AGIS/IRIS

Airborne Geophysical Information System

Operation Manual

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Version 2.3.2

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REVISION LIST APRIL 2004

The following list the revisions and upgrades for the latest release of the IRIS / AGIS software suite.

1. Addition of manual line selection and numbering. User may now enter any alpha / numeric line number of up to 8 characters
2. Manual line numbers may now include a decimal. This allows re-flights of a survey line while allowing a unique line number
3. If manual line number entered as numeric value only, then navigation system automatically selects the closest line in the survey area as locked line. This eliminates the need to scroll through the lines in the area to get to the first line to be flown
4. **END , F2** keys / touch screen buttons disabled while data recording is enabled.
5. Pressing **F5,** gives instant value display for all analog trace displays.
6. Addition of NO GPS RAW DATA RECORDED message at lower left of main screen
7. Addition of ADRG map coordinate system for navigation in extreme north and south latitudes
8. Implementation of ARINC data interface support.
9. Graphics for PGU pilot display revised for better clarity with drape flying. Random scale changes problem on pilot display has been corrected.
10. Flight path REPLAY mode removed from IRIS / AGIS software and inserted into PEI Convert program.
11. Screen freezing and / or program crashes while using keyboard for data entry or line changes has been addressed and fixed.
12. IRIS / AGIS software now supports line heading selection in increments of 0.1 degrees instead of integer degrees only.
13. When creating a new project from scratch it is no longer necessary to recreate all the analog display settings. This information is now preserved in the C:\IRIS\PAR directory. Copying this directory from an old project to a new project will save all these settings.

INTRODUCTION

1.1. DISCLAIMER

The navigation system used within this apparatus is not a primary type of navigation and serves always as navigation aid only under VFR (Visual Flight Rules) conditions. Pico Envirotec neither assumes nor accepts any responsibility for positional errors in navigation caused by GPS system malfunctions, incorrect set up of area navigation files and / or the AGIS system software suite, or failure of the users to operate the system properly.

1.2. OVERVIEW

The Airborne Geophysical Information System **AGIS** is an advanced, software driven instrumentation specifically designed for mobile aerial or ground geophysical survey work. The AGIS is a fully integrated survey system incorporating the state of the art MMS4 Magnetometer processor with/without compensation, GRS410 Gamma Spectrometer, advanced Satellite (GPS) navigation, real-time flight path information that can be displayed over a map image (BMP format) of the area, and a reliable data acquisition software package. As a result of its simple interfacing, additional intelligent sensors can be easily integrated into the system. Automatic synchronization to the GPS position and time provides very close correlation between data and geographical position. The AGIS is equipped with a sophisticated software suite allowing easy maintenance and upgrades.

Notes:

This manual describes AGIS all software versions but is predicated towards version 03-01.1 and higher. Screen images may differ slightly between versions due to custom variations required by some users.

From the introduction of AGIS software version 01-10.2, the recorded data time lag is corrected by one second. Real time data display is not modified.

Pico Envirotec Inc. (PEI) will make every effort to keep the manual up to date with the software advancements. It would be appreciated if any discrepancies or disagreements that are found in the documentation by our users, between the manual and real operation would be reported to the manufacturer.

1.3 Manual Conventions

This manual contains certain type conventions that identify specific actions and/or features.

Convention	Meaning
<>	Represents Keyboard or Touch screen entry.
EDITING PARAMETERS	To start editing press <ENT> then position the highlighted area to the position to be edited and press <ENT>. There are several options of editing implemented. • Available options will automatically appear on each next <ENT> • Available parameter limits are shown in the second row and the value or text must be entered. It has to be terminated by <ENT>. • White highlighting means that no editing is possible • Brown highlighting means that the parameter must be at first unlocked by <#>. It is strongly recommended to lock it back by <#>.
SMALL CAPITALS	Small capitals are used to identify Pico Envirotec Inc. file names, file extensions and directories.
VERSION	Version consists of "YY-MM.V" where YY are last two digits of the year (00.99), MM is the month (1.12) and V is the consecutive modification in the month.

1.4 BACKUP SYSTEM SOFTWARE COMPACT DISK (CD)

Pico Envirotec supplies a compact disk (CD) with each system that contains a copy of all the software and manuals / documentation originally supplied with / for the AGIS or IRIS system. This CD can be used to re-install the operating system and AGIS / IRIS software suite in the event of a hardware failure or to upgrade the software when new software releases are available.

IT SHOULD BE NOTED THAT FILES EXTRACTED FROM A COMPACT DISK ARE "READ ONLY" . THIS MEANS THE CONTENTS OF ANY FILE CANNOT BE CHANGED BY NORMAL DOS OPERATING SYSTEM FILE SAVE FUNCTIONS. WHEN ANY FILE IS COPIED FROM THE COMPACT DISK AND PLACED ON THE INTERNAL HARD DISK OF THE DATA SYSTEM THE USER SHOULD ENSURE THE FILE ATTRIBUTES ARE CHANGED FROM READ ONLY TO ARCHIVE.

2.0 SURVEY MODE

The AGIS provides great flexibility in survey applications. It can be used to guide the aircraft on a pre-defined flight plan designed to ensure comprehensive coverage of the target area. Grids can be generated in UTM or Latitude/Longitude coordinates.

2.1.1 Survey planning

The pre-defined flight plan can be designed prior to the start of the project, or can be designed/altered during the flight. The area of interest can be delineated 'on-the-fly' e.g. while in the air flying the boundary and entering corner coordinates. Survey area corner coordinates, maps, flight line direction, separation must be entered. The altitude, altitude source and ground speed with tolerances are entered into the system. These features provide versatility of the AGIS, enabling it to produce instant, effective and detailed results.

2.1.2 Replay Mode (implemented as part of PEI Convert)

There is a Post Flight Replay program used to display selected data along the flight-path right after the termination of the survey flight. It serves for instant QC of the aircraft flight-path and the altitude. This program is a windows based program.

During data acquisition a file is generated along with the geophysical data that carries the letter F (for flight path) as its leading character. It contains all the flight path information acquired for that particular project. In other words, each successive flight will have its position data appended to this file. This file can then be imported into the PEI Convert program supplied with the data system and can be displayed over the pre-planed AREA.XYZ file for the project. Details of this procedure are provided in the PEI Convert manual.

2.2 NAVIGATION

The AGIS provides highly accurate navigation information, based on the satellite Global Positioning System (GPS). Various makes and models of GPS receivers are supported. A GPS receiver accepting real-time differential corrections will provide positional accuracy of approximately 2 to 3 meters. The AGIS relates all collected data to the instant position from the GPS receiver and overlays real-time data over the map of the area. For more accurate position determination RAW data from the GPS can be recorded and used for post-flight differential position processing. Post flight differential corrections require a stationary set of positional raw data - called "Base station raw data". Additional software is required to process these data sets.

2.3 GEOGRAPHICAL DATA BASE – MAPS

There are two basic coordinate systems used with the AGIS. UTM and ADRG. In the UTM system all distances and calculations are done in **meters** or **feet**. In the ADRG system the calculation are based on a unit called **"au"** (angular unit representing 0.025 seconds of angular measurement). This unit is closely related to 1 meter in normally flown areas, therefore it does not distort badly the visual images. (1kau = 1000 au).

2.4 MAGNETOMETER

The AGIS uses the MMS4 Magnetometer. The MMS4 Magnetometer is designed for high resolution (0.001 nt), high sample rates of up to 100Hz, and will accommodate up to four cesium, potassium, or helium sensors. The MMS4 Magnetometer is equipped with minimum eight channels of analog inputs.

2.4.1 Magnetic Compensation

New, advanced non-directional algorithm for either post mission magnetic compensation of aircraft maneuvers or real time corrections is available with the MMS4 Magnetometer.

2.5 GAMMA RAY SPECTROMETER

The AGIS uses the GRS410 Gamma Ray Spectrometer system (maximum 10 crystal detectors) or the GRS 416 Gamma Ray Spectrometer system (maximum 16 crystal detectors), to provide real-time information on levels of radiation. The GRS410 is designed for moving vehicles (airborne and ground) to measure radiation levels of the ground surface. It uses NaI (Tl) detectors with fully automated detector control and does not require implanted sources in the detector array for spectrum stabilization (see GRS410 manual).

The performance and proper functioning of the GRS410 Gamma Spectrometer is verified and tested by the Calibration and Verification program **AGISCA10** or **PEICALIB**.

Other types of Gamma Ray Spectrometer may be integrated with the system.

2.5.1 Gamma Detector

The recommended AGIS Gamma detector consists of two boxes each containing two 101x101x406mm (4x4x16inch) NaI (Tl) crystals. Other detector packages may be used – consult manufacturer. Maximum number of detectors is 40.

2.6 OTHER SENSORS

A variety of additional geophysical systems may be integrated into the AGIS package. EM systems, Laser altimeters and other sensors working with the serial communication protocol can be connected to the AGIS. Operation of these sensors is described in their specific operation manual.

2.7 REAL TIME DATA PRESENTATION

The AGIS displays flight path and geophysical data as it is recorded aiding the data quality control and real time navigation guidance. User selected data is displayed as a color flight path over the displayed geographical map.

2.8 DATA ACQUISITION

The AGIS program provides a multi-function system that is used to control data acquisition, display, and navigation / flight control. A special Pilot Guidance Unit (PGU) is available to provide the pilot with necessary steering information. Acquired data is stored in a compressed binary data format that can be written to several storage media. Positional information, timing and data are stored in up to three different data files.

Flight-path-data file is stored all the time and cannot be turned off by the operator. It contains position, timing, altitude and it may still contain some of the selected data.

Data file contains all above plus all enabled data. Operator controls when data is recorded.

Raw-data (GPS) file, when enabled and supported by the GPS receiver in use, contains data necessary for post-flight position correction.

The AGIS data acquisition software performs a number of complex mathematical calculations in real time but the data collection and storage takes the highest priority.

2.9 FLIGHT PATH VIDEO RECORD

The AGIS may be equipped with the video recording option. This option provides the user with the direct data-ground surface relation. Video record is annotated with navigational and some additional information.

2.10 DATA RETRIEVAL

Collected data can be retrieved from the storage media (hard or flash disk) via PCMCIA port using a removable data storage media such as flash disk, hard disk, etc.

Standard copying procedures from the operating system are used. Retrieved data should be safely stored and verified for integrity before the original data in the AGIS Console is deleted.

Retrieved data conversion into ASCII or Geosoft GBN files is provided via PEIView program **version 01-09.1 or higher**.

2.11 INTERFACING

Except for the Radar Altimeter fluxgate magnetometer, and barometric altimeter all sensors and devices are interfaced to the AGIS via RS232 serial communication link allowing for simple sensor exchange and easy upgrades. Radar Altimeter output is connected to the analog input of the MMS4 Magnetometer or GRS410 Concentrator. Altitude control is selectable in the AGIS parameters.

3.0 AGIS PROGRAM INSTALLATION

3.1 INSTALLATION

The AGIS system comes with installed AGIS and all other supporting executable programs. A backup programs copy is supplied on *Backup AGIS CD*. This CD includes this manual as well.

3.2 OPERATING SYSTEM

Based on recommendations not to use Windows as an operating system used in an aircraft, a reliable expanded 32bit system has been used. It provides excellent stability, recoverability and short and easy restart in case of a power failure. All recorded data is protected from a potential loss during power failure to a maximum of the last ten seconds of collected data. Fast and safe program restart does not “consume” expensive flying time of the aircraft.

3.3 FILE ALLOCATION

The disk must contain the appropriate files in the AGIS directory (IRIS or other).

DIRECTORY (AGIS)	**Files**
\IRIS (SEE NOTE 1)	AD32TEST.EXE ADP32.SCL ADP32.TXT ADSET.TXT AGIS.BAT AERA.XYZ ASYNCALL.EXE CWSDPMI.EXE GRSCA10.EXE * GRSCA16.EXE * IRIS.COL IRIS.EXE IRIS.HLP IRIS.INT IRIS.USR LICENSE.DAT MMS4.INP MMS4.TXT MMS4PROC.EXE MM4TEST.EXE PEILOADM.EXE PEILOADS.EXE PERMIT.DAT TRIP.CHR SL.XYZ TL.XYZ RS232TST.EXE TSENVCAL.EXE TS.CAL TSENVCAL.INI
\IRIS\LASTPR	P_IRIS.LST PYMMDDHH.PRJ*
\IRIS\MAPS	MAPDEFLT.BMP
\IRIS\PAR	IRIS.EXE IRIS.INT IRIS.PAR IRIS.USR

	IRIS.VER OPD1.PD1 PARAM.PRM
\IRIS\SURV\PYMMDDSX	PYMMDDSX.BMX PYMMDDSX.BSX PYMMDDSX.FLP PYMMDDSX.HDW P PYMMDDSX.INF PYMMDDSX.MG1 PYMMDDSX.MG2 PYMMDDSX.NV1 PYMMDDSX.PD1 PYMMDDSX.SP1 PYMMDDSX.SP2 PYMMDDSX.SPT PYMMDDSX.SPX
\IRIS\PYMMDDSX\DATA	BL.XYZ FYMMDDHH.P00 SL.XYZ TL.XYZ NOTE: SURVEY DATA FILES WILL ALSO BE STORED HERE

*note:

1. UPON INITIAL INSTALLATION OF THE SOFTWARE ONLY THOSE FILES IN THE C:\IRIS DIRECTORY NEED BE PRESENT. WHEN THE AGIS SOFTWARE IS RUN, THE REMAINING SUB-DIRECTORORIES AND FILES WILL BE CREATED AUTOMATICALLY
2. FILES MARKED WITH * WILL ONLY BE REQUIRED IF A GRS-410 SPECTROMETER IS USE
3. **PYMMDDHH** indicates project name, automatically generated, with extension indicating type of the project where Y=year, MM=month, DD=day, HH=hour. For unique name generation, if more than one project is defined within one hour last digit of hour is changed from a digit (0 to 9) to a character (A to z).

PRJ = Survey Mode

Table 2.1 AGIS Directory Structure

The **IRIS** directory or other name main directory must be created. All listed files in this directory must be loaded. All subdirectories are automatically created as well as the listed files except the AGIS.HLP file. The AGIS.HLP file is an ASCII file and may be re-written in different languages.

\IRIS\MAPS directory should contain all geographical images used in the intended area of flying. Geographical images are created in a different way either from scanned maps with calibration coordinates entered via **PEICONV** program or direct conversion of digital maps.

P_IRIS.LST file contains the name of the last project. Once a project is initiated it is placed in the P_IRIS.LST file and a reference file with essential parameters describing the project is created.

Example:

P_IRIS.LST contains project name P00510S1.PRJ that refers to the P00510S1.PRJ file in the same directory containing list of map images *.BMP used in this project. At same time the PRJ extension indicates that the Survey type of operation was selected. New subdirectory **\IRIS\SURV\P00510S1** is created. This subdirectory contains all definitions (settings) of individual peripheral devices for the selected project.

The **\IRIS\SURVEY\P00510S1** will contain files:

P00510S1.BMX	Description of the area and coordinate system
P00510S1.BSX	Description of flight lines
P00510S1.HDW	Description of used hardware connected to the AGIS
P00510S1.NV1	Flight settings and tolerances
P00510S1.SPT	Gamma Spectrometer window, energy, resolution settings
P00510S1.UEM	EM settings
P00510S1.MG1	Magnetometer 1settings
P00510S1.MG2	Magnetometer 2settings
P00510S1.WPT	List of waypoints

Additional subdirectory \AGIS\SURVEY\P00510S1\DATA is created to store the acquired data in.

```
Note: P00510S1 means:
       |||||||_   10:00 hours (24 hour clock)
       ||||||__   survey type
       ||||____   day(10th)
       ||______   month(05th)
       |_______   year(2000)
```

3.4 TOUCH SCREEN

Touch screen parameters:

Touch screen type

Touch screen Com Port

Touch screen interrupt

Touch screen Baud rate

are preset in the TS.INI file for a different type of touch screen controller.

IRISTS.EXE program is designed to calibrate and select proper programs via touch screen.

This program generates TS.CAL file that is used by PEI programs to activate touch screen.

During the AGIS operation a circle in the upper left (inside the airplane silhouette) or right (during initiation) part of the display is shown. If an improper place is touched a yellow, expanding circle is shown. For a good touch a red circle is shown. There is no action if the touch is not detected in active areas of the screen (buttons, etc.).

4.0 AGIS PROGRAM INITIALIZATION

The AGIS program is normally operated from a touch screen. Refer to the description of the touch screen control program AGISTS. Program will test the availability of the Touch Screen control and indicate it as well as measure the system speed. It is not recommended to run the AGIS program on system with the relative speed under 0.6.

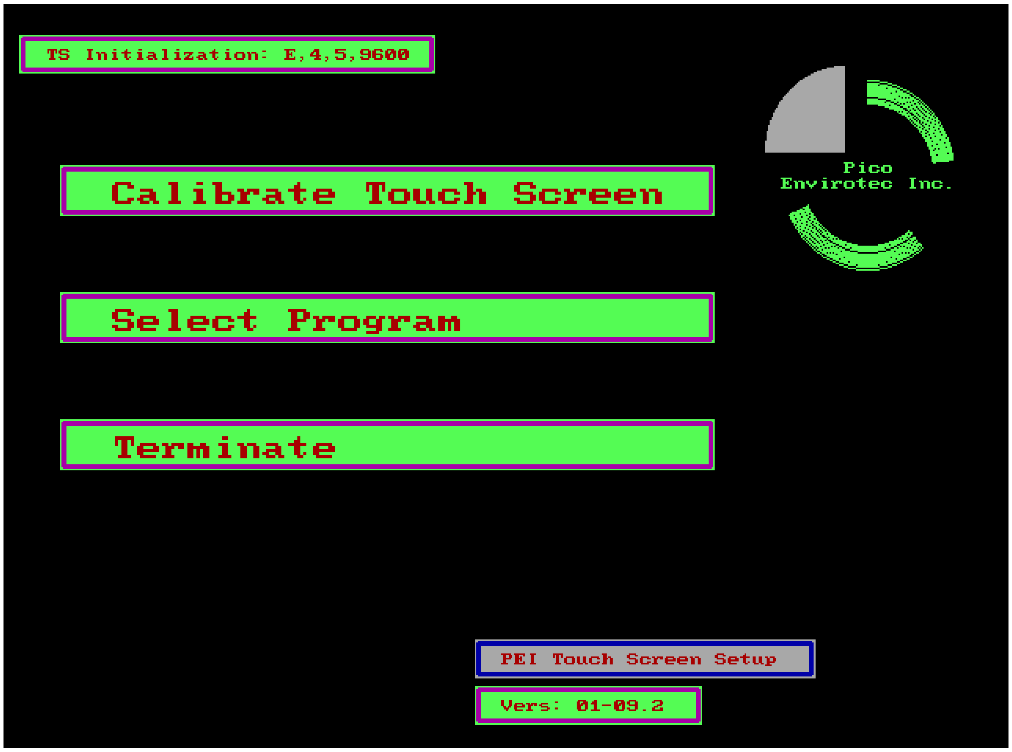


Fig 1 Opening Screen for AGIS program

The above screen depicts the opening screen for the AGIS program. The user is presented with three options

Calibrate Touch Screen
Select Program
Terminate

4.1 TOUCH SCREEN CALIBRATION

If the version of AGIS that you have purchased is equipped with a touch screen, before it can be used the screen must be calibrated. Pressing C on the keyboard (from the opening screen shown in figure 1) will take the user to the calibration screen. Follow the instructions displayed on the screen. The user should be aware there is a parallax issue due to the placement of the LCD display behind the touch screen. The touch screen should be calibrated after the AGIS console is positioned in the aircraft.

The calibration screen will resemble the picture below:

Fig2: Touch screen calibration

After completion of the calibration the user is taken to the program selection screen automatically.

<u>4.2 SELECT PROGRAM</u>:

Once the touch screen is calibrated the user has the option of making further selections by touching the screen in designated areas or by using the external keyboard. It is recommended the initial system setup and calibrations be done with the keyboard. This will allow the setup procedure to be completed quickly. Once the setup is completed and during survey flights the touch screen may be preferred for operator input and control.

Pressing the **S** key on the keyboard or tapping the screen on the Select Program bar will take the user to the program selection screen

<u>4.3 TERMINATE</u>

Pressing **T** on the keyboard or tapping the TERMINATE bar on the touch screen will cause the AGIS software to exit and enter the DOS command prompt mode.

The screen will display

C:\IRIS> and a flashing curser.

To re-start the AGIS software from this point enter (type) ***AGIS*** from the keyboard and press the enter key

5.0 PROGRAM SELECTION

As seen below the select program screen presents the user with the choices of installed software that may be executed on their particular system. The choices may vary slightly depending on the system configuration but will resemble those shown below:

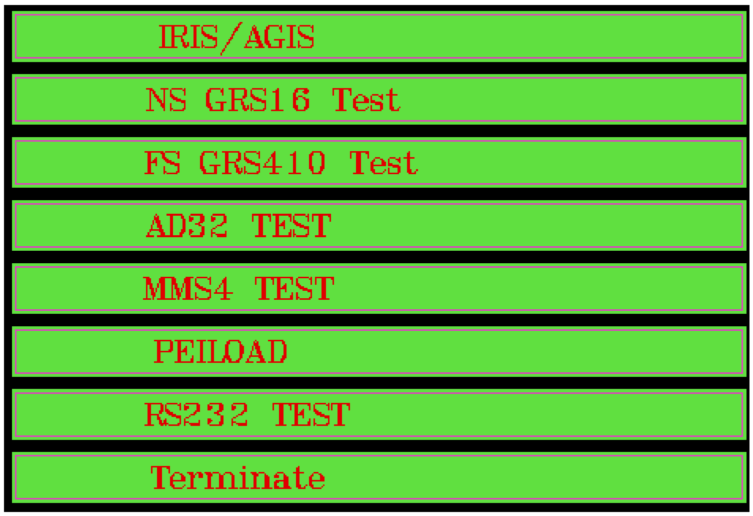


Fig 3: Select Program Screen

The user may select any of the program options either by tapping the touch screen on the program option of choice or by typing the first letter of the desired program option on the keyboard. For example, if the MMS-4 TEST program is selected then either tap the touch screen anywhere on he MMS-4 TEST green bar or simply press the **M** key on the keyboard.

IN the AGIS system there are currently seven selections available for program options as shown above in Fig 3. The following sections will describe the procedures for the set up and operation of each of the program modules.

5.1 IRIS / AGIS PROGRAM INITIALIZATION

AGIS / IRIS is the main survey data acquisition module. Pressing **I** on the keyboard or tapping the touch screen anywhere on the green bar containing the IRIS \ AGIS text will initiate the AGIS software . The user will be presented with additional screens to guide them through the AGIS software suite. These screens and options are discussed in detail in Section 6.0

5.2 MMS-4 TEST SOFTWARE

The MMS-4 magnetometer processor is a stand alone PC-104 based unit capable of processing data from up to 4 magnetometer sensors at data rates of up to 100 Hz. Signal de-coupling, power control, and anti-aliasing filtering is supported.

The module also includes data ports for (RS-232) a wide variety of GPS receivers at data rates of up to 10 Hz. An 8 channel 16 bit Analog to Digital (A/D) board is included to allow data acquisition from analog peripheral devices such as fluxgate magnetometers, radar and barometric altimeters, temperature and humidity sensors.

The MMs-4 test software allows the user to view the magnetometer outputs graphically, change sampling rates and view the data from the analog channels in real time. This software is discussed in detail in MMS-4 User manual

5.3 GRS 410 CALIBRATION:

If the AGIS system has been configured with the optional GRS 410 spectrometer package, Pico Envirotec provides a suite of software for calibrating and monitoring the performance of the crystal detector packages. The suite includes peak monitoring, peak adjustment, monitoring of individual and groups of spectra, and regions of interest . For more detailed information and use of this system please refer to the GRS-410 Users manual.

5.4 PEILOAD

PEOLOADM is s remote software loading program. Hardware modules that are microprocessor controlled but have no video monitor or keyboard still require software to be loaded into them in order to operate. The PEILOADM program allows the user to load programs in these modules (such as the MMS-4 processor) via the serial ports. For details on use of this software please refer to section 15 in this manual.

5.5 GRS416 TEST

If the AGIS system has been configured with the optional GRS 416 spectrometer package, Pico Envirotec provides a suite of software for calibrating and monitoring the performance of the crystal detector packages. The suite includes peak monitoring, peak adjustment, monitoring of individual and groups of spectra, and regions of interest . For more detailed information and use of this system please refer to the GRS-416 Users manual.

5.5 RS232 TEST

The AGIS / IRIS system has 10 RS-232 serial ports available for use. Typically several of these ports are dedicated for specific instruments such as the touch screen, magnetometer data and GPS data. The remainder of the ports are available for additional sensors such as spectrometers, altimeters, temperature and humidity probes, etc. The RS232 test program allows the user to view the data either being received or sent on any of the ports active on the system. The user may select any port, define the port configuration and baud rates, and may even record incoming data to a text file.

5.6 AD32 TEST

PEI has developed a high speed (100 HZ sampling rate) high resolution 32 channel analog input module for recording precision analog data. The AD32 test program allows the user to display the analog data from this module graphically, set scales and sample rates, so as to determine the quality of the data.

6.0 AGIS SOFTWARE SUITE

Selecting the AGIS / IRIS option from the Program selection screen will take the user to the window shown below.

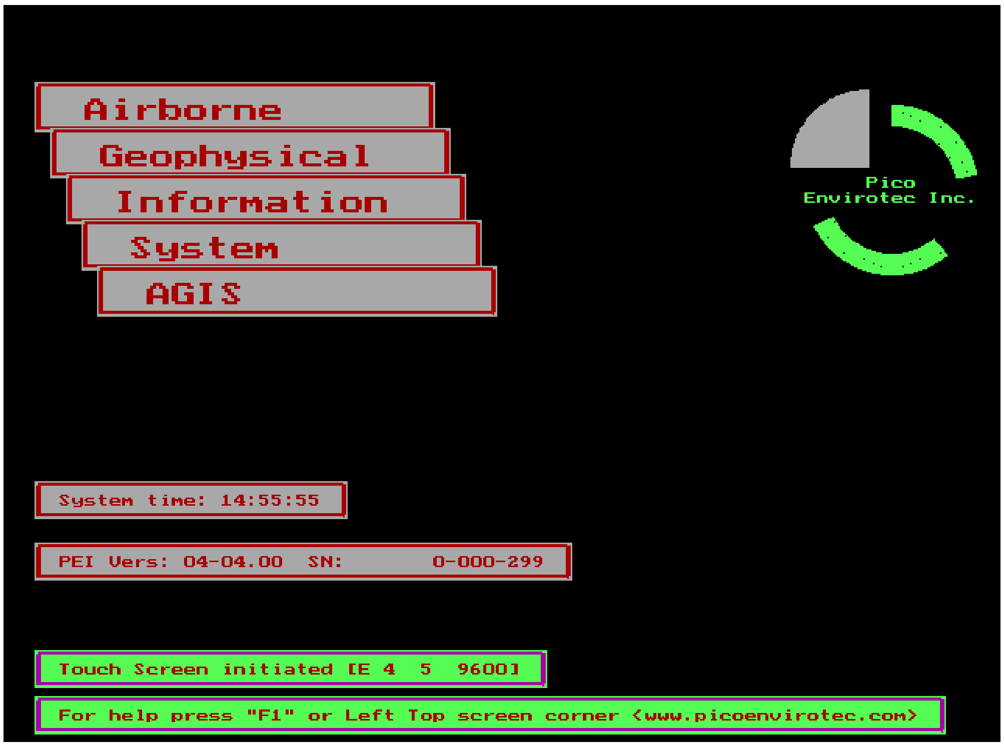


Fig 4: program version screen

The user is presented with the current version / release and serial number of the AGIS software, the current time from the COMPUTER SYSTEM clock (this may not be the same as local time or GPS time depending on how the system clock has been set by the user).The user is informed if the touch screen (if available) is active and the system also performs a system speed test. The speed test should return a value in the range of 1.7 to 1.99 depending on the installed micro processor. Any value less than 0.99 indicates a problem with the AGIS computer. The AGIS software probably will not function with a CPU speed index of less than 1

The initialization screen is displayed for approximately 15 seconds then switches to the options selection screen

The user is presented with a number of options to select from:

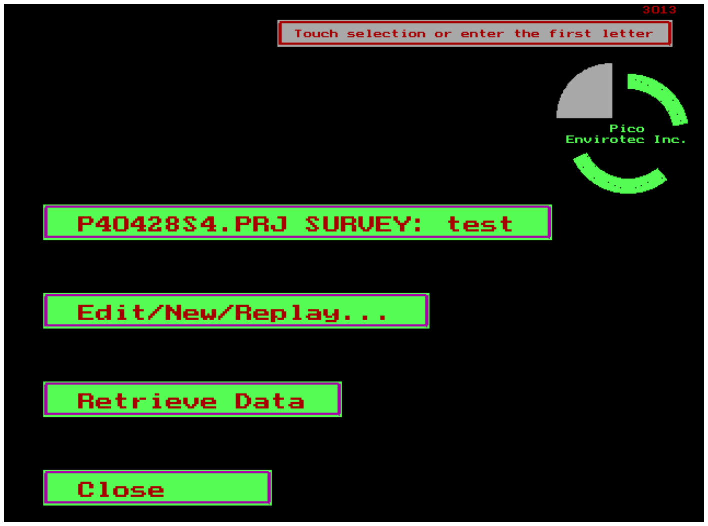


Fig 5: AGIS program options

LAST / CURRENT PROJECT:

The last project configuration used to collect data on the system is indicated on the first highlighted line. Touching this line or entering the <**P**> character on the keyboard will set the program to load parameters and maps associated with this project and go into Fast Track Operation (Section 3.1).

Edit / New / Replay

Touching the second line or entering <**E**> via keyboard sends the program into System Options. This software suite allows the user to select another project, edit the parameters of the current project, or create a new project file. This software suite is described in detail in Section 8

.

RETRIEVE DATA:

The third line, "Retrieve Data" allows the user to transcribe data from the AGIS main storage media onto the removable storage media. Touching the third line or entering <**R**> via keyboard sends the program into Retrieve data option. This software suite is described in detail in Section 3.3

CLOSE:

To return to the startup screen, touch "Close" or enter <**C**.

6.1 QUICK START OPERATION

Once a project has been set up a "fast track" initialization of the AGIS is used. This is done by selecting The PROJECT FILE NAME from the AGIS software suite. It takes the user quickly to the real time navigation, data collection and system control. All essential parameters for the project would have already been selected during the Project Setup procedure. See section 8.

6.1.1 FLIGHT NUMBER ENTRY

The first screen appearing in the Fast Track selection allows the user to enter the mission / flight number, the operators and clients name, and allows the user to set the hours in the clock to be used for the survey. The minutes and seconds are automatically set. The hours may be selected as either local time or GPS time. Figure 5 shows an example of this screen:

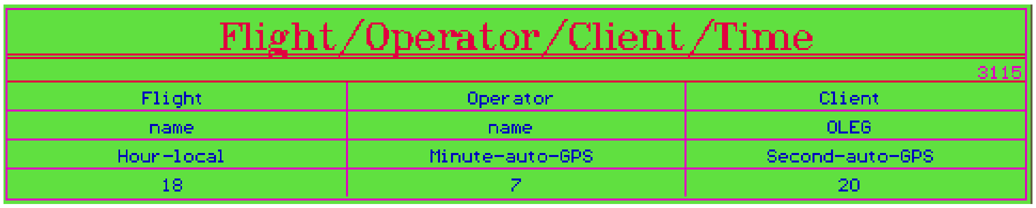


Fig 6: Enter flight number, names and time

Fig 7: flight number selection

Fig 8: set hours

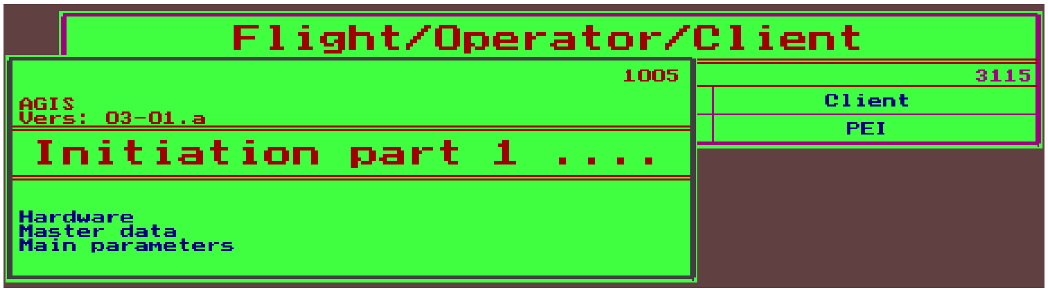
To change any of the five parameters (flight number, operator name, client name, hours source, or hours) press the enter key on the keyboard (if present) or tap the enter button on the lower right of the touch screen keypad. The parameter window will change to highlighted blue. Use the left or right arrow keys to choose the parameter to be modified. Pressing the <Enter> key will allow entering new parameter information. Enter the desired information and press <Enter> again. The newly entered information will appear in the selected window. Repeat this operation as required for the remaining options. Pressing the <End> key on either the keyboard or the touch screen will move the user to the next series of screens.

6.1.2 AUTOMATIC SYSTEM AND PARAMETER CHECKS

These next screens are auto sequenced and will show the user all the pre-selected parameters for each installed sensor. The duration of displaying of each parameter window is preset to one second but it may be changed (see Parameter adjustments Section 8.1.2)

The screens displayed here may vary slightly depending on the devices attached to the system and the revision of the AGIS software used

Fig 9:



Checking Main parameters

Fig10: Checking survey and Tie line validity

Fig 11: Checking area corners, waypoints and final parameters

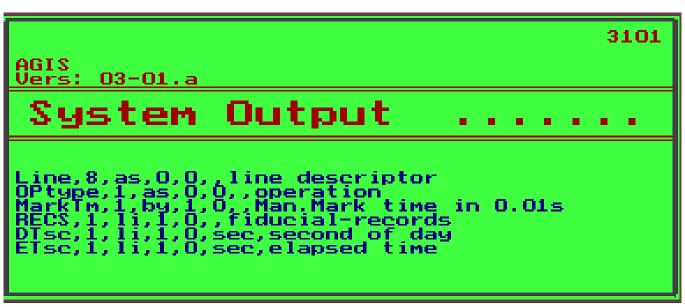


Fig 12: Verify system outputs

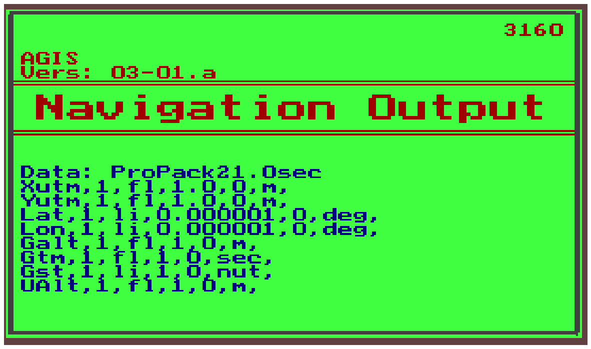


Fig 13: Verify Navigation parameters and GPS type

If a spectrometer system has been enabled in the project set up but has not been connected, turned on, or has not yet finished its boot cycle the system will warn the user the spectrometer has not been detected. The user is given the option of having the AGIS try and detect the spectrometer once more by entering a **Y** from the keyboard. If the user chooses to ignore the availability of the spectrometer they may press **N** on the keyboard. If the user selects **No** a warning message (as shown below) will indicate the spectrometer concentrator has not been detected and the system will automatically switch to simulation mode for the spectrometer.

Figure 14: detect spectrometer again

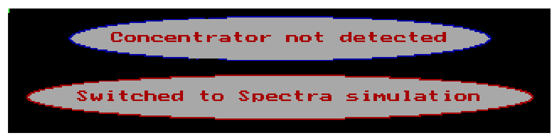


Figure 14A spectrometer simulation warning

Once the system has warned the user the spectrometer will be generating simulated data only, the configuration screens for the spectrometer channels is displayed and verified. Depending on the type and configuration of the users spectrometer the screens displayed will be identical or at least similar to those shown below:

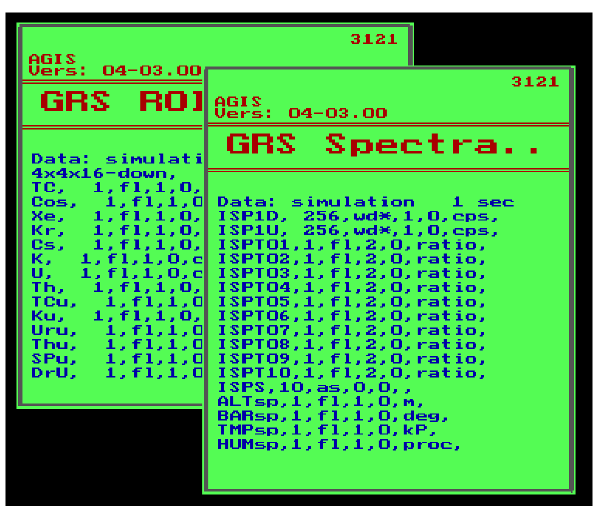


Figure 15: checking spectrometer settings

After verification of the spectrometer setup (if applicable) the program will proceed to check the status of the magnetometer processor in a similar fashion as the spectrometer.

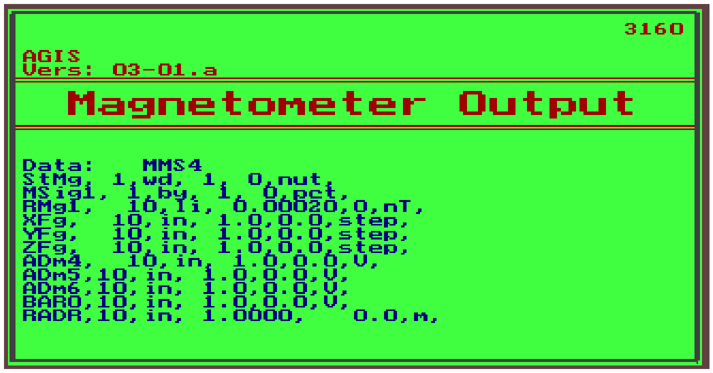


Fig 16: Verify magnetometer and analog channel configuration

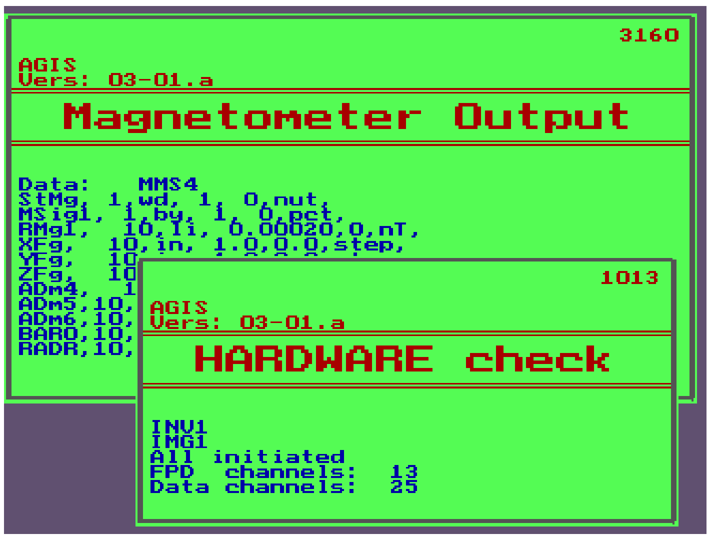


Fig 17: Verify operation of magnetometer and navigation systems

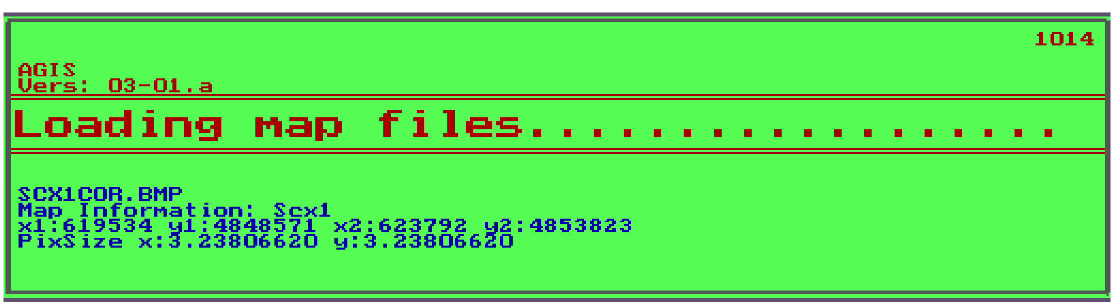


Fig 18: load map file overlay if available

If there is a geographical image available and selected, it will be loaded into the processor memory for fast access). X and Y are in UTM WGS-84 coordinates system.

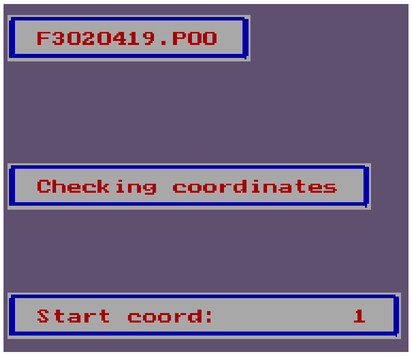


Fig 19: check project number line co-ordinates

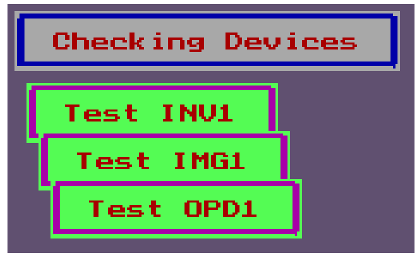


Fig 20: Test communication to all and system devices

6.1.3 SELECT FLIGHT LINE TYPES

The final screen in the sequence (Fig 18) allows the user to select which line pattern is to be flown during the course of the survey mission.

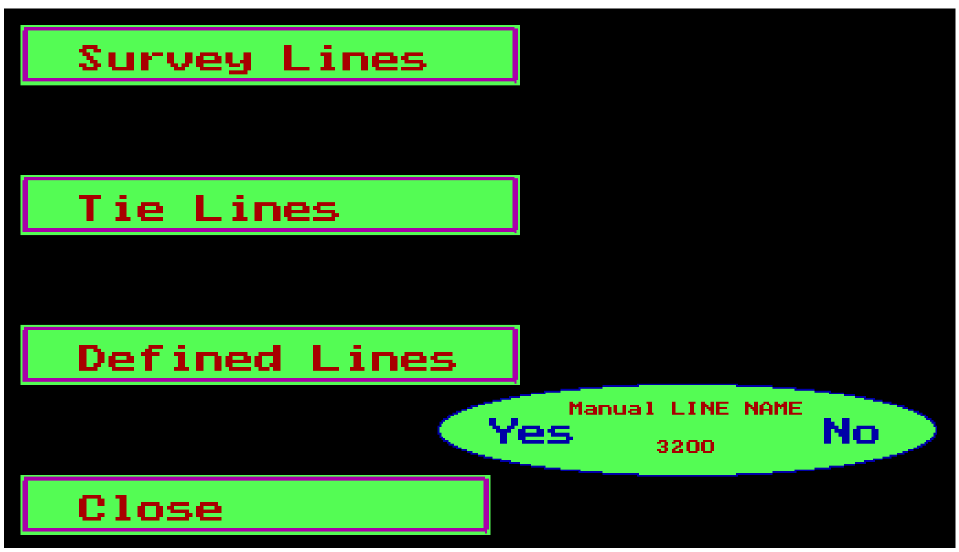


Fig 21: selection of line type to be flown

The user is currently provided with an escape to close the program should they wish to exit, three line options to select from, as well as selection of manual or automatic line numbering:

SURVEY LINES: This group of lines usually represents the majority of the flight lies for data acquisition.

TIE LINES: These lines are usually flown perpendicular (at 90 degrees offset) to the survey lines. Depending on the contract specification these tie lines may be up 10 times further apart than the survey line spacing.

DEFINED LINES: This is a special group of lines used primarily for calibration purposes. These lines include aircraft magnetic compensation, Cloverleaf (heading effect) flight pattern, specific calibration lines such as radar and barometric altimeter calibration. Spectrometer calibration and background test lines, and navigation verification test lines. This software suite is still under development as of this software release.

6.1.4 MANUAL / AUTOMATIC LINE NUMBERING

After selection of the survey line type the user is given the option of having the line numbers selected automatically from the area file or manually selecting or naming a line. The user is presented with a screen as shown in figure 18 above asking for confirmation of manual line numbering selection:

If the user selects **No** the AGIS system will all only the standard line numbers as defined by he AERA.XYZ area file. If the user selects **Yes** then line names of up to 8 alpha/ numeric characters can be chosen for any flight line.

In addition, in manual mode the user may specify line number to include a decimal. This allows a specific flight line to be flown more than once but have a unique line number for each time it is flown. For example if the operator wishes to fly line 400 for a second time but needs to identify it as a unique line number then in manual mode he could enter a line number of 401 or 402 up to 409. This gives the user an opportunity to re-fly the line as many as 9 times. After entering the manual line number , pressing the line lock key on the screen or F10 on the keyboard will lock the line 400 for navigation purposes but enter the line number in the recorded data as line 40X where X is the incremental value between 0 and 9.

When in manual mode, selecting a defined line number will automatically set the navigation system to the line specified. This eliminates the requirement for scrolling through the entire survey area to set the desired locked line.

When the manual line numbering method is selected the user will be prompted to enter the line number immediately after pressing the **HOME** key to start recording.

```
No LL - New Line:
Special line must contain at least 1 character
```

Fig 22: Manual line name / number

The user may enter any combination of alpha characters and digits of up to 8 characters maximum.

```
No LL - New Line:   RADAR
Special line must contain at least 1 character
```

Fig 23: Alpha line number entered

The manually entered line name will be displayed automatically when the main survey screen is presented. See example below:

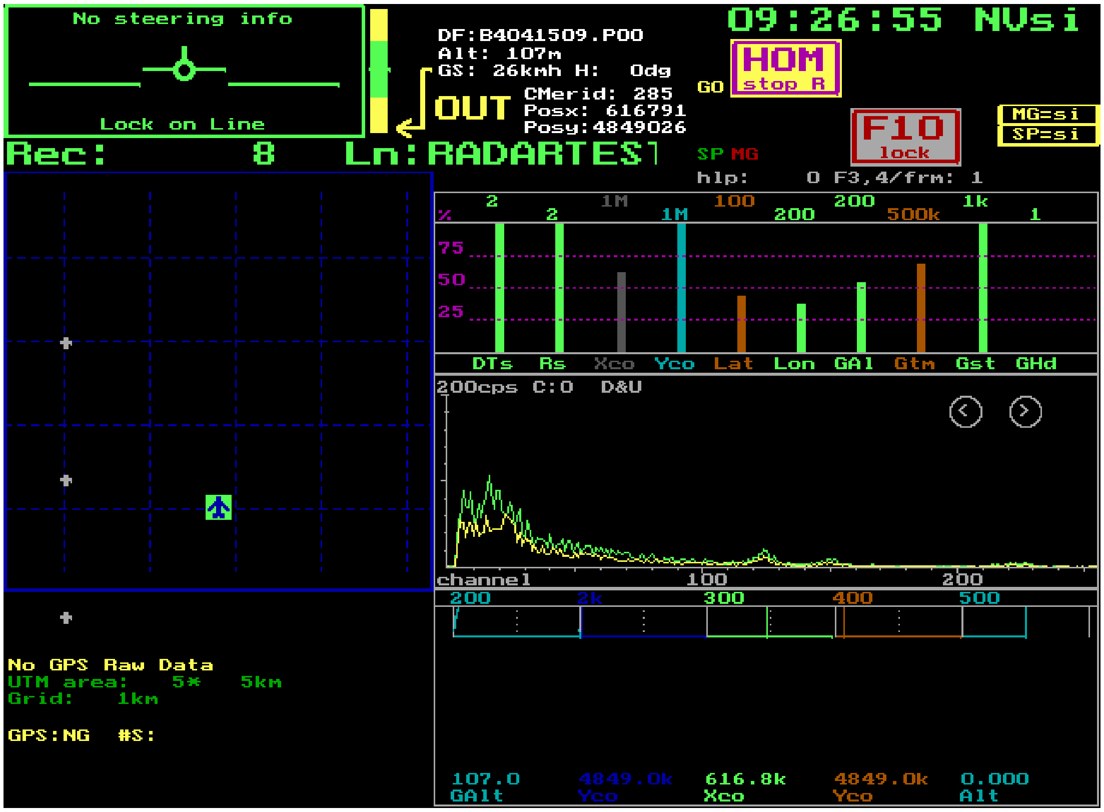


Fig 24: manual line number displayed

6.2 REAL TIME DATA ACQUISITION

Once the flight line type has been selected the AGIS system will move to the real time navigation and data display window. The user will be presented with graphical representations of the survey area, flight lines, navigation status, and sensor data. If the system is equipped with a gamma ray spectrometer spectra data may also be displayed.

The user should be aware that even though data is displayed on the screen no data is recorded and stored on the system until the operator initiates data logging. This is done by pressing the **<HOME>** key on the keyboard or by tapping the home key on the touch screen display. When data is recorded the home key will stop flashing and remain a solid yellow color. The record numbers will also increment. To stop recording data tap the home key on the touch screen or press the <HOME> key on the keyboard. Data logging will stop, all data files will be closed and the home key on the main display will start to flash.

For a description of the control buttons and their functions see Section 6.2

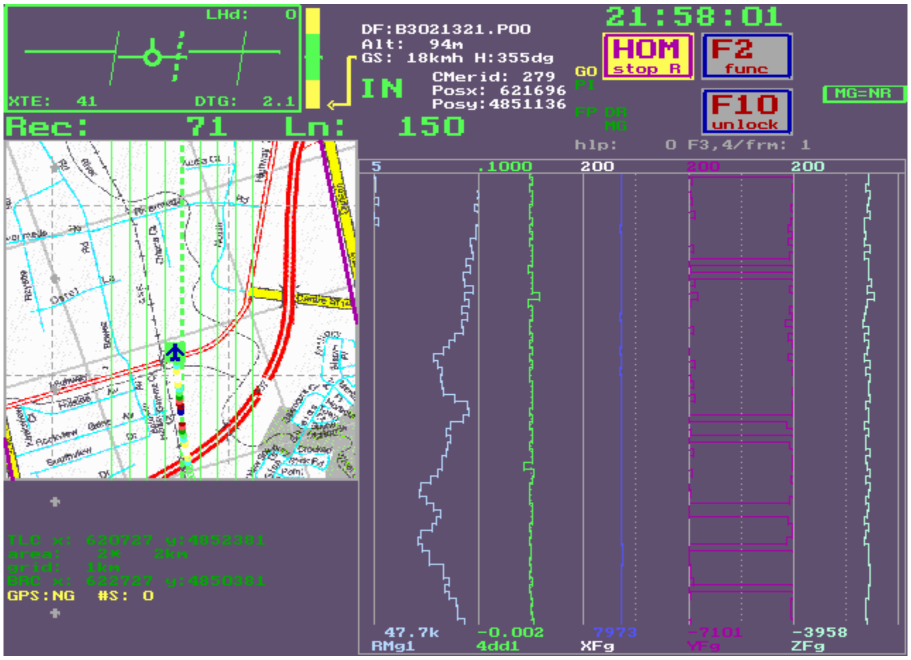


Fig 25: AGIS main screen set up for magnetics

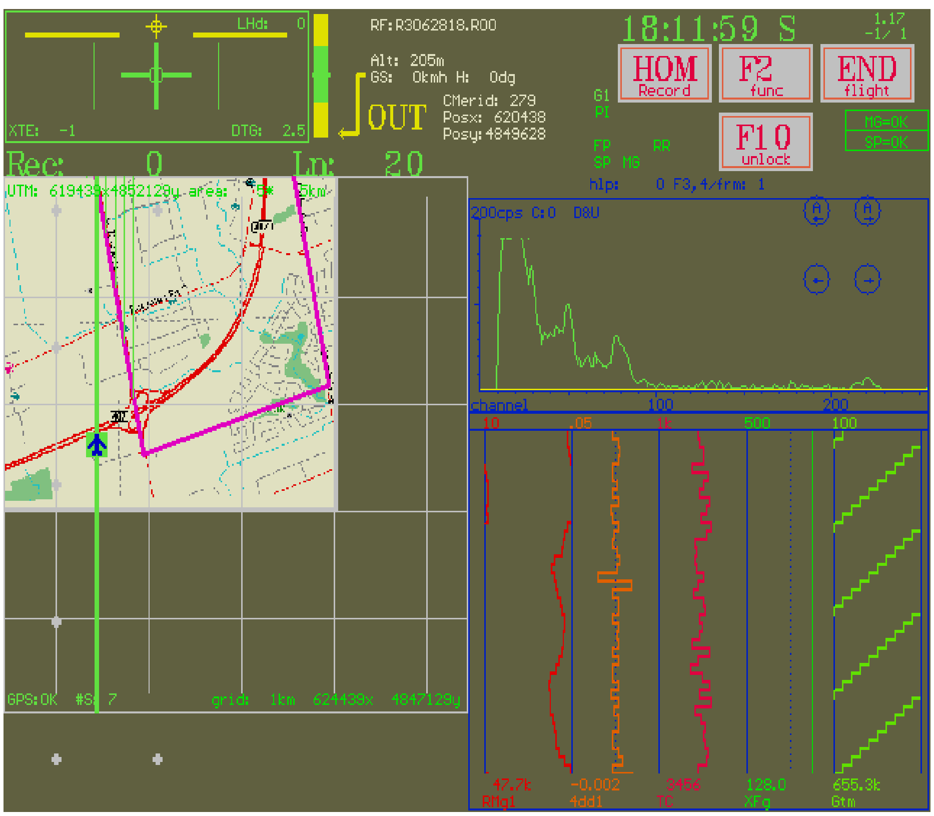


Fig 26 main screen view with spectrometer system info

6.3 CONTROLS AND INDICATORS:

FIG 27 Accessible control buttons ***scanning***

accessible control buttons during ***data recording***

The top right hand corner of the screen is dedicated to system control and function indicators. All controls can be executed either by touching the screen at the proper button position or by a keyboard entering the appropriate character a function key.

There are four system controls:

<F2(func)>	Allows a number of adjustments to the displayed data. Allows access to turn on waypoint mode navigation (see Main F2 adjustments section 7.0) This button will not be visible or accessible during data recording
<F10(func)>	Locks or unlocks the selected line in the navigation system of the AGIS. Allows the operator to scroll to the desired flight-line of the area grid. Navigation system will always lock to the closest flight-line by default
<HOM(record)>	This control function turns on complete data recording file system that stores all pre-selected data from individual sensors. **Flashing yellow Highlight color** is used to remind the operator that the flight-path data is **DISPLAYED ONLY**. Once data system data recording is enabled the color will change to constant green. If any sensor is in simulation mode or if any sensor stops operation the color of this button changes to yellow and stays yellow. Fiducial numbers will increment
<HOM(stop)>	meaning to stop full recording, Fiducial numbers will stop incrementing
<END(flight)>	Will only be visible if the system ***is not*** in data recording mode. When the end button is visible and pressed the Real Time Operating Mode will terminate and the program will exit to allow the operator to choose a different line type or to exit data acquisition completely.

6.4 NAVIGATION / OPERATION CONTROLS:

There are additional, partially hidden operation controls that will allow the user to change viewing parameters and navigation operations in real time. These controls are listed in the table below:

<**F1**> or Tapping the top left corner of screen These controls will remain visible for only 5	Displays 5 additional controls for the navigation system: <↑> increment line number (if line lock off) **<page up>** zoom out display of survey area and map **<insert>** display map underlay if available, pressing again removes

seconds	map underlay **<page dwn>** zoom in display of survey map and area <↓> decrement line number (if line lock off)
<L> or tap screen over position display	Automatically changes the display of the real time position from UTM to Lat / Lon or vice versa
<F3>	Allows the user to scroll up to any of the 8 available “analog chart displays”
<f4>	Allows the user to scroll down through any of the 8 available “analog chart displays”

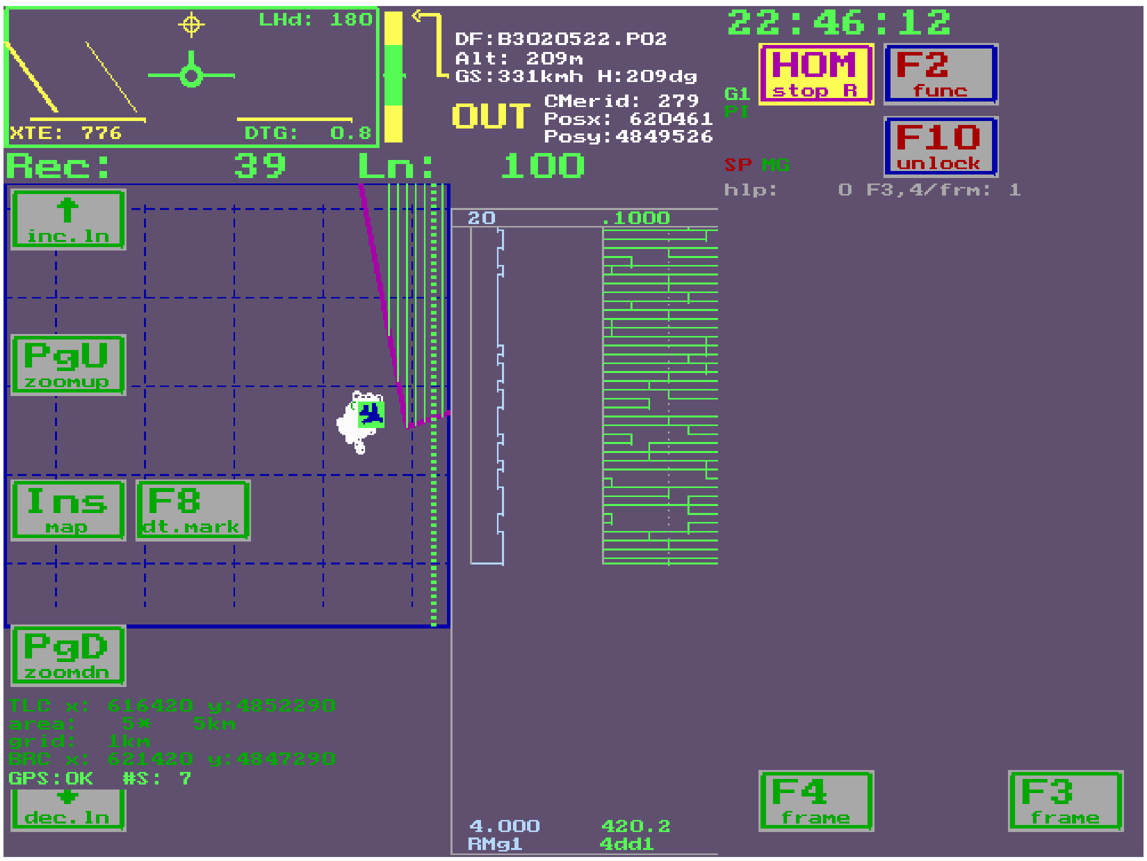


Fig 28: main screen showing normally hidden navigation and analog display controls

6.5 STATUS INDICATORS

Fig 29: status indicators

Flashing light-indicators (one or two character combination) indicate the operation of essential AGIS functions

FP	Flight Path Recording (red when recording)
DR	Data recording (when in recording mode – red when recording)
RW	Raw Navigation Data recording (when ON – red when recording)
PP	Synchronization to GPS pps (when applicable)
G AND 0,1,2	GPS data (0=yellow: no GPS data; 1=green: GPS data OK; 2=green GPS data OK with real time differential correction)
SP	Gamma Spectrometer: when red indicating data transfer
MG	Magnetometer: when red indicating data transfer
EM	Electromagnetic System: when red indicating data transfer
PI	Data transfer to the PGU
MAG=NO PPS	No 1PPS detected from GPS receiver
MAG=NC	Magnetometer not connected or no magnetometer data received or no PPS from GPS detected StMg channel in data file will have value of 0000000
MAG=NR	Magnetometer functioning but not ready, trying to sync to 1PPS StMg channel in data file will have value of 10000
MAG=OK	Magnetometer sync'd to 1 PPS StMg channel in data file will have value of 20000
MAG=si	Magnetometer in simulation mode
SPEC =si	Spectrometer in simulation mode
SPEC=OK	Spectrometer data received OK
ARINC=NC	Arinc enabled but not connected or detected
ARINC=NR	Arinc data detected but not decoded
ARINC=OK	Arinc data detected and decoded
NVsi	Navigation system in simulation mode, no GPS available or connected

6.6 SCREEN AREAS

The AGIS main screen is divided into regions. Each screen segment or region has been allocated a specific function. This allows the user to focus on specific areas of the screen depending on the requirements of the moment.

6.6.1 MAIN CONTROLS

The upper right area of the screen is reserved for the main control buttons governing starting and stopping data recording, line lock / unlock for the navigation system, calling the auxiliary functions and terminating the real time data acquisition mode of the AGIS software suite. The figure to the right indicates the buttons available.

Fig 30: Main screen Controls

6.6.2 REAL TIME POSITION

This section of the screen is located in the upper center of the screen and displays the real time position information as delivered by the GPS navigation system. The coordinates may be displayed in either UTM or Geodetic format (Lat / Lon). The coordinate display may be toggled by pressing <L> on the keyboard or tapping the touch screen over the coordinate display.

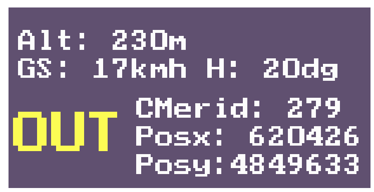


Fig 31: Real time Positions

6.6.3 PILOT INDICATOR

This display segment is located in the upper right hand corner of the screen. It depicts the relative position of the aircraft to the selected (locked) flight line. Interpretation of this graphic is explained in detail in Section 4.1

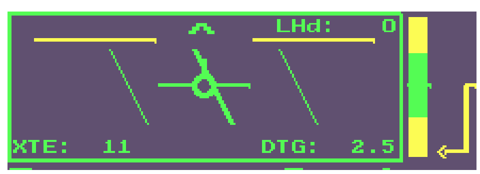


Fig 32: Pilot reference indicator

6.6.4 RECORD NUMBER / LINE NUMBER

Fig 33: Fiducial and Line number Display

Located directly below the pilot navigation graphic display is a presentation of the current record number (fiducial) and the current selected (locked) line. The record number increases at 1 second intervals **ONLY** while data is recorded to the storage media. This number serves as a data locator during data processing.

6.6.5 SURVEY GRID DISPLAY

In the left center of the screen a graphical representation of the survey area is shown. In this graphic the operator can see the relative position of the aircraft in relation to the survey area and the selected flight line. The locked flight line is depicted as a dashed green line The grid squares are defaulted to a 1 X 1 kilometer area. The grid squares size can be changed by pressing the <PAGE UP> or <PAGE DOWN> keys on the keyboard or by tapping the appropriate dot on the touch screen (see Fig 23) This screen is discussed in more detail in Section 4.2

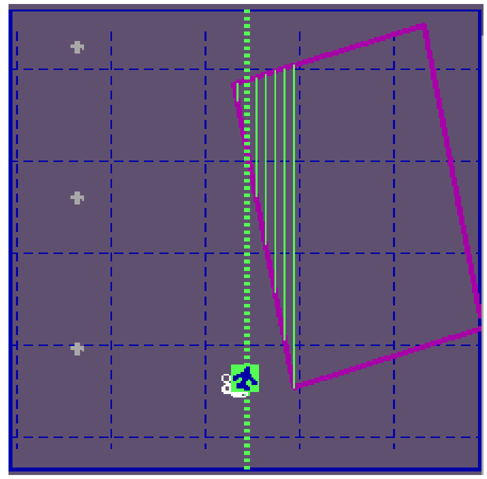


Fig 34: Survey Grid Display

6.6.6 MAP OVERLAY

If available the user may overlay a map image on the survey grid. This is accomplished by pressing the <INSERT> key on the keyboard key board or by tapping the appropriate dot on the touch screen (see Fig 23) This screen is discussed in more detail in Section 4.2 See also the PEIConvert program manual.

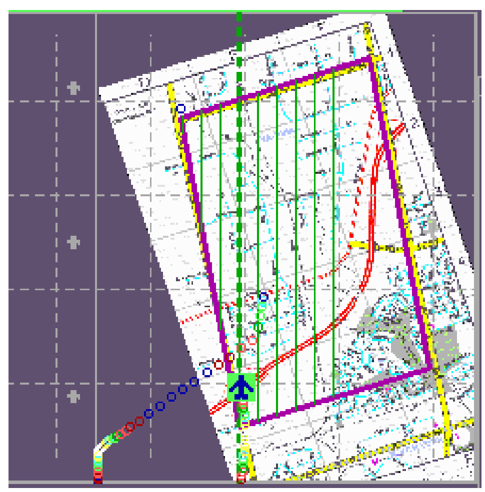


Fig 35: Survey Grid with Map Overlay

6.6.7. GRID POSITION & GPS STATUS

Located at the lower left hand corner of the screen is a navigation data display. The information included here includes information on status of the GPS data, number of visible satellites, the current size of the grid squares. Note that the "No raw GPS data " flag remains visible at all times unless GPS raw data recording is enabled and data is received from the receiver.

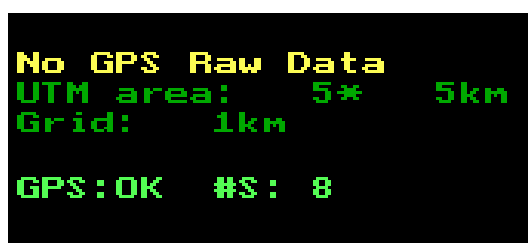


Fig 36: Grid Position & GPS status

6.6.8 ANALOG CHART DISPLAY

Located on the lower right quarter of the main screen are the analog chart displays. There area total of 8 user definable chart screens each capable of displaying up to 5 channels of information. The channel selection, scale and sensitivity are user definable (See section 4.5). The user may scroll through the 8 analog screens by pressing either <F3> or <F4> on the keyboard or by tapping the extreme lower right corner of the touch screen.

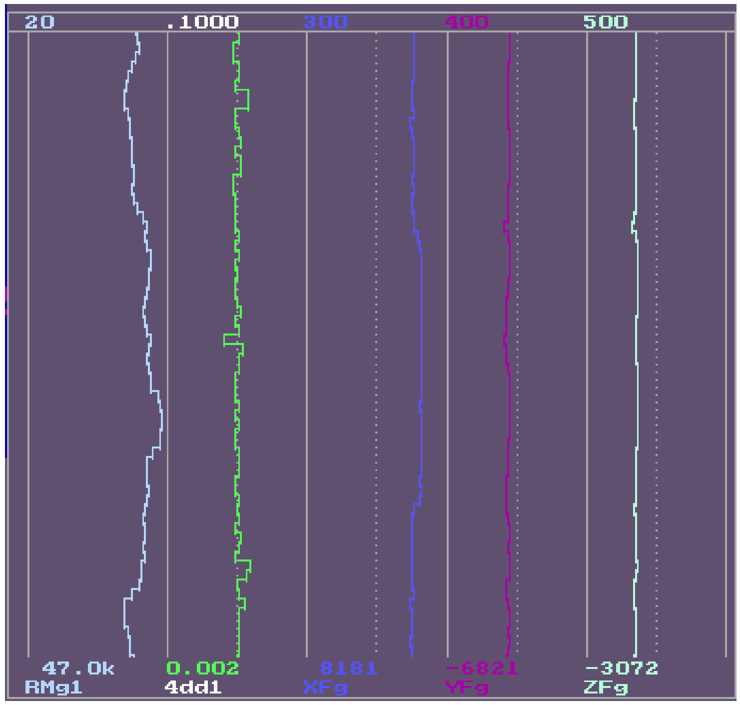


Fig 37: Real time Analog Chart Display

6.6.8.1 DISPLAY OF FULL NUMERICAL VALUES

Due to space limitations on the graphs the user will se the values for the readings on the charts are limited to 4 digits / characters. If the user wishes to see the full numerical value for the traces at any time, pressing the **F5** key on the keyboard will display the instant value for each trace. The numbers will remain visible on the screen but will scroll down and disappear after a short period of time.

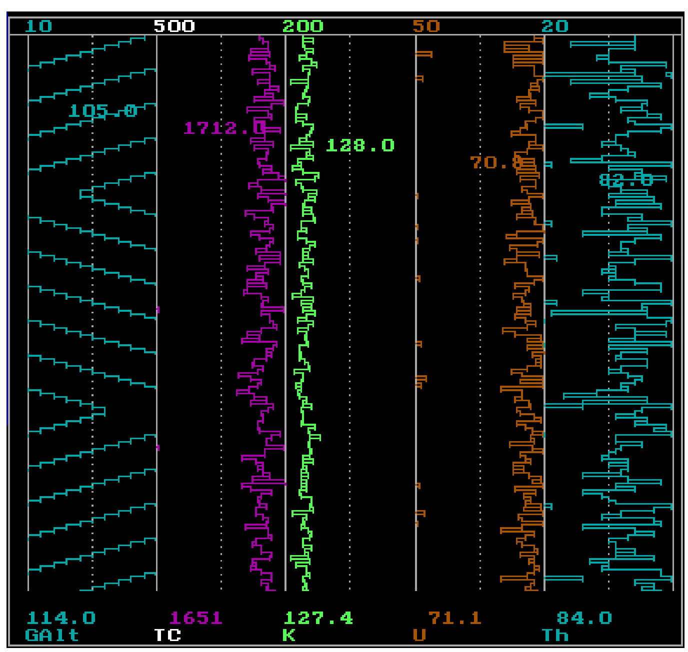


Fig 38: displaying numerical values on analog charts (press F5)

6.6.9 SPECTROMETER DATA PRESENTATION

If the user has a radiometrics package (spectrometer) installed and has enabled the display of spectra and bar graph data (see project setup Section 8.0) the area used for the display of analog chart data display area will be reduced and the additional spectrometer data will displayed above it as shown here.

The user may shift the reference cursor on the spectra display by tapping the touch screen over the 4 circles in the spectra display or by pressing the <**←**> **or** <**→**> keys on the keyboard. Pressing the <**←**> **or** <**→**> keys will move the cursor by one channel increments. Pressing <ALT **←**> **or** <**ALT→**> will shift the cursor by 10 channel increments.

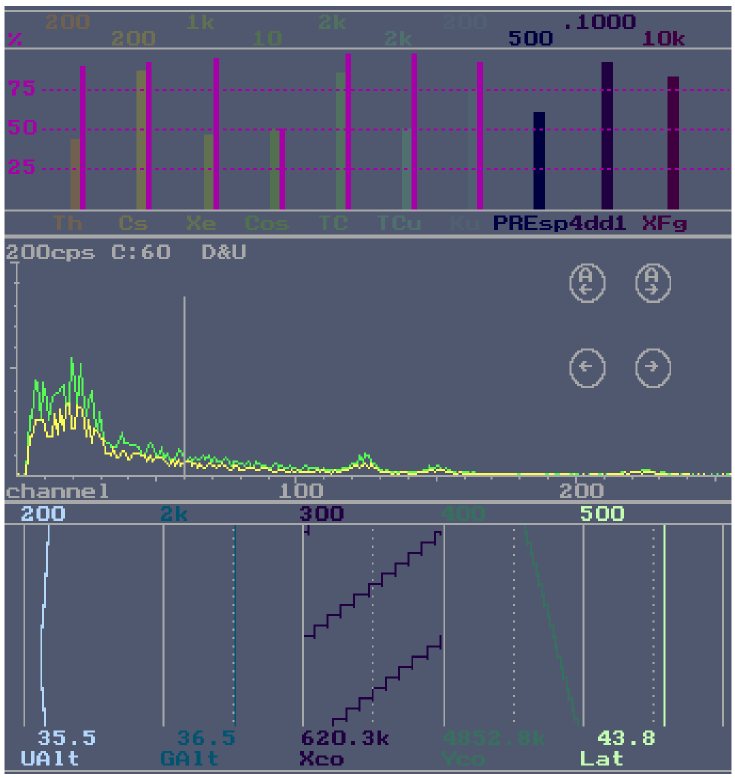


Fig 39: Real Time Radiometrics Spectra Display

6.7 Flight path Data presentation

The large square area on the left-hand side of the screen is dedicated to color data presentation along the aircraft flight path. The flight line information may be displayed over a geographical map image if available. The map image is imported as a bitmap (BMP) file and can be created from a scaned image of a paper map or as an image generated from another digital image file. The file must be in BMP format of 256 colors in order to be displayed properly. Please refer to the PEI Convert program users manual for more detailed information.

The displayed area may be “zoomed” in or out. The grid cell display size can be selected from a cell of 200 x 200 meters to 1000KM x 1000 KM . When zooming out the maps may be shown as a gray rectangle only. Whenever the map is inserted the display grid changes the color from blue to gray. Displayed data type and trace shape can be selected (see Main F2 Adjustments).

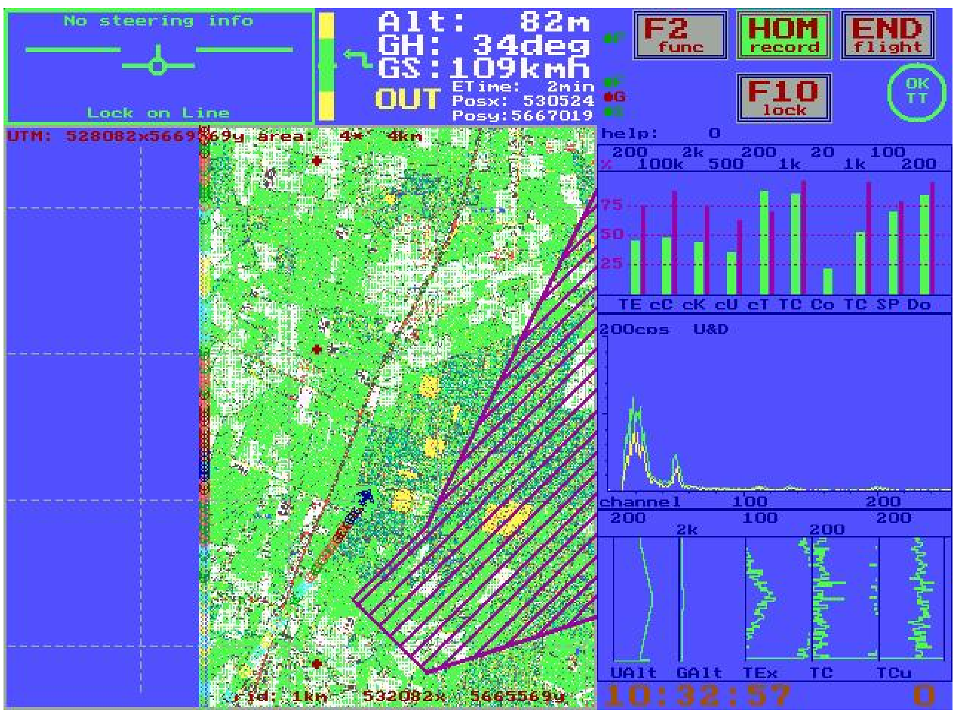


Fig 40: Flight Path Grid with Map Overlay

Color of the displayed data is automatic and is continuously adjusted by the program. It may change slightly after each screen redraw. The display is moving aircraft type with automatic redraw when aircraft reaches 10% distance from the boundary. The redraw function automatically positions the aircraft into optimal position with respect to the flight direction. Survey area is delineated by the survey polygon with indicated flight lines.

6.7.1 AIRCRAFT GUIDANCE INFORMATION

The operator / navigator of the AGIS system can follow the aircraft navigation information from the top left corner of the display screen Data is presented in both numeric and graphic forms The following figures demonstrate the possible display configurations depending on the aircraft position relative to the selected flight line and altitude.

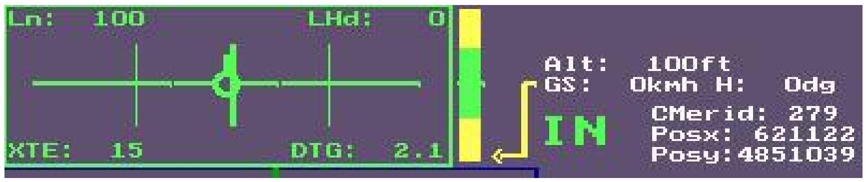


Fig 41 : Aircraft guidance display

The navigator is presented with altitude, relative position, and relative heading information. Ground Speed is indicated both numerically and graphically as a vertical bar with the indicated tolerance span in green.

Ground heading is indicated numerically together with the instant aircraft position coordinates and Elapsed time display.

If no survey line has been selected the message “No steering information” is displayed except for the altitude and ground speed. When the Survey Line is selected by pressing **<F10>** steering information is displayed in the Aircraft Guidance information part of the screen. The display shows the attitude of the aircraft towards the latched line, distance to go (DTG) to the survey area border and cross track error (XTE) representing the deviation from the selected line in meters or feet.

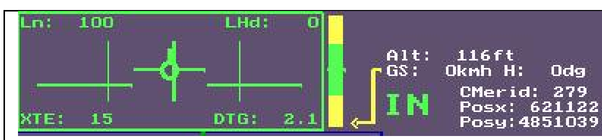


Fig 42: aircraft position to high

Altitude is shown numerically as well as graphically (aircraft is higher than pre-selected altitude of 100 meters).

Aircraft is slightly to left of desired flight line . The distance off line is shown as XTE: A positive number indicates the aircraft is to the left of the locked line , a negative number indicates the aircraft is to the right of the selected line.

The Distance To Go (DTG) represents the distance from the aircraft to the end of the selected line or area boundary.

The figure to the right displays what the navigator would see on the navigation screen when the aircraft has changed heading with respect to the desired flight line heading.

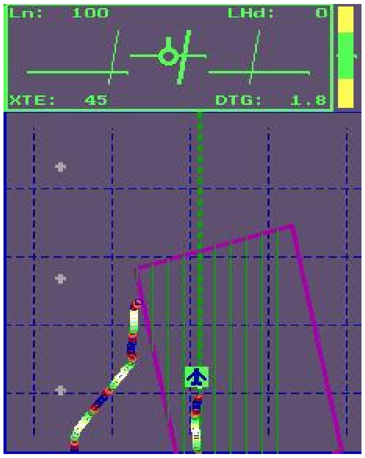
The solid thick green line vertical line represents the selected (locked) flight line. The fine lines to either side represent the next closest lines on either side of the locked line.

The aircraft depiction on the lower section of the screen shows the aircraft is heading off line to the left of the desired flight path. In the upper section of the navigation display the user can see the aircraft has changed orientation with respect to the flight lines. The dashed green line represents the selected (locked) flight line.

Fig 43: Heading Change

The figure to the right indicates the aircraft is too high in altitude . The horizontal green lines represent the specified flight altitude for the survey. The aircraft is shown as being above these lines and so is above the desired flight altitude. As the aircraft descends the aircraft picture will also descend.

The aircraft is also left of the desired flight line. The actual distance "off line" is displayed as **XTE**: in the lower left corner of the navigation graphic display. The selected (locked) flight line is to the right of the aircraft. To move the aircraft back onto the desired flight line the aircraft must be flown to the right until the selected line is centered on the aircraft display..



F*ig 44: aircraft too high and left*

The figure to the right shows the aircraft is below the prescribed flight altitude and is to the right of the desired flight line by 88 meters. It also shows the aircraft is still heading away from the desired flight line. A course correction to the left would be required to bring the aircraft to the desired flight line.

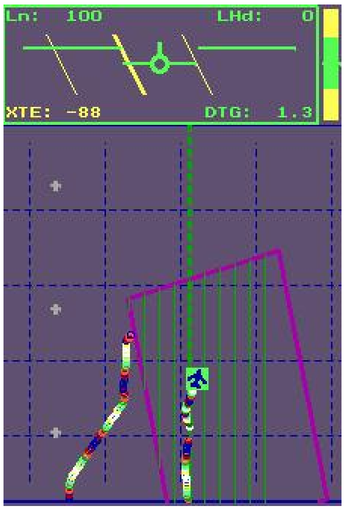


Fig 45: Aircraft low and right

Lines are numbered automatically. The default increment is 10. The starting line number and the increment value can be set in the AREA.XYZ file and / or during the project setup. (See APPENDIX F for additional information).

The Line number of the locked line is displayed (Ln), along with the Line heading (LHd) in degrees. As the aircraft approaches the area border a white dotted line will appear above the aircraft graphic in the navigation display. When crossing the survey boundary (entering the survey area) the dotted line will move under the aircraft. Once inside the area, the dotted line will disappear. It will re-appear a the pre-specified distance from the flight-path and border intersection (as specified in the survey parameter file). This serves to warn the pilot and navigator of the impending approach of the area boundary and end of the flight line.

6.7.1.1 PILOT GUIDANCE UNIT (PGU) DISPLAY

The AGIS ./ Iris system supports an external graphical display that can be mounted remotely from the data system to assist the pilot / navigator in keeping the survey aircraft on the desired flight path. This unit is an intelligent device containing a full VGA 640 X 480 pixel display. The CPU unit may either be contained in the PC-104 console or may be integrated directly into the display housing depending on the version purchased.

Where space is limited; a stand alone 7 inch TFT daylight readable color LCD monitor may be supplied to mount on top of the aircraft instrument panel. This display (as shown to the right)

Fig: 46 PGU LCD Display

Where more space is available or where the user desire to load drape flight grid files directly into the pilot guidance system a PGU can be supplied that contains the processor and provision for a compact flash card containing the drape files. Since this unit contains more electronics the housing is greater in depth and would require more space on the instrument panel. The unit is shown here.:

Fig 47 Intelligent PGU display

Both display units have the same functionality and graphics display capability. If the standalone color display is used the drape flies and controlling CPU are contained in the same housing as the AGIS data system. Drape files are uploaded from the PCMCIA card slots in the AGIS housing to the PGU computer via the internal parallel ports on the computers using “LAPLINK” file transfer software included with the system.

6.7.1.1.1 LOADING DRAPE FILE INTO PGU

As of this printing there are two versions of the PEI pilot navigation display. Both displays use the same format of drape file. The process to load the user created drape file differs slightly.

6.7.1.1.2 STAND ALONE PGU DISPLAY

If the user has purchased the stand alone, intelligent PGU (figure 47), loading the drape file is quite simple. This display features a user available compact flash card slot. This slot is designated as drive D by the processor controlling the pilot guidance unit. The user should install the grid file on the **ROOT DIRECTORY** of the provided compact flash card (for example: D:\UTMGRID.GR1) and install the card into the guidance unit.

NOTE: the display must be powered off when inserting or removing the compact flash card. Inserting the card after the unit is powered up will result in the computer failing to recognize the presence of the compact flash memory card. Extracting the card after the unit is powered up will result in the software attempting to access a card that is not present possibly causing the computer to crash or “hang”.

When the display is powered on the software automatically detects the presence of a grid file and attempts to load the file. (See section 6.7.1.2)

6.7.1.1.3 INTEGRATED AGIS \ PGU DISPLAY

PEI also supplies a version of the PGU that has all the electronics and firmware for the pilot display (PGU} integrated into the AGIS electronics module. The actual display is a stand alone 7 inch, ,LCD, TFT, video monitor. This allow the user more flexibility in choice of monitor size and serves to reduce the power and wiring requirements for the system. Since the integrated version of the PGU does not have its own externally accessible compact flash slot to allow loading of the drape file a different methodology is required.

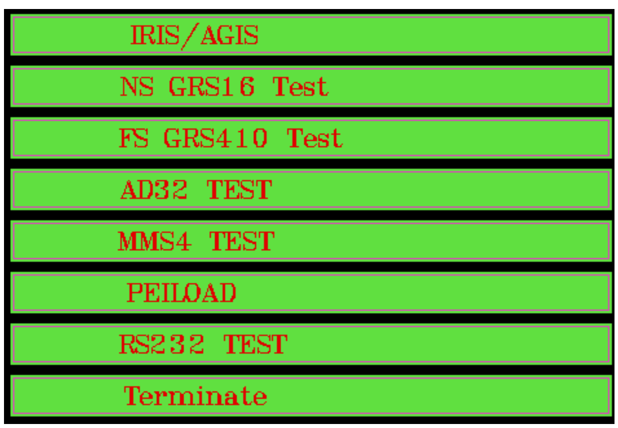
Because the user has no real access to the hard drive on the pilot display CPU the user must transfer the drape file via a "LAPLINK" program that connects the parallel port on the AGIS to the parallel port on the PGU.

These ports are already connected together internally in the AGIS console.

In order to install a grid file onto the integrated PGU system the user must have a keyboard available to connect to the PGU keyboard port on the AGIS console.

Follow the steps listed below in sequence:

1. power off the AGIS console and connect a keyboard to the PGU keyboard connector
2. Power on the AGIS console. During the boot cycle press the ESC key on the PGU keyboard to interrupt the auto loading sequence of the PGU firmware. The loading of the PILOT.EXE program will be terminated and the VOLKOV COMMANDER (VC) program will be loaded instead.
3. Using the down arrow key scroll the highlight bar down to the program LL3.EXE then press the ENTER key. This will load and start the LAPLINK program. The LAPLINK program will wait for the AGIS computer to also load the LAPLINK program and establish communication.
4. On the AGIS main screen the following screen should be visible



To exit from the AGIS software suite the user should either press the “Terminate bar on the touch screen or press the T key on the keyboard. This will exit the user to the DOS prompt

5. The user may elect to use either the VOLKOV COMMANDER, XTGOLD or standard DOS commands for the following procedures:

a. The user should create a directory on the AGIS C drive called GRIDS if it does not already exist
b. The grid file should be transferred from its source to a compact flash card. The external compact flash should then be inserted into on of the available card reader slots in the side of the AGIS console.

c. Use the method of choice and transfer the grid file from the external compact flash to the GRIDS directory on the AGIS C drive.

6. from the DOS prompt type the following command on the AGIS keyboard:

CD\ and press the enter key. This should take the user to the root directory of the AGIS hard drive.

7. type the following command on the AGIS keyboard:
   LL3 and press ENTER. This will start the LL# program running on the AGIS computer. The software should automatically connect with the PGU computer
8. The AGIS main screen will be split into two (2) segments. The left side of the screen will be designated the LOCAL screen for AGIS drive C and the right hand side will be the remote computer drive C (PGU).
9. Use the left arrow key on the AGIS keyboard to move the highlight bar to the laft side of the screen if is not already there.
10. Using the down arrow key on the AGIS keyboard move the highlight bar down to the GRIDS directory.
11. press L and ENTER to log into the GRIDS directory
12. Use the down arrow key to move the highlight bar down to the UTMGRID.GR1 file
13. **Press C then ENTER to copy the grid file from the GRIDS directory to the root directory of the PGU hard disk.**
14. The user will see a visual indication of the file being transferred. At the end of the transfer the message "copy completed, press any key to continue" will be displayed.
15. Press any key on the keyboard. The user will now see that the grid file has been copied to the root directory of the PGU hard disk.
16. Press the CTRL, ALT and DEL keys simultaneously on the PGU keyboard to reset and reboot the PGU computer system. Upon reboot the PGU software will automatically detect and load the grid file.
17. Use the same procedure to reset and reboot the AGIS computer.

6.7.1.2 PGU DATA DISPLAY SCREENS

When the PGU is powered up it will perform a standard boot cycle similar to a standard personal computer. Once the boot cycle is complete the computer loads the internal pilot display program. The system checks to see of there is a drape grid flight file available to be loaded

Fig 48: check for drape grid file

The software assumes the drape file is loaded onto the D drive of the system if available and checks there first. The drape grid file must be named **utmgrid.gr1 .** If the file is not to be found on the D drive the software continues to look for the file on the remaining drives available in the system.

If no drape grid file is located the user is presented with the following screen:

Fig 49: No grid file located

If the system is unable to locate any grid file the software will proceed directly to the main navigation screen. If an acceptable file is located the file will be loaded into the PGU memory for use. The user will see the following screen during the loading of the utmgrid.gr1 file:

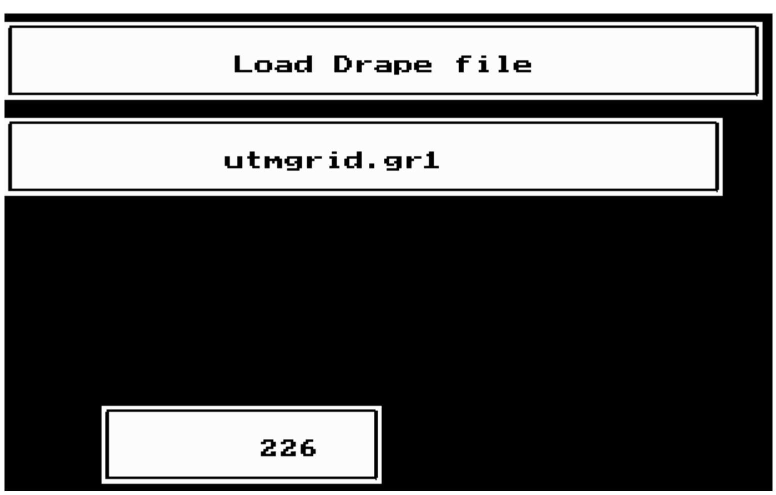


Fig 50: Loading the grid file

The software will display each intersection point as the file is loaded**.**

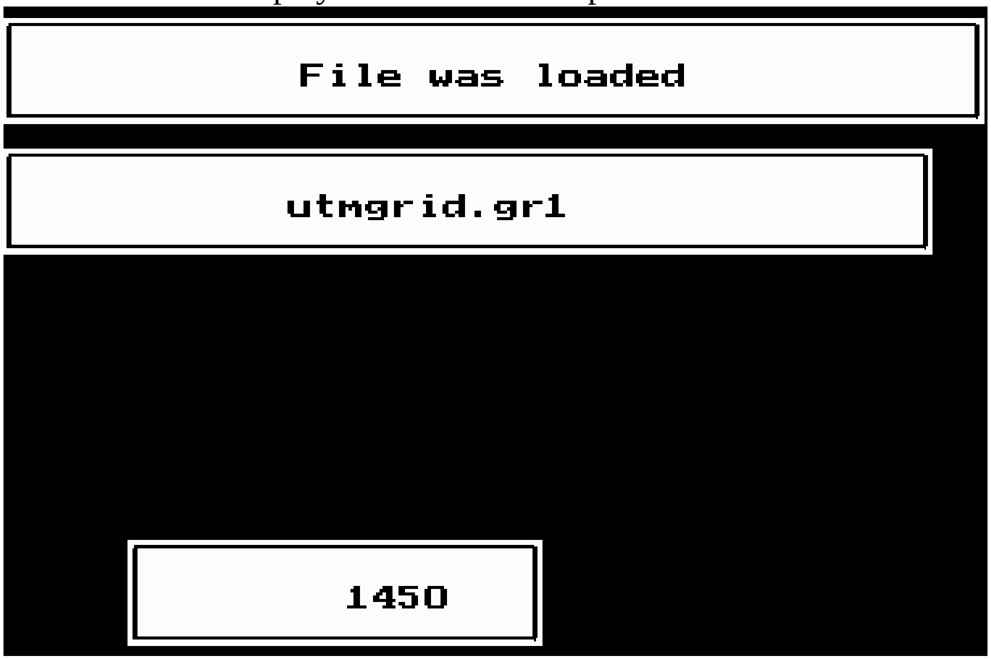


Fig 51: confirmation of grid file loaded

Upon successful completion of the file load the above screen will be displayed.

If a drape file is not located or the file located is incompatible the file will not be loaded and the following screen will be presented. The user must determine the file is in the proper location and is of the proper format.

Fig 52: drape file not found / loaded

Once the file loading sequence has been completed or abandoned the user is presented with the PGU opening splash screen

Fig 53: PGU splash screen

The screen will remain visible for several seconds while the balance of the software is configured and the PGU searches for navigation information from the host computer (AGIS).

If no communication can be established between the host computer and the PGU computer system a warning screen is presented indicating that no steering information has been received.

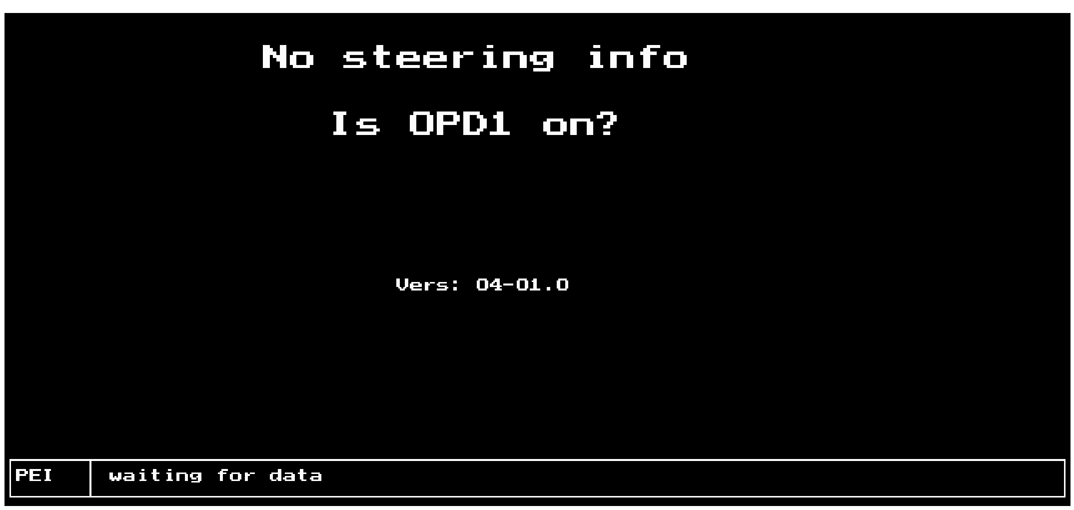


*Fig 54: No steering information received***.**

The user is asked to confirm the PGU system has been turned on (the PGU must be enabled in the project setup section of the AGIS software before any navigation data will be sent to the navigation system. The PGU computer will continue to wait for data. Once data is received the full navigation display will be turned on.

Once navigation data has been received the system will conduct an internal check to see if a grid file has been loaded and if the grid file matches the current geographical position of the GPS receiver. The AGIS system requires the current central meridian as determined by the GPS receiver position to be the same as the central meridian specified in the grid file. This is extremely important since UTM coordinates can be the same even though they are in different zones. Without this check it would be possible for the user to load an acceptable grid file from a different project and location but with matching UTM coordinates. This could result in the pilot attempting to fly a drape surface during survey that did not conform to the terrain beneath the aircraft.

If the central meridian of the grid file does match the local central meridian the grid file is disabled and the following screen will be displayed:

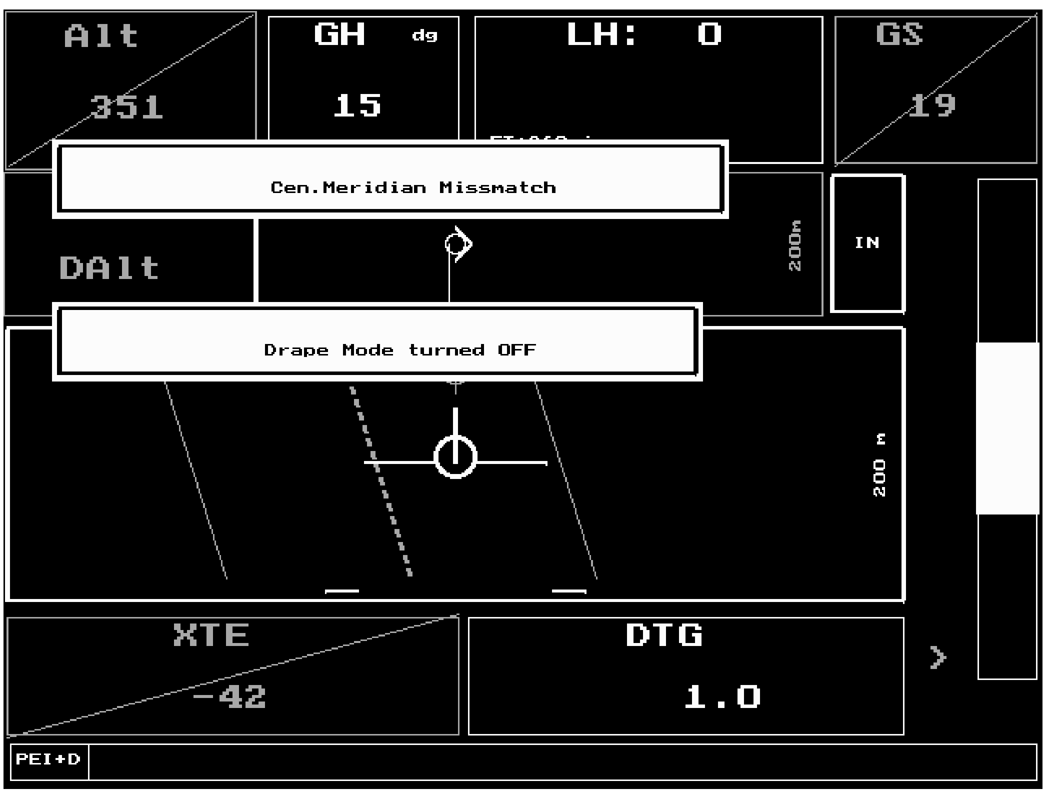


Fig 55: central Meridian mismatch

The navigation system used within this apparatus is not a primary type of navigation and serves always as navigation aid only under VFR (Visual Flight Rules) conditions. Pico Envirotec neither assumes nor accepts any responsibility for positional errors in navigation caused by GPS system malfunctions, incorrect set up of area navigation and / or drape grid files and / or the AGIS system software suite, or failure of the users to operate the system properly.

If the drape grid files are used and correct or the user simply uses the PGU in basic navigation mode the PGU will start to function as soon as navigation data is received from the host computer. The functional navigation screen will resemble the figure below:

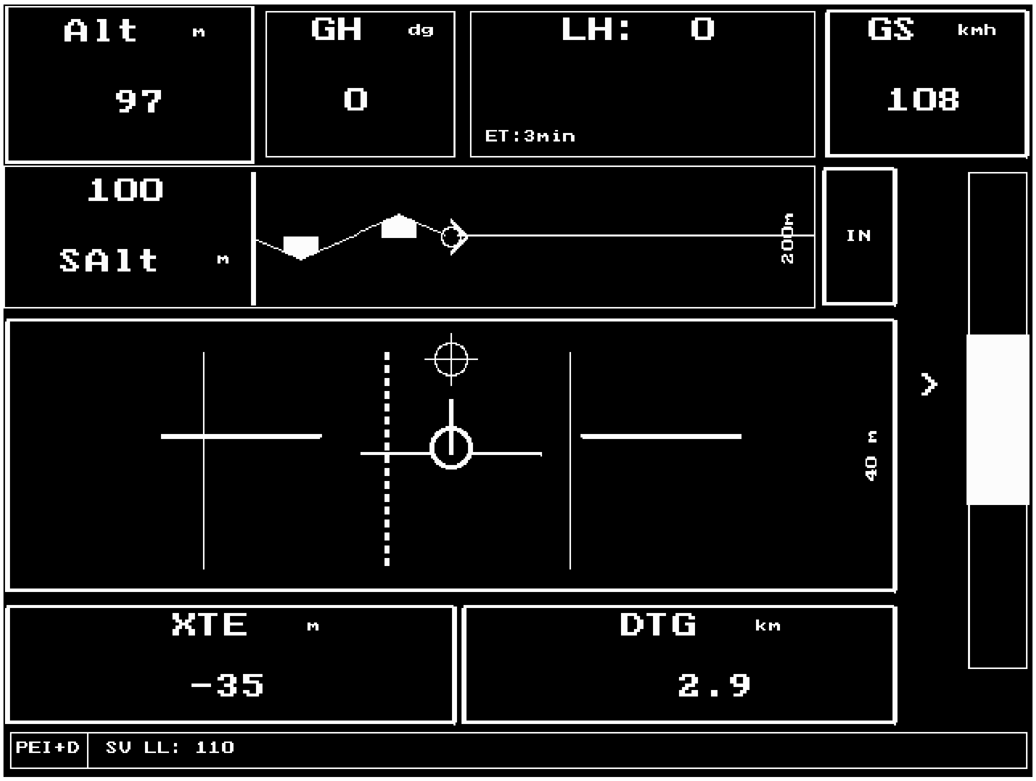


Fig 56: main navigation screen

The pilot / navigator is presented with a number of information items as well as a graphical display of the aircraft's actual position in to its desired position. The information presented includes. Current altitude, selected or desired altitude, groundspeed, elapsed time, current heading, current position, the current selected line number and weather the aircraft is inside or outside the survey block boundaries.

The large central graphic depicts the aircraft position with regard to the flight line chosen. The smaller central graphic displays the terrain ahead of the aircraft (if a drape file is being used) as well as the terrain behind the aircraft.

The graphic on the right hand side of the screen indicates if the aircraft is operating inside the ground speed tolerance range specified in the contract. (the ground speed parameter is set up during project creation in the AGIS software.)

(refer to section 6.7 for detailed description of navigation display icons and screens).

6.7.2 CHANGING / SELECTING FLIGHT LINES

Once outside the survey area the ^ sign will appear above the aircraft graphic indicating that the aircraft is moving away from the survey area.

To change the desired flight line number the operator has two choices, he may press **<↓>, <↑>** keys on the keyboard (if available) or use one of the touch screen hot keys. The hot keys are represented by 6 small crosses displayed on the left side of the navigation window. Pressing <F1> on the keyboard or tapping the uppermost cross on the touch screen will display a menu for the hidden buttons. The button menu will automatically disappear after 5 seconds.

The navigation system is designed to allow the user to select and fly parallel lines outside the area

Pressing the <f10> key on the touch screen or the keyboard will automatically select the closest flight line to the aircraft. Using the <↓> key or the <↑> will allow the user to move across the survey area and select the desired flight line. (See also Section 6.4).

6.8 PROGRAM TERMINATION

When the data collection along the flight lines is to be terminated the **<HOM(stop)>** command must be used to end the data recording, then **<END(flight)>** function is activated.

This function closes all the files and connected hardware.

7.0 MAIN ADJUSTMENTS – F2

All real time screen display adjustments are called by pressing the **<F2)>** on the keyboard or by tapping the touch screen over the **<F2 func>** button **.** Once recognized, the button is replaced with the **<Esc(return)>** to return to normal operation**.** There is an automatic time-out on this function and if there is no action, after approximately 10 seconds, the program is returned to normal operation.

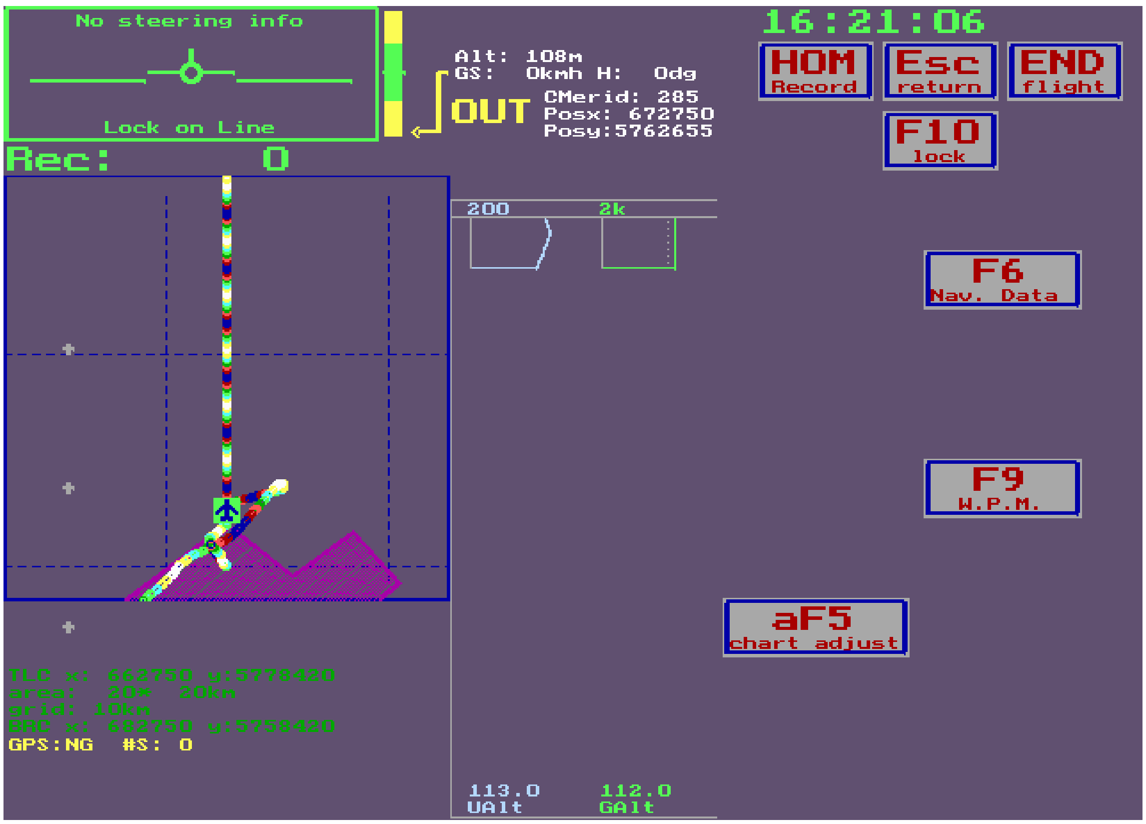


Fig 57: Real Time Screen Adjustments (magnetometer system only)

<F3(bar)>, <F4(graph)> and **<F5(chart)>**are used for Data presentation adjustment.
<F6(Nav.Data)> is used to select displayed data along the flight-path.
<F9(W.P.M.)> is used to switch the navigation to the Waypoint mode.

If the GRS-410 spectrometer system is installed and enabled the user will be presented with additional screen controls to allow setup of spectrometer data for display. The user will be presented with a display similar to that shown in figure 48.

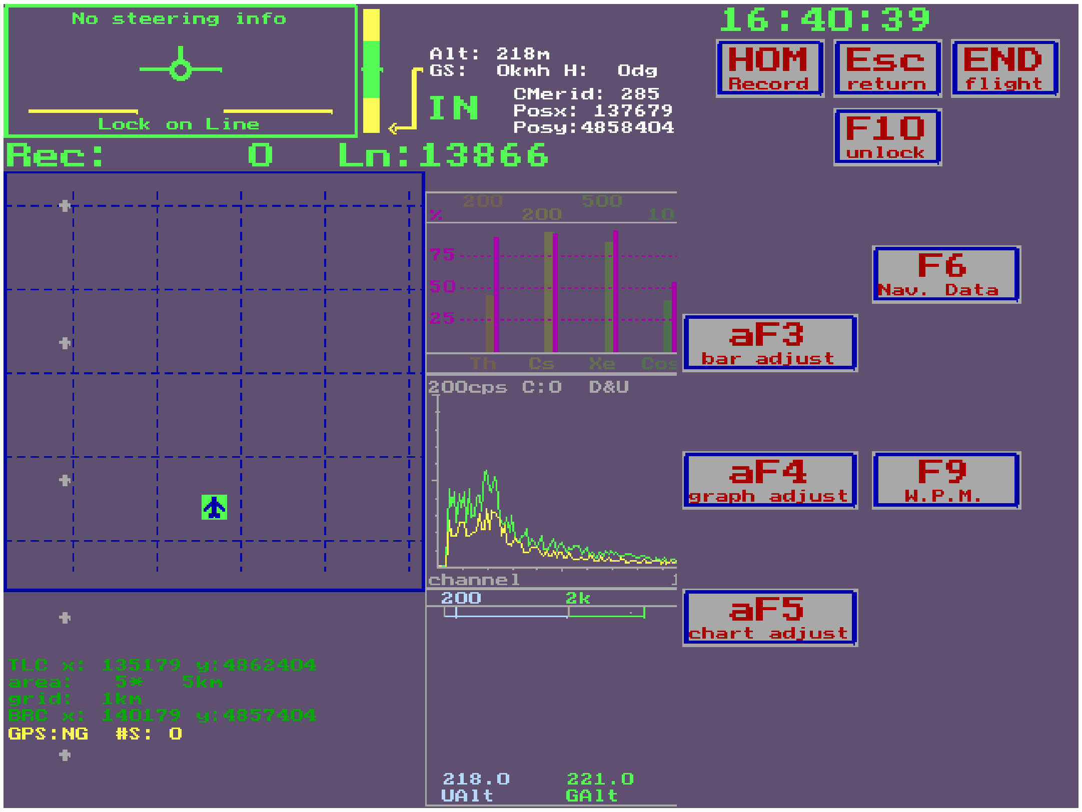


Fig58: Real Time Screen Adjustments (spectrometer screens included)

7.1.1 SETUP OF ANALOG CHART DISPLAY:

After selecting the <F2> key to make real time adjustments to the screen displays the user is presented with a number of options. Selecting the <ALT F5> button on the touch screen or by holding down the ALT key on the keyboard and pressing the F5 on the key board will take the user to the analog chart display setup screen. Here the user may select any of the data channels to be displayed. The width of each trace, its sensitivity and position, trace color, and polarity, may be set independently. There are 8 frames (windows) available with a maximum of 5 displayed channels per window.

7.1.2 BUTTON DEFINITION:

Figure 49 below shows the analog chart definition screen along with the control buttons displayed. Note this display is for a system WITHOUT A GRS-410 SPECTROMETER SYSTEM.

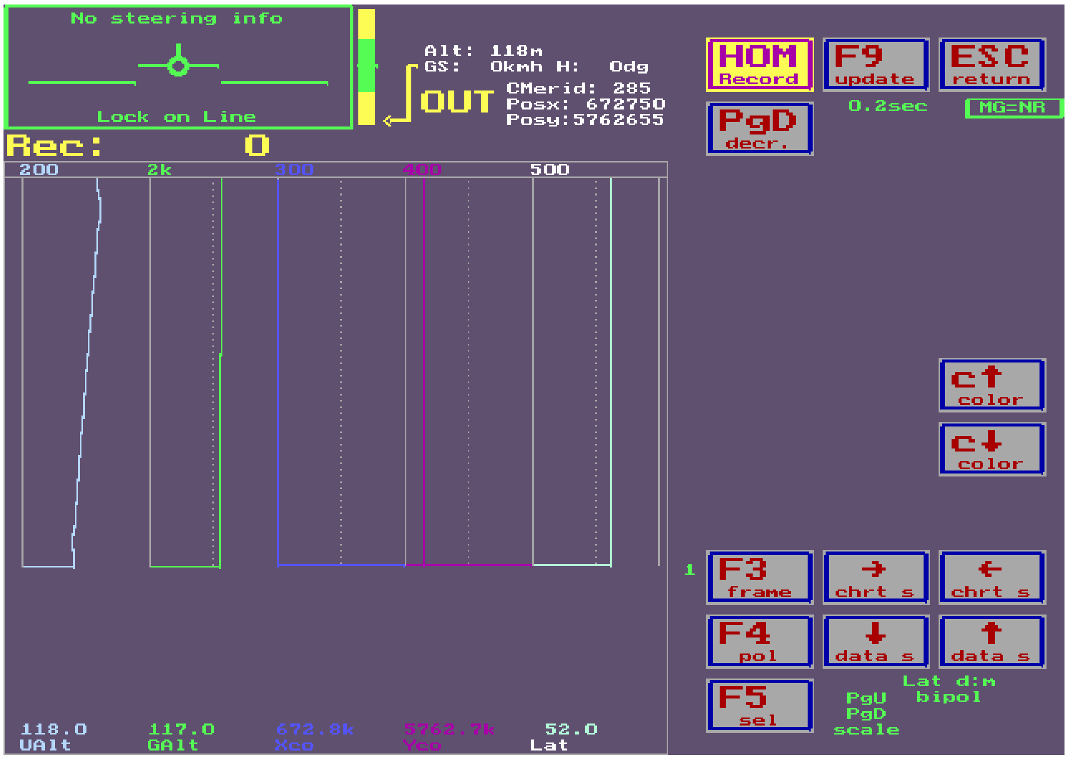


Fig 59: Analog chart definition screen

<F3> Allows the user to cycle through the available chart windows. There are 8 frames available with a maximum of 5 traces per frame.

<F4> Allows the user to select the trace polarity. The options are

uni-polar: trace has a value of 0 at its left hand side and a full scale value at the right hand extent of the trace.

Bi-polar: This assumes the data values can be either positive or negative. As such the 0 position for the data is moved to the center of the trace span.

<F5> Allows the user to select the control options to position data on the traces. Pressing the <F5> key scrolls the user through 3 choices for data . The options are:

POSITION: When the position option is selected pressing the <PAGE UP> or <PAGE DOWN> keys will move the left hand boundary of the selected trace. The boundary position is expressed as a percentage of the available screen area

SPAN: The SPAN function allows the user to set the desired with or span of the selected trace. The <Page Up> or <Page Down> keys will allow the user to move the right hand boundary position. This position is expressed as a percentage of the available screen area

SCALE: The scale option allows the user to define the full scale value for the selected trace. Pressing the <Page Up> or <page Down keys will increment the scale values. Available scales range from 0.01 to 1million

TRACE SELECTION: Using the <←> or <→> keys will allow the user to select which of the five available traces in each frame to be modified. The trace name is displayed at the bottom of each trace. The user may select a different color for each trace. The trace selected for modification will have the color of its displayed name changed to white while it is selected for modification.

7.1.3. ANALOG GRAPH DATA SELECTION: Using the <↓>**,** <↑> buttons or keyboard keys will allow the user to select which of the available data inputs should be displayed on the selected trace.

All data sources are available to be displayed. Magnetometer, spectrometer, GPS, positional and analog source data can all be displayed as part of the graphics.

There are predefined channel names as part of the data set in addition to the channel names that may be assigned by the user for various inputs such as altimeters and temperature sensors. Listed below are the pre-defined data names and a brief description of each:

7.1.3.1. MAGNETOMETER SYSTEMS:

DTsc:	Time of day expressed as seconds after midnight
Rs:	Record number or Fiducial
Xco:	value of Easting (x) for current UTM position
Yco:	value of Northing (y) for current UTM position
Lat:	value of Latitude for current geodetic position +=North , -=South
Lon:	value of Longitude for current geodetic position, +=East, -=West
Galt :	height above sea level as acquired from GPS data / receiver
Gtm:	UTC (GMT) time expressed as seconds of the day after midnight as taken from the GPS receiver
Gst:	GPS status indicator. This number will be either 0, 1, 2, or 3. 0 value indicates no valid position data has been received

1 value indicates a single point position fix
2 value indicates a real time differential corrected position fix

Ualt: Represents the value of the altitude data from the source selected to fly a predetermined flight surface. This can either be from GPS altitude data, radar altimeter data, or barometric reference data

Smag x: This value is the magnitude of the magnetometer larmor signal as produced by the signal separator card and amplifier in the MMS-4 processor module.
X represents the number of the attached senor. If there is more than one magnetometer attached to the system there will be asset of readings for each sensor. Maximum number of sensors allowed at this time is 4.

Rmag x This value is the total magnetic field read by the magnetometer sensor measured in Nano-tesla. X represents the number of the attached senor. If there is more than one magnetometer attached to the system there will be asset of readings for each sensor. Maximum number of sensors allowed at this time is 4.

4dd x This represents the measure of the fourth digital difference noise calculated for each magnetometer sensor. X represents the number of the attached senor. If there is more than one magnetometer attached to the system there will be asset of readings for each sensor. Maximum number of sensors allowed at this time is 4.

Xfg displays the value for the X axis of the 3 axis fluxgate magnetometer. This optional sensor is used for magnetic compensation.

Yfg displays the value for the Y axis of the 3 axis fluxgate magnetometer

Zfg displays the value for the Z axis of the 3 axis fluxgate magnetometer

Adm x displays the data acquired through the Analog to Digital (A/D) converter card resident in the MMS-4 processor module. This card has 8 inputs. Channels 0,1, and 2 are reserved for the Fluxgate magnetometer. Channel 8 is reserved for Radar Altimeter data. Channels 3 through 6 inclusive are user definable. For detailed information please refer to the MMS-4 USER Manual.

Balt If a barometric altimeter or pressure transducer is incorporated into the system it is typically assigned to A/D input channel 6. The user may give this channel any he so chooses but convention usually defers to BALT.

Ralt Radar altimeter data is assigned to Channel 7 of the A/D converter. This is not a reserved channel, however defaults in the survey program assume the radar altimeter will be assigned to this channel

7.1.3.2 RADIOMETRICS SYSTEM:

If the system is configured with A GRS-410 spectrometer system additional channels will be available for assignment to the analog trace display. The format for each channel is defined in the header information provided at the beginning of each data file.

The header information at the beginning of the data file defines the data types and formats for each configured channel as follows:

```
Each data channel or data array is decribed by a string:
Name,Array,Data_type,Const,Offset,Unit,Comment
For "as" (Const,Offset,Unit) not applicable
For "db" and "fl" Const = dec.digits
For other Const = multiplication constant
Any data type ending with "*" such as "wd*"
indicates that data is a spectrum, while
without "*" the data is a time sequence
Data Types:
as=ascii    array*1 byte   ASCII characters
by=byte     1 byte   0..255
db=real     8 byte   5.0e-324..1.7e308 15-16d.
fl=float    4 byte   1.5e-45..3.4e38  7-8dig.
in=smallint  2 byte   -32768..32767
li=longint  4 byte   -2147483648..2147483647
si=shortint 1 byte   -128..127
wd=word     2 byte   0..65535
```

For example: the Total count channel is defined as follows:

tC, 1,FL,1,0,CPS

where:

"TC" is the name for the TOTAL COUNT channel

"1" indicates the sample rate of 1 Hz

"fl" indicates the data is in floating point format

"1" indicates the number of decimal places applied to the data

"0" used as a place holder only, has no value for float data and is not used

"cps" indicates the engineering or scientific units used to measure the data

. The channels listed below are default assignments. Depending on system configuration and client requirements additional channels may also be available.

Tc	Total count Energy Span (ESp) or window for downward looking crystal detectors.
Cos	Cosmic radiation Span (ESp) or window for downward looking crystal detectors.
Xe	Xenon radiation Energy Span (ESp) or window for downward looking crystal detectors.

Kr	Krypton radiation Energy Span (ESp) or window for downward looking crystal detectors
Cs	Cesium 137 radiation Energy Span (ESp) or window for downward looking crystal detectors
K	Potassium 40 radiation Energy Span (ESp) or window for downward looking crystal detectors
U	Bismuth 214 (Uranium) radiation Energy Span (ESp) or window for downward looking crystal detectors
Th	Thalium 208 (Thorium 208) radiation Energy Span (ESp) or window for downward looking crystal detectors
Tcu	Total count Energy Span (ESp) or window for upward looking crystal detectors
Ku	Potassium 40 radiation Energy Span (ESp) or window for upward looking crystal detectors
Uru	Bismuth 214 (Uranium) radiation Energy Span (ESp) or window for upward looking crystal detectors
Thu	Thalium 208 (Thorium 208) radiation Energy Span (ESp) or window for downward looking crystal detectors
Spu	Total spectrum (256 channels) for upward looking crystal detectors.
Dru	Ratio of upward spectrum to downward spectrum
ISP1D	summed 256 channel spectrum from all downward looking crystals
ISP1U	summed 256 channel spectrum from all upward looking crystals
ISPT01	defines the tuning position of the THORIUM peak for each crystal detector connected to the data system.The number assigned here is the calculated ratio of the actual position of the thorium peak (usually about channel 180) to the desired position of thorium (usually about channel 222) This ratio should be in the range of 0.85 to indicate proper tuning of the crystal. There will be a ratio number for each detector
ISPS,10,	This data item is an ASCII string that defines the tuning status for each crystal connected to the spectrometer system For the GRS-10 spectrometer system there will be a string of 10 ASCII characters delimited by a comma (,). The possible characters dispalyed are 0 indicates there is no crystal detected at this position

T indicates crystal is tuned by / on thorium peak
N indicates the crystal is not tuned
A indicates the crystal is using alamanac information for tuning
K indicates crystal is tuning using K40 (potassium) peak
U indicates crystal is tuning using B214 (uranium) peak

ALT sp	Radar Altimeter data if supplied through A/d card in spectrometer system
Tmp sp	Outside Air temperature
Pre sp	barometric altitude or pressure as supplied through spectrometer system
Hum sp	Relative humidity of outside air as supplied through spectrometer system.

7.2 SPECTROMETER DISPLAY OPTIONS

Bar Graph Adjustment

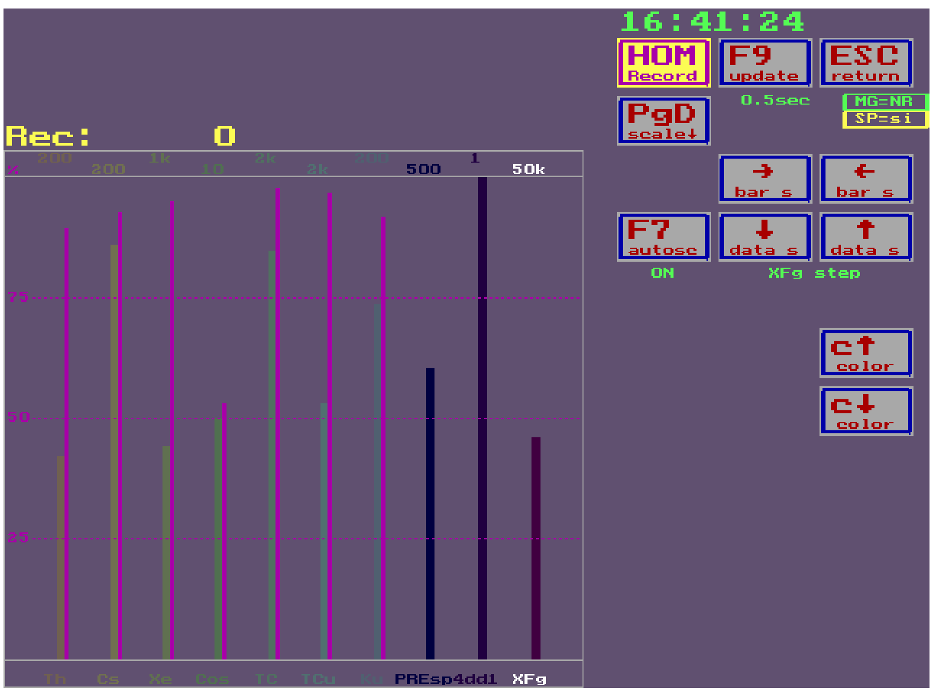


Figure 60: selecting bar graph displays

The graphic image of the bar functions is moved into the larger “Aircraft and Data” area by **<F3(bar)>**, while the navigation part of the display stays intact and functioning

The scale for each Bar is shown at the top of the new bar display area, while the signal name is shown at the bottom.

TRACE SELECTION: Using the <←> or <→> keys will allow the user to select which of the 10 available bar traces is to be modified. The channel name is displayed at the bottom of each bar. The user may select a different color for each trace. The trace selected for modification will have the color of its displayed name changed to white while it is selected for modification**.**

DATA SELECTION: Using the <↓>**,** <↑> buttons or keyboard keys will allow the user to select which of the available data inputs should be displayed on the selected trace.

All data sources are available to be displayed. Magnetometer, spectrometer, GPS, positional and analog source data can all be displayed as part of the bar display graphics.

SCALE: Scale for a selected bar can be set to automatic or manual.

Manual scale is controlled by **<PgU(scale↑)> or <PgD(scale↓)>.**

To return into automatic scale use **<F7>.**

Use **<c↓(color)>** or **<c↑(color)>** to change the color of the bar.

The Gamma spectrometer data also displays a reliability bar (magenta) indicating reliability of the reading expressed in % next to each bar trace

<F9(update)> allows to change the screen refresh update rate (not the data collection update).

To return to normal operation use **<Esc(return)>.**

7.3 Spectra Graph Adjustment

Detected Gamma spectra (Down and Up) are displayed in several modes. These modes and other parameters may be controlled when displayed on a larger display area by pressing >f2> from the main survey screen then <F4(graph)>on the touch screen or <ALT F4> on the keyboard. See fig 45 below

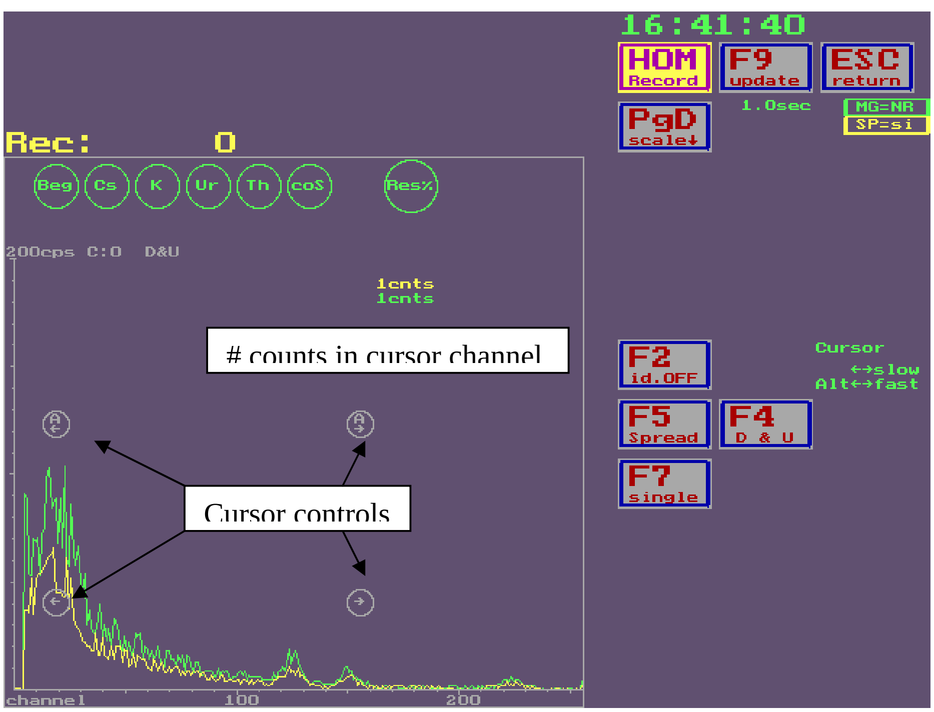


Fig 61: Spectra Display Setup Control (Simulated spectra only)

This screen has a number of control buttons to enable the user to set up and display desired data The controls and their function are listed below:

<PgU(scale↑)> and **<PgD(scale↓)>** controls the scale of the spectra.
<F9(update)> changes display update
<Esc(return)> returns to normal operation
<F2(id)> calls ON/OFF radio nuclei identification
<F3(curs)> enables/disables cursor
<F5(graph)> in normal display area the graph is compressed to fit. Using this command the graph may be left justified, right justified or fitted.
<F4(disp)> selects Down, Up, Down-Up, Up-Down Down+Up, Down & Up spectra
<F7(data)> changes spectrum to accumulated or sampled interval (1 second)
<F6(output)> for GRS402 only controls input/output/tune data
<F8(st.)> for GRS402 only controls spectrometer status
<→>, <←>, are used to move the cursor by 1 channel increments
<a→>, <a←> are used to move the cursor by 10 channel increments

At the top of the vertical axes the count is displayed together with scale unit [cps], cursor position and the type of data display. In case the cursor points to one of the spectral lines the color of the cursor is changed and the element is shown.

7.4 Flight path Data Switch

<F6(Nav. Data)> brings the controls to selection of data along the flight path. It is used to preset displayed data to the element of interest. Data may be displayed in number of selectable formats. Length of the re-trace is 3600 seconds – if already available. When in this mode automatic intensity color set is displayed together with a selected channel and its units. Colors are associated in a linear way with the maximum value of the displayed channel. The maximum value of each displayable channel is updated along the flight and therefore the colors may change during the display update. Color scheme and distribution is the same as in the Data Replay option.

<F9(shape)> changes the shape of the displayed data (circle, bar, line)

<Esc(return)> **returns to normal operation**

<↑(data s)>, <↓(data s)> changes the displayed data. All available data plus navigation trace only can be selected

. *Fig62: Flight path data display*

7.5 Waypoint Switch

At any time when in Real Time operation (from any mode “Survey”, “Plume” or “Chase”) the navigation may be switched to Waypoint mode of operation by pressing the **<F2>** key followed by **<F9(W.P.M.)>**. This is useful for determine a direct flight path route from the current position to one of the previously defined waypoints set up in the AREA. XYZ parameter file.

It is important to understand that the navigation system used within this apparatus is not a primary type of navigation and serves always as a navigational aid only. This system is certified for daylight VFR (Visual Flight Rules) only. It may be used as a reference only during IFR conditions.

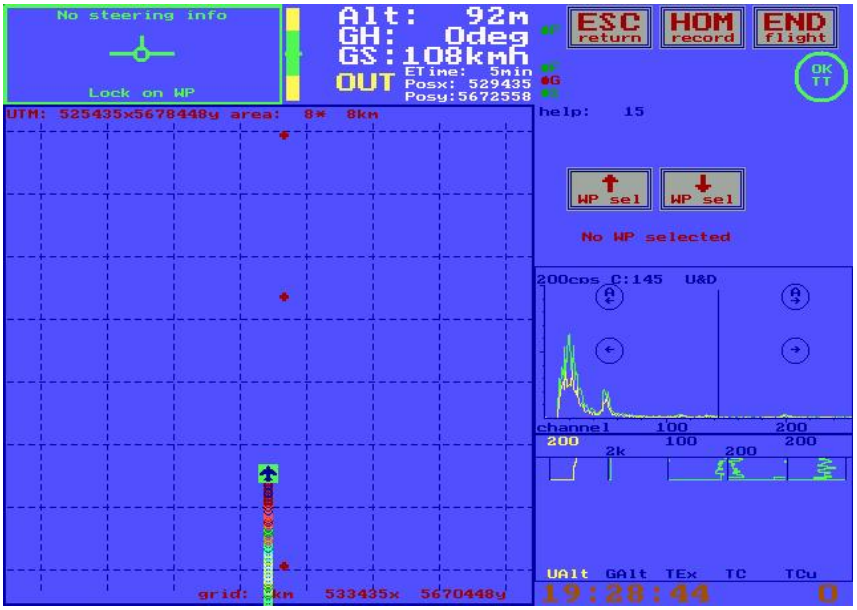


Fig 63: Waypoint navigation display

<Esc(return)> returns to normal operation

<HOM(record)> record full data set

<END(flight)> terminate flight

<↑(WP sel)>, <↓(WP sel)> selects any available Waypoint. When entering this control automatic Waypoint is generated for possible return to this point. Navigation is now switched to waypoint mode.

8.0 SYSTEMS OPTIONS

From the AGIS program options screen (see Fig 4) the user may select the Edit / New / Replay software suite by pressing <E> on the keyboard or by tapping the green highlight bar on the touch screen. This software package allows the user to edit an existing project file, select a different project file to use rather than the currently selected one, create a new project file from scratch, or download data from the AGIS internal storage media to the PCMCIA smart media card.

When selecting the option EDIT/NEW/REPLAY…
Program will allow operator to select one of the offered options (***Fig.***54).

Fig.64: Edit options screen

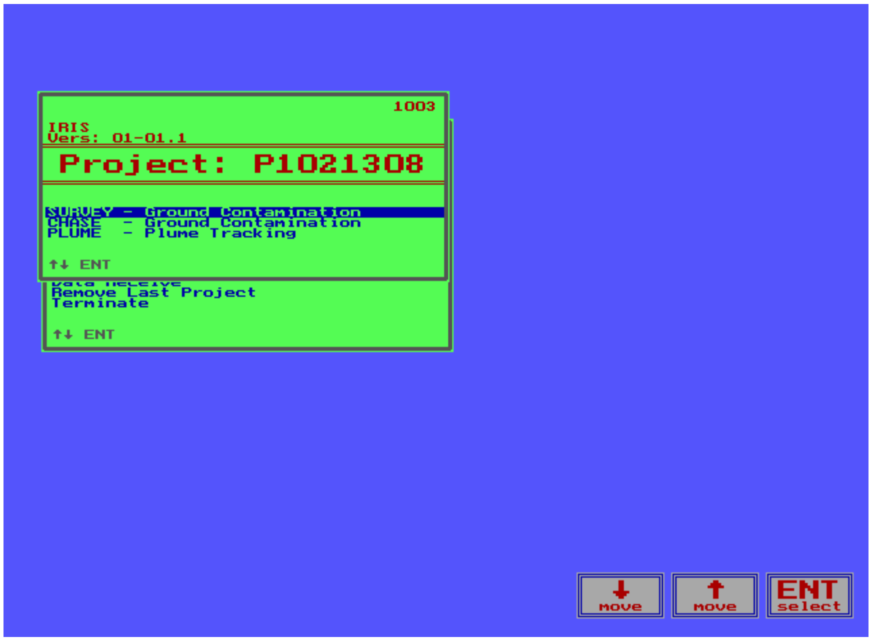
♦ **Edit Project:**	To change parameters of the current project or to add map or waypoints (5.5.1).
♦ **Select other Project**	If more than one project (more different areas) are flown the operator can switch among the projects.
♦ **Data Replay**	Data from any project residing in the system may be viewed in similar form as in real time with the possible map insertion.
♦ **New Project**	Creates new project. If there is no project designated as the “Last Project” in the system than this option is automatically called (5.).
♦ **Terminate**	This selection will terminate the program.

Note:

"Edit Project" and "New Project" options are identical, except for a new project name and parameters creation in the "New Project" while "Edit Project" works with already existing project name and parameters. AGIS automatically selects survey type of operation while the IRIS allows generation of several different project types: "Survey", "Chase" or "Plume".

Fig. 65: Iris project type selection (not available on AGIS)

"Data Replay" is described as a separate section.



8.1 EDIT PROJECT

If there is more than one project defined on the system the user will be given a choice as to which project they wish to edit.

Selection of the project must be made.

There are two groups of project parameters.

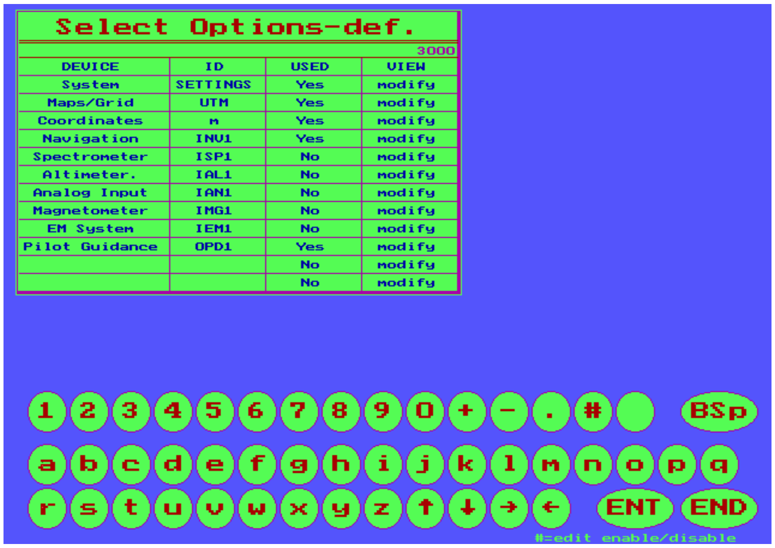


Fig. 66: Sensor / Equipment options

- Protected Parameter setup protected by a “password”.
- Unprotected Parameter setup.

There are two devices that cannot be turned off. “SYSTEM” and “Coordinates”.

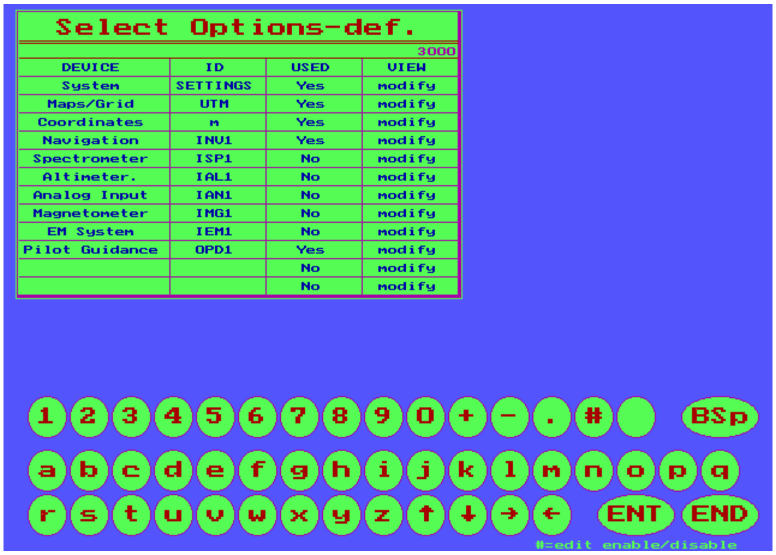
8.1.1 DEFINITION OF AGIS PARAMETERS

Fig. 50 lists AGIS system options. These options may vary with different sensors connected to the system. Description if the device is under “DEVICE”. “ID” identifies the specific device. “USED” indicates if the device is used in the present setting. “VIEW” allows modifying settings of each device.

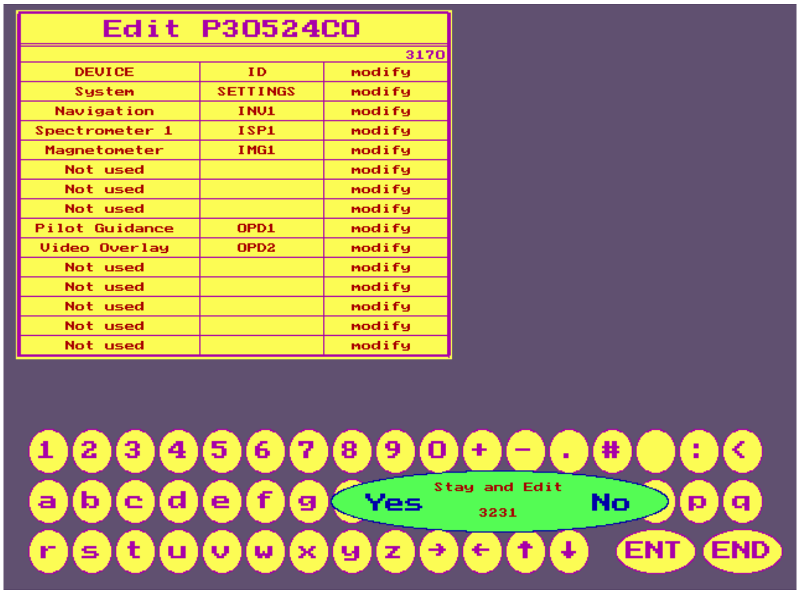
8.1.1.1 AREA.XYZ file:

In order to facilitate creation of a survey area polygon and related flight and control lines the AGIS system provides two methods to enter and create the desired navigation file. The user may enter the corner points, line master points, line directions and line spacing manually. (Refer to sections 8.2 and 8.3 in this manual) The user may also create an AREA.XYZ file externally on another computer using the PEI Convert program supplied with the AGIS system . This allows the survey area definitions to be created at some other location than the survey site and lets the operator of the AGIS system import the pre-defined survey grid directly into the AGIS system. This helps eliminate any “keyboard” entry errors when defining the survey area parameters.

After the operator has defined the parameters for the number and type of instruments to be used on the survey He is presented with a completed systems definition screen as shown below:



Pressing the ENTER key will allow the user to continue the instrument parameters Pressing the “End” key will open a dialog box requesting the user to either stay and continue editing or to continue with definition of the survey area as shown in the picture below.



If the user elects to continue the message window shown below will appear:

IF THE USER SELECTS YES, IF AN AREA.XYZ FILE IS PRESENT IN THE MAIN IRIS DIRECTORY OF THE HARD DRIVE THEN THE CONTENTS OF THIS FILE WILL BE LOADED IN TO THE PROJECT PARAMETER FILES. THIS WILL OVERWRITE ANY EXISTING SURVEY AREA CORIDINATES AND LINE INFORMATION THAT MAY ALREADY HAVE BEEN LOADED MANUALLY FOR THIS PROJECT.

IF THE USER SELECTS “NO” THEN NO AREA.XYZ FILE WILL BE LOADED. THE PROJECT PARAMETER FILES WILL CONTAIN ONLY DEFAULTS OR PREVIOUSLY MANUALLY ENTERED INFORMATION..

THE USER SHOULD ALSO BE AWARE THAT AFTER LOADING SURVEY PARAMETERS FROM AN AREA.XYZ FILE THE USER MAY STILL EDIT ANAY PARAMETERS MANUALLY. THE USER SHOULD ALSO BE AWARE THAT MANUALLY EDITING INFORMATION CHANGES THE PROJECT PARAMETER FILES ONLY , IT DOES NOT ALTER THE CONTENTS OF THE AREA.XYZ FILE.

8.1.2 System Settings

These settings are accessable by the user during project edit. If a new project is started the user is given the opportunity to select some additional system parameters.

Icon: available icons can be selected for aircraft image on the real time and replay display.

Display dim : defines the size of the “MAP” area used for flight display. The smaller the “MAP” the larger the data display area. Default value is 250 dots, maximum value is 380 dots , minimum value is 200 dots.

Display scale:size of displayed area in km (4x4) at start.

Altitude Control: Choose source of altitude data for flight control reference. Altitude reference can be selected from GPS, analog channel 8 (radar alt), barometric altitude or laser (if available)

Menu Hold Time: in seconds. It indicates how long the setting information of set system is displayed.

Display Bar Graph: Turns Bar graph data display on or off (see section 7.2)

Display Spectra: Turns radiometrics spectra display on (see section 7.3)

Display Chart Graph: Turns on analog chart displays

Display Map Area	Allows the user to display a pictorial representation of the survey area from a scanned picture of a map. The map image MUST be in BMP format and set for 256 colors.
Store Data On	Allows the user to specify the storage media upon which the survey data may be stored. The user may store data on one of the removable PCMCIA data cards or on the internal hard drive.
Backg Color	Allows the user to select the desired background color for the LCD screen. There are 65536 colors to choose from

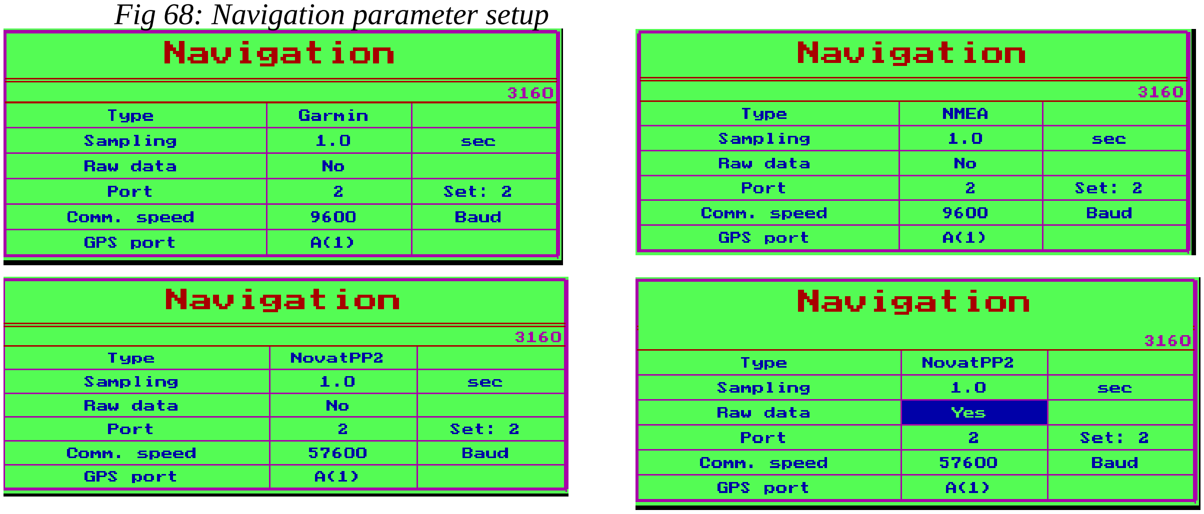
Fig.67: System definitions

8.1.3 Navigation parameters

The Agis system currently supports a number of different specific GPS receivers. Included are the Novatel line of receivers including the Millenium, Propak, and PC card versions, Ashtec GG12 and GG24 receivers, the CSI DGPS Max1 receiver, Most Garmin Receivers and any GPS receiver that outputs the NMEA 0183 (National Marine Electronics Association) GPGGA data string.

The user is present with an number of options as shown in the figures below:

Fig 68: Navigation parameter setup



"Type"	Navigation Receiver can be selected. Selected receiver sets automatically it's own parameters. The operator may change some of the parameters. This may be necessary for testing on different hardware. Recommended parameters are indicated in [ ] brackets. Changing the navigation to the Simulation mode sets the Port to 0 address and vice versa. Supported GPS receiver will appear automatically during the receiver selection process.
Sampling:	This controls the update rate at which data is acquired from the receiver and added to the geophysical data set. The default value is 1 (once per second). Data may be acquired at higher rates of up to 20 Hz depending on the receivers ability to transmit data and the selected baud rates.
Raw Data:	Some receivers allow the output of "raw data" to allow the user to post mission differentially correct the position data. If this extra data is required and is supported by your receiver this parameter should be set to YES
PORT:	The GPS data transfers are reserved for Com port 2 on the AGIS console. The user may change this to simulation mode for testing purposes
COM Speed:	This baud rate is defaulted to 9600 baud. Different speeds are available up to 115200 baud. The user is reminded the baud rate on the GPS receiver must match the baud rate selected in the AGIS com port in order to achieve successful data transfer. If raw data is selected then the minimum baud rate selected should be 57600. For the Novatel Millennium series of receivers the default value baud rate is set to 57600.
GPS PORT:	Most GPS receivers have more than one serial port available to transfer data. The user must specify to which port ON THE GPS RECEIVER the data system is connected.

8.1.4 Magnetometer parameters

Magnetometer - Def.

		3121
Type	MMS4	
Mags	3	
Samples	20	persec
Bandwidth	2.8	Hz
Sig.Scale	0.0002	nT
Compensation	ON	
Analog ch.	8	
Port	3	Set: 3
Comm. speed	57600	Baud

Fig 69 Magnetometer setup Parameters

Supported types of Magnetometers and their parameters will be displayed when a selection of a magnetometer is made. Any magnetometer system providing data in a serial (RS-232) format may be useable in the AGIS system. Custom configurations are available upon request. The default Magnetometer processor is the MMS-4

User definable parameters are as follows:

TYPE: This allows the user to select the type of magnetometer processor system to be used with the AGIS. Default selection is the MMS-4 (See section 8.1.4.1 for specifications)

MAGS Configures the system for the number of magnetometer sensors attached to the AGIS system / magnetometer processor. The AGIS currently supports up to 4 high resolution cesium vapour sensors

SAMPLES: current sample rates are limited to 10, 20, 25, 50, and 100 Hz

BANDWIDTH: The bandwidth selection is determined by the sample rate selected by the user. It is not selectable independantly

SIG SCALE: Co-efficient used to convert processed larmor frequency into Nano-tesla

COMPENSATION: The AGIS system currently supports both real time and post mission magnetic compensation The default setting is POST and is not changeable by the user unless the real time compensation package has been purchased by the user.

ANALOG CH The MMS 4 processor module is supplied with an 8 channel A/d processor card. This provides the user with 8 channels of 0-10 volt aanalog input data capability. In the standard configuration Channels 0,1,and 2 are reserved for the Fluxgate magnetometer.

PORT Com port 3 is reserved for the magnetometer data transfer. The user may qualified technician

COM SPEED Because of the possibility of high data volumes in limited time periods the default baud rate for this port should be set to 57600

8.1.4.1 ANALOG CHANNEL SETUP IN MMS-4 MODULE

Magnetometer AD

3121

Channel	User name	Coeff.	Offset	Unit
ADm1	XFg	1.0	0.0	step
ADm2	YFg	1.0	0.0	step
ADm3	ZFg	1.0	0.0	step
ADm4	ADm4	1.0	0.0	V
ADm5	ADm5	1.0	0.0	V
ADm6	ADm6	1.0	0.0	V
ADm7	Baro	.03052	600	mb
ADm8	Alt	.12207	0.0	ft

Fig 70: MMS-4 Analog Channel Setup

The MMS-4 A/D processor cards provides the user with 8 channels of analog input having a range of 0 to 10 volts DC. These inputs are isolated from each other and from ground.

The user may change the default names of Adm0 through 7 to more meaningful names . It is recomended to keep names descriptive but short (4 or 5 characters)

The first 3 channels are normally reserved for use with a fluxgate magnetometer but may be used for other devices if a fluxgate magnetometer is not included as part of the system.

The user may also enter co-efficients and offsets to each channel to convert the incoming voltage data into real world engineering units. Real time data monitoring is greatly simplified whendata is observed in their natural units (altimeter data expressed in feet makes more sense than in millivolts) Calculation of co-efficients and offsets is discussed in Appendix A

8.1.4.2 MMS4 parameters

MMS-4 is a fully automated Mmagnetometer processor working with CS2 or other continuos frequency magnetometer sensors.

Resolution: 1picoTesla (0.001 nT)
Sampling rates: 100Hz @ 20Hz bandwidth (no special filter)
40Hz @ 8Hz
20Hz @ 4Hz
10Hz @ 2Hz
Synchrinization: available to:
pps with a check on GPS update signal
Signal strength: measured in % with automatic gain adjustment
Manual adjustments: none
Data transfer: 1 second data burst on serial RS232 port

8.1.5 Electro-Magnetic system EM (HEM)

Pico Enviretec does not produce an Electro-Magnetic system, but offers simple and efficient interfacing to any system available. Parameters and control of such a system will be described in the EM manual supplied by the EM manufacturer.Gamma Ray Spectrometer (GRS410) parameters.

8.1.6 Gamma Spectrometer

Supported types of Gamma Spectrometers and parameters related to this Gamma Spectrometer will be displayed when a particular type is selected.

GRS Options		
		3120
Spectrometer	GRS410	word fmt
Spectra sampling	1.0	sec
Down Detect. type	2.5x2.5x3.5	in
Up Detector type	none	in
Alarm	200	nSvph
Port	5	Set: 5
Comm. speed	115200	Baud
Spectral Resolution	256	channels
Energy Span	3000	keV

Fig.71: Setup of GRS-410 spectrometer

Spectra sampling 1.0 or 0.5 second for 256 channels**.**

For 512 channels 1.0 second only.

Down Detectors Type of detectors to resolve absolute measurements. The user may select from 10 different crystal detector sizes

Up Detectors For record only.

Alarm: Used only in Iris system. Used to determine alarm point for dangerous radiation levels

Port: Serial port settings (For simulation the Port is set to 0.)

Comm Speed: default baud rate for the spectrometer is 115200

Spectral Resolution Selectable 256 and 512 channels. Simulation supports 256 channels only.

Energy span 3000 keV.

Note: values in [] represent settings for AGIS hardware.

8.1.6.1 Definition of ROIs for Down Detectors (Fig.)

Energy widths of ROIs are set according to the IAEA specifications. They may be changed by editing the ascii file ***.spx** only. An expert user only should attempt this modification. First eight ROIs are set to calculate absolute units of contamination and exposure in real time.

Spectrometer/Down (256ch)-def.

3122

ChNum	Chnnl	ChBeg	ChEnd	Unit	Record
1	cTh	202	242	Bqpkg	n.a.
2	cU	135	165	Bqpkg	n.a.
3	cK	111	135	Bqpkg	n.a.
4	cCo	88	110	Bqpm2	n.a.
5	cCs	48	64	Bqpm2	n.a.
6	cRu	37	48	Bqpm2	n.a.
7	cI	25	36	Bqpm2	n.a.
8	TEx	25	255	pSvps	n.a.
9	TC	34	254	cps	Yes
10	Cos	255	255	cps	Yes
11	Xe	17	26	cps	Yes
12	Kr	21	31	cps	Yes
13	Cs	48	64	cps	Yes
14	K	111	137	cps	Yes
15	U	135	165	cps	Yes
16	Th	202	242	cps	Yes

Fig. 72 ROI settings for down looking crystals

8.1.6.2 Definition of ROIs for Up Detectors (Fig.)

The same applies for Up looking Detectors.

Spectrometer/Up (256ch)-def.

3122

ChNum	Chnnl	ChBeg	ChEnd	Unit	Record
1	TCu	37	254	cps	Yes
2	Ku	111	137	cps	Yes
3	Uru	135	165	cps	Yes
4	Thu	202	242	cps	Yes
5	SPu	160	242	cps	Yes
6	DrU	37	254	ratio	Yes

Fig. 73 Definition of ROIs for Up Detectors

8.1.7 Pilot Guidance Display setup

The AGIS system currently supports two types of pilot guidance unit. The PDI is a 3 line text based display unit that provides cross track, heading and speed information to the pilot.

Fig 74 AG-NAV Pilot display Unit (PDI)

The PGU is a graphical display type unit that provides continious information to the pilot when flying a pre-determined flight surface as determined by a digital terrain model.

Fig 75: graphical pilot guidance unit (PGU)

The user should select the appropriate guidance unit the system. If no external pilot display is used the display should be set to no output by setting the serial port value to 0 (zero)

P G U and Video		
		3170
Type	PDI	
Update	1.0	sec
Port	1	Set: 1
Comm. speed	38400	Baud
Xtk/char	1.0	m

Fig.76 Pilot Guidance and video overlay setup

8.2 NAVIGATION GENERAL PARAMETERS

8.2.1 Navigation Geodetic Parameters

Navigation param.-def.		
		3103
Approx.Longitude	-73.00001	deg +E,-W
Approx.Latitude	43.00	deg +N,-S
Central Merridian	279	
Earth Datum	0	
Datum Shift X	0	m
Datum Shift Y	0	m
Datum Shift Z	0	m

Fig 77: navigation Parameters

Before starting the project Operator must enter approximate position of the area in degrees to be surveyed. Longitude east of Greenwich is entered as positive and west as negative. Latitude for northern hemisphere is entered as positive and for southern as negative. The central meridian is calculated automatically. The approximate longitude and latitude can be entered manually if desired. If an AREA.XYZ file was imported for the project, these parameters will be extracted from the file and entered into the parameter table automatically. In those systems where ellipsoids **other** than WGS-84 are permitted, offset corrections for datum shifts X, Y, and Z may be entered. Due to the complex nature of geodetic conversions and the great possibility of error Pico Envirotec recommends the coordinates supplied be converted to the WGS-84 ellipsoid before creation of the AREA.XYZ file or entry into the AGIS survey area setup.

8.2.2 UTM ZONE BOUNDARIES

Due to the nature of UTM coordinates and UTM zone boundaries it is possible that problems will arise if the survey area crosses a UTM zone boundary. When creating the survey area polygon either by using the PEI Convert program or directly inside the AGIS / IRIS “create project” window the user should determine if the area to be surveyed does in fact cross a UTM zone boundary. (A list of Zone boundaries and central meridians can be reviewed in Appendix G of this manual.) If the project polygon crosses a zone boundary the user should select the central meridian from the western most of the two zones involved. It is also recommended the master points for determination of the tie line and survey line positions be placed in / selected from positions in the western most zone area.

Failure to observe this convention creates the possibility of generation of UTM coordinates having negative values. This can cause the navigation system to become unstable, resulting in erratic navigation and / or system software failure.

8.3 SURVEY/PROJECT PARAMETERS

All parameters are set in a tabulate format. Individual tables are stored as project parameter files and than re-loaded when the project is recalled. (See figure 61)

8.3.1 Project Navigation Limits

“Altitude”	Project planned altitude
“Altitude tolerance”	When exceeding the tolerance the warning display color (yellow) is of the parameter is displayed
“Used Alt. Control”	Different types of altimeters may be used. Indicated ALTsp is part of the Grs410 Gamma spectrometer when containing dedicated analog input to altimeter measuring device. Selection of several sources is possible (Magnetometer AD channel 8, GPS, etc).
“Rad.Alt.Break” and “Alt.Scale Ratio”	Are used for special radar altimeters with a scale break for higher altitudes.
“Ground Speed” “Ground speed Tolerance”	Project planned ground speed and groundspeed tolerance
“Max. Crosstrack” “Crosstrack Tol.”	Is used to control the settings of the aircraft to flight line attitude graphic display.

Project Setting Info

3112

		Unit
Altitude	100	m
Altitude tolerance	20	m
Rad.Alt.Break	500	m
Alt.Scale Ratio	1.0	
Ground Speed	100	kmh
Ground Speed Tol.	20	kmh
Crosstrack Tol.	50	m

Fig 78: Altitude and Speed limits

8.3.2 Map Selection

Provides the user with a list of geographical map stored in the system. The operator can select up to four maps that can be used as a geographical image for data and aircraft references. Once the map is selected it is annotated with **#** sign. At the end **“Selection finished”** terminates this

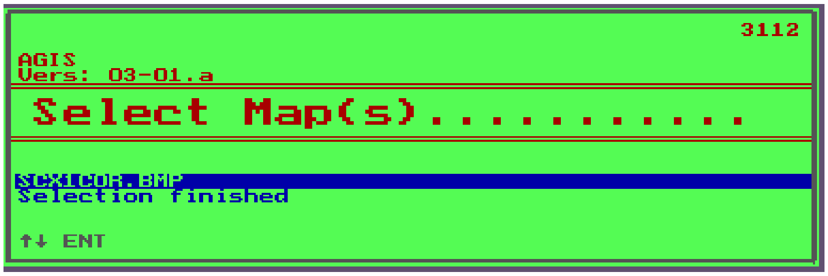


Fig 79: map selection

8.3.3 Survey Block Information

This table defines starting point of Survey and Tie lines as well as their headings. Further it defines Survey and Tie lines spacing (separation) (see Fig. 63).

Survey Block Info		3106
Lines Increment	10	
Lines Reflown	0	
Survey Line X point	620937	m
Survey Line Y point	4849543	m
Survey Line Heading	0	deg
Survey Line Spacing	100	m
Tie Line X point	620937	m
Tie Line Y point	4849543	m
Tie Line Heading	90	deg
Tie Line Spacing	200	m
Min. Line Length	100	m
Distance to border	500	m

Fig. 80 Survey Block definition

Lines Increment Determines the value by which line numbers will be assigned. The default value is 10. This allows the user to assign additional line numbers between existing lines in the event of re-flights.

Lines Re-flown: Allows the addition of an extra digit to a line number in the event that it is re-flown

Survey Line X specify the value of the Easting (X) for the master point of the survey line. Is usually the most south western corner of the area

Survey Line Y specify the value of the Northing (Y) for the master point of the survey line. Is usually the most south western corner of the area

Survey Line Hdg	specify the line direction or heading. When UTM coordinates are used the heading is specified as a grid heading, If Latitude / Longitude coordinates are used the heading specified should be a magnetic heading**.**
Survey Line Spacing	specifies the distance between consecutive flight lines
TIE LINE x,y,hdg	These lines are usually flown at right angles to the survey lines. Their parameter set up format is the same as the flight lines. Specifics of spacing, and direction will be supplied by the contract
“Min. Line length”	Defines shortest line generated by the line generator process
“Distance to border”	Control for dotted white line on the Aircraft Guidance Information display.
“Coord. Type”	UTM in [m] or Latitude/Longitude in [DD.] or in [DD:MM.].

8.3.4 Survey Area Corner Information

Survey Area Corners 1 to 32

3107

Coord #	X-m	Y-m	Coord #	X-m	Y-m
1	620304	4852829	17		
2	622313	4853466	18		
3	622946	4850171	19		
4	620937	4849543	20		
5			21		
6			22		
7			23		
8			24		
9			25		
10			26		
11			27		
12			28		
13			29		
14			30		
15			31		
16			32		

Fig 81: survey area corners definition

A survey polygon with up to 96 corners delimiting the surveyed area may be created. The area corners may be entered either manually as individual corner coordinates or “On Fly” in real time flying over the area and manually marking the corners (see chapter 9).

The user may also import the survey area information through the use of the AREA.XYZ file. This is a pre-assembled file created by the project manager or geophysicist that contains all the relevant information for the survey. This AREA.XYZ file can be imported during the set up of a new project. (See appendix F for specific details) If the information has been imported via the AREA.XYZ file, the user my verify the parameters when displayed in the navigation set up screens.

For testing purposes an area-generation pattern is available.

8.3.5 Survey Area Verification

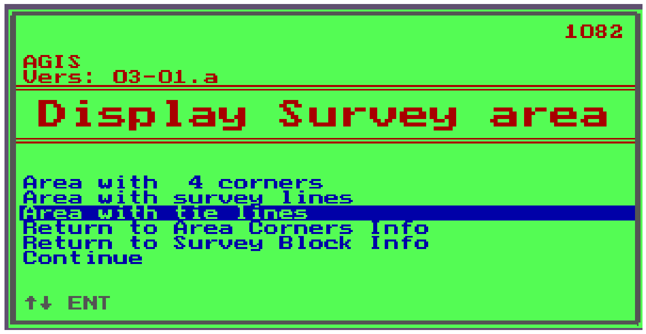


Fig. 82: Survey area verification

Once the survey area has been defined the user may visually check the area to see if the line pattern is acceptable and correct. The display survey area window allows the user to see a representation of the area displayed in several ways.

Area with 4 corners	Sample display survey area for test purposes
Area with Survey Lines:	This option will display the survey area polygon with all the flight lines displayed inside it
Area with Tie Lines	This option will display the survey area polygon with all the tie lines displayed inside it
Return to Area Corners:	Allows the user to return to the area definition window to correct any corner points that may be incorrect
Return To Survey Block:	Returns the user to the flight line parameter setup window. Enables changes in flight line spacing and heading to be made.
Continue:	If the user is satisfied with the survey area layout, flight line and tie line heading and spacing they may continue to the data acquisition mode of the program Refer to Section 6.1

While checking the area some area statistics are displayed (see ***Fig.*** 66). To return to the figure ***Fig.***83 press <Any key>

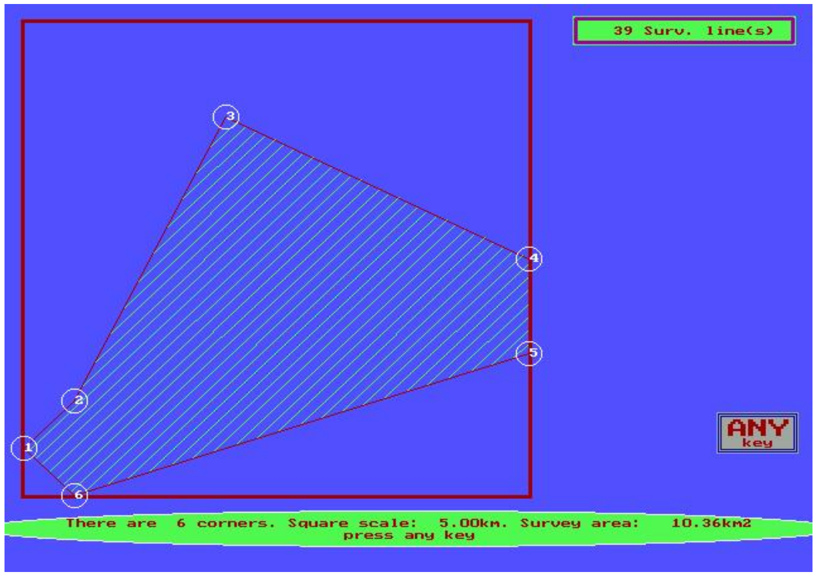


Fig. 83 Survey area verification

8.3.6 Waypoints

Up to 16 waypoints can be entered either manually or in real time while flying or by means of the AREA.XYZ file

Waypoints provide the means to navigate directly from point the aircrafts' current position to a predefined point such as the home airport or other important locations. These points may be entered with an abbreviated name instead of a number (***Fig.***67).

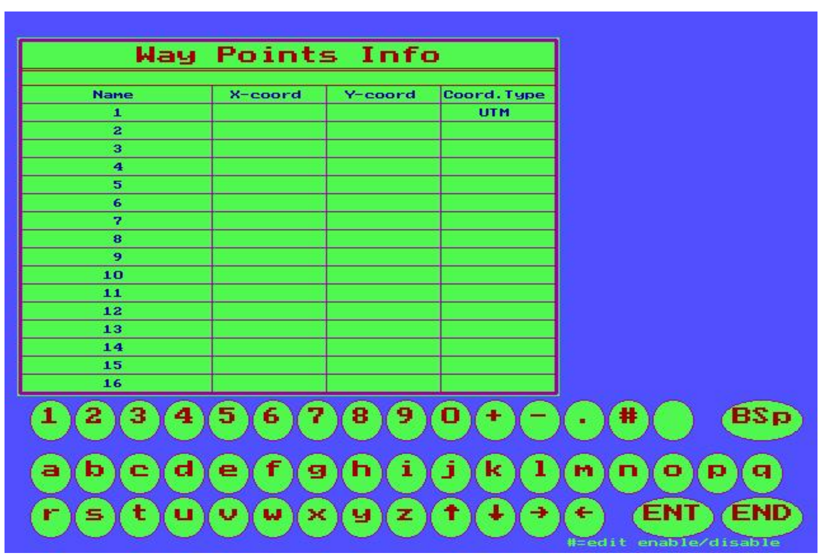


Fig.84 generation of waypoints

8.3.7 SPECIAL LINES

During the course of a geophysical survey it is often necessary to re-fly specific lines at regular intervals for instrument calibration purposes. Such lines would include daily radar altimeter checks, spectrometer calibration test lines, lag tests, heading effect tests, crosstalk and nulling tests for electro-magnetic systems etc. As a general rule these lines must be flown in precisely the same manner and position each time. In order to provide for these requirements the AGIS system allows the user to pre-define up sixteen (16) such lines. These lines can be defined during the creation of the AREA.XYZ file using the PEI Convert program or may be entered manually during the project setup routine in the AGIS software.

When in the project setup menus the following screen will be presented to the user after the waypoint selection screen

Special Lines-def.

3108

Name	X1-m	Y1-m	X2-m	Y2-m	Alt-m
li1	680000	477900	680000	477000	100
li2	680200	477900	680200	477000	300
Line 3					
Line 4					
Line 5					
Line 6					
Line 7					
Line 8					

Fig 85: special line definition screen

9 ON FLY SURVEY AREA GENERATION

On Fly allows entering the area corners without having precise coordinates of the area corners. Flying to the area of interest and marking the corners on the fly simplifies the task of area definition and produces WGS-84 coordinates.

Fig. 86

Area can be flown with or without the inserted map. Map insertion and removal is activated by pressing **<INS>** control.

Individual corners are a\entered by **<ENT>** control. Minimum three corners must be entered before the **<F2> (head)** is activated. Maximum thirty two corners can be entered. The count of entered corners is displayed in the navigation area of the screen. Always the last corner can be deleted by entering **<DEL> (corn)**.

To enter the direction of the survey lines aircraft must be brought inline with the required direction and **<F2>** must be entered.

When **<ESC> (term)** is activated the process of area generation is cancelled.

When the flight line direction is entered the **<END> (area)** id activated. When pressed, program returns to 5.6.5 Survey area verification.

10 DATA RETRIVAL

Data can be retried from the system when exiting the program. The user may automatically export the contents of the Press <R> or touch the “Retrieve Data> line.

Fig. 87

The user may export acquired data to the compact flash card residing either as drive E or Drive F.

If the Retreive data option is selected the following screen will apper reminding the user to ensure the flash memory is inserted into the Agis PCMCIA card slot located on the top of the console

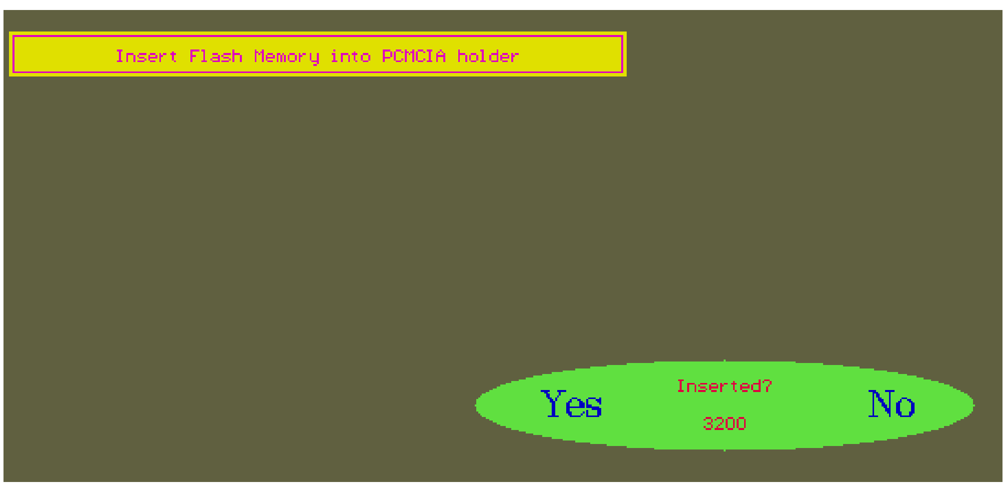


Fig 88*: data recovery flash disk warning*

If NO is selected (press N on the keyboard) the software will exit. If Yes is selected the software will ask if the flash memory is inserted into Slot E or slot F in the PCMCIA card holder. Ensure your selection matchs the actual position of the Flash card. Failure to do so will cause the system to crash. Once theproper slot has been selected the data is transfered from the AGIS hard drive to the flash card. The transfer may take a few minutes as some of the files may be quite large and the compact flash media has a much slower data rate than the computer hard disk

NOTE: Due to restrictions placed on the system by virture of the speed of the compact flash memory and its maximum read / write speed plus the short comings of the DOS operating system the RETREIVE DATA mode will only work with the following parameters being observed:

1. **The compact flash card must have been formated as FAT 16 under DOS ie in the AGIS Sysyem not under / by a computer using the WINDOWS operating system.**

2. **The compact flash card must be empty**

11 COLOR CODING

Principally the information displayed on the screen is color-coded.

- Green color is used for generally acceptable data.
- Yellow color is used for out of tolerance data.
- Other colors when used as indicators are intended for the image enhancement.
- Vertical chart traces, as well as bar graphs can be adjusted to any color by the operator.

Specific use of colors:

Navigation:

Green: data within tolerance

Yellow: data out of tolerance

Time and Fiducial (record number):

Green: Synchronized to GPS

Yellow: Not synchronized to GPS

Any simulated data: Record button yellow

Any sensor data interruption: Record button yellow

12 BACGROUND AND OTHER COLOR ADJUSTMENTS

Background color can be adjusted in the system definition.

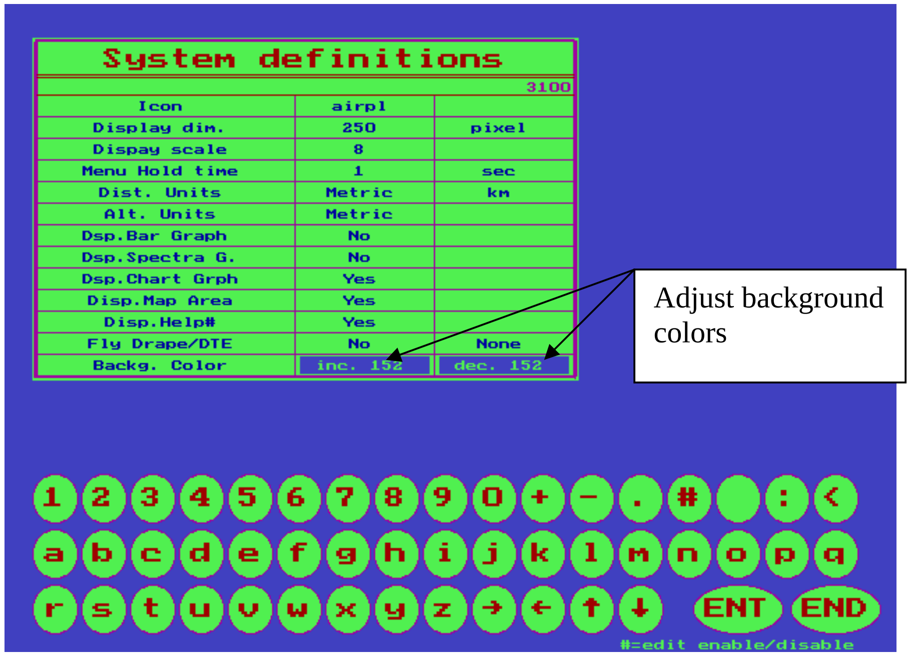


Fig. 89

Trace colors are adjusted by indicated buttons or by <c↑> or by <c↓>. Same system applies for bar graph color adjustment.

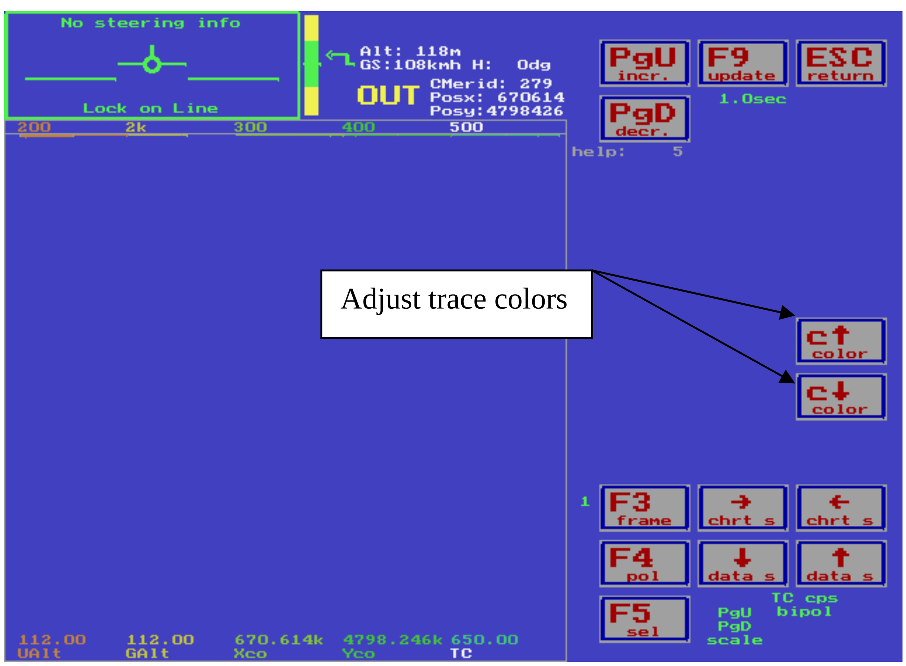


Fig. 90

13 HELP

Help for individual parts of the program is guided by the "help level" number. This number may be enabled or disabled from being available on the screen. Whenever there is some work to be done on the AGIS.HLP file than enabling the display of help level is very helpful. The AGIS.HLP file is an ASCII file that can be easily edited. For each help level contains help text that can be written in any language supported by the computer.

Here is the example of the help file.

```
{AGIS help}
{@ = precedes help level}
{following is the help text up to}
{12 lines of 28 characters per line}

@1000
Testing all required
directories

@1001
Program is initialized
read HELP instructions

@1002
Continue - Short cut to
already initiated project
To change parameters,
to select a new project,
to select other option
or to Terminate program

@1003
Select one of the options
Note:
“Data receive” is an option

@1004
Program loads selected maps
Corrected maps are *.IMG
Name of the map is shown
with UTM co-ordinates

@1005
Loading hardware drivers
as selected for operation

@1006
You can re-start AGIS
program by pressing ‘Y’

@1100
If you use Touch Screen
```

Enter changes using displayed keyboard

etc.

Help is called by <F1> or touching the top left corner of the screen.

Help text appears in a special help window with the indication of help level and instructions how to return (**Fig.**).

Fig. 91

Special help appears when in real time operating mode indicating touch points and equivalent keys. Simulation flight control works from the keyboard only

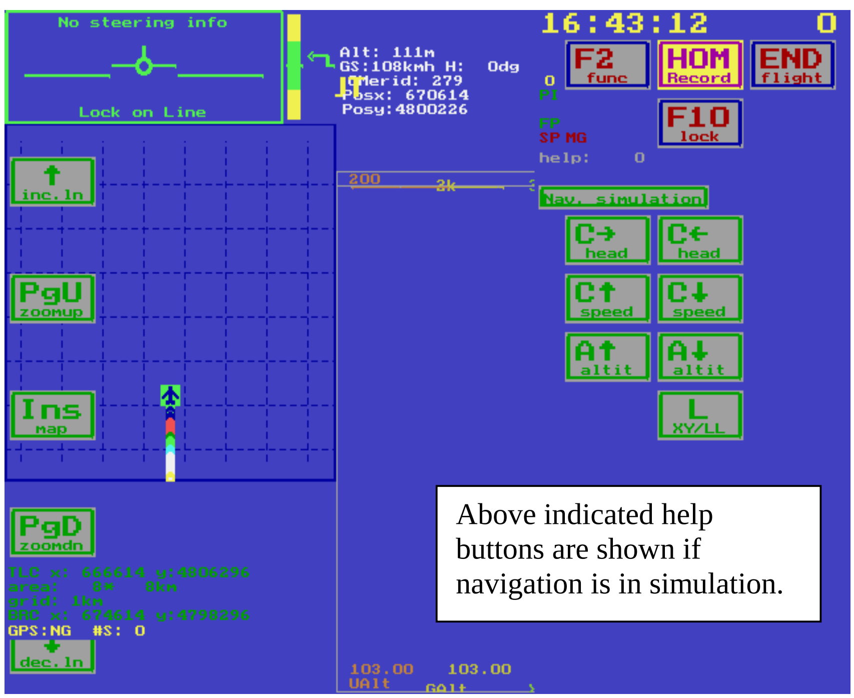


Fig. 92

14 PEI ACCESSORY SOFTWARE, PEILOADM.EXE USING PEI-LOAD SW TO UPGRADE FIRMWARE

OVERVIEW

The intelligent sensor arrays and display units manufactured by PEI all contain firmware programs to control their specific functions. This firmware may be upgraded or changed by the user without dis-assembling the instrument. This is accomplished by means of uploading new software to the selected instrument from the AGIS console or any DOS based computer that has a standard RS-232 serial port. Since in most instances the instrument to be upgraded will already be attached to the AGIS console it makes the most sense to conduct the uploading procedure through the AGIS.

METHODOLOGY

The PGU, MMS4, GRS410, GRS16 and AD32 instruments all have an AUTOEXEC.BAT file configured for the remote upload of files. The slave loading software program, PEILOADS.EXE is called at the beginning of the Autoexec .bat program execution loop. When the instrument is powered up and starts its “boot sequence” ,this slave program looks to see if the master computer (the AGIS) is attempting to communicate with the slave. If no communication is established with the host computer running the PEILOADM.EXE within 5 seconds, the PEOLOADS program times out and then stars to run its main firmware. The main program (PILOT.EXE for PGU, MMS4PROC.EXE for MMS4, IRISCO10.EXE for GRS410, GRSCO16.EXE for GRS16 and AD32PROC.EXE for AD32) starts automatically after the PEILOADS timeout. If the PEILODM.EXE was successful in establishing a communication link with PEILOADS.EXE, an upload procedure from host to slave starts automatically. All data blocks are secured with a CRC checks.

PROCEDURE

1. **PROGRAM DIRECTORY & STORAGE:** Copy the program that you want to upload to the slave instrument into a directory on the master computer (usually the AGIS console.) In the same directory, ensure there is a copy of the PEILOADM. A copy of the PEILOADM.EXE program was supplied and installed in the C:\IRIS directory. Of the C drive.

2. **SLAVE INSTRUMENT SERIAL PORT:** Determine the serial port number on the master computer that is connected to the slave instrument to be upgraded. The serial port configuration varies with each series of systems. The user may determine the correct port by starting the IRIS survey program and going to the project edit section of the program. Refer to the AGIS user manual section 8.1 for more information.

   The figure below shows the main device screen in the edit mode of the AGIS survey program:

Fig 93: Equipment options configuration

The devices that are configured for your system will be indicated by a “YES” in the USED column of the Select options screen. If the user presses the enter key the modify button in the VIEW column will become highlighted. Using the UP or DOWN arrow keys on the keyboard will allow the user to select the device to be viewed or modified.

3. From the figure below it can be seen the pilot display (PGU) is selected to be on port or COM 1. This would be the port number to be used when using PEILOADM to upload new firmware to the pilot display unit.

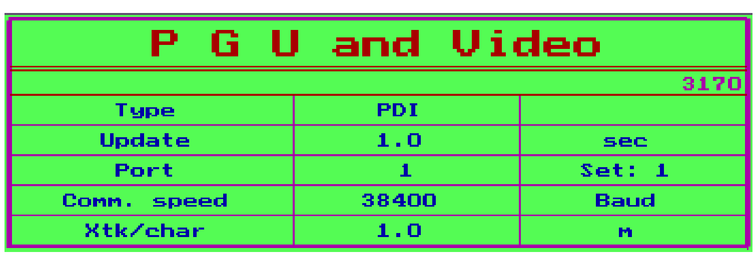


Fig 94: pilot display selection

Once the port number for the device has been correctly determined, exit from the project setup menu. The user will have to continue through the project set up sequence to reach a window that allows an exit from the software.

You are now ready to start the software sequence to upload the new software.

4 . **UPLOADING THE NEW SOFTWARE**:

4.1 Power off the unit you want to upgrade.

4.2 Go to the directory on the master computer where the new firmware and the PEILOADM programs are residing.

4.3 Start The PEILOADM.EXE The user will see a screen like the one below

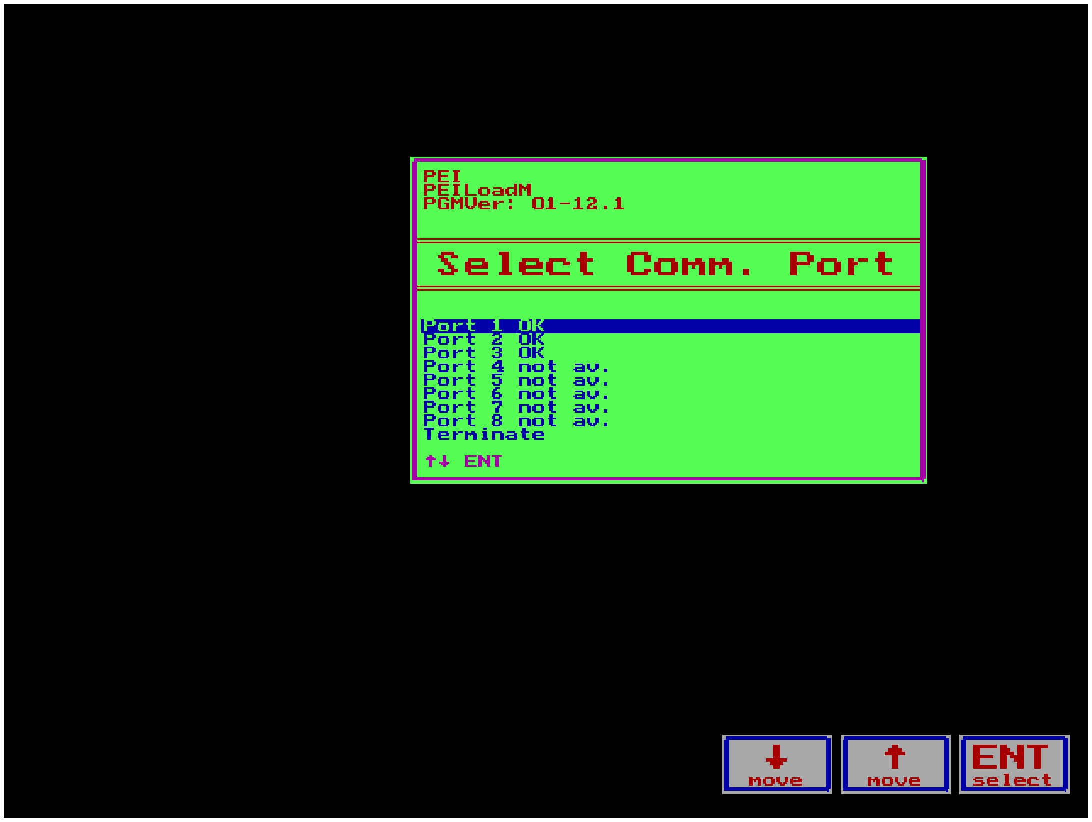


Fig 95: selecting com port for software upload

4.4 All the active ports on the master computer are displayed. Select the port used by the slave unit you want to upgrade:

A typical configuration would be: COM1 for PGU
COM3 for MMS4
COM5 for AD32

After selecting the correct port by using the UP or DOWN arrow keys press ENTER on the keyboard. A new screen will appear similar to the one below:

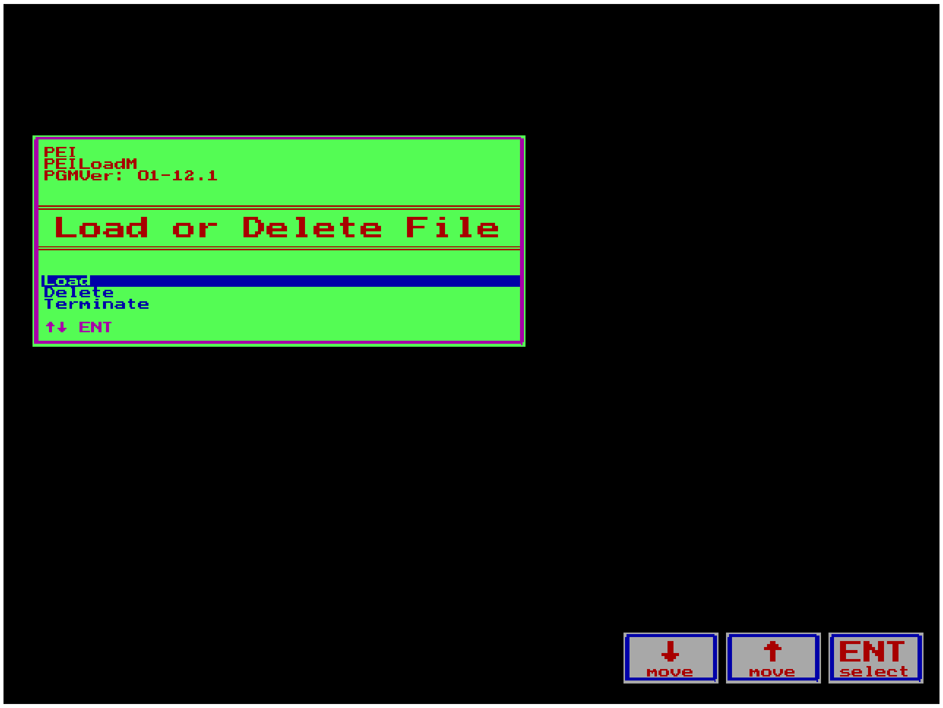


Fig 96: specify source file location for upload

4.5 Select LOAD file. A new window will open asking the user to enter the location and the full file name of the file to be uploaded. The full directory path and name must be entered as shown by the figures below:

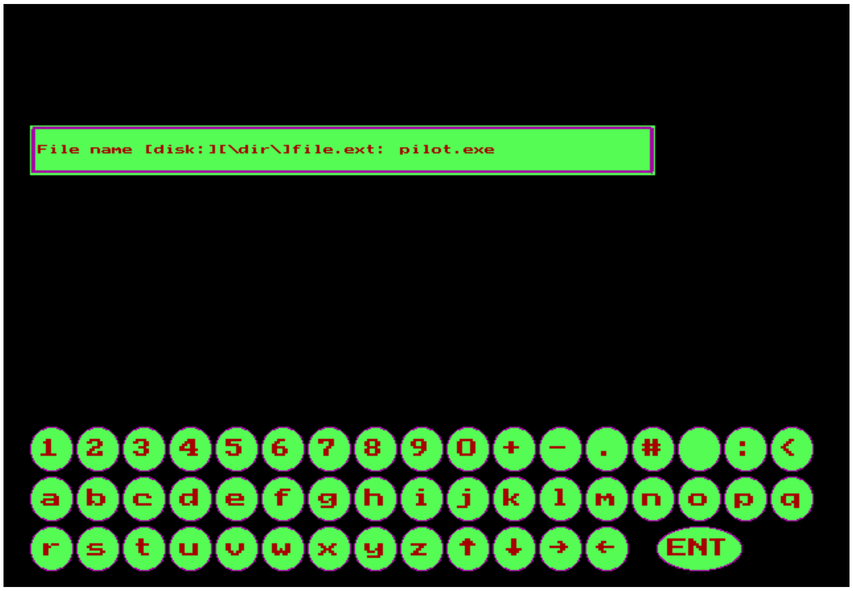


Fig 97: source file specified

4.6 Depending on the device to be upgraded the user would enter PILOT.EXE for a PGU upgrade, MMS4PROC.EXE for MMS4, IRISCO10.EXE for GRS410, GRSCO16.EXE for GRS16 and AD32PROC.EXE for AD32. After entering the directory path and file name, press ENTER.

4.7 The user will then be asked to enter the destination directory and the file name. The user has the option to rename the file when it is transferred to the slave device. If the file to be transferred is going to the root directory of the slave device C:\ and there is no requirement to change the file name or extension the user may simply press the ENTER key and the file will be transferred in default mode.

The screen will appear as shown in the next figure:

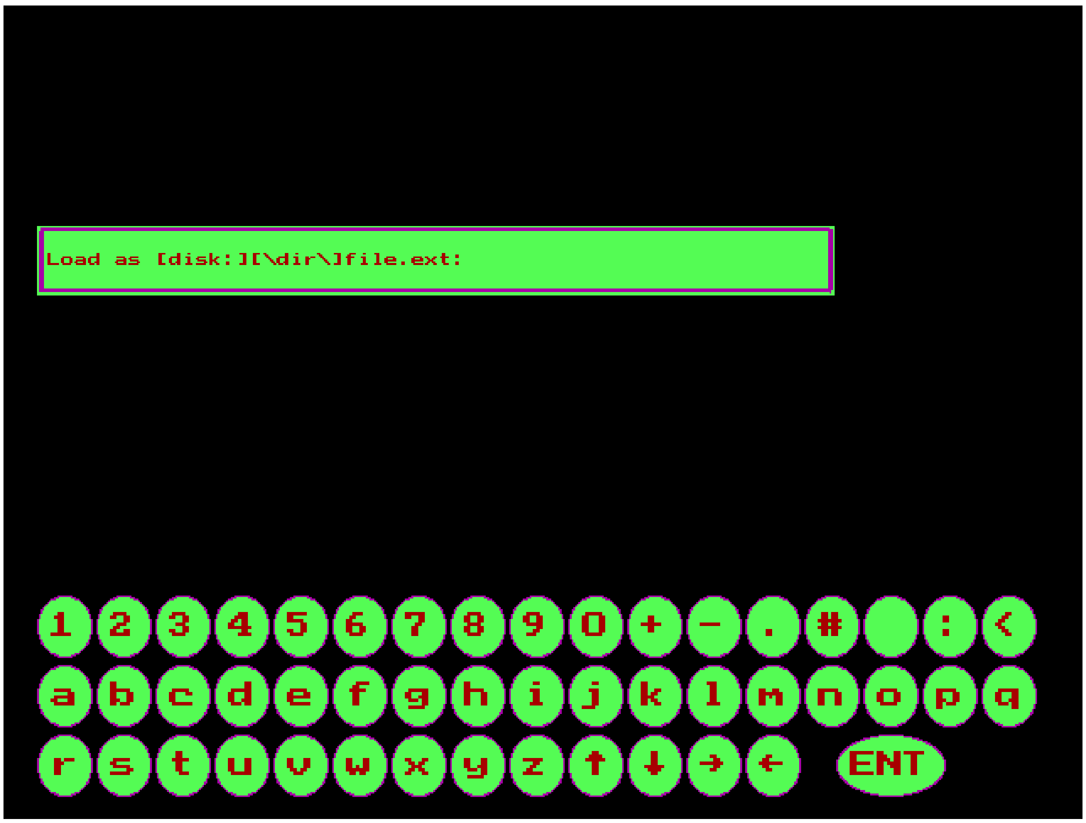


Fig 98: enter target location and file name for upload

After pressing the enter key the next screen will appear

4.10 When the above screen appears, turn the slave unit ON to start the upload. Once communication is established between the master and the slave you will see the progress of uploading sequence on the screen. The program will indicate the completion of a successful upload. Once this is displayed ,exit the PEILOADM after the upload is finished. The upgraded unit exits PEILOADS and automatically starts regular operation. It is recommended to power off the whole system and start again after a few seconds.

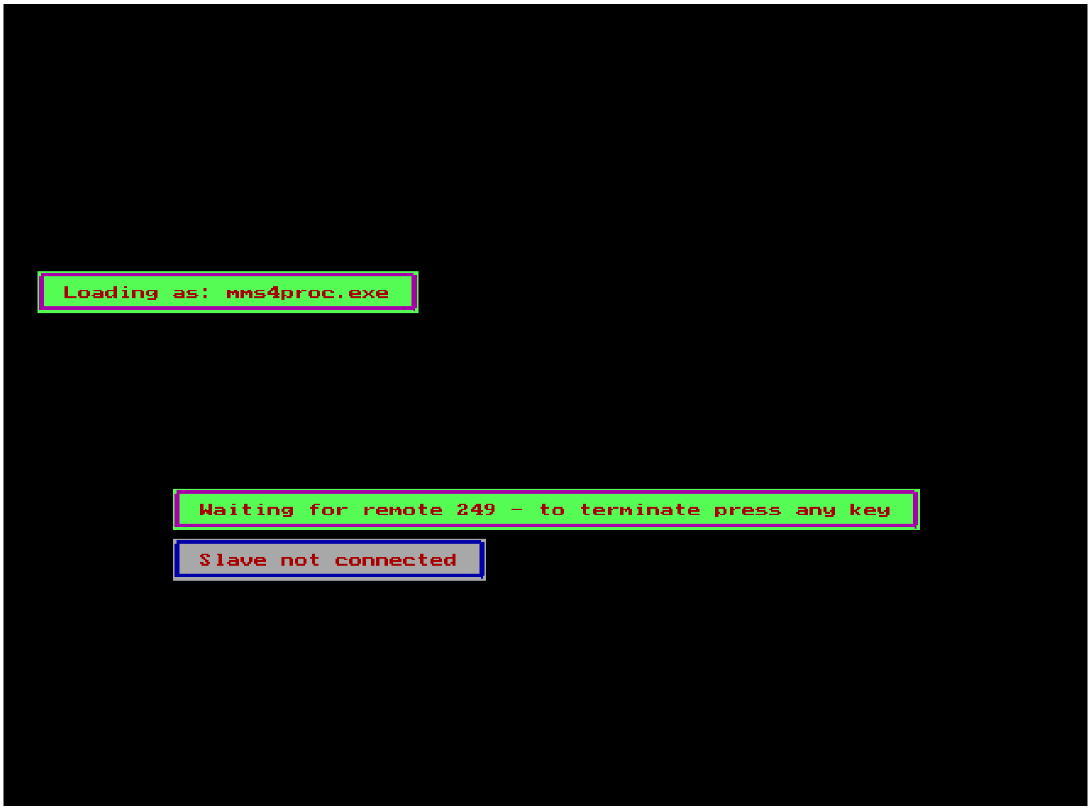


Fig 99: start software upload

5.0 Use testing programs to verify devices functionality, MMS4TEST for MMS4, GRSCA10 for GRS410, GRSCA16 for GRS16 and AD32TEST for AD32 analog unit.

APPENDIX A: RELATED PROGRAMS

There are programs related to the operation of AGIS.

Directly related programs

- IRISCA10 is used for GRS410 Gamma Spectrometer calibration
- IRISCO10 operates the GRS410 Gamma Spectrometer
- MMS4TEST test program for the MMS4 Magnetometer
- MMS4PROC operates the MMS4 Magnetometer
- IRLOADM is used for GRS410 and Pilot Guidance Unit remote upgrade
- IRLOADS is part of the GRS410 and Pilot Guidance Unit allowing remote upgrade
- IRISPI operates Pilot Guidance Unit
- IRISCOSI simulates GRS410 Gamma Spectrometer

Indirectly related programs operating under WINDOWS

- PEIVIEW Quality Control (QC) for AGIS acquired data with the possibility to generate ASCII and Geosoft binary outputs
- PEICONV scanned map conversion program
- PEILOAD is used for sensor and Pilot Guidance Unit remote upgrade
- PEICALIB is used for Gamma Spectrometer Calibration

Third party software operating under WINDOWS

- GEOSOFT is data processing package used to generate final output maps.

APPENDIX B: DATA FORMATS

There are two data files recorded. One called flight path data (FPD) and normal data binary format (PEI).

FPD file is turned on and kept on all the time during the real time operation. It contains a limited number of data channels and serves as a monitoring data set.

PEI file is turned on and off by the operator and contains all of the data to be recorded.

Both files have a common structure defined by the file header written in the ASCII and separated from data by the hex 1A character.

The 'channel description line' describes each data channel. Channel description lines are placed between two key words (lines) **BEGIN … END.**

Channel description line contains following parameters placed on one line separated by commas.

Name, Number of elements in unit of time (1 sec), Type of data, Coefficient, Offset, Unit, Comment

Internal file description should be self-explanatory.

FPD file header – example

```
PEI BINARY Data Format

 Data is stored in one second RECORDPEIs
 Each data channel or data array is described by a string:
 Name,Array,Data_type,Const,Offset,Unit,Comment
 For "as" (Const,Offset,Unit) not applicable
 For "db" and "fl" Const = dec.digits
 For other Const = multiplication constant
 Data Units marked with '*' indicate spectra while
 Without the data is time sequence of data
Data Types:

 as=ascii    1 byte   ASCII character
 by=byte     1 byte   0..255
 db=real     8 byte   5.0e-324..1.7e308 15-16d.
 fl=float    4 byte   1.5e-45..3.4e38  7-8dig.
 in=integer  2 byte   -32768..32767
 li=longint  4 byte   -2147483648..2147483647
 si=shortint 1 byte   -128..127
 wd=word     2 byte   0..65535
 RECORDPEI definition:

 BEGIN
 Month,2,as,1.0,0,,
 Day,2,as,1.0,0,,
 Prj,1,as,1.0,0,,
 Recd,1,as,1.0,0,,
 In/O,1,as,1.0,0,,
 CMer,1,in,1.0,0,deg,
 Coord,1,li,1.0,0,,
 DaySec,1,li,1.0,0,sec,
 Xco,1,li,1.0,0,m,
 Yco,1,li,1.0,0,m,
 cTh,1,fl,3,0,Bqpkg,
```

```
cU,1,fl,3,0,Bqpkg,
cK,1,fl,3,0,Bqpkg,
cCo,1,fl,3,0,Bqpm2,
cCs,1,fl,3,0,Bqpm2,
cRu,1,fl,3,0,Bqpm2,
cI,1,fl,3,0,Bqpm2,
TEx,1,fl,3,0,pSvps,
TC,1,fl,0,0,cps,
Cos,1,fl,0,0,cps,
Xe,1,fl,0,0,cps,
Kr,1,fl,0,0,cps,
Cs,1,fl,0,0,cps,
K,1,fl,0,0,cps,
U,1,fl,0,0,cps,
Th,1,fl,0,0,cps,
TCu,1,fl,0,0,cps,
Ku,1,fl,0,0,cps,
Uru,1,fl,0,0,cps,
Thu,1,fl,0,0,cps,
SPu,1,fl,0,0,cps,
DoU,1,fl,0,0,cps,
END
```

PEI file header – example

```
PEI BINARY Data Format
Data is stored in one second RECORDPEIs
Each data channel or data array is described by a string:
Name,Array,Data_type,Const,Offset,Unit,Comment
For "as" (Const,Offset,Unit) not applicable
For "db" and "fl" Const = dec.digits
For other Const = multiplication constant
Data Types:

as=ascii    1 byte   ASCII character
by=byte     1 byte   0..255
db=real     8 byte   5.0e-324..1.7e308 15-16d.
fl=float    4 byte   1.5e-45..3.4e38  7-8dig.
in=integer  2 byte   -32768..32767
li=longint  4 byte   -2147483648..2147483647
si=shortint 1 byte   -128..127
wd=word     2 byte   0..65535
RECORDPEI definition:

BEGIN
Line,12,as,0,0,,line descriptor
OPtype,1,as,0,0,,operation
RECS,1,li,1,0,,fiducial-records
DTsc,1,li,1,0,sec,second of day
ETsc,1,li,1,0,sec,elapsed time
Xutm,  1,li,1.0,0,m,
Yutm,  1,li,1.0,0,m,
```

```
Lat,  1,li,0.00001,0,deg,
Lon,  1,li,0.00001,0,deg,
Galt,  1,li,1,0,m,
Gtm,  1,li,1,0,sec,
Gst,  1,li,1,0,,
UAlt,  1,wd,1,0,m,
TC, 1,fl,0,0,cps,
Cos, 1,fl,0,0,cps,
K, 1,fl,0,0,cps,
U, 1,fl,0,0,cps,
Th, 1,fl,0,0,cps,
TCu, 1,fl,0,0,cps,
Ku, 1,fl,0,0,cps,
Uru, 1,fl,0,0,cps,
Thu, 1,fl,0,0,cps,
SPu, 1,fl,0,0,cps,
DoU, 1,fl,0,0,cps,
ISP1D, 256,wd*, 1,0,cps,spectrum
ISP1U, 256,wd*, 1,0,cps,spectrum
ISPS,10,as,0,0,,status
ISPT,10,fl,4,0, ,
ALTsp,1,fl,1,0,m,
TMPsp,1,fl,1,0,deg,
PREsp,1,fl,1,0,kP,
HUMsp,1,fl,1,0,%,
END
```

PEIVIEW program (version 01-09.1 and higher) provides easy QC and possibility to retrieve the data into the ASCII format or Geosoft Binary format (GBN).

APPENDIX C: DISK NAMES AND USE OF SERIAL PORTS

Simplified top view of the AGIS/IRIS main console.

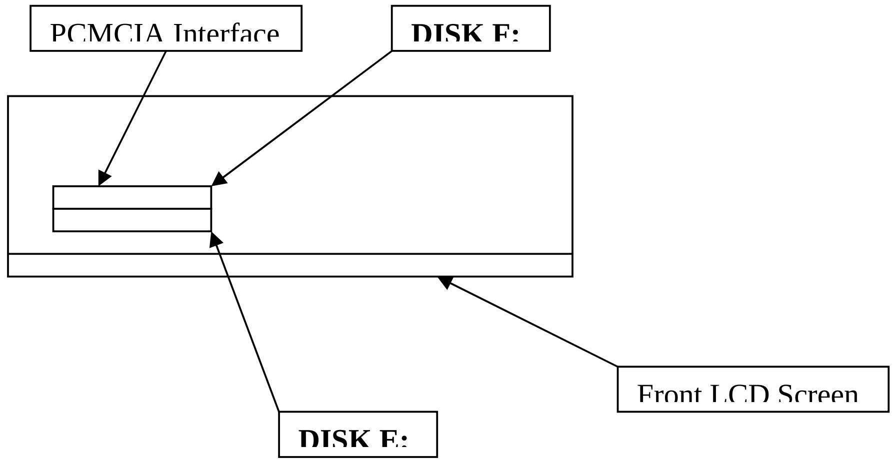


Fig. 100

Internal Program and Data Acquisition disk is **DISK C:**
Internal RAM disk for flight path control storage is **DISK D:**

Normal use of serial ports (RS232):

COM1	Pilot Guidance Unit
COM2	GPS interface
COM3	Gamma Spectrometer if no Magnetometer Else Magnetometer
COM4	Touch screen
COM5	Magnetometer if Spectrometer on Com3
COM6	EM
COM7	Spare
COM8	Spare

The above list is typical of the comm. port assignments. Because the AGIS system can be configured in many ways depending on the sensors available and the requirements of the user the comm. port assignments can vary from system to system. The user should make note of the settings for their particular system. This information is stored in the IRIS.INT file in the C:\ IRIS directory.

APPENDIX D: GLOSSARY

Word	Definition
ADRG	System of geographical coordinates based on Latitude and Longitude. For internal processing a unit **au** (angular unit) was devised. This unit approximates 1m but it varies with the earths Latitude. This system, without a special conversion program is usable to approximately 75 degrees of Northern and Southern latitudes.
Central Meridian	The central longitude value of each 6° of longitude swath, starting from 0° and working eastward. For example, the Central Meridian for all values of longitude between 0° and 6° East is 3 and longitude values between 270° and 276° East have a Central Meridian of 273. Central Meridian values range from 3 to 357.
DGPS	Differential GPS is a system based on correcting for the majority of the errors associated with GPS by concurrently recording GPS signals at a known reference position.
Dosage	The total radiation exposure at 1m above ground level in Sieverts per time (pSv/s or nSv/hour). 1nSv/hour = 3600pSv/sec.
Ellipsoid/ Spheroid	The geometrical figure used to most nearly approximate the shape of the Earth (flattened slightly at the poles and bulges slightly at the equator) is an ellipsoid of revolution. An ellipsoid is therefore a set of parameters that define the shape of the Earth in a two coordinate system of latitude and longitude.
Flight Path	The displayed and/or recorded (at 1/second) GPS received UTM coordinates of the aircraft.
GPS	The Global Positioning System (GPS) is a satellite based navigation system that is capable of providing a 24 hour, highly accurate, continuous 3D position fixing navigation.
IAEA	The International Atomic Energy Agency (**IAEA**) is the world-wide accepted governing body on radiation monitoring and control.
Image File	Binary file (*.BMP) containing geographical bitmap image for use with AGIS.
nT, pT	nanoTesla, picoTesla units of magnetic field
ROI	Region of Interest – Gamma spectrometer energy window definition
Survey	The digital acquisition and organization of various data variables in order to make some conclusions about their source.
UTM	The Universal Transverse Mercator (UTM) geodetic projection system of Easting and Northing coordinates

	is defined as a standard rectangular map grid. The projection is onto a cylinder tangent to the Earth along a Central Meridian. The Earth is divided into 60 North-South columns, each of 6° longitude wide. The Central Meridian is assigned the value of 500,000m Easting and the equator a Northing of 0m in the Northern hemisphere and 10,000,000m in the Southern Hemisphere.
WGS-84	A standard navigation ellipsoid datum based on latitude and longitude. The standard Semi-Major Axis is 6378137.0, Flattening Factor of 298.25722, Delta X, Y and Z of 0, 0, 0.

APPENDIX E: CALCULATION OF CO-EFFICIENTS AND OFFSETS FOR ANALOG INPUT CHANNELS.

To convert the voltage provided by the various analog outputs from such devices as radar and barometric instruments, temperature and humidity probes, fluxgate magnetometers into real world engineering units such as feet, meters, degrees etc. some conversions must be calculated and entered into the setup window for the MMS-4 (see section 8.1.4.1).

Properly calculated and entered the co-efficients will allow the user to view instrument readings in units that are more meaningful than just voltages.

It should be noted however that the data system records the raw data values (voltages) as part of the data set. The data processor must add these or similar co-efficients to the data while undergoing assimilation into the project data base.

To generate the co-efficients the user must have the following information for each instrument channel to be set up:

1 > Maximum output voltage in millivolts (**MOV**) from the instrument that will be connected to the A/D converter . This will be variable **MOV** in the formula.

2> the maximum value of the real world units (**RWU**) represented by the maximum output voltage.

3> Known constants :

max input voltage to A/d card= 10,000 mv

# of steps generated by 10,000 mv input = 32768

4> co-efficient = RWU / ((MOV/ 10,000) *32786)

For Example a Terra TRA-3000 radar altimeter has a maximum output voltage of 62500 milli-volts (6.25 VDC) and at that output voltage the instrument should read 2500 feet above ground.

Therefore :

MOV=62500

RWU=2500

Co-efficient= 2500/((62500/10000)*32768)

C0-efficent=.12207

APPENDIX F: DEFINITION OF AREA.XYZ FILE

The example below shows the composition of the area .xyz file for a simple survey area containing only 4 corners. More complex survey areas having more corners would be identical to this file with the exception of the additional corner point information. The structure of this file must be rigidly adhered to or errors will be generated in other parameter files when the area.xyz file data is imported during project set up.

```
UTM,    L1 coordinate system "UTM" or "ADRG"
m,      L2 "deg" = lat/lon, "d:m"=lat/lon "m" =meters (for UTM any, for ADRG
deg or d:m only)
metric, L3 for speed and distance "metric" [m, km, km/h], "US" [ft,nm,knot]
ft,     L4 for altitude "m" meters, "ft" feet
Devtec, L5 client name
-79.502 Lat
43.789  Lon
279 CM
0 dsx
0 dsy
0 dsz
620937  xSL
4849543  ySL
0 HSL
100 spacing SL
620937  xTl
4849543  yTl
90 HTL
200 spacing TL
c 620304 4852829  c1
c 622313 4853466  c2
c 622946 4850171  c3
c 620937 4849543  c4  up to 96
w wp1 620937 4849543 w1 way points
w wp2 622313 4853466 w2b up to 16
l li1 680000 477900 680000 477000 l1 up to 16 special lines
l li2 680200 477900 680200 477000 l2_
```

The first item in each line is the defined value followed by a comma. The remainder of each line is a comment only that gives a brief description of the line.

The lines in the file are defined as follows:

UTM, L1 coordinate system "UTM" or "ADRG"

This defines the type of coordinate system the user will employ to define the survey area. As of this revision only UTM coordinate systems are supported.

m, L2 "deg" = lat/lon, "d:m"=lat/lon "m" =meters (for UTM any, for ADRG deg or d:m only)

This line defines the type of geodetic system used for the survey. The user can choose between specifying positions in degrees and decimal degrees, **(deg),** degrees minutes and decimal minutes **(d:m)** and in meters for UTM **(m).**

metric, L3 for speed and distance "metric" [m, km, km/h], "US" [ft,nm,knot]

This line defines the units for speeds and distances displayed on the pilot reference indicators and navigations screens of the AGIS system. Information is sourced from the GPS system only.

ft, L4 for altitude "m" meters, "ft" feet

Defines the units used for altitude data derived from the GPS system

Devtec, L5 client name

provides a user name reference for the project

-79.502 Lat
43.789 Lon

IN the two lines shown above the user should enter the approximate latitude and longitude of the center of the survey area expressed as degrees –decimal degrees. This allows the survey program to properly determine line parameters.

279 CM

The cental meridian is used in the determination of the UTM co-ordinates. The Central Meridian value is determined by the longitude of the survey area. Refer to the table in appendix G to determine the CM for your survey area. The span of a UTM boundary area is 6 degrees of longitude.

NOTE: IF YOUR SURVEY AREA LIES ACROSS A UTM BOUNDARY LINE CHOOSE THE NEXT CENTRAL MARIDIAN TO THE WEST AS THE DESIRED CM FOR THE SURVEY.

0 dsx
0 dsy
0 dsz

The values of **dsx, dsy, and dsz** should always be set to a value of **zero (0)** unless the coordinate system used in the survey is different from WGS-84. Since GPS is now the primary method of navigation on geophysical surveys and is based on the WGS-84 reference ellipsoid there should be no requirement for datum shifts to be entered. These numbers should only be changed by knowledgeable personnel.

620937 xSL
4849543 ySL

The values of xSL and ySL serve as the master point from which line spacing and orientation will be derived. This point does not have to be inside the survey area. It is recommended that the point be selected such that it lies south of the most southern extent of the survey area and west of the most western point of the survey area. The southwest corner of the area will usually make a good default master point.

0 HSL

This is the heading the survey lines will be flown. For navigational purposes and simplicity heading selection should be restricted to be between the range of 270 to 359.9 degrees and from 0 to 89.9 degrees. Headings entered outside this range will be automatically converted.

100 spacing SL

This determines the space between surveys lines for the survey area.

620937 xTl
4849543 yTl
90 HTL
200 spacing TL

These 4 lines perform the same function for Tie lines (also called control lines) as the previous 4 lines do for survey lines. Typically the Tie lines are flown at 90 degrees to the survey lines and usually have much wider spacing. The same master point should be used for the tie lines as the survey lines as a general rule. If desired a different master point MAY be used.

c 620304 4852829 c1
c 622313 4853466 c2
c 622946 4850171 c3
c 620937 4849543 c4 up to 96

This series of lines defines the corner points of the survey polygon. Each line should be prefaced by the letter c followed by the x and y UTM values for each point. Each point should be assigned a corner number as shown in the example. The survey program supports a polygon with up to 96 points.

The points should be entered in order around the perimeter of the polygon. Convention and good navigation practices dictate the user should start point entry in either the south western most point or the north western most point in the polygon and proceed to enter the remaining points moving around the polygon in a clockwise manner.

w wp1 620937 4849543 w1 way points
w wp2 622313 4853466 w2 up to 16

The user is allowed to enter up to sixteen (16) waypoints. These points can be locations of emergency landing strips, home base, test areas etc.

The waypoint line should be started with the letter w, followed by the waypoint number wp1, wp2, wp3, etc. The waypoint x and y UTM values should then be entered followed by a short descriptive name for the waypoint.

l li1 680000 477900 680000 477000 l1 up to 16 special lines
l li2 680200 477900 680200 477000 l2_

The user may add up to 16 special lines that are not included in the survey area. These are typically test or calibration lines that must be repeated on a regular basis in the same location each time. These would include altimeter, spectrometer repeatability and background tests, navigation tests, heading effect, and compensation.

The lines are prefaced with the letter l. This is followed by a line number designation as shown in the example above, li1,li2, li3 etc up to a maximum of 16 lines. The start and end points of each line would then be entered followed by a short name description.

APPENDIX G:
CENTRAL MERIDIAN AND ZONE NUMBERS

LONG(-)	LONG(+)	CM	ZONE	LONG(+)	CM	ZONE
-180..-174	180..186	183	1	000..006	003	31
-174..-168	186..192	189	2	006..012	009	32
-168..-162	192..198	195	3	012..018	015	33
-162..-156	198..204	201	4	018..024	021	34
-156..-150	204..210	207	5	024..030	027	35
-150..-144	210..216	213	6	030..036	033	36
-144..-138	216..222	219	7	036..042	039	37
-138..-132	222..228	225	8	042..048	045	38
-132..-126	228..234	231	9	048..054	051	39
-126..-120	234..240	237	10	054..060	057	40
-120..-114	240..246	243	11	060..066	063	41
-114..-108	246..252	249	12	066..072	069	42
-108..-102	252..258	255	13	072..078	075	43
-102..-096	258..264	261	14	078..084	081	44
-096..-090	264..270	267	15	084..090	087	45
-090..-084	270..276	273	16	090..096	093	46
-084..-078	276..282	279	17	096..102	099	47
-078..-072	282..288	285	18	102..108	105	48
-072..-066	288..294	291	19	108..114	111	49
066..-060	294..300	297	20	114..120	117	50
-060..-054	300..306	303	21	120..126	123	51
-054..-048	306..312	309	22	126..132	129	52
-048..-042	312..318	315	23	132..138	135	53
-042..-036	318..324	321	24	138..144	141	54
-036..-030	324..330	327	25	144..150	147	55
-030..-024	330..336	333	26	150..156	153	56
-024..-018	336..342	339	27	156..162	159	57
-018..-012	342..348	345	28	162..168	165	58
-012..-006	348..354	351	29	168..172	171	59
-006..-000	354..360	357	30	174..180	177	60

FORMULA TO CALCULATE CENTRAL MERIDIAN

CM= (Trunc(east longitude /6)*6)+3

APPENDIX H:

Ellipsoid values

ELLIPSOID	SPHEROID	DX	DY	DZ
ADINDAN	CLARKE 1880	162	12	-206
ADINDAN Mean (Ethiopia & Sudan)	CLARKE 1880	166	15	-204
ADINDAN Ethiopia	CLARKE 1880	165	11	-206
ADINDAN Mali	CLARKE 1880	123	20	-220
ADINDAN Senegal	CLARKE 1880	128	18	-224
ADINDAN Sudan	CLARKE 1880	161	14	-205
AFG Somalia	KRASSOWSKY 1940	43	163	-45
AIN EL ABD 1970 Bahrain I	INTERNATIONAL 1924	150	251	2
ANNA 1 ASTRO 1965 Cocos Is	AUSTRALIAN NATIONAL	491	22	-435
ARC 1950 Mean	CLARKE 1880 Mod	143	90	294
ARC 1950 Botswana	CLARKE 1880 Mod	138	105	289
ARC 1950 Lesotho	CLARKE 1880 Mod	125	108	295
ARC 1950 Malawi	CLARKE 1880 Mod	161	73	317
ARC 1950 Swaziland	CLARKE 1880 Mod	134	105	295
ARC 1950 Zaire	CLARKE 1880 Mod	169	19	278
ARC 1950 Zambia	CLARKE 1880 Mod	147	74	283
ARC 1950 Zimbabwe	CLARKE 1880 Mod	142	96	293
ARC 1960 Mean	CLARKE 1880 Mod	160	8	300
ARC 1960 Kenya	CLARKE 1880 Mod	161	7	300
ARC 1960 Tanzania	CLARKE 1880 Mod	158	12	299
ASCENSION ISLAND ASTRO 1958	INTERNATIONAL 1924	207	-107	-52
ASTRO BEACON E Iwo Jima	INTERNATIONAL 1924	-145	-75	272
AUSTRALIAN GEODETIC 1966	AUSTRALIAN NATIONAL	133	48	-148
AUSTRALIAN GEODETIC 1984	AUSTRALIAN NATIONAL	134	48	-149
BELLE VUE IGN Efate & Erromango Is	INTERNATIONAL 1924	127	769	-472
BERMUDA 1957	CLARKE 1866	73	-213	-296
BOGOTA OBSERVATORY Colombia	INTERNATIONAL 1924	-307	-304	318
BUKIT RIMPAH Indonesia	BESSEL 1841	384	-664	48
CAMP AREA ASTRO Antarctica	INTERNATIONAL 1924	104	129	-239
CAMPO INCHAUSPE Argentina	INTERNATIONAL 1924	148	-136	-90
CANTON I ASTRO 1966 Phoenix Is	INTERNATIONAL 1924	-298	304	375
CAPE CANAVERAL Florida & Bahamas	CLARKE 1866	2	-150	-181
CAPE South Africa	CLARKE 1880 Mod	136	108	292
CARTHAGE Tunisia	CLARKE 1880 IGN	263	-6	-431
CHATHAM 1971 Chatham I NZ	INTERNATIONAL 1924	-175	38	-113
CHAU ASTRO Paraguay	INTERNATIONAL 1924	134	-229	29
CORREGO ALEGRE Brazil	INTERNATIONAL 1924	206	-172	6
DJAKARTA Sumatra I	BESSEL 1841	377	-681	50
DOS 1968 New Georgia Is	INTERNATIONAL 1924	-230	199	752
EASTER ISLAND ASTRO 1967	INTERNATIONAL 1924	-211	-147	-111
EUROPEAN 1950 Cyprus	INTERNATIONAL 1924	104	101	140
EUROPEAN 1950 Egypt	INTERNATIONAL 1924	130	117	151
EUROPEAN 1950 Greece	INTERNATIONAL 1924	84	95	130
EUROPEAN 1950 Iran	INTERNATIONAL 1924	117	132	164
EUROPEAN 1950 Italy Sardinia	INTERNATIONAL 1924	97	103	120
EUROPEAN 1950 Italy Sicily	INTERNATIONAL 1924	97	88	135
EUROPEAN 1950 Mean	INTERNATIONAL 1924	87	98	121
EUROPEAN 1950 Norway and Finland	INTERNATIONAL 1924	87	95	120
EUROPEAN 1950 Spain & Portugal	INTERNATIONAL 1924	88	109	122
EUROPEAN 1950 United Kingdom	INTERNATIONAL 1924	86	96	120
EUROPEAN 1950 Western Europe	INTERNATIONAL 1924	96	98	120
EUROPEAN 1979 Mean	INTERNATIONAL 1924	86	98	119

G. SEGARA Borneo	BESSEL 1841	403	-684	-41
G. SERINDUNG Borneo	WGS 84	0	0	0
GANDAJIKA BASE Maldives	INTERNATIONAL 1924	133	321	-50
GEODETIC 1949 New Zealand	INTERNATIONAL 1924	-84	22	209
GHANA	WGS 84	0	0	0
GUAM 1963 Marianes Is	CLARKE 1866	100	248	-259
GUX 1 ASTRO Guadacanal	INTERNATIONAL 1924	-252	209	751
HERAT NORTH	INTERNATIONAL 1924	333	222	-114
HJORSEY 1955 Iceland	INTERNATIONAL 1924	73	-46	86
HONG KONG 1963	INTERNATIONAL 1924	156	271	189
HU TZU SHAN Taiwan	INTERNATIONAL 1924	634	549	201
INDIAN India, Bangladesh & Nepal	EVEREST 1830C	-289	-734	-257
INDIAN Thailand & Vietnam	EVEREST 1830C	-214	-836	-303
IRELAND 1965 Eire	AIRY 1830 Mod	-506	122	-611
ISTS 017 ASTRO 1969 Diego Garcia	INTERNATIONAL 1924	-208	435	229
JOHNSTON ISLAND ASTRO 1961	INTERNATIONAL 1924	-191	77	204
KANDAWALA Sri Lanka	EVEREST 1830C	97	-787	-86
KERGUELEN ISLAND	INTERNATIONAL 1924	-145	187	-103
KERTAU 1948 W Malaysia & Singapore	EVEREST 1830M	11	-851	-5
LA REUNION Mascarene Is	INTERNATIONAL 1924	-94	948	1262
LC 5 ASTRO Cayman Brac I	CLARKE 1866	-42	-124	-147
LIBERIA 1964	CLARKE 1880	90	-40	-88
LUZON 1911 Mindanao I	CLARKE 1866	133	79	72
LUZON 1911 Phillipines ex Mindanao	CLARKE 1866	133	77	51
MAHE 1971 Seychelles	CLARKE 1880 Mod	-41	220	134
MARCO ASTRO Salvage Is	INTERNATIONAL 1924	289	124	-60
MARCUS ISLAND ASTRO 1952	INTERNATIONAL 1924	-134	234	25
MASSAWA Eritrea (Ethiopia)	BESSEL 1841	-639	-405	-60
MERCHICH Morocco	CLARKE 1880 IGN	-31	-146	-47
MIDWAY ASTRO 1961	INTERNATIONAL 1924	-912	58	-1227
MINNA Nigeria	CLARKE 1880	92	93	-122
NAHRWAN Masirah I (Oman)	CLARKE 1880	247	148	-369
NAHRWAN Saudi Arabia	CLARKE 1880	231	196	-482
NAHRWAN United Arab Emirates	CLARKE 1880	249	156	-381
NAMIBIA	BESSEL 1841 Namibia	-616	-97	251
NAPARIMA BWI Trinidad & Tobago	INTERNATIONAL 1924	2	-374	-172
NTH AMERICAN 1927 Alaska	CLARKE 1866	5	-135	-172
NTH AMERICAN 1927 Alberta & BC	CLARKE 1866	7	-162	-188
NTH AMERICAN 1927 Bahamas	CLARKE 1866	4	-154	-178
NTH AMERICAN 1927 Canada	CLARKE 1866	10	-158	-187
NTH AMERICAN 1927 Canada East	CLARKE 1866	22	-160	-190
NTH AMERICAN 1927 Caribbean	CLARKE 1866	7	-152	-178
NTH AMERICAN 1927 Central America	CLARKE 1866	0	-125	-194
NTH AMERICAN 1927 Cuba	CLARKE 1866	9	-152	-178
NTH AMERICAN 1927 Eastern USA	CLARKE 1866	9	-161	-179
NTH AMERICAN 1927 Greenland Hayes	CLARKE 1866	-11	-114	-195
NTH AMERICAN 1927 Manitoba & Ont	CLARKE 1866	9	-157	-184
NTH AMERICAN 1927 Mean ConUS	CLARKE 1866	8	-160	-176
NTH AMERICAN 1927 Mexico	CLARKE 1866	12	-130	-190
NTH AMERICAN 1927 NWT & Saskatch.	CLARKE 1866	-4	-159	-188
NTH AMERICAN 1927 Panama Canal Zone	CLARKE 1866	0	-125	-201
NTH AMERICAN 1927 San Salvador I	CLARKE 1866	-1	-140	-165
NTH AMERICAN 1927 Western USA	CLARKE 1866	8	-159	-175
NTH AMERICAN 1927 Yukon	CLARKE 1866	7	-139	-181
OBSERVATORIO 1966 Azores	INTERNATIONAL 1924	425	169	-81
OLD EGYPTIAN 1930	HELMERT 1906	130	-110	13
OLD HAWAIIAN Mean	CLARKE 1866	-61	285	181

OLD HAWAIIAN Hawaii	CLARKE 1866	-89	279	183
OLD HAWAIIAN Kaui	CLARKE 1866	-45	290	172
OLD HAWAIIAN Maui	CLARKE 1866	-65	290	190
OLD HAWAIIAN Oahu	CLARKE 1866	-56	284	181
OLD HAWAIIAN Kaui	INTERNATIONAL 1924	-190	230	341
OLD HAWAIIAN Maui	INTERNATIONAL 1924	-210	230	357
OLD HAWAIIAN Oahu	INTERNATIONAL 1924	-201	224	349
OMAN	CLARKE 1880	346	1	-224
ORDNANCE SURVEY GREAT BRITIAN 1936	AIRY 1830 OSGB	-375	111	-431
OSGB 36 England	AIRY 1830 OSGB	-371	112	-434
OSGB 36 England & Wales	AIRY 1830 OSGB	-371	111	-434
OSGB 36 Scotland	AIRY 1830 OSGB	-384	111	-425
OSGB 36 Wales	AIRY 1830 OSGB	-370	92	-434
PICO DE LAS NIEVES Canary Is	INTERNATIONAL 1924	307	92	-127
PITCAIRN ISLAND ASTRO 1967	INTERNATIONAL 1924	-185	-165	-42
PROV. STH AMERICAN 1956 Bolivia	INTERNATIONAL 1924	270	-188	388
PROV. STH AMERICAN 1956 Columbia	INTERNATIONAL 1924	282	-169	371
PROV. STH AMERICAN 1956 Ecuador	INTERNATIONAL 1924	278	-171	367
PROV. STH AMERICAN 1956 Guyana	INTERNATIONAL 1924	298	-159	369
PROV. STH AMERICAN 1956 Mean	INTERNATIONAL 1924	288	-175	376
PROV. STH AMERICAN 1956 N Chile 19	INTERNATIONAL 1924	270	-183	390
PROV. STH AMERICAN 1956 Peru	INTERNATIONAL 1924	279	-175	379
PROV. STH AMERICAN 1956 S Chile 43	INTERNATIONAL 1924	305	-243	442
PROV. STH AMERICAN 1956 Venezuala	INTERNATIONAL 1924	295	-173	371
PROV. STH CHILEAN 1963	INTERNATIONAL 1924	-16	-196	-93
PUERTO RICO Puerto Rico & Virgin Is	CLARKE 1866	-11	-72	101
QATAR NATIONAL	INTERNATIONAL 1924	128	283	-22
QORNOQ South Greenland	INTERNATIONAL 1924	-164	-138	189
ROME 1940 Sardinia	INTERNATIONAL 1924	225	65	-9
SANTA BRAZ Azores	INTERNATIONAL 1924	203	-141	-53
SANTOS (DOS) Espirito Santo I	INTERNATIONAL 1924	-170	-42	-84
SAPPER HILL 1943 East Falkland I	INTERNATIONAL 1924	355	-16	-74
SIERRA LEONE 1960	WGS 84	0	0	0
STH AMERICAN 1969 Argentina	SOUTH AMERICAN 1969	62	1	37
STH AMERICAN 1969 Bolivia	SOUTH AMERICAN 1969	61	-2	48
STH AMERICAN 1969 Brazil	SOUTH AMERICAN 1969	60	2	41
STH AMERICAN 1969 Chile	SOUTH AMERICAN 1969	75	1	44
STH AMERICAN 1969 Columbia	SOUTH AMERICAN 1969	44	-6	36
STH AMERICAN 1969 Ecuador	SOUTH AMERICAN 1969	48	-3	44
STH AMERICAN 1969 Guyana	SOUTH AMERICAN 1969	53	-3	47
STH AMERICAN 1969 Mean	SOUTH AMERICAN 1969	57	-1	41
STH AMERICAN 1969 Paraguay	SOUTH AMERICAN 1969	61	-2	33
STH AMERICAN 1969 Peru	SOUTH AMERICAN 1969	58	0	44
STH AMERICAN 1969 Trinidad/Tobago	SOUTH AMERICAN 1969	45	-12	33
STH AMERICAN 1969 Venezuala	SOUTH AMERICAN 1969	45	-8	33
STH ASIA Singapore	FISCHER 1960 SA	-7	10	26
SOUTHEAST BASE Porto Santo/Madeira	INTERNATIONAL 1924	499	249	-314
SOUTWEST BASE Azores	INTERNATIONAL 1924	104	-167	38
ST HELENA ASTRO DOS 71/4	INTERNATIONAL 1924	320	-550	494
TANANARIVE OBSERV. 1925 Malagasy	INTERNATIONAL 1924	189	242	91
TERN ISLAND ASTRO 1961 B4 SOR ATOLL	INTERNATIONAL 1924	-114	116	333
TIMBALAI 1948 Brunei	BESSEL 1841	639	-583	55
TIMBALAI 1968 Sabah/Sarawat/Brunei	EVEREST 1830B	689	-691	46
TOKYO Mean	BESSEL 1841	128	-481	-664
TOKYO Japan	BESSEL 1841	123	-483	-662
TOKYO Korea	BESSEL 1841	128	-481	-665

TOKYO Okinawa	BESSEL 1841	135	-478	-661
TRISTAN ASTRO 1968 Tristan da Cunha	INTERNATIONAL 1924	632	-438	609
VITI LEVU 1916 Fiji Is	CLARKE 1880	-51	-391	36
VOIROL	WGS 84	0	0	0
WAKE ENIWETOK 1960 Marshall Is	HOUGH 1960	-101	-52	39
YACARE Uruguay	INTERNATIONAL 1924	155	-171	-37
ZANDERIJ Suriname	INTERNATIONAL 1924	265	-120	358

APPENDIX J: SYSTEM BIOS FOR AGIS (BLUE UNIT)

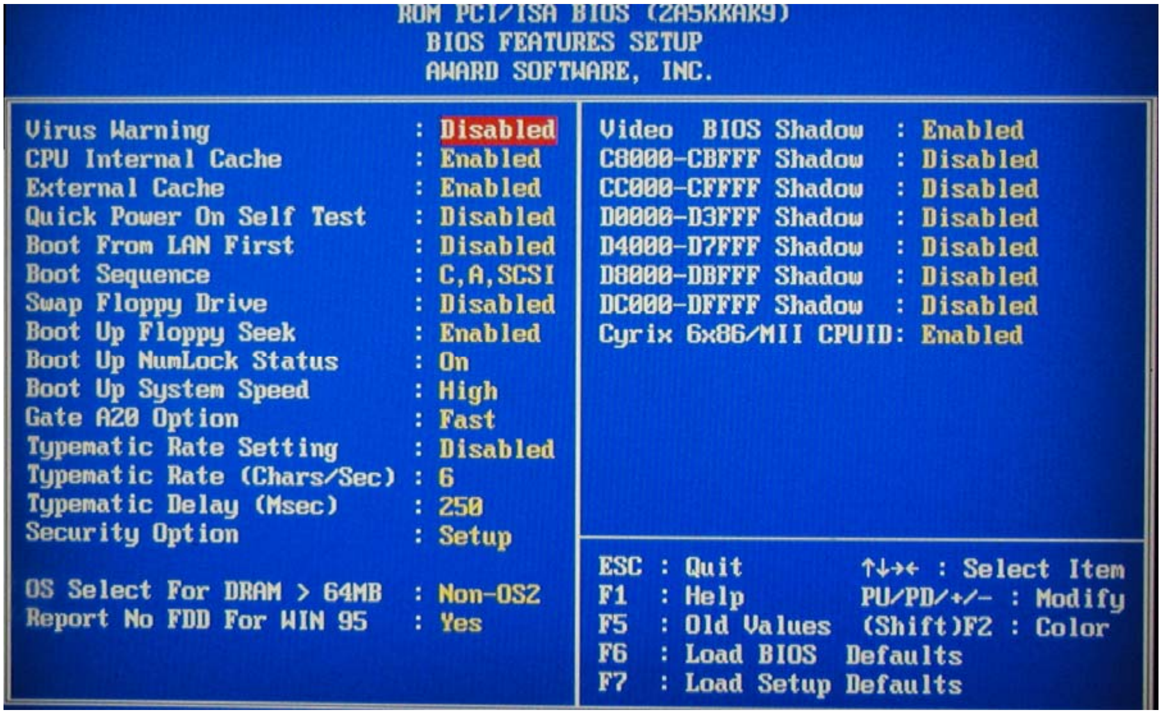


Fig 101 Bios Features

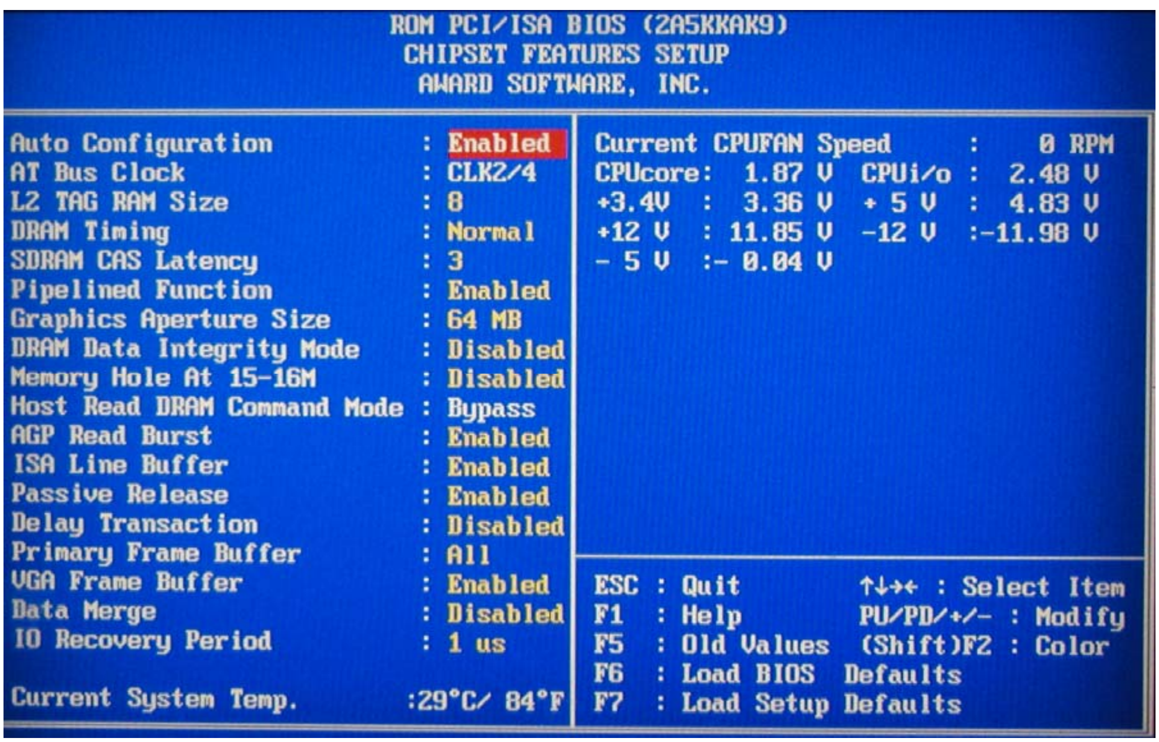


Fig 102 chipset features setup

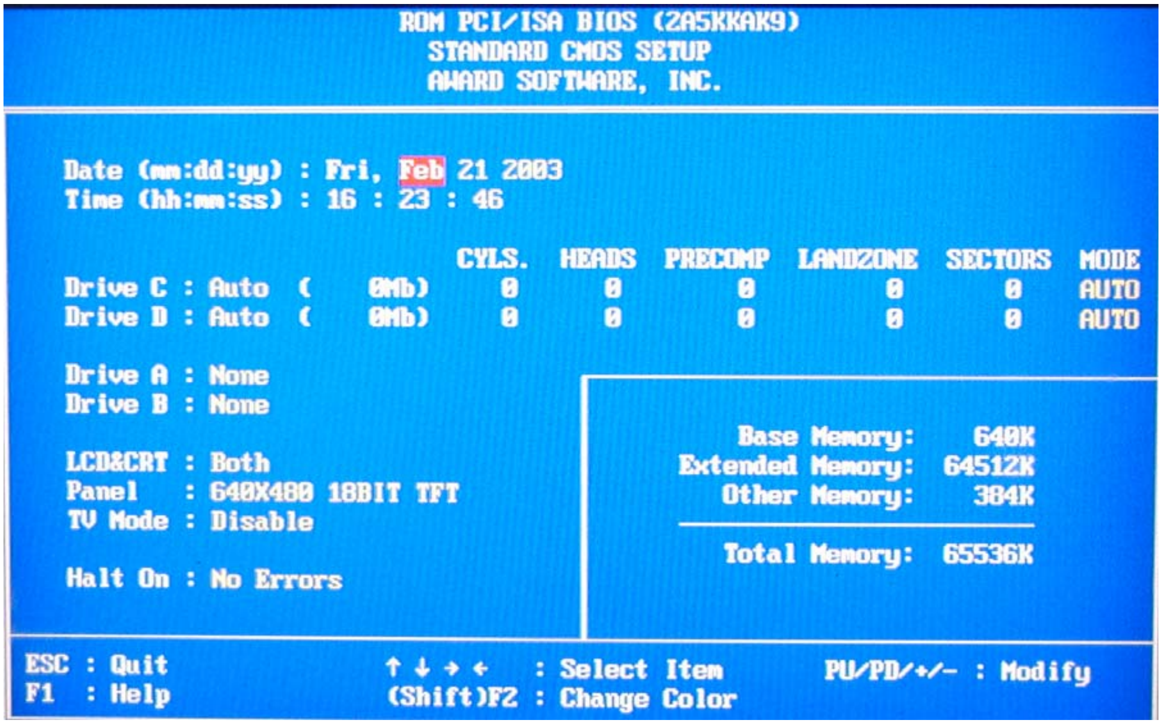


Fig 103: standard CMOS setup screen

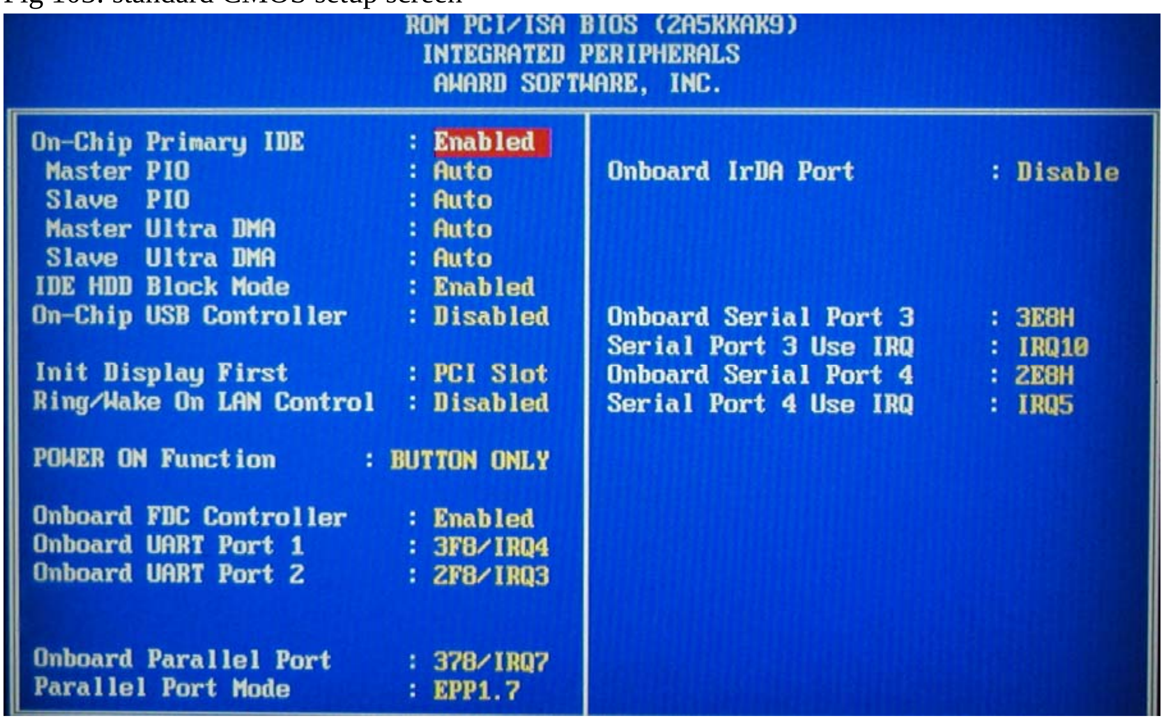


Fig 104: integrated peripherals selection and setup

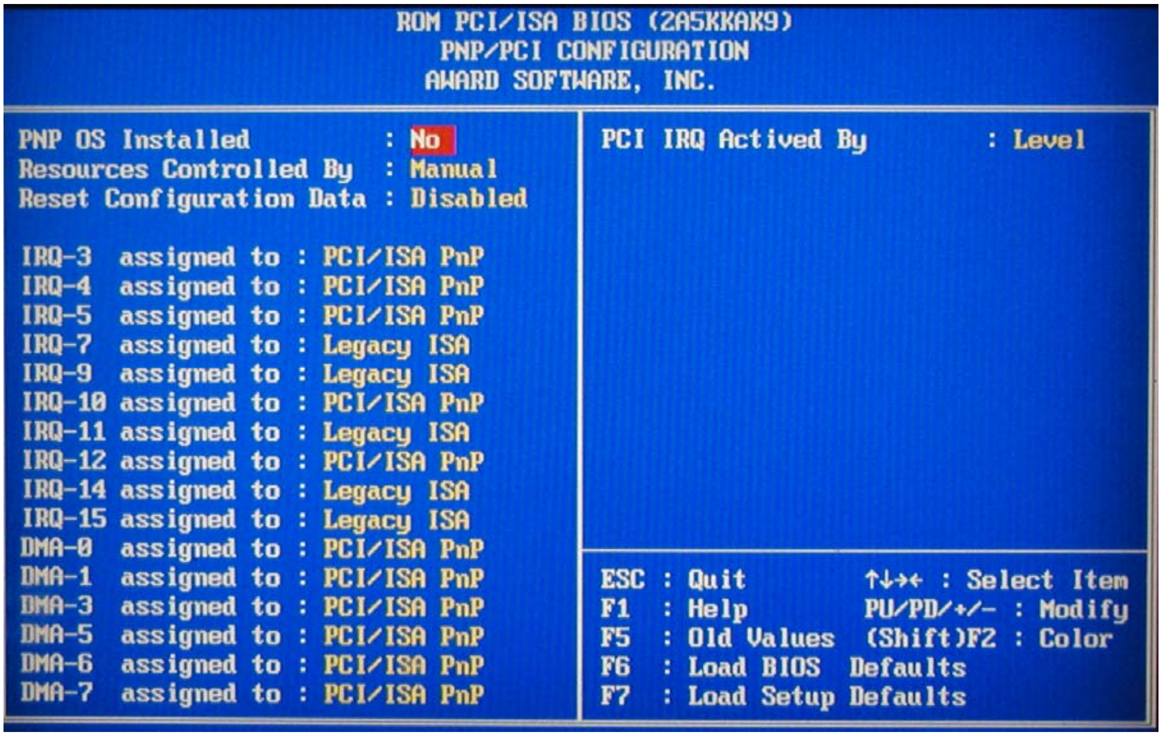


Fig 105: PNP / PCI setup

Appendix K: Contacts

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www.picoenvirotec.com

APPENDIX L: AGIS PC-104 CONNECTOR LAYOUT

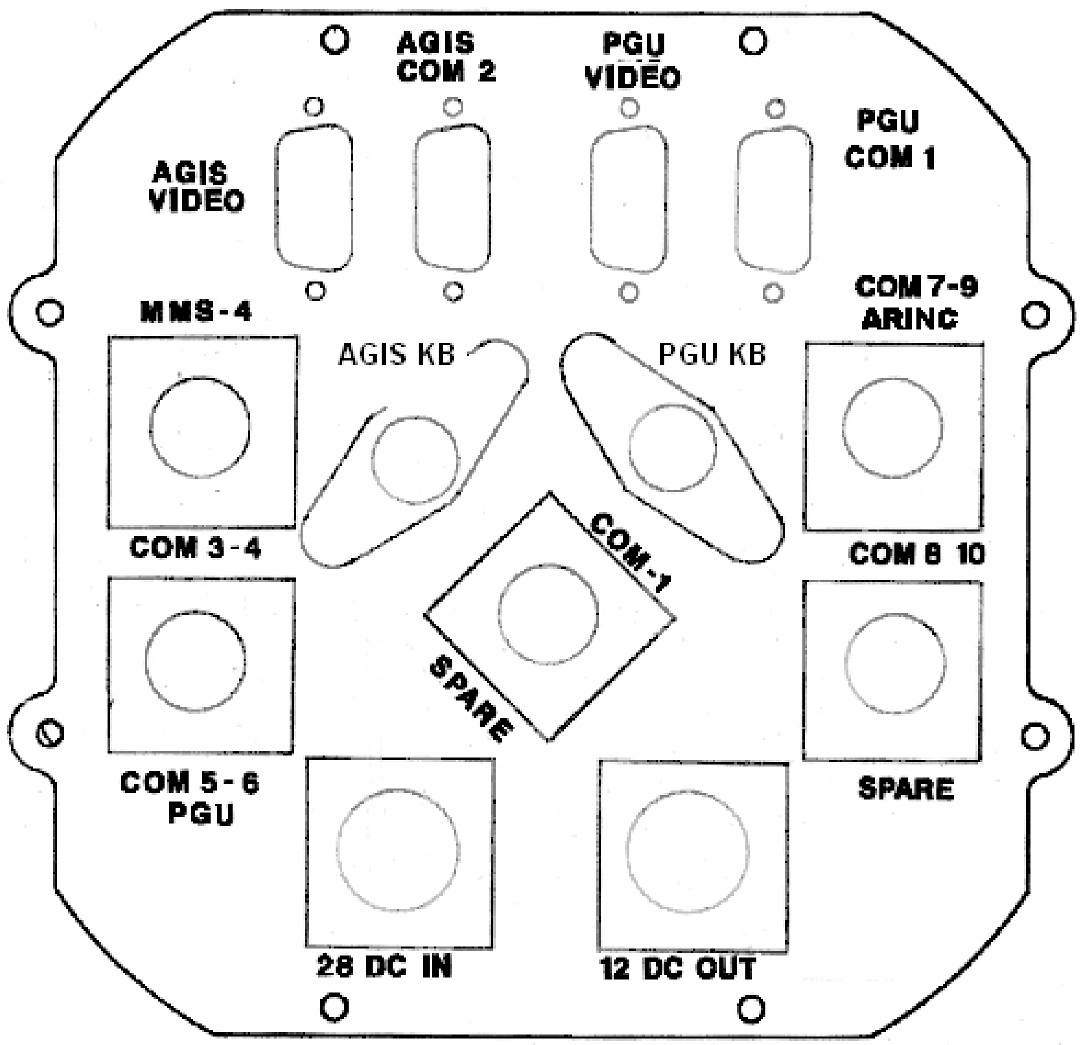
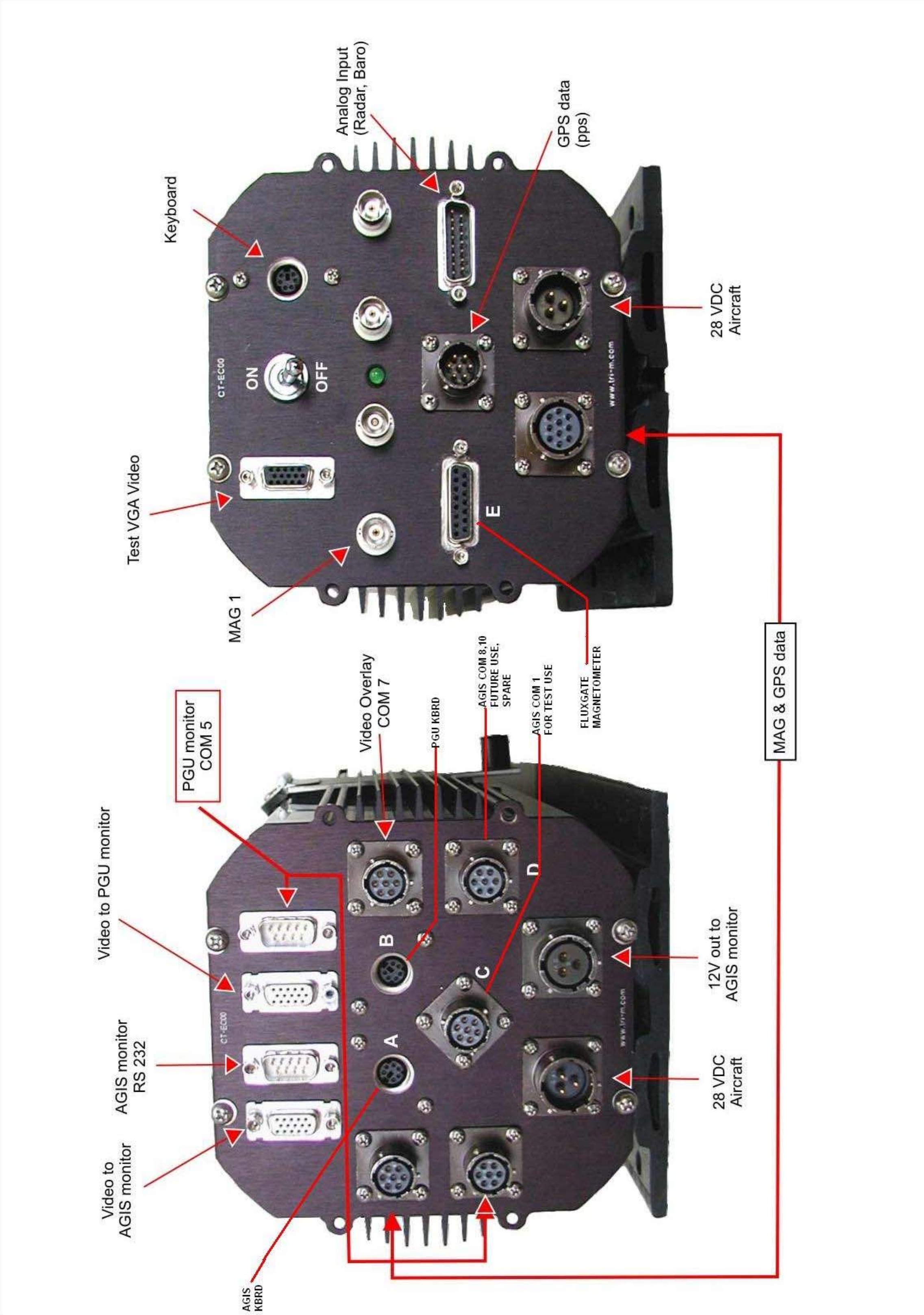


Fig 106 Connector layout for AGIS PC-104 console

APPENDIX M: BASIC INTERCONNECT FOR AGIS / MMS-4 SYSTEM UNITS



APPENDIX N: PROCEDURE TO UPGRDE FIRMWARE IN MMS-4 PROCESSOR

READ THIS DOCUMENT CAREFULLY AND COMPLETELY BEFORE ATTEMPTING TO DISMANTLE THE MMS-4 PROCESSOR. FAILURE TO FOLLOW THIS INSTRUCTIONS CAN RESULT IN SERIOUS DAMAGE TO THE WIRING HARNESS AND / OR THE ELECTRONICS.

PROPER PRECAUTIONS AGAINST ELECTROSTATIC SHOCK AND DISCHARGE SHOULD BE TAKEN WHEN DISASSEMBLING THE MMS-4

1. REQUIRED HARDWARE

- new firmware version of MMS4PROC.EXE , MMS4.PAR, MMS4TEST.EXE, either and RS232TST.EXE on CD, floppy disk or on computer disk These have been provided on a CD as zipped files.
- computer capable of reading or writing to compact flash memory modules, or a compact flash reader / writer that may be connected to a computer.
- Screwdriver to disassemble the MMS-4 magnetometer processor

2. MMS- DISASSEMBLY

- remove the MMS-4 magnetometer module from the survey equipment rack ensure all cables are properly marked and user is able to properly identify and re-connect the unit after the upgrade has been completed.
- Remove the front and rear faceplate screws. The front plate with all the connectors will come free from the main housing. The cable harness has sufficient length to allow the face plate to be pulled away from the case. Care should be taken not to place any stress on the wiring harness by excessive pulling or placing tension on the wiring.
- Gently pull the rear panel free of the case. There will be some resistance to pull the rear plate free. The computer cards are mounted to the rear plate and are also supported by rubber rails along the interior corners of the case.
- Once the rear panel with the card stack is free of the case, pull the card stack out of the case as far as possible to expose the main CPU card. The CPU will be the card on the top of the stack (closest to the FRONT panel). If there is insufficient cable length to allow the card stack to be fully exposed then the front panel will have to be passed through the case.
- If the front panel is turned edge on to the case and placed across corners you can see that the panel can be passed through the interior of the case and out the back. This allows complete removal of the connector panel, wiring harness and the card stack from the instrument case. (see photo below:

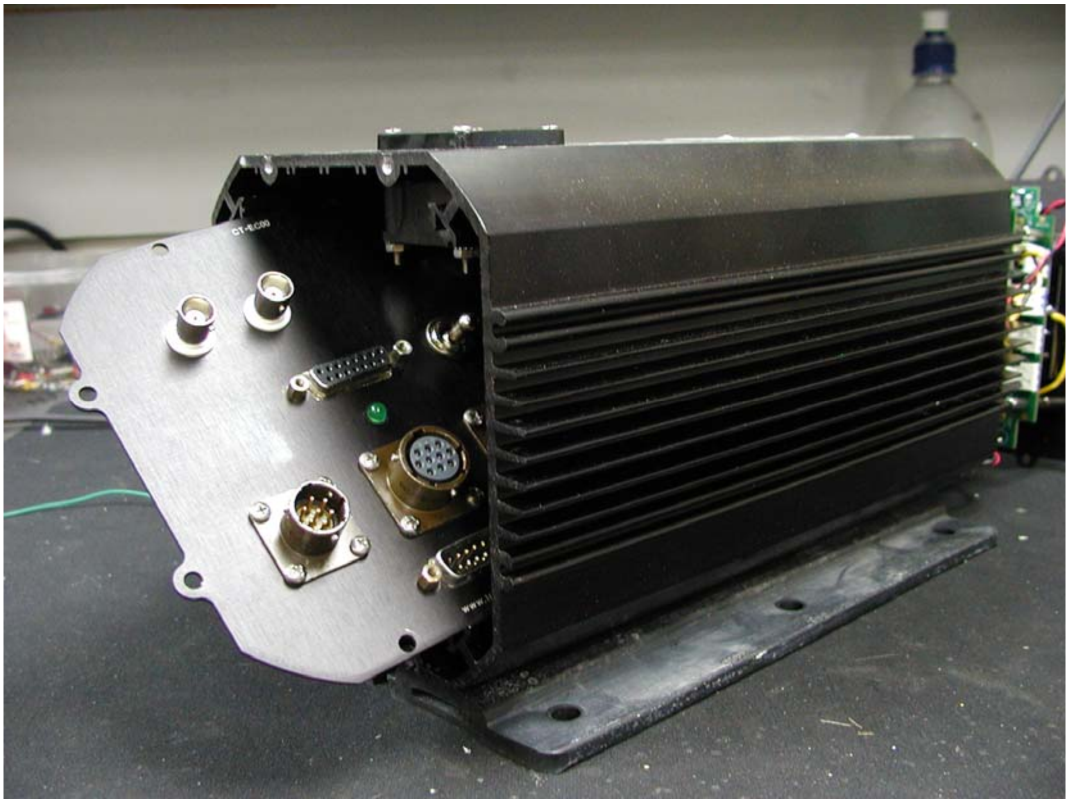


Fig 107: FRONT VIEW OF MMS-4 HOUSING WITH END PLATES REMOVED AND FRONT PANEL ORIENTED FOR REMOVAL THROUGH THE INSTRUMENT HOUSING

- note carefully the positions of the cables along the sides of the card stack. It is important to remember how the cables are oriented so as to be able to re-assemble the unit without damage to the wiring harness.

3. REMOVAL OF COMPACT FLASH CARD

- the compact flash card protrudes from the side of the CPU card. Note the orientation of the card in the holder. The card will only fit in the holder one way.
- Carefully grasp the flash card by the edges and pull it out of its holder. (see photo below showing CPU card and compact flash card)

COMPACT
FLASH CARD

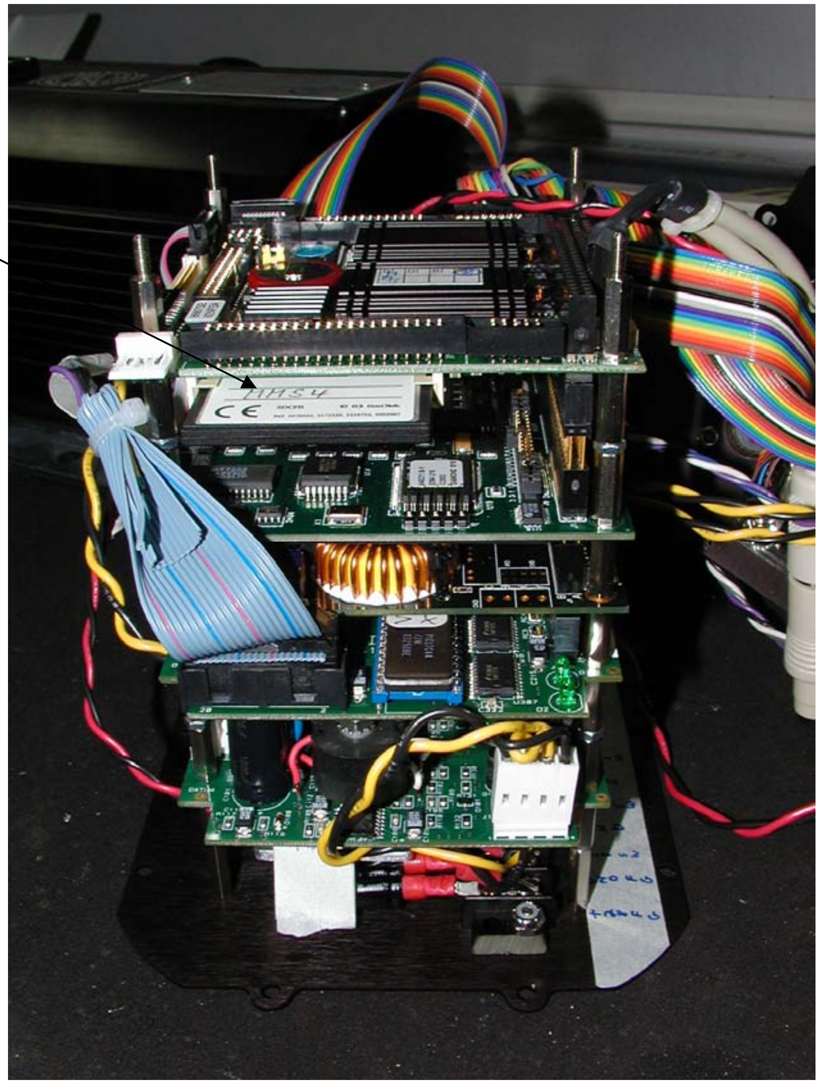


Fig 108 Extracting compact flash card

4. UPLOADING NEW FIRMWARE INTO THE FLASH CARD

- Insert compact flash card into the card reader or computer. Using windows explorer or the file management program of your choice display the contents of the compact flash card removed from the MMS-4 processor. The list of files should be as shown here

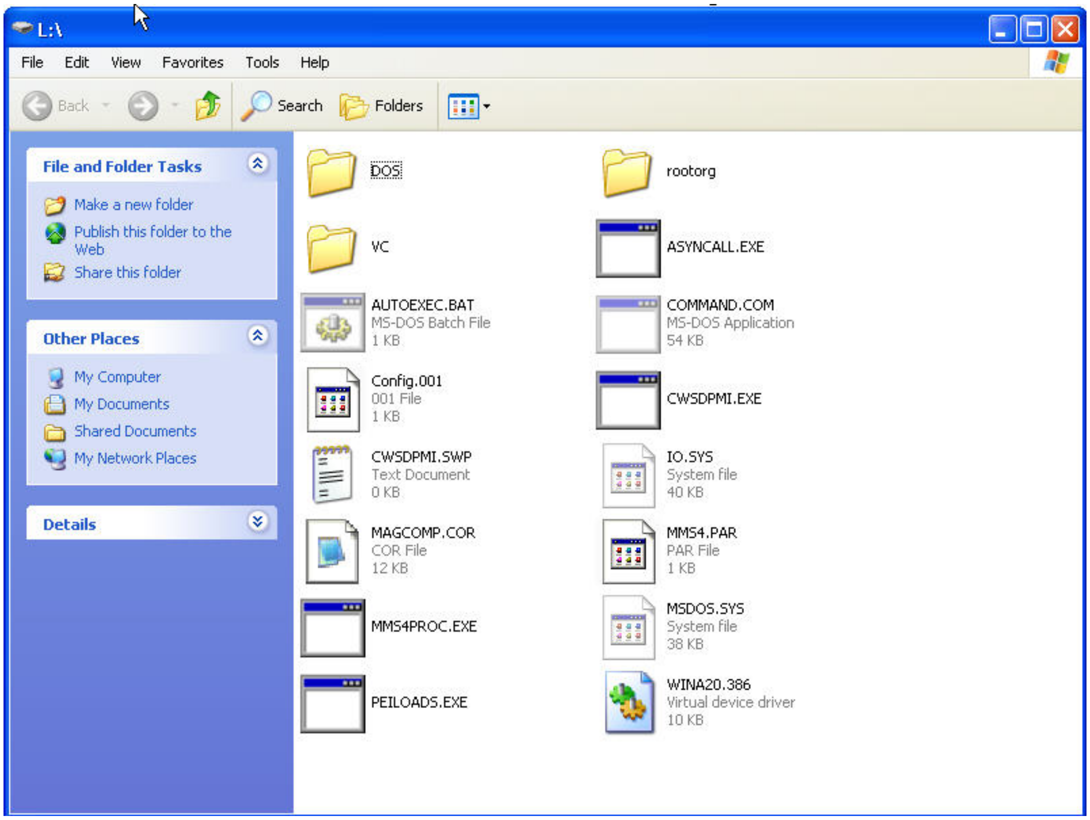


Fig 109: editing compact flash contents

- Using the file editor, delete the file **MMS4PROC.EXE**
- **DO NOT DELETE ANY OTHER FILES**
- Copy the new version of MMS4PROC.EXE to the root directory of the compact flash card

5. REPLACING COMPACT FLASH CARD

- remove the compact flash card from the reader and replace it in the holder of the MMS4 CPU. Observe the orientation of the card before inserting it into the holder. Improper orientation of the card when inserting can damage the connector on both the processor card and the compact flash memory.
- Pico Envirotec will not assume responsibility for any damage to either the CPU card or the compact flash memory card as a result of improper insertion

6. RE-ASSEMBLY OF MMS-4 PROCESSOR

- carefully insert the front panel through the rear of the MMS-4 housing and feed the cable harness and the card stack into position. This procedure is the exact opposite of the procedure used to remove the card stack and front panel. Ensure none of the cables are pressed between the side of the instrument case and the circuit boards.
- Replace the mounting screws holding the front and rear panels in position

7. INSTALATION AND TEST

- reinstall the MMS-4 processor into the survey rack and re-connect the cables.

- power up the AGIS system and MMS-4 processor. Load the compensation file (MAGCOMP.COR) if it has not already been done into the MMS-4 processor using the LOADM.exe program as described in the AGIS manual.
-real time compensated data should be selected in displayed data channels.

8. ADDITIONAL SOFTWARE

Provided with the MMS4PROC software are upgrades to two additional program modules. These programs are RS232TST.EXE and MMS4TEST.EXE. Older versions of these programs currently reside in the IRIS directory of the AGIS console and n on original installation CD's of the software provided by Pico Envirotec.

The older versions of these programs should be deleted from the IRIS directory on the AGIS console hard drive C and replaced with the new versions provided.

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