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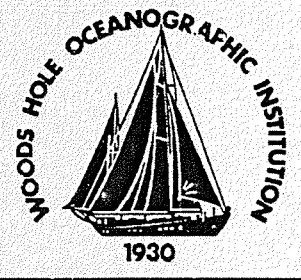
Woods Hole Oceanographic Institution



IMET Shipboard Systems, Operations and Software User Manual

by

Kenneth E. Prada

November 1992

Technical Report

Funding was provided by the National Science Foundation
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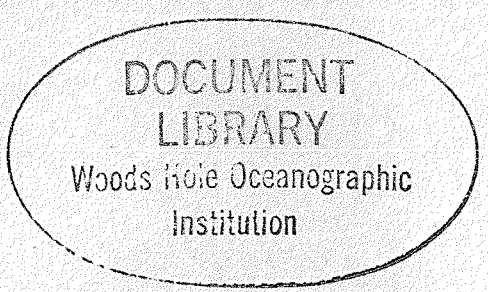

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Approved for Distribution:

George V. Frisk

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ABSTRACT

This report has two parts. The first is a copy of the *Operations and Software User Manual* prepared for use with the IMET shipboard software distribution. It describes the programs used to acquire and record data from IMET systems installed on *RV Knorr* and *RV Oceanus*. The second part adds appendix material that contains the documentation pages for programs and subroutines used in the IMET shipboard software system. These items are available through network or diskette access. This report has been prepared to give this information broader visibility and circulation.

1 INTRODUCTION

To meet World Ocean Circulation Experiment (WOCE) specified measurement needs for the 1990's, a development project was undertaken to provide new methods for meteorological measurements from ships and buoys. The results are the IMET system. Following successful prototype testing and evaluation, the technology for IMET was transferred to industry for small quantity commercial production.

KNORR and *OCEANUS* have the first permanent shipboard installations of IMET systems. This manual provides operational and software documentation for these installations.

2 HARDWARE INFORMATION

This section contains a brief description of the IMET system hardware. It is provided for general information background and is not a complete hardware reference for any portion of the IMET system. The user is directed to the IMET system technical manuals available from Alden Electronics in support of their IMET products.

2.1 IMET SYSTEM

IMET is a system of autonomous intelligent sensor modules interconnected using the EIA-485 standard. Figure 1 shows a block diagram of a shipboard IMET system. Each module contains a microcontroller programmed to handle the unique needs of the individual sensor. Typically a module samples its sensor as often as practical and, when interrogated, returns data in the form of one-minute averages. These data in are in calibrated scientific units. There are currently seven modules in the shipboard installation:

- wind speed and direction
- barometric pressure
- relative humidity
- air temperature
- water temperature
- short wave radiation
- precipitation

In later configurations, modules for long wave radiation and ARGOS telemetry may be added.

On both *KNORR* and *OCEANUS*, these modules (except water temperature) are mounted on a mast at the bow. They are wired through a local junction box and 4-wire cable to the logger system. The cable provides power and communications between the data logging system and the modules. The water temperature module, installed in an engine room or bow chamber inlet, uses a separate 4-wire cable.

An additional cable is routed to the bow mast from a power supply if a forward compartment, typically the bosun's locker. This cable supplies low voltage to the precipitation sensor heating coils. The heaters prevent freezing of collected rain during cold weather. They are controlled by a thermostat internal to the sensor module and may be powered at all times.

2.2 DATA LOGGING SYSTEM

The data logging system performs several functions. These include:

- provide controlled power to IMET modules

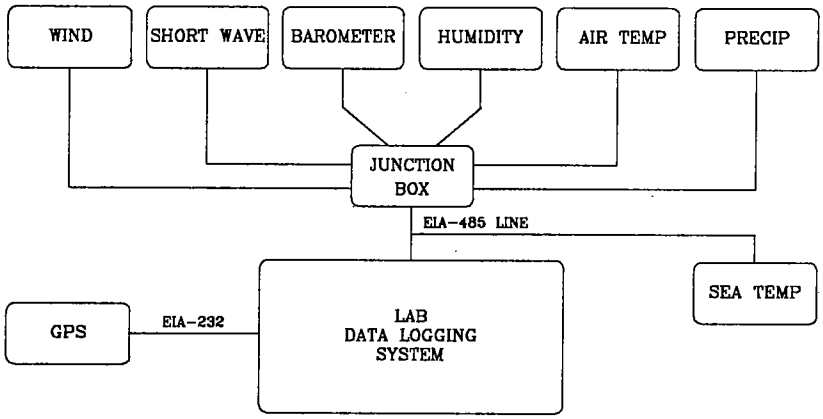

Figure 1: Block Diagram of Shipboard IMET System

- interrogate IMET modules
- format and record IMET data values
- archive data files to optical disk
- provide data to external users via EIA-232
- when available, acquire and record navigation from a local GPS receiver

2.2.1 Hardware Configuration

The data logging system uses a small footprint PC with a 25MHz 386 and numeric coprocessor. Figure 2 shows a block diagram of the logging system. Four megabytes of RAM are installed to support later operating system changes or enhancements.

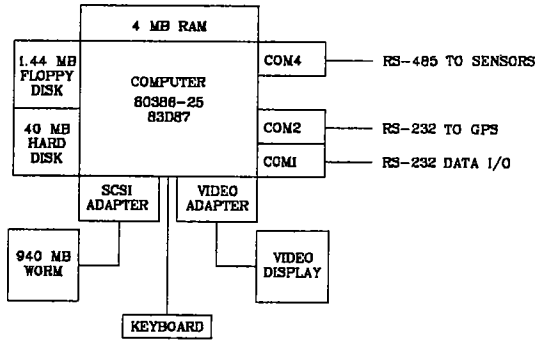

Figure 2: Block Diagram of IMET Data Logger

Standard peripherals include a 1.44 Mb floppy drive, 40 Mb hard drive, monochrome video display, and keyboard. The archive media is a 940 Mb (470 per side) WORM optical disk drive. There are three serial ports:

- COM1 - (EIA-232) is used for data communications to external users.
- COM2 - (EIA-232) provides communication with a GPS receiver (when provided).
- COM4 - (EIA-485) communications with the IMET modules.

Printer ports LPT1 and LPT2 are available but are not used in the current system configuration.

2.2.2 Module Power Supply

Power for IMET module operation is derived from a small laboratory power supply (Lambda LA-200). This supply is located at or near the data logging computer. It is adjusted to provide 12-13 volts DC. Its output is enabled or disabled by the computer. An auxiliary output signal from the COM485 card provides a logic level (low = on) to the rear connector strip on the power supply.

2.2.3 Module - Logger Interconnect

Communications between the data logging system and IMET modules uses the EIA-485 standard. EIA-485 is a two-wire balanced differential method with multipoint capability. It has excellent noise immunity and can be used over long distances at high baud rates (1 km at 100k BAUD).

Four wires interconnect the logger system with IMET modules. Two of the wires are used for the EIA-485 signals. The remaining wires carry power and common.

Aboard *KNORR* the ship's permanent wiring system connects the logger in the science chart room to the bow mast through several junction boxes. The same lines also extend to the sea surface temperature module located at the bow chamber raw water inlet.

Aboard *OCEANUS* two special cables have been installed. The first connects the logger to the bow mast. The second cable connects to the engine room where the sea surface temperature module is located in a raw water inlet line.

3 SOFTWARE

This section describes acquiring, installing, and using the operational software. Programs used for module test, maintenance, and calibration are discussed in the IMET systems Technical Documentation, available from Alden Electronics.

3.1 Acquiring Operational Software and Documentation

The IMET/UNOLS operational software distribution is available in two ways. It can be acquired using anonymous ftp methods over Internet and also is available on diskette to those without network access.

The distribution contains several groups of items:

- program binary executables (.EXE files)
- sources and objects for programs and libraries
- miscellaneous documents in LaTeX or PostScript format, which includes this manual in PostScript printable form.
- UNIX style manual pages for reference to both programs and library functions. Also included are Postscript versions of these manual pages for printer output.

3.1.1 Diskette Distribution

To order the diskette distribution, send a request, with a check for $50 to cover media, duplication, handling and postage, to:

IMET/UNOLS Shipboard Software Distribution
Attention: M. Tavares
Woods Hole Oceanographic Institution
Woods Hole, MA 02543

The request should specify diskette type. Three diskette formats are supported, 5-1/4" high density (1.2Mb) and 3-1/2" high and low density (1.44Mb and 720 kb). These formats are for use in the DOS environment.

Comments, feedback, and requests for other information also should be directed to the above address.

3.1.2 Network Distribution

The network distribution of the IMET/UNOLS operational software can be accessed using anonymous ftp to Internet address **isdl.whoi.edu**. A *tar* file can be accessed (in ftp binary mode) from the file **unols/imetship.tar** in the anonymous ftp directory of **isdl.whoi.edu**.

Three additional files should be transferred to your local directory. These are **read.me**, **tar.exe** and **hd_setup.bat**. The **read.me** file contains preliminary instructions for handling the distribution. **tar.exe** is a program to un-archive the **imetship.tar** file into appropriate directories and files. The file **hd_setup.bat** is a batch file containing procedures for automatically installing the distribution onto a hard disk system.

The command steps used to acquire the software distribution are shown in Table 1. The user responses are shown in *italics*, and the ..... sequences indicate ftp activity and status responses.

Comments, feedback, and requests for other information can be sent via e-mail to *kegp@isdl.whoi.edu.*

ftp isdl.whoi.edu
connected to isdl.whoi.edu
isdl FTP server ready
Name: *anonymous*
Password: *(enter your network id here)*
Guest login OK, access restrictions apply
ftp> *cd unols*
CWD command successful
ftp> *get hd_setup.bat*
.....
ftp> *binary*
Type set to I
ftp> *get imetship.tar*
.....
ftp> *get tar.exe*
.....
ftp> *bye*

Table 1: Instructions for FTP Access to IMET/UNOLS Software Distribution

3.2 Installing Operational Software

The operational programs and support files can be automatically installed in the proper directories of the hard disk on the logger system. Installation procedures vary depending on how the software was acquired. These procedures include answering questions that produce a site configuration file. All installation procedures are interactive.

3.2.1 Installing From Floppy Diskette Distribution

1. Insert the diskette labeled *Installation* in the **A:** drive.
2. Type **A: <ENTER>**.
3. At the DOS prompt (A:>) type **FL_SETUP <ENTER>**.
4. A directory will be created (*UNOLS*) on the hard disk and files will be copied to it and its subdirectories.
5. Answer the procedure questions.
6. When procedure is complete, remove diskette.
7. Proceed to the following section on configuration

3.2.2 Installing From Network Distribution

This procedure assumes that installation is being performed on a DOS machine. The distribution can be unpacked on a UNIX machine if necessary but those instructions are not covered here.

There are three files obtained from the network distribution that must be in the root directory of the hard disk prior to starting the installation procedure.

- **imetship.tar**
- **tar.exe**
- **hd_setup.bat**

The following steps will install the software distribution on the hard disk.

1. Transfer to the root directory (**CD **)
2. At the DOS prompt (C:>) type **HD_SETUP <ENTER>**.
3. A directory will be created (*UNOLS*) on the hard disk and the **imetship.tar** file will be unpacked into it and its subdirectories.
4. Answer the procedure questions.
5. Proceed to the following section on configuration

3.3 System Configuration

Several steps must be taken to configure the system for operation. These include:

- installation of the drivers for the optical disk archive media.
- creation or editing of the **CONFIG.SYS** file.
- creation or editing of the **AUTOEXEC.BAT** file.
- creation or editing of the ship name and module configuration file.

3.3.1 Optical Disk Drivers

There should be instructions available with the purchased optical disk subsystem drivers. Follow these instructions to install any drivers or related programs for use of the optical disk drive. These installation procedures might involve formatting and partitioning the optical disk cartridge. This document does not deal with these device-specific issues. They are left to the judgement of the individual user based on local environment and needs. However, the operational software assumes that the archive drive will be available through the drive **E:** designation.

3.3.2 The CONFIG.SYS File

The system needs a **CONFIG.SYS** file. This file is used during the boot procedure. It contains certain commands which configure the DOS system. Refer to the DOS manual for details on the creation and contents of the **CONFIG.SYS** file. The **CONFIG.SYS** file must contain commands to load and configure the drivers needed to operate the optical disk drive. Instructions for these commands should be supplied with the optical disk software drivers. Follow these instructions and those supplied in the DOS documentation to generate a **CONFIG.SYS** file. An example file is shown in Appendix A.

The **CONFIG.SYS** file must contain a line that loads the **ANSI.SYS** file. This is a driver that makes the PC keyboard and video respond to ANSI compatible terminal commands. This driver is installed by inserting the following line in the **CONFIG.SYS** file:

```
DEVICE=C:\ANSI.SYS
```

The driver **ANSI.SYS** is a part of the DOS system file set and should be installed in the root directory.

3.3.3 The AUTOEXEC.BAT File

An **AUTOEXEC.BAT** file is a special batch file that is automatically executed whenever DOS is started. It is useful for executing certain commands before using the system.

If the UNOLS/IMET system is to be configured for turn-key operation, the **AUTOEXEC.BAT** file must have as its last line:

```
C:\SH_IMET
```

This runs the main operational program whenever the system is started or restarted. See the example in Appendix A.

3.3.4 The SHIPNAME File

The main operational program **SH_IMET** needs a file that contains ship name and module configuration information. This file is called **SHIPNAME** and should be located in the root directory. It is generally created during the software installation process.

The file contains two lines. The first line is the ship name. The second line contains the names, in lower case, of all modules present in the current system configuration. Table 2 contains a list of the module names and functions. The following lines are an example of a typical **SHIPNAME** file.

```
R/V Knorr
wnd bpr hrh tmp sst swr prc gps
```

The file contains only ASCII text and can be created and edited with any text editor.

NAME	FUNCTION
wnd	wind speed and direction
bpr	barometric pressure
hrh	relative humidity
tmp	air temperature
sst	sea temperature
swr	short wave radiation
lwr	long wave radiation
prc	precipitation
gps	Global Positioning

Table 2: IMET Module Names and Functions

3.4 Operational Program SH_IMET

SH_IMET is the primary program for data collection and recording. Its basic functions are:

- interrogate modules once each minute
- format and record the returned data values
- display data values, time, date, and messages on the CRT screen
- monitor keyboard input for user commands
- output data values to serial port, periodically or on request
- copy data file to archive optical cartridge once daily
- maintain a log file of program activity and errors
- control module power, cycling power when necessary to reset modules
- initialize, control and interrogate GPS unit, when provided

3.4.1 Module Interrogation

The **SH_IMET** program uses the data logging computer's hardware real-time clock for time-keeping. The hardware alarm interrupt feature of the real-time clock is used to provide an interrupt each second. At the start of each minute the program begins an interrogation sequence that includes all modules. If a module does not respond to interrogation within an alloted time, a time-out flag is set for that module (and the system). If more than ten timeouts are encountered for any module, it is removed from the interrogation list. The program monitors these time-out flags. When several have been encountered the module power supply is cycled in an effort to reset the modules and clear any hangups. The entire system is reset at the start of each day.

3.4.2 Data Format and Record

Data values received from the sensor modules are formatted into the netCDF interface specifications (see Appendix C). A record is written to a hard disk file each minute. Each file contains values for one full day. At the start of each day, the file from the prior day is copied to the archive media (optical disk) and the original hard disk file deleted.

File name conventions in the IMET system use chronology to generate the name. A file name consists of the year, month, and day. The name *911224.MET* is for a file containing data from 24 December 1991.