolator* configuration such as GYRO compass and ORE underwater positioning system usage. In case if you have such systems you should configure interpolator manually (see below).

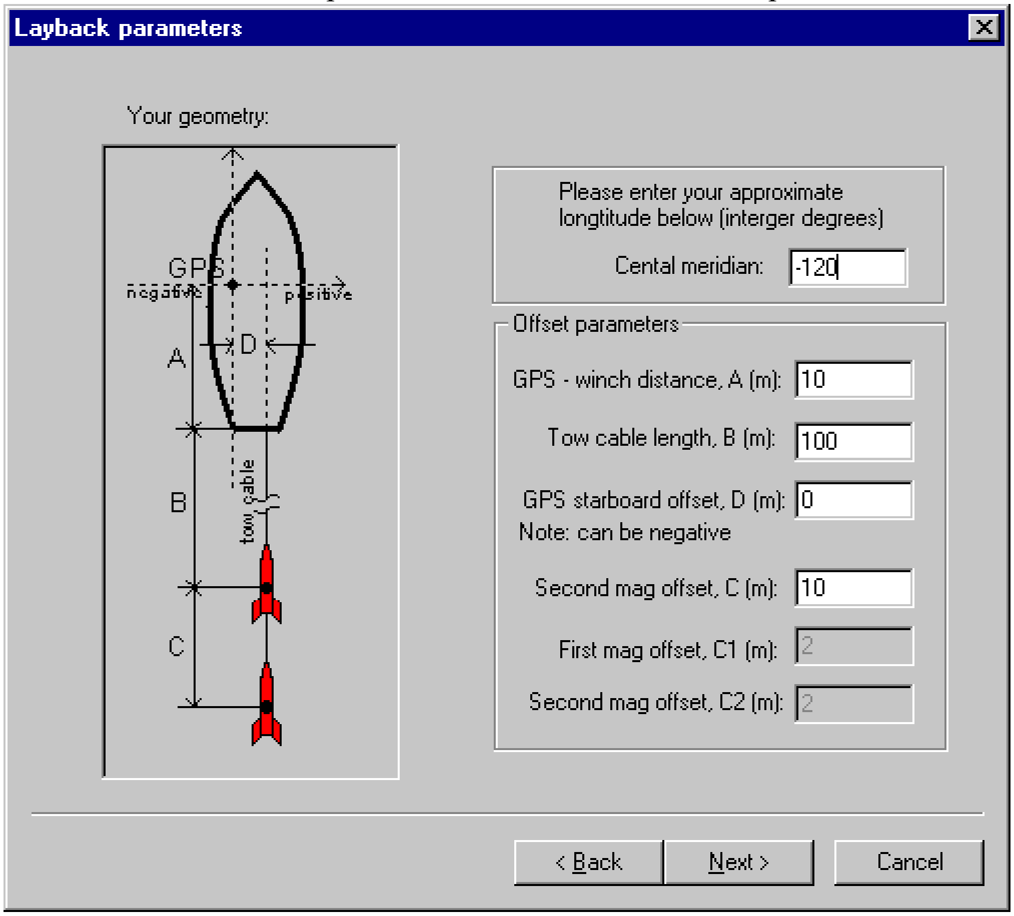
The next screen allows you to choose between two basic single sensor or gradiometer sensor array configurations (for multiple sensors). Note the gradiometer applications are many and varied, primarily associated with wider swath of coverage or removal of the diurnal field variations. Contact Geometrics for more details:




Pick the picture which best fits your real geometry. Be ready to enter the values A,B,C,D,C1 and C2. Even if you have just only one magnetic sensor, MagLog always calculates two positions; in this case simply ignore the second sensor position data. On the next screen, enter these values (all distances are in meters and the central meridian in degrees). If your survey configuration is completely different from these, you will need to manually configure the interpolator. Please see MagLogNT or MagLogLite manual for further instructions.

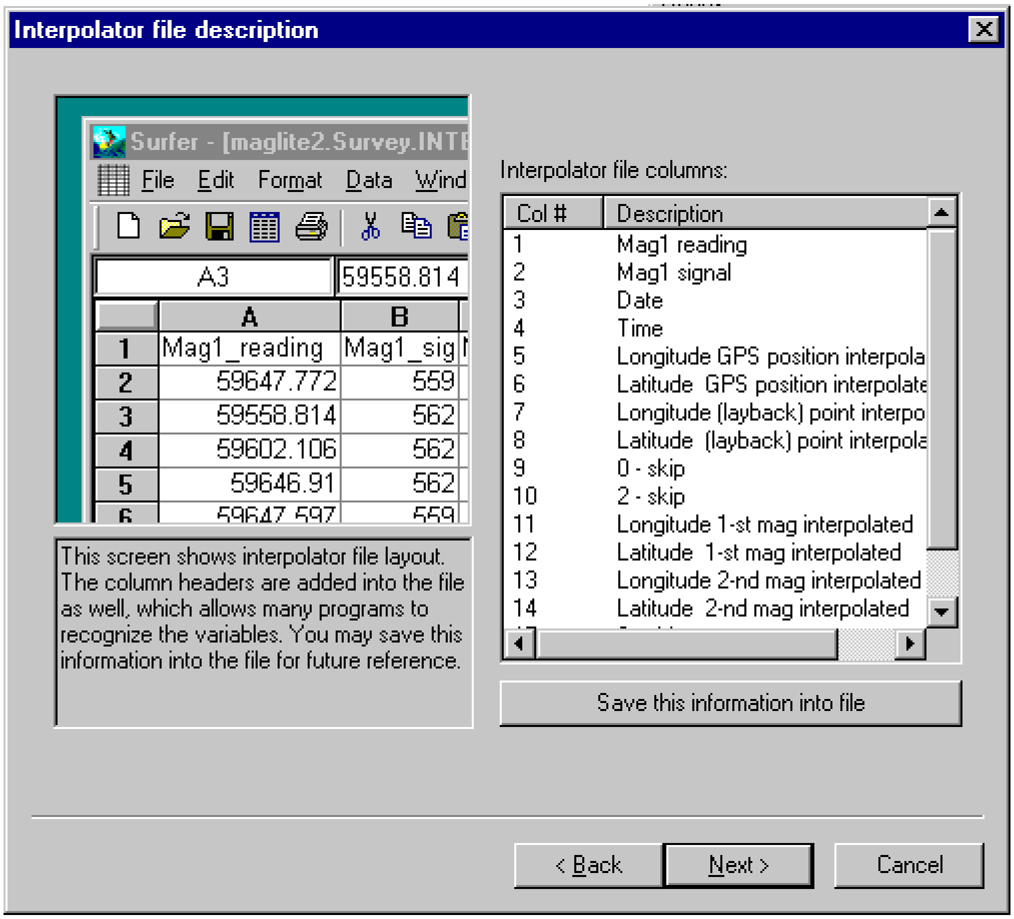
You still can use these two configurations even if you have just only one magnetometer fish; just ignore the second pair of coordinates.

On this screen you choose which mode (parallel or transverse) fits your actual geometry best and select it. The next screen presents the selected mode and its parameters:




Note that *Central meridian* field will be filled in automatically if you auto-detected GPS. Other values have to physically measured on the vessel and entered.

The final Interpolator Configuration screen presents the layout of interpolator log file. This file consists of many columns and includes magnetic field, signal, depth and altimeter readings as well as the GPS antenna and magnetometer fish positions.  The file can be loaded directly into popular program like Golden Software SURFER or *Geometrics* MagMap 2000. It is recommended that you note which data in which columns are being logged for future reference during the analysis and interpretation phase of the data reduction and map making.



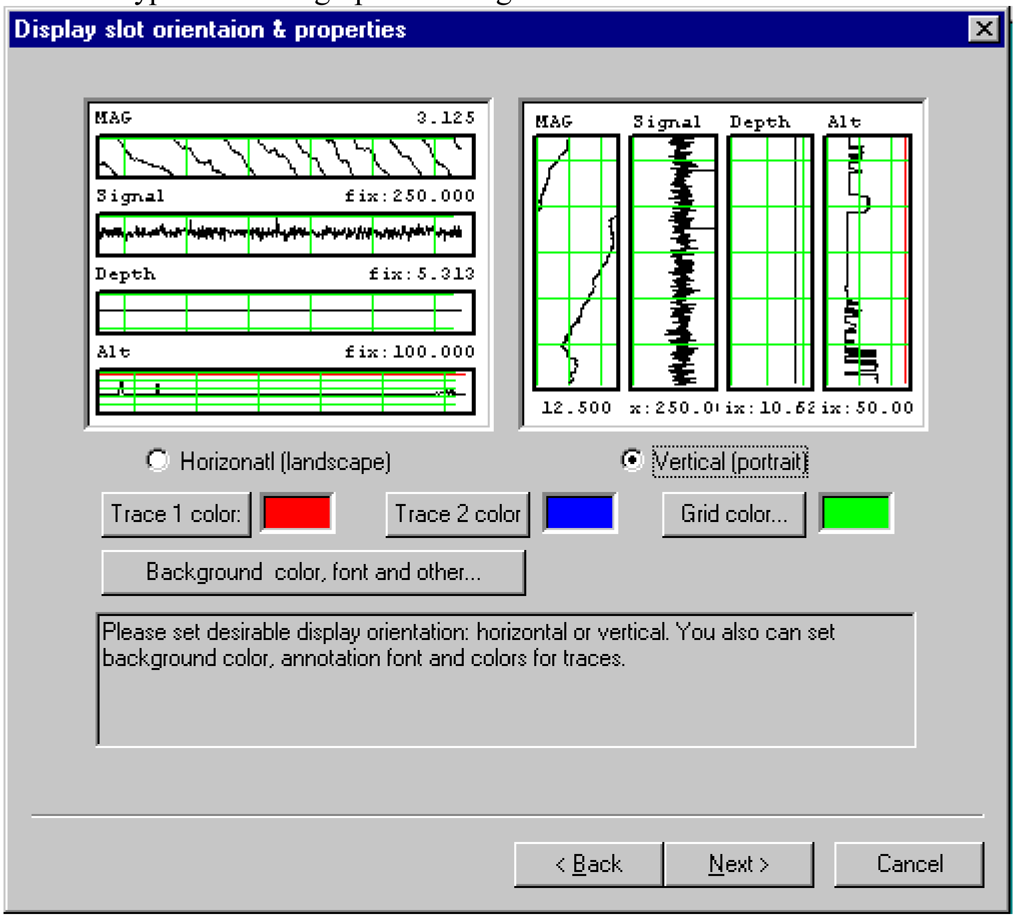

***Data Display configuration.***

MagLog has different options on how to display incoming data. Primarily, the data is presented as analog chart traces. There can be multiple analog charts on the screen (slots) and they can be oriented in either horizontal or vertical mode. Also each chart (slot) can be set with different rates of speed and full scale values. The Wizard covers only a subset of the possible display configurations. The user can choose from the following display configurations:

- Horizontal (landscape) or vertical graph orientation
- Color of the traces.
- Color of coordinate grid.
- Annotation text font and color.
- Window background color.

Depending on the configuration, Maglog will display one or more traces in each display slot. For example, it there is only one magnetic sensor, its field is displayed with color 1;
If there are two of them, then color 1 used for first sensor and color 2 used for the second sensor, and both fields are displayed in the same slot. All these parameters can be changed later after the survey is configured.

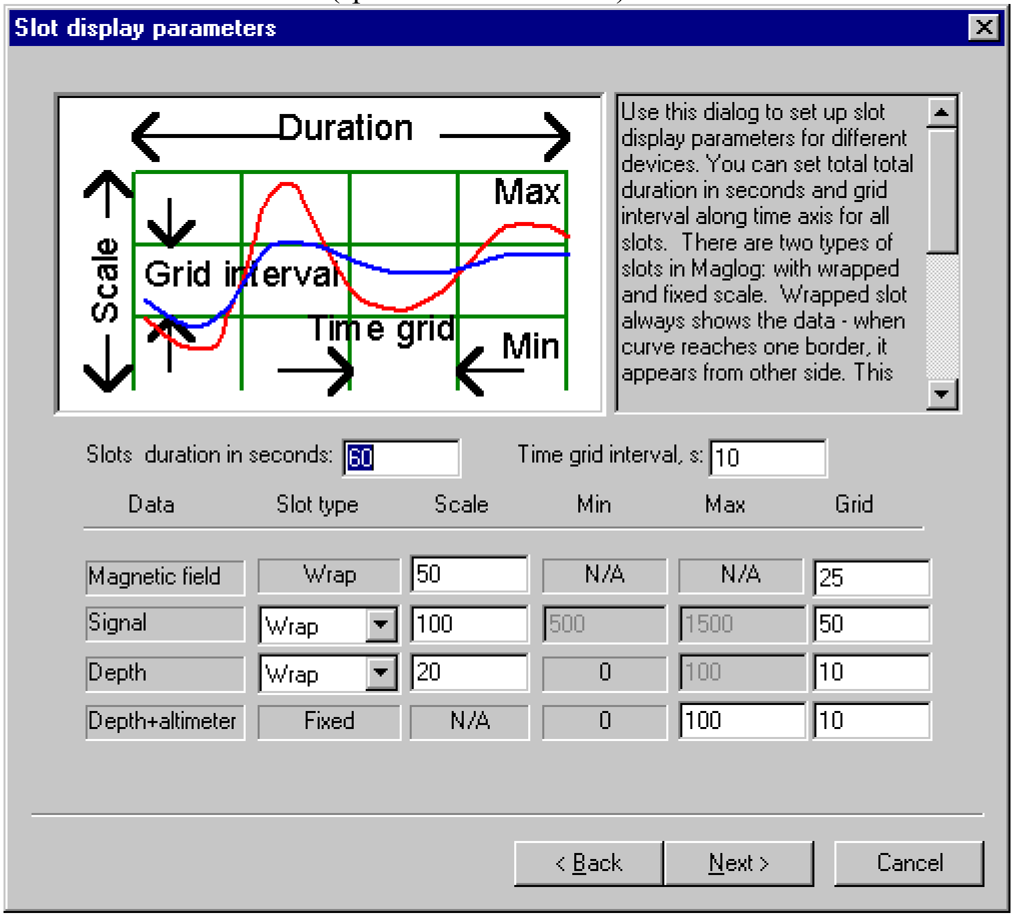
Here is a typical wizard graphics configuration screen:




The next screen allows you to set the scale and grid parameters for the  slots, as well as the slot type. MagLog produces an automatic display layout based on your configuration and the following rules:

- Magnetic field is always displayed in the wrapped mode. This means that when the graph reaches the slot's border, it reappears from other side of the slot.
- Signal strength can be displayed as in wrapped mode or in fixed mode. In fixed mode slot's borders have fixed values; if value to be plotted is out of this range, the curve simply disappear from the screen.
- Depth also can be plotted in either mode.
- If there are depth and altimeter sensors, MagLog makes a "flying fish" plot. This includes plotting of sum of depth+altitude to show bottom profile and depth plotting in the same slot to show the fish's actual vertical position in the water column. This kind of plot has a fixed range with the positive axis pointing down (in landscape mode) or left (in portrait mode).

In the dialog box below, the user can set ranges and scales for all the above slots, as well as total slot's duration in seconds (speed of trace control).




***Configuring printer.***

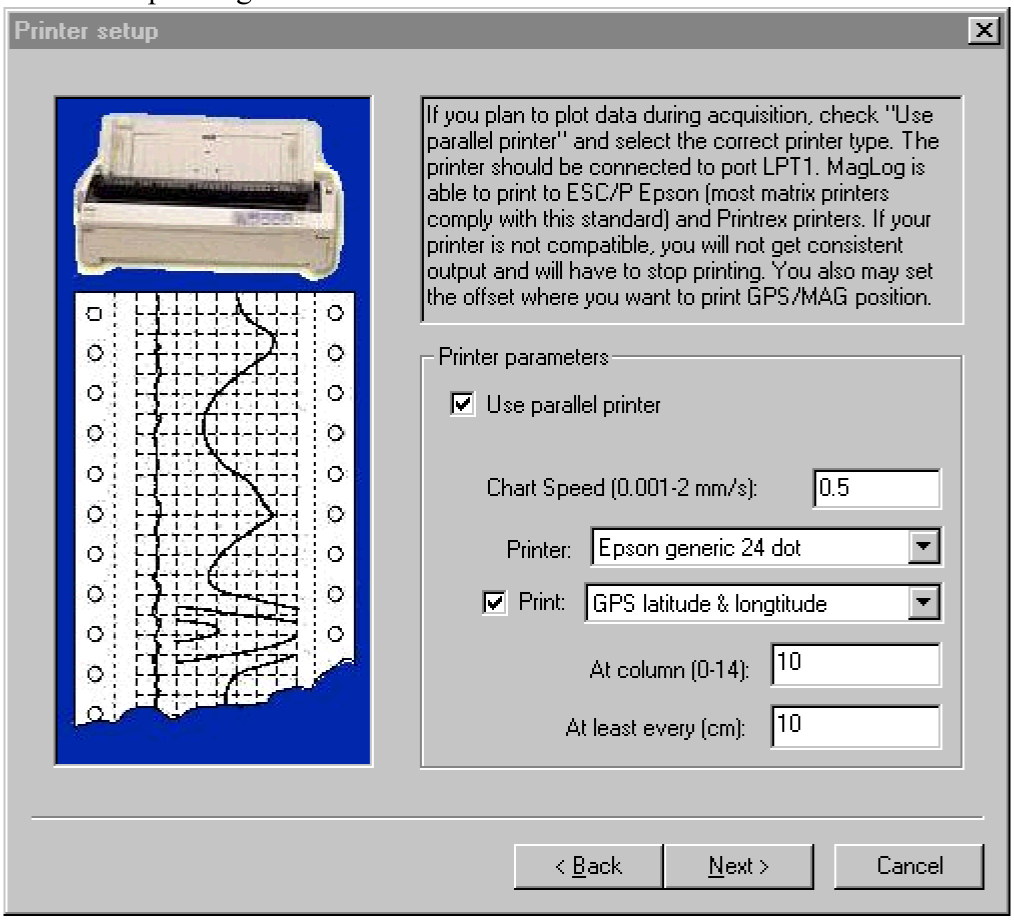
MagLog allows you to produce hardcopy output during data acquisition. This option works with Printrex 8" or 11.5" thermal printers or with standard Epson type dot matrix 8 or 24 pin printers that are ESC/P compatible. Most dot matrix and some jet printers are compatible with this specification, however consult your printer manual regarding your specific printer.

Connect the printer to LPT1 and check the *Use parallel printer* box to enable printing. Then select the correct printer type. Note that if the printer type is incorrectly selected, unrecognizable characters will be printed.
You also can configure the following printer options:

- Select chart speed.
- Print GPS position in decimal formal or lay back calculated position (actual sensor position in Lat Long) if layback calculation is enabled.
- Select the position on the chart where text is printed.

MagLog creates a automatic printer layout based on your hardware configuration. This layout can be altered later by hand if you wish. At the beginning of the chart MagLog prints a short legend where it explains the printer layout.

Printer setup dialog:




***Finishing setup.***

After the final Finish button is clicked (screen not shown here), MagLog tries to set up the survey as it was configured. You should have your GPS and magnetometer up and running at this time. If you don't have real inputs coming into the serial ports, Maglog still will create a survey, but you won't be able to run it. If you are running an unregistered version of the program or do not have a registration Dongle Key (goes into printer port to enable full access to program), MagLog will switch data inputs from serial ports input to data file input (demo mode).

MagLog creates two windows, a magnetometer display window and a GPS view window, and tiles them on the screen. The GPS window initially has the minimum possible magnification so you are able to see whole earth globe. Make this window active with mouse (by clicking once on it) and then use "+" and "-" keys to set desirable magnification (zoom to your area). Use the arrow keys to shift or translate the location map horizontally or vertically.

The Magnetometer window begins with  a default layout. It can be altered by hand if desired (see MagLog manual). Make this window active with a mouse click and then use arrow keys to navigate between slots and change data FULL SCALE inside each slot.

NOTES

# 4.0 APPENDIX A - TECHNICAL MANUAL for FIRMWARE

***4.1 Notes on Startup for the G–877 Magnetometer for Installations Not using* MagLogLite™**
**If you are using Geometrics MagLogLite or MagLogNT please the following information is not required for proper operation.**

The G–877 Magnetometer communicates via RS-232. Measured Data, as well as all control and setup commands are handled over this link.
To communicate with the G–877 Magnetometer, as a minimum, a "dumb" terminal is required. The usual method to operate is with a computer running at least a program such as Windows "Hyperterminal". This will allow all commands to be transmitted and to capture data to a file. The usual system may also have a logging software package, such as **MagLogLite™** mentioned elsewhere in this manual. It should be noted that the following information is not required for **MagLogLite™**or **MagLogNT™**users and is supplied for developers of their own logging systems or for third party software vendors.

-------------- **IMPORTANT NOTE**-------------------
All communication to the G–877 Magnetometer
must be UPPER CASE LETTERS
-------------------------------------------------------------------

The following table lists the commands that are possible to transmit to the G–877 while it is running:

| Command Letter | Command Meaning | Description |
|---|---|---|
| T | Tuning | Allows Setting To Local Field |
| C | Cycle Rate | Sets Cycle Rate In Seconds |
| P | Polarize On/Off | Means Of Stopping Signal To Observe System Noise |
| TA | Autotune On | Engages Automatic Tuning |
| Q | Quit | Stops Cycling To Get Into Setup Menu (Hold Q Down Till Cycling Stops) |

The Following table lists the commands that may be transmitted to the G–877 while it is in the Setup Menu (may be used for changing operating default settings):

| | |
|---|---|
| M | Mode of operation |
| T | Tuning |
| B | Baud and modem setting (9600 Baud is normal factory setting) |
| L | Inductance of cable and sensor to minimize tuning offsets |
| A | Abandon Changes |
| E | Everything |
| Q | Quit, abandon changes (Activates menu to reload default settings) |
| S | Save parameters |
| C | Cycle time |
| F | Format of output |
| R | Run magnetometer |
| D | Display all parameters |
| N | Next (for multi sensor systems) |

All of the setups are stored in FLASH so they are saved when power is shut off. Many of the settings are only set at the factory and never need to be changed in the field. The setting can be saved by typing "S" at the ">" prompt and following the directions.

The G–877 Magnetometer may be used as a diagnostic tool to verify a “clean” installation. With the G–877 powered on, observe the incoming data stream, in particular the “signal” amplitude. Locate the sensor and sensor cable away from any noise sources. Observe the “signal” amplitude with the polarize disabled which is a measurement of system Noise (see paragraph 3.4, Pol OFF). This is accomplished by typing “P255” <Enter> on the Control and Display Computer. The Noise amplitude should be approximately in the range 10 to 50. By moving either the sensor cable and/or the G–877 Magnetometer unit, search for a location where the smallest number for the Noise signal may be found. If the G–877 Magnetometer begins to polarize again while you are still searching, type “P255” <Enter> again until the search is complete. Typing “P1” <Enter> will restart sensor polarization.

### *4.2 DATA TRANSMISSION FORMAT FOR CUSTOMER SUPPLIED SOFTWARE*

After a few seconds the magnetometer will begin sending serial data in the following format :

```
= 50495.72  255  137
= 50495.49  255  138

FIELD   SIGNAL   DEPTH
```

The values shown are for example only and will vary with system configuration. The first reading is the magnetometer field and its value will vary greatly if the sensor is positioned close to a large ferromagnetic mass such as a steel deck or dock. The normal format is magnetometer data, signal strength and depth in meters.

You will use the signal level to tune the magnetometer for maximum signal under actual survey conditions. The value at maximum tune should be between 400 and 500. However, this can vary with ambient field strength (signal amplitude is proportional to field strength, i.e., we would expect half the signal strength value in a 25,000□ field compared to a 50,000□ field), sensor orientation (you will get more signal going north-south than east-west) and gradients (you will not get a useable signal with the sensor on a steel deck due to high magnetic field gradient). Data quality will vary from installation to installation depending upon the distance of the sensor from the ship and general diurnal conditions, but in general, you should expect data in the 0.1 to 0.2 gamma range. If the data is significantly noisier than that, re-tune for maximum signal.

### *4.3 ALTERNATIVE SOFTWARE*

There are several alternatives for configuring and operating the Magnetometer. Configuration may be accomplished with either Hyperterminal or Procomm type software. Operation may be accomplished with any of three software programs as follows: **MagLogLite™** logging software, Hyperterminal, other terminal emulators. Note that logging of position is important and programs other than MagLog not designed to log GPS will have minimal usefulness.

If **MagLogLite™** logging software was purchased, follow the instructions in the **MagLogLite™** logging software manual to install the **MagLogLite™** software.

Windows Hyperterminal terminal emulation software may be used to configure and run the Magnetometer. Start Hyperterminal, set up a Direct to Port connection on the port connected to the Magnetometer and turn on power to the Magnetometer. After a short time the Magnetometer will begin transmitting data or information for the configuration mode.

### *4.4 G–877 MAGNETOMETER FIRMWARE CONFIGURATION*

**DOWNLOAD OF PARAMETERS**

To change the magnetometer operational parameters other than the Tuning (for example, change cycle rate or set auto tuning) you must enter the Software Configuration Mode by using a communication package (terminal emulator) such as HYPERTERMINAL. System Tuning and cycle rate, however, may also be changed directly from within the MagLogLite™ logging software.

We assume here that the RS-232 port has initialized properly, that the magnetometer is cycling and sending data and HYPERTERMINAL is receiving and displaying the transmissions from the Magnetometer. The software will enter set-up mode if it sees a string of upper case "Q" keys on its serial input. Enter these "Q's" by pressing and holding down the Q key. Only the upper case "Q" character will be accepted. We suggest that you press the "CAPS-LOCK" key on the keyboard.

When the system is in the configure mode it will display a prompt that looks like "->", at which the user may type a single character to select the item to be set (character set listed below). When the character is typed, the system will respond with the current value of the parameter and allow the user to edit the value or press return to retain the old value. Section 4.5 lists the messages that can be displayed during the configuration process and their meanings. If an entry is in error, you will have to proceed down through the menu of changes and restart. If entries are out of bounds, a comment will appear.

***Note:*** ***If instead you see "CHECK SUM ERROR"****, this means that both primary and backup parameter blocks in the FLASH have been corrupted. You will need to go into the configure mode and set all the parameters correctly and save them before you can run.*

***Warning:***

*A space and return, i.e., " <return>" is not the same as "<return>".*

In many cases, pressing a character will cause a list of items to be sent and/or set before returning the prompt. A few moments may be required before you get a response.

Once finished with the configuration changes, save the new configuration into FLASH **by pressing the character "S"** at the prompt. If you don't save the changes now, they could be lost should power inadvertently be removed from the system. During the save process, the software checks for proper ranges in the new configuration and will not download erroneous or out-of-range values.

After the checking, the software requires that you **press a "Y" to write data to the FLASH**. If you inadvertently disconnect power during the download, the results can be difficult to predict, but significant effort may be needed to reinitialize the system. When the prompt comes back it is safe to turn off the power.

## *4.5 G–877 MAGNETOMETER COMMAND CODES*

Note: Set the “Caps Lock” key in order to control the magnetometer.

**M** Run mode (0=config, 1=magnetometer) : 1
Determines at “power on” if the magnetometer will begin operation in the configuration mode or the run mode. This feature may be useful in certain battery-powered applications.

**Q** If pressed while in the magnetometer run mode, will switch from the run mode to configure mode (press and hold down until the magnetometer recognizes the command).
If pressed while in the configure mode two choices appear:

1) to reload from FLASH (pressing a “1” will cause the user saved defaults to be reloaded)
2) to reload factory settings (pressing a “2” will allow a reload of the factory settings)

**D** Pressing will cause all of the current system default parameters to be displayed on the CPU screen. This is useful when using a terminal emulator to allow capture of this information to a file.

**S** Pressing will cause any changes made to system parameters to be saved to the FLASH. If not pressed before “power off” any changes will be lost.

**R** Pressing will exit the configuration mode returning to the run mode.

**C** Cycle time in seconds : 1.5 in seconds

**T** Initial tuning in kilogammas : 50.0 In K□
Auto tuning (0=off, 1=on) : 0.0 Logical
Max auto tuning in kilogammas : 100.0 In K□
Min auto tuning in kilogammas : 20.0 In K□

**F** Pressing will cause the initiation of the process of defining the format of the data string that is transmitted by the Magnetometer. Each paragraph below represents a data item that may be included in the data string. For each data item its individual format (e.g. ######.##) and position in the data string may be defined. Each data item will be presented by the Magnetometer one at a time showing the current definition for acceptance or new definition. After any changes desired are made press the <Enter> to accept the changes and proceed to the next data item. The current definition may be accepted by pressing the <Enter> key. Each data item must be acknowledged by pressing the <Enter> key until the Magnetometer has presented all the data items. Note that some data items in the data string with a “0” (zero) position setting are not transmitted.

Preamble := [NOTE: This “=“ is used by the MagLogLite™ software and may be different for other logging software.] The preamble is factory set to “=“ but may be changed to be compatible with other data logging software.

```
Example Configuration file for G-877 s.n.006  12-27-00

Run mode (0=config, 1=magnetometer, 2=mag half duplex) :1
Cycle time in seconds :  1.5
Initial tuning in kilogammas : 50.0
Auto tuning (0=off, 1=on) :0
Max auto tuning in kilogammas :100.0
Min autotuning in kilogammas : 20.0
```

**(following is data transmission format control)**

```
Preamble :=
field display position(1=1st, 2=2nd, .. etc) : 1
field display format :######.##
time display position(0=none,1=1st, 2=2nd, .. etc) : 0
time display format :#####.#
```

```
fid display position(0=none,1=1st, 2=2nd, .. etc) : 0
fid display format :#####
signal display position(0=none,1=1st, 2=2nd, .. etc) : 2
signal display format :####
depth display position(0=none,1=1st, 2=2nd, .. etc) : 3
depth display format :###.##
input voltage display position(0=none,1=1st, 2=2nd, .. etc) : 5
input voltage display format :##.#
temperature display position(0=none,1=1st, 2=2nd, .. etc) : 0
temperature display format :####
polarize voltage display position(0=none,1=1st, 2=2nd, .. etc) : 0
polarize voltage display format :####
tuning display position(0=none,1=1st, 2=2nd, .. etc) : 4
tuning display format :###.#
Status display position(0=none,1=1st, 2=2nd, .. etc) : 0
Status display format :##
Postamble :\N

Baud rate : 9600
Cable length in feet :  2.0
Capacitance per foot in pF : 25.0
Sensor inductance in mH : 55.8

(the following sections are under factory password control.  Contact Factory
if you need to access these parts of the firmware)

Password :
Gate time as percent of cycle time : 50.0
Maximum gate time in seconds :  0.5
Maximum pol time :  5.0
auto tuning search increment in Kgammas  :  2.0
Bad readings before auto tuning searches : 3
Max change in auto tuning per reading in kilogammas :  5.0
Minimum accepted signal for auto tuning :200
When in configure mode turn pol. (0=OFF,1=ON) :  0
Trigger character :=
Lump capacitance in nF : 26.5
C[01] in nF :  3.0
C[02] in nF :  5.5
C[04] in nF : 13.9
C[08] in nF : 24.0
C[10] in nF : 54.5
C[20] in nF :114.4
C[40] in nF :218.1
C[80] in nF :442.3
Pol to connect delay in mS :  5.0
Connect to damp delay in mS :  4.0
Damp to deQ delay in mS :  2.0
de-Q to gate delay in mS : 40.0
IPP Time outdelay in mS : 20.0
signal scale factor :    1
signal bias sign (0 = add, 1=subtract) :0
signal bias :    0
signal decimals :0
depth  scale factor :  595
depth  bias sign (0 = add, 1=subtract) :1
depth  bias :  832
depth  decimals :4
input voltage  scale factor :  145
input voltage  bias sign (0 = add, 1=subtract) :0
input voltage  bias :    0
input voltage  decimals :4
```

```
temperature scale factor :    1
temperature bias sign (0 = add, 1=subtract) :0
temperature bias :    0
temperature decimals :0
polarize voltage  scale factor :  145
polarize voltage  bias sign (0 = add, 1=subtract) :0
polarize voltage  bias :    0
polarize voltage  decimals :4
Manufacture code :    0
Unit code :    0
Factory code :
```

**A** Pressing will allow all parameters that may be changed in **B, C, F, L, P,** and **T** to be accessed for change, all at the same time, in one large list.

Two copies of the configuration data block are stored with a checksum each. Should power be disconnected during the FLASH write, the software will reject the partially written block. If both blocks are bad, the software will be forced into Configuration Mode and all values will be set to factory default values. If the factory configuration block is bad, safe values are used.

If you exacerbate the situation by turning off the power before resetting and saving a valid configuration, or if you are having problems initializing the system, do the following:

1) Turn/leave the power off to the magnetometer.

2) Press the <CAPS LOCK> to select all upper case letters to be output to the Magnetometer.

3) Hold the "Q" key to return to configuration mode and turn the AC Power Unit on.

4) If this procedure fails to reinitialize the system, repeat from (1) above. Otherwise see the **G-876/G–877 FLASH DOWNLOADER PROGRAM** section below.

5) Correct the configuration and save.

### *4.5.1 Cycle time:*

A two second cycle rate produces the best data, approximately 0.1 to 0.2 gamma during actual towing conditions. Some of this "noise" is a mixture of sea swell generated noise, ship motion noise, sensor motion noise with geologic signal and diurnal variations mixed in. The system will cycle at a 0.5 second rate if the transmitted data formats are short. Some loss of performance will occur at higher repetition rates.

### *4.5.2 Tuning:*

The tuning value set during this procedure is used at power up. It can be changed during actual magnetometer operation by using the "T" command from the graphics or character display screen, but that value will not be permanently stored.

Auto tuning is not recommended if large changes in the field are anticipated, such as those associated with steel target location. The limits on the **span of autotuning** should be set close to the local field (i.e., ± 10K□) when the auto tuning is employed. The manual tuning uses strings in the form of:

T531<enter> meaning tune to 53,100 gammas

TA<enter> to enable auto tuning:

If you are in HYPERTERMINAL, you also can re-tune in this way. To send the tuning manually, press "T". <u>You must use upper case letters</u>. Wait for the magnetometer to echo the "T", then press the next character and wait for an echo and so on. The magnetometer assumes that the first digit it gets is the tens of kilogammas the next the kilogammas and third hundreds of gammas. All three digits must follow the "T" code. After the three digits are echoed, press enter. If you make an error, press "T" to restart the entry procedure.

### *4.5.3 Transmitted Data Format:*

The data transmitted from the magnetometer has the following line format: [factory set - field changeable]

magnetometer value - signal level -depth- tuning - input voltage

MagLogLite™ defaults to assuming the preamble string is the "=" sign that is transmitted but not displayed. This string marks the start of the line of text that is the data so that the manual tuning information does not get confused with the data. After the preamble comes the data item selected by the user to be sent first, then the second, third, and so on until all selected values are displayed. This is followed by the postamble string. In the postamble string there will be a "\N" to cause a carriage return/line feed pair to be sent.

The formatting of the numbers is controlled by strings of pound signs (#) and optionally a decimal point (.). If the format is in the form "###.##" this would mean three digits before the decimal and two after. Only those digits specified in the format will be transmitted, e.g., if the field is 51234.56 and the field format is set to "###.#", then the value sent will be 234.5.

The total field reading is transmitted after conversion to nT (gammas). The A to D Converter values are scaled to a conventional unit of measure before transmission. For example, Volts (input DC voltage) and the signal strength presented in arbitrary units. Typical signal levels of 300-500 units can be expected depending on the direction of tow and local field strength. The signal strength scaling is fixed and can not be changed.

Status Codes:

0 I'm OK
1 Unexpected 'R' received
2..9 Reserved for other minor errors

11 Counter 1 failed
12 Counter 2 failed
13 Counter 3 failed
14 Counter 4 failed
15 Counter 5 failed
16 Counter 6 failed
17 Tuning reads back wrong
18..99 Reserved

#### *4.5.4 Pol OFF:*

This procedure provides a method to obtain a relative noise figure by turning off the polarizing current to the sensor. Type “Pn” (n=1 - 255) <Enter>. This will turn the polarizing cycles off for the number of cycles specified (n). Polarize will automatically restart after the n cycles. Polarize may also be restarted by typing P1 <Enter>.

This procedure should be useful to evaluate noise problems with a G–877 system installation.

### *4.6 Magnetometer Configuration Mode Message Displays*

The following messages may be displayed during the configuration of the magnetometer electronics process. To help the user in properly programming the magnetometer operation, we offer these descriptions. Specific questions should be addressed to Geometrics Customer Service.

1." Invalid character in number "

This message is displayed anytime a character other than a digit or a decimal point is detected in a number entered.

2." Number out of range. Value must be ?? to ?? "

After each number is entered, it is checked against the allowed range for this parameter. If it is outside the range this message is displayed with the range limits displayed where the "?" characters are above.

3." Checking "

Whenever you press "R" to run or "S" to save this message is displayed to indicate that the parameters are being checked for validity.

4." Press "Y" to store to FLASH, any other key to abort: "

When pressing "S" to save the software this gives you a chance to change your mind before writing to the FLASH.

5."  Press "Y" to ignore warning and save to FLASH or any other key to abort:  "

Some checking of values includes tests for unlikely values.  When a value is not illegal but unexpected this message is displayed to inform the user.

6."  Save function aborted  "

When the user is asked to press "Y" to save, pressing any other key causes this message to be displayed.

7."  Value has been corrupted  "

This message should never be seen by the user except possibly after loading a new version of the software.  This indicates that the parameter displayed has a value that is not allowed in this version of software.  The remedial action is to change the listed parameter to a value that is legal.

8.   " Two variables in same place  "

This message indicates that the position numbers specified in the "F" group for two variables are the same.

9.   " Has a gap before it  "

If you have a variable specified to print in the fourth position you also must have ones in the first second and third positions.

10.  " is a nonstandard BAUD rate  "

If you enter a number such as 1300 for the baud rate you will see this message displayed after the baud rate. Although the hardware can transmit at such a rate it is very unlikely that this would be useful.  **Do not save such a Baud rate, since communication would cease to work.**

11.  " is not close to twice the previous "

The stored values for the tuning capacitors are checked whenever the "R" or "S" is typed.  If a value is far from its expected relationship to the others, this message will be displayed.

12.  "  Running magnetometer software  "

Obvious!

13.  "  Press "Y" to ignore warning-  "

When a warning message is displayed after the "R" key is typed, this message gives the user the option of running the magnetometer software regardless by pressing the "Y" or returning to the configuration mode by pressing anything else.

14." Attempt to run aborted due to error "

This message is displayed if the checking done when the "R" is pressed discovers an error that precludes running the magnetometer software with the current parameters.

15. " Press: 1 to reload from FLASH
2 to reload factory settings "

When the "Q" is pressed this message gives the user the option of reloading the values he last saved or the ones we saved at the factory. Pressing any other key will cause neither to happen.

16. " Factory values corrupted default values loaded "

When an attempt to load the factory values from the FLASH discovers that the settings have been corrupted this message is displayed.

17. " M Mode of operation
T Tuning
B Baud and modem setting
L cable and sensor
A Abandon Changes
E Everything
Q Quit, abandon changes
S Save parameters
C Cycle time
F Format of output
R Run magnetometer "
D Display all parameters
N Next (for multi sensor arrays)

A message displayed as a reminder any time the user types an unrecognized key at the "->" prompt.

18. " Error on parameter block! Backup parameters used. Suggest you re-save "

There are two copies of the users' parameters saved in the FLASH. This suggests that one of them was damaged. The correct one is loaded but we suggest you save the parameters to write the correct values into the damaged block.

19. " Error on both parameter blocks! Factory values loaded. Suggest you reconfigure system and re- save. "

If both copies of the users' parameters are found to be damaged the software loads the factory settings and suggests that you manually restore the correct values and save them.

20. "  Error FLASH damaged!!  Default   values loaded
    Suggest you reconfigure system and re-save.  "

This message indicates that none of the configuration blocks where "good."  All parameters for the system need to be reset and saved.

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Please refer any comments, questions or technical support issues to:

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