www.ashtech.com

Presents

Micro-Manager®

&

Micro-Manager® Pro

(Receiver Management and Control Software for the Ashtech µZ-Family of GPS Receivers)

User's Manual

February 24, 2002

Printed in the United States of America by The XYZs of GPS, Inc. XYZs' Part Numbers: Micro-Manager, xyzgps12-h0; Micro-Manager Pro, xyzgps12-h1 Ashtech's Part Numbers: Micro-Manager, 110424; Micro-Manager Pro, 110449

February 16, 2002

Trademark Notice

MicroMgr™ and Micro-Manager™ and µ-Manager™ and µ-Mgr™ are trademarks of The XYZs of GPS, Inc. All other product and brand names are trademarks or registered trademarks of their respective holders.

SOFTWARE LICENSE AGREEMENT

IMPORTANT: BY OPENING THE SEALED DISK PACKAGE CONTAINING THE SOFTWARE MEDIA OR INSTALLING THE SOFTWARE, YOU ARE AGREEING TO BE BOUND BY THE TERMS AND CONDITIONS OF THE LICENSE AGREEMENT ("AGREEMENT"). THIS AGREEMENT CONSTITUTES THE COMPLETE AGREEMENT BETWEEN YOU ("LICENSEE") AND THALES NAVIGATION ("LICENSOR"). CAREFULLY READ THE AGREEMENT AND IF YOU DO NOT AGREE WITH THE TERMS, RETURN THIS UNOPENED DISK PACKAGE AND THE ACCOMPANYING ITEMS TO THE PLACE WHERE YOU OBTAINED THEM FOR A FULL REFUND.

LICENSE. LICENSOR grants to you a limited, non-exclusive, non-transferable, personal license ("License") to (i) install and operate the copy of the computer program contained in this package ("Program") in machine acceptable form only on a single computer (one central processing unit and associated monitor and keyboard) and (ii) make one archival copy of the Program for use with the same computer. LICENSOR and its third-party suppliers retain all rights to the Program not expressly granted in this Agreement.

OWNERSHIP OF PROGRAMS AND COPIES. This License is not a sale of the original Program or any copies. LICENSOR and its third-party suppliers retain the ownership of the Program and all copyrights and other proprietary rights therein, and all subsequent copies of the Program made by you, regardless of the form in which the copies may exist. The Program and the accompanying manuals ("Documentation") are copyrighted works of authorship and contain valuable trade secret and confidential information proprietary to LICENSOR and its third-party suppliers. You agree to exercise reasonable efforts to protect the proprietary interests of LICENSOR and its third-party suppliers in the Program and Documentation and maintain them in strict confidence.

USER RESTRICTIONS. The Program is provided for personal use or use in your internal commercial business operations and must remain at all times upon a single computer owned or leased by you. You may physically transfer the Program from one computer to another provided that the Program is operated only on one computer at a time. You may not operate the Program in a time-sharing or service bureau operation or rent, lease, sublease, sell, assign, pledge, transfer, transmit electronically or otherwise dispose of the Program or Documentation, on a temporary or permanent basis, without the prior written consent of LICENSOR. You agree not to translate, modify, adapt, disassemble, decompile, or reverse engineer the Program, or create derivative works of the Program or Documentation or any portion thereof.

TERMINATION. The License is effective until terminated. The License will terminate without notice from LICENSOR if you fail to comply with any provision of this Agreement. Upon termination, you must cease all use of the Program and Documentation and return them and any copies thereof to LICENSOR.

GENERAL. This Agreement shall be governed by and construed in accordance with the Laws of the State of California and the United States without regard to conflict of laws provisions thereof and without regard to the United Nations Convention on Contracts for the International Sale of Goods.
Unless modified in writing and signed by both parties, this Agreement is understood to be the complete, exclusive and final agreement between the parties, superseding all prior agreements, oral or written, and all other communications between the parties relating to the Software, Program and Documentation. No employee of Thales Navigation or any other party is authorized to make any agreements in addition to those made in this Agreement.

LICENSEE ACKNOWLEDGES THAT IT HAS READ THIS AGREEMENT, UNDERSTANDS IT, AND IS BOUND BY ITS TERMS.

DISCLAIMER OF WARRANTIES AND LIMITATION OF LIABILITY

THIS SOFTWARE, PROGRAM AND DOCUMENTATION IS DISTRIBUTED AND LICENSED "AS IS" AND WITHOUT ANY WARRANTIES, EXPRESS OR IMPLIED, BY LICENSOR AND ITS THIRD-PARTY SUPPLIERS WHO ALSO EXPRESSLY DISCLAIM ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE, PERFORMANCE, FUNCTIONALITY, ACCURACY OF DATA, TITLE OR NONINFRINGEMENT. LICENSOR AND ITS THIRD-PARTY SUPPLIERS DO NOT WARRANT THE SOFTWARE, PROGRAM OR DOCUMENTATION WILL MEET YOUR REQUIREMENTS OR THAT ITS OPERATION WILL BE UNINTERRUPTED, ERROR-FREE, OR VIRUS-FREE. THE USER ASSUMES THE ENTIRE RISK OF USING THIS SOFTWARE, PROGRAM AND DOCUMENTATION.

ANY LIABILITY OF LICENSOR, ITS THIRD-PARTY DISTRIBUTORS, OR ANYONE ELSE INVOLVED IN THE CREATION OR DELIVERY OF THE SOFTWARE, PROGRAM OR DOCUMENTATION IS LIMITED TO THE PURCHASE PRICE THEREOF. THERE SHALL BE NO OTHER LIABILITY FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL OR OTHER DAMAGES OF ANY KIND, WHETHER BASED ON BREACH OF WARRANTY, BREACH OF CONTRACT, NEGLIGENCE, STRICT LIABILITY OR ANY OTHER LEGAL THEORY, ARISING OUT OF OR RELATING TO THE USE OR INABILITY TO USE THE SOFTWARE, PROGRAM OR DOCUMENTATION, OR THE PROVISION OF OR FAILURE TO PROVIDE SUPPORT SERVICES, EVEN IF LICENSOR HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.

MANUAL DISCLAIMER.
THIS MANUAL IS PROVIDED "AS IS"; THALES NAVIGATION MAKES NO WARRANTIES TO ANY PERSON OR ENTITY WITH RESPECT TO THE SUBJECT MATTER, CONTENTS OR USE OF INFORMATION CONTAINED HEREIN OR ANY DERIVATIVES THEREOF. THALES NAVIGATION DISCLAIMS ALL IMPLIED WARRANTIES, INCLUDING, WITHOUT LIMITATION, WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, NONINFRINGEMENT, AND TITLE. FURTHER, THALES NAVIGATION DOES NOT WARRANT, GUARANTEE, OR MAKE ANY REPRESENTATIONS REGARDING THE USE, OR THE RESULTS OF THE USE, OF THIS MANUAL IN TERMS OF CORRECTNESS, ACCURACY, RELIABILITY, OR OTHERWISE. THIS PUBLICATION AND FEATURES DESCRIBED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE.

U.S. GOVERNMENT RESTRICTED RIGHTS

The Software, Program and Documentation are provided with RESTRICTIVE RIGHTS. Use, duplication, or disclosure by or on behalf of the United States government is subject to restrictions as set forth in subdivision (c)(1)(ii) of the Rights in Technical Data and Computer Software clause at DFARS 252.227-7013 or subdivision 9(C)(1) and (2) of the Commercial Computer Software-Restricted Rights 48 CFR 52.227.19, as applicable.

Should you have any questions concerning this Disclaimer of Warranties and Limitation of Liability, please contact in writing: Thales Navigation, Legal Department, 471 El Camino Real, Santa Clara, CA 95050, USA.

INDEX

Chapter 0

Micro-Manager vs. Micro-Manager Pro

There are two basic editions of **Micro-Manager**: **Micro-Manager** and **Micro-Manager Pro**. Throughout this document we generically refer to **Micro-Manager** and do not highlight the differences between **Micro-Manager** and **Micro-Manager Pro**.

The primary differences between the two editions, at the current time, are the remote access features. That is, **Micro-Manager Pro** provides facilities for remote access (i.e., local computer modem configurations, telephone dialing directories, modem dialing and disconnect options, and automatic/command-line driven remote modem connections) while the standard **Micro-Manager** does not. Additional features are being considered for Micro-Manager Pro.

By product design and definition Micro-Manager Pro has all of the features and functionality of Micro-Manager plus additional features. While both products may change and mature this assumption is expected to remain valid. Please refer to the table below.

To verify which edition you have, see the Help About window of the program. When the professional configuration is in use, a clear indication of the “Professional” version will be indicated.

Current Features	Micro-Manager	Micro-Manager Pro
32 bit multitasking & multithreaded architecture running on Windows 95/98/ME/NT/2000	Yes	Yes
Windows Graphical User Interface	Yes	Yes
Choice of GUI (manual) or Command Line (automatic) interface	Yes	Yes
Ring file data control	Yes	Yes
Receiver data file management	Yes	Yes
Session programming	Yes	Yes
Receiver script file uploading feature	Yes	Yes
Powerful terminal window capability	Yes	Yes
User configurable alerts	Yes	Yes
Reliable firmware uploads	Yes	Yes
Z-modem protocol for data transfers	Yes	Yes
File translations to Ashtech or RINEX formats	Yes	Yes
RTCM base station configuration control status	Yes	Yes
Built in user safeguards	Yes	Yes
User configurable real time information screens	Yes	Yes
Direct receiver connection	Yes	Yes
Remote (modem) receiver connection	No	Yes
Full control over dialing parameters and hardware handshaking for modems	No	Yes
Dialing directory facilities	No	Yes
Modem settings	No	Yes
RINEX Site/Header table Feature	No	Yes
Post-Download Command Feature	No	Yes

Chapter 1

Introduction to Micro-Manager

1.0 OVERVIEW

Micro-Manager is a PC based program that was designed for the management of remotely and locally operated µZ-Family of GPS receivers. **Micro-Manager** software provides users with the ability to control essential receiver parameters and logging features while allowing full access to all of the data stored within the receiver. Users can interface with the program using its state-of-the-art Graphical User's Interface (GUI) or through command-line options which facilitate automation. The result is an advanced reference station system capable of managing numerous GPS receivers. These receivers can be located locally or, through its modem access features, virtually anywhere in the world.

Micro-Manager was designed to run on Windows 95/98/ME/NT/2000 platforms. While capable of operating on all of these platforms, **Micro-Manager** is 32-bit in nature and takes full advantage of the preemptive multi-tasking and multi-threading capabilities of the Windows NT and 2000 platforms. These features provide the user with a stable and secure platform that requires minimal maintenance. **Micro-Manager** should run equally well on Windows XP.

Micro-Manager currently supports the Ashtech µZ-Family of GPS receivers. This includes the µZ-CGRS and µZ-Surveyor receivers. It has been designed to allow both direct connections (i.e., via RS-232 cables) to the GPS receiver and remote connections through modems. **Micro-Manager** offers extensive modem configuration options and, as such, will support a wide variety of modems. Furthermore, the modem configuration options support a wide variety of installation needs. For example, one installation of **Micro-Manager** is configured to use a spread-spectrum modem. That modem employs a TDMA network access scheme and utilizes several repeaters to reach some of the remotely located receivers. Without the availability of the extensive configuration options, such an installation may not have been possible.

Micro-Manager is capable of exploiting the following major features of the µZ-Family of GPS receivers.

1) GPS data collection and data file storage.
2) GPS data collection "configuration" parameters including satellite filtering and site information.
3) Session programming features.
4) Receiver communication port configuration.

5) RTCM configuration and control.
6) Remote Firmware Uploading.
7) Parameters which control the protocol used in the transfer of GPS data.

Using **Micro-Manager,** users can configure receiver-logging sessions. This feature, referred to as the Session Programming feature, establishes the time periods during which GPS data will be recorded and the parameters governing that collection. For example, the user can define a data collection session beginning at 1:00 AM every day, lasting 1 hour, based upon a 1-second data epoch, with an elevation mask of 5 degrees. The user could then define another data collection session (up to 24 sessions) beginning at 10:00 AM every day, lasting 4 hours, based upon a 20-second data epoch, with an elevation mask of 10 degrees, and storing data only when there are 4 or more satellites.

Micro-Manager also can be called from a command-line. This facilitates automatic and/or unattended management of local or remote receivers. Using this feature, one can command **Micro-Manager** to dial-up and download receiver data. Furthermore, you can instruct **Micro-Manager** to delete the successfully downloaded files from the receiver's memory, thereby enabling further data collection within the receiver. For Windows NT users, the "AT" command of the "Scheduler" service can be used to schedule runs of **Micro-Manager**. In fact, one can set up a batch file containing commands to dial your entire set of remote receivers and then use the AT feature of Windows NT to schedule the execution of that batch program. Users desiring more elaborate and/or user-friendly scheduling features can employ commercially available scheduling programs, such as Norton Scheduler.

Micro-Manager contains a Post-Download Command feature that allows users to configure and call applications that may operate on data created by **Micro-Manager**. For example, one can configure **Micro-Manager** to call an FTP program that will create target directories on an FTP server and then upload data files created by **Micro-Manager** to that FTP Server.

When it becomes necessary to change your receiver's firmware, you will find that Thales Navigation has paid particular attention to providing reliable and stable firmware uploads. That is**, Micro-Manager** contains a built in firmware uploading capability that utilizes a protective firmware upload protocol, reliable firmware file formats, and very stringent firmware crosscheck procedures. The result is a reliable means of upgrading your receiver's firmware either through a direct connection or a remote connection.

Additionally, **Micro-Manager** has been designed to operate in concert with other commercially available software packages, such as Bulletin Board Systems (BBS) and FTP servers. It must be emphasized that **Micro-Manager** does not, by itself, contain *all* of the tools necessary for automated Internet and BBS operation. Rather, it has been designed to work in concert with such packages. Thales Navigation recommends obtaining commercially available and well-recognized software systems to support these needs.

1.1 Minimum System Requirements

Micro-Manager requires a Windows 95, Windows 98, Windows ME, Windows NT or Windows 2000 based computer. While **Micro-Manager** requires less than 5 megabytes of memory to run, Windows platforms impose higher minimums. It is recommended, for performance reasons, that your computer have no less than 32 megabytes of RAM memory for Windows 95/98/ME and 64 megabytes for Windows NT/2000 platforms. Thales Navigation strongly recommends either a Windows NT or Windows 2000 platform because of the true 32-bit nature of these platforms .

Your disk space requirements will vary depending upon your unique installation and data collection needs. **Micro-Manager** actually requires less than 10 Megabytes of disk space to store the program and its ancillary files, but it is recommended that your available disk space be much larger to accommodate your data storage needs. Storage solutions such as ZIP (100 MB or 250 MB) and JAZ (1 or 2 GB) from Iomega provide but two examples of alternate storage solutions.

To optimize the performance of **Micro-Manager**, please give special consideration to the PC you choose to run the software. It is important to choose a leading brand system to avoid less capable components such as serial cards often found in cheap knock-offs. Although **Micro-Manager** will run on most all Intel (and AMD) processors (486 and up), it's performance may be superior on a well-built Pentium system specifically designed for Windows NT/2000.

To communicate with remotely located receivers, you will need a minimum of two modems: i.e., one for the computer and one for every remotely located GPS receiver. Thales Navigation recommends that you utilize modems from the same manufacturer throughout your installation to avoid compatibility problems. Furthermore, Thales Navigation recommends that you use either US Robotic Courier or Sportster Modems. Check with Thales Navigation regarding other modems, including spread-spectrum type radio modems.

It should be emphasized that Thales Navigation does not support all modems; so it is necessary to verify that the modems you wish to use are supported**.**

1.2 Demo Modes of Micro-Manager

There are two basic modes of **Micro-Manager**: fully operational and demonstration (i.e., demo). This document applies to both modes. Demo modes, which are freely distributed over the Internet or provided on diskette, have a greatly reduced capability when compared with a fully operational program but do not require a sentinel key. Demos will differ from operational programs by disallowing at least the following: (1) all file download and delete features, (2) the editing of receiver control parameters, and (3) the command-line features. Basically the demos permit one to observe but not to accomplish.

One can obtain a Demo **Micro-Manager** from the Reference Station link on the Ashtech web page at the following address: ***http://www.ashtech.com***

Chapter 2

Installation Instructions

2.0 INSTALLATION OVERVIEW

From a total system perspective, there are two primary sides of the installation process: 1) installing hardware and 2) installing software. The primary purpose of this manual is to describe the installation and use of the **Micro-Manager** software package. We will not provide in-depth installation guidelines and steps for hardware installation; we refer you to the appropriate computer and receiver manuals for details. We will, however, introduce some important GPS receiver, modem and computer installation issues as they relate to the operation of the **Micro-Manager** software package.

2.1 Hardware Installation

Micro-Manager has been designed with two primary configurations in mind: 1) direct connections and 2) remote connections. Figures 2.1.A and 2.1.B provide basic block diagrams for these configurations. Figure 2.1.A provides a direct connection (also called a local receiver connection) block diagram while Figure 2.1.B provides a remote receiver connection block diagram.

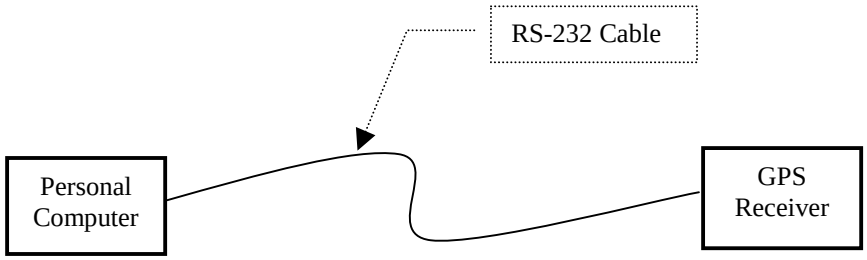


Figure 2.1.A: Direct Connection

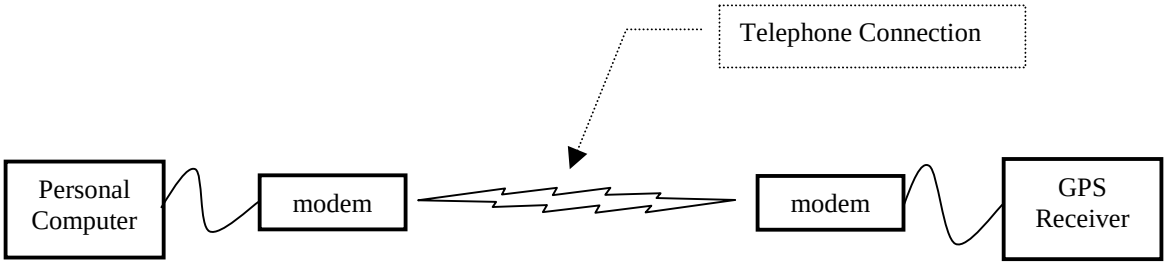


Figure 2.1.B: Remote Connection

As can be seen in the above block diagrams, the primary difference between these two configurations is the use of modems to establish the link between the Personal Computer and the GPS Receiver. For details on connecting modems to your GPS receiver, please consult the appropriate receiver manual. Likewise, the manuals of your Personal Computer should describe how to connect/install modems.

To communicate with remotely located receivers, you will need a minimum of two modems: i.e., one for the computer and one for every remotely located GPS receiver. Thales Navigation recommends that you utilize modems from the same manufacturer throughout your installation to avoid compatibility problems. Furthermore, Thales Navigation recommends that you use either US Robotic Courier or Sportster Modems. Check with Thales Navigation regarding other modems, including spread-spectrum type radio modems. It should be emphasized that Thales Navigation does not support all modems; so it is necessary to verify that the modems you wish to use are supported**.**

The particular type of receiver, and, for certain receiver types, the communication port of the receiver used for **Micro-Manager** functions, plays a key role in the **Micro-Manager** configuration process. This is because there are slight hardware variations in the various µZ-Family of GPS receivers. With the exception of Port A of µZ-CGRS receivers, the DTR/DSR hardware handshaking lines ARE NOT implemented. It is essential to understand this because many modems are pre-configured so that when the DTR line is dropped, it signals the modem to terminate a telephone connection. Therefore, when using µZ-CGRS receivers it is suggested that you connect the receiver's modem to Port A of the receiver. When connecting a modem to a non-µZ-CGRS receiver (or Ports B through D of a µZ-CGRS receiver), ensure that you configure the receiver to instruct its modem to ignore the DTR/DSR signal (See Section 4.1.5.4.2). For direct connections, this is key because **Micro-Manager** must be configured according to the availability of the DTR/DSR flow control of the receiver or receiver port. Section 3.1.1.3.5 describes the configuration of the DTR/DSR hardware flow control for direct connections.

2.2 Micro-Manager Installation

In this section, we describe the installation of the **Micro-Manager** software program (and its ancillary programs and files).

For most users of **Micro-Manager** the installation is very straightforward. The installation uses an industry recognized installer program. If for any reason you decide to remove **Micro-Manager** (such as to install an upgrade to **Micro-Manager**), it can be removed (along with all of its support components) using normal Windows 95/98/ME/NT/2000 software uninstall mechanisms. Please see the end of this section for details on uninstalling **Micro-Manager**.

Please note that when installing **Micro-Manager** on a Windows NT or Windows 2000 machine, it is necessary to install **Micro-Manager** under an account that has full administrative privileges (such as the Administrator's account). If you attempt to install **Micro-Manager** under an account that does not have full administrative access, **Micro-Manager** will not install and run properly. This is because the **Micro-Manager** installer needs to add device drivers for its sentinel key.

During the installation of **Micro-Manager** the following major components will be installed:

- **Micro-Manager** Program files
- Sentinel Drivers
- **Micro-Manager** Sound Files
- **Micro-Manager** Ancillary/Support Program Files

The program files include the executable program and its configuration files. The sentinel drivers are required to allow **Micro-Manager** to communicate with its sentinel key. In fact, without these drivers, **Micro-Manager** would not be expected to run. This sentinel key comes standard with each copy of the program. The sentinel key allows **Micro-Manager** and its support utilities to run on a single workstation. Please note that multiple copies of **Micro-Manager** can be run on a single workstation based upon a single sentinel key (i.e., without the need of additional sentinel keys). Furthermore, there is virtually no limit to the number of remote receivers that can be controlled using a single copy of the program.

The **Micro-Manager** sound files are a set of WAV files that **Micro-Manager** can be configured to play when certain events occur (see Section 3.1.6.1). The user selects which sound files to play, in each situation, during the configuration of **Micro-Manager**.

The ancillary program files, installed when **Micro-Manager** is installed, include the programs UPACKU12.exe, XYZAshRx.exe, and XYZs_FTP.exe. These programs UPACKU12.exe and XYZAshRx.exe convert receiver memory files to standard Ashtech GPS data files and to RINEX, respectively. The program XYZs_FTP.exe is a command-line callable program that can be used with the Post-Download feature of **Micro-Manager**.

2.2.1 The Installation Process

The Micro-Manager Installer comes in one of three typical forms: 1) a CD-ROM based installer; 2) a diskette based installer; or 3) an installer suite downloaded over the Internet (from the Ashtech Web page). The CD-ROM is the most common method used, especially for new installations. The Internet/Web approach is the most common method used to obtain updates. Each of these installers has a common executable program (i.e., "SETUP.EXE") that is used to control the installation. To start the installation process, one simply launches that executable.

The table that follows provides information related to the three typical installer forms.

Form	Installer Information
CD-ROM	The top-level directory of the CD-ROM contains three items: 1) a file named "Install.txt", 2) a "MicroMgr" folder; and 3) a "Remote32" folder. The file "Install.txt" describes how one installs various programs from that CR-ROM (however, we will describe herein how one installs the **Micro-Manager** program). The "MicroMgr" and "Remote32" folders contain the files and folders needed to install **Micro-Manager** and Remote32, respectively. Please note those that have **purchased Micro-Manager Pro** can install and run Remote32 (i.e., if you did not purchase the Pro version, you can install Remote32 but it will fail to run). Within the CD-ROM "MicroMgr" folder are a set of folders (e.g., "Disk1", "Disk2", "Disk3", etc.). Simply browse (using Explorer or a like approach) into the "\MicroMgr\Disk1" folder and double-click the program "SETUP.EXE".
Diskette	To install **Micro-Manager** onto your computer, insert the **Micro-Manager** installation diskette labeled "**Micro-Manager** Install Disk 1" into the A (or B) drive of your computer. Press the "Start" button and select "Run". Use the "Browse" command to locate and run the "Setup" program on the diskette located in the A (or B) drive of the computer.
Internet Download	Micro-Manager installer files downloaded from the Ashtech Web page will likely be in the form of several PkZipped files (named "Disk1.zip", "Disk2.zip", "Disk3.zip", etc.). Simply unzip these files into the same temporary directory (that you create) on your hard drive. Then browse (using Explorer or a like approach) to the temporary folder where the files were unzipped and double-click the program "SETUP.EXE". Note: After the installation has completed successfully, you can remove the files in the temporary folder.

Once you have started the "SETUP.EXE" program (described in the above table), the installer program will start. The install program guides you through the installation of the **Micro-Manager** software. At each step you will be given an opportunity to accept default options or tailor these to your individual needs. You will be required to enter your 8-character serial number. For the CD-ROM distribution form, the serial number is located on the CD-ROM jewel case (and the original software container box). For the diskette distribution form, the serial number is located on each of the **Micro-Manager** installation diskettes (and the original software container box). For Internet forms, the serial number must be obtained from the original form

(CD-ROM or diskette) shipped to you. The following is an example **Micro-Manager** serial number.

KF004561-MICROM-011598

The first 8 characters of the serial number are the numbers that should be entered during the installation process. In the above example the **Micro-Manager** serial number that one would enter is KF004561. Please note that without the proper serial number you will not be able to continue the **Micro-Manager** installation.

Upon completing the installation of the **Micro-Manager** program and data files, you will be asked two questions:

1) Do you want a **Micro-Manager** entry in the Windows Start Program menu?
2) Do you want a shortcut to **Micro-Manager** on your desktop?

Answering no to either question does not prohibit you from later manually activating or deactivating the features. Likewise, answering yes to either question will not prohibit you from manually deactivating the features. Manually activating and deactivating these features can be accomplished through standard Windows configuration parameters (such as creating shortcuts) at any later time.

If you decide to add **Micro-Manager** to the Windows Start Program menu, then you will be able to quickly launch **Micro-Manager** using the Windows "Start" button. If you choose to have a **Micro-Manager** shortcut added to your desktop, then the installer will place the program icon onto your desktop. To launch the program from the desktop, you will simply need to double-click the program icon. In both cases, the link to the program is installed without any additional command-line parameters (i.e., double-clicking the program icon will place the program into its GUI mode, rather than its command-line mode).

2.2.1.1 Installing the Sentinel Key

Before actually running **Micro-Manager**, you will need to install the software sentinel key. Please note that **Micro-Manager** will not run without this sentinel key. Also note that you cannot start **Micro-Manager** with the key and then later remove the key while **Micro-Manager** is running. The software sentinel key is installed by attaching the end of the sentinel key labeled ↑COMPUTER↑ to a parallel printer port of your computer. Please tighten the screws of the sentinel key to securely connect the key to your computer. If a printer is connected to your computer, attach that cable to the sentinel. If the sentinel cannot be installed because of an obstruction behind the computer, you can place the sentinel key later in the parallel sequence (for example, you could attach the sentinel key to a DB-25 male to DB-25 female cable which is connected to your computer's parallel port). To ensure a good connection between the computer, the sentinel key and other parallel devices, use only IEEE standard parallel printer cables.

The sentinel key allows **Micro-Manager** to run on a single workstation. As stated earlier, multiple copies of **Micro-Manager** can be run on a single workstation without need of additional keys.

2.2.1.2 Uninstalling **Micro-Manager**

Micro-Manager and all of its components can be uninstalled via the "Add/Remove Programs" feature of the "Control Panel" in Windows. Please note that **Micro-Manager** must be removed prior to installing a new version. The Install Shield program, which installs **Micro-Manager**, does not detect and remove old versions.

Chapter 3

Configuring Micro-Manager

3.0 CONFIGURATION OVERVIEW

Before actually running **Micro-Manager**, you will need to install the software sentinel key. Please note that **Micro-Manager** will not run without this sentinel key. Also note that you cannot start **Micro-Manager** with the key and then later remove the key while **Micro-Manager** is running. The software sentinel key is installed by attaching the end of the sentinel key labeled ↑COMPUTER↑ to a parallel printer port of your computer. Please tighten the screws of the sentinel key to connect the key securely to your computer. If a printer is connected to your computer, attach that cable to the sentinel. If the sentinel cannot be installed because of an obstruction behind the computer, you can place the sentinel key later in the parallel sequence (for example, you could attach the sentinel key to a DB-25 male to DB-25 female cable which is connected to your computer's parallel port). To ensure a good connection between the computer, the sentinel key and other parallel devices, use only IEEE standard parallel printer cables.

The sentinel key allows **Micro-Manager** to run on a single workstation. Multiple copies of **Micro-Manager** can be run on a single workstation without need of additional sentinel keys.

Prior to connecting to the GPS receiver, **Micro-Manager** needs to be configured to suit your data collections needs. Please note that this configuration process is extremely important, as the **Micro-Manager** factory defaults will probably *not* meet your needs.

The **Micro-Manager** configuration information is stored in 3 files:

1) MICROMGR.PNM;
2) MICROMGR.MDM; and
3) MICROMGR.INI.

All of these configuration files are located in the same directory where the main program file (i.e., MICROMGR.EXE) is stored. The file named MICROMGR.PNM stores the telephone numbers to be dialed to reach each of your remote receivers. The file named MICROMGR.MDM stores all of the configuration information associated with each of the modems you have configured to be used with your PC. Finally, the file named MICROMGR.INI contains all other configuration information related to the program.

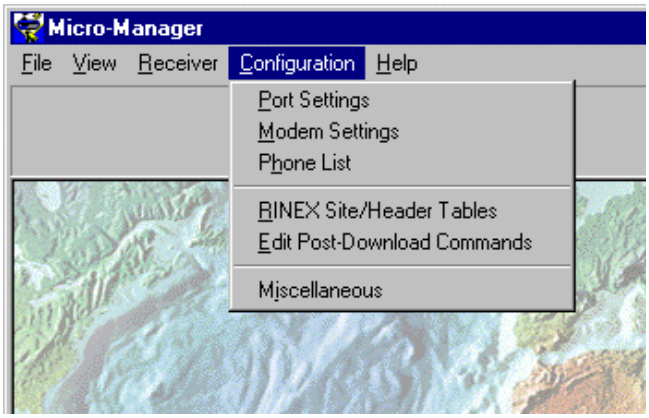
Micro-Manager automatically updates the contents of the configuration files as the operator makes changes using the "configuration" menus. Changes are written to these files so that the configuration may be recalled at the start of the next run of the program. In this way, once the desired configuration is set, the operator no longer needs to change it -- unless, of course,

it needs to be altered to support a new configuration. The “Configuration” sub-menus of the **Micro-Manager** program are used to set the majority of these parameters. Details of the contents of the Configuration sub-menus will be provided in later sections of this document.

The above mentioned configuration files are text (i.e., ASCII) files. As such, the configuration can also be modified with any text file editor. However, you are strongly discouraged from making configuration changes using this approach. In fact, after you get **Micro-Manager** configured as desired, it would be prudent to make a backup copy of these configuration files. Should you need to modify any of these files with a text editor, please verify that you have a backup copy before editing them.

3.1 Configuration Menus

Most **Micro-Manager** parameters are set through the main menu "Configuration" option. The “Configuration” drop-down menu is divided into 6 different selections. These 6 selections become available when “Configuration” is selected (a drop-down menu appears).



The following Sub-Sections describe each of the 6 configuration windows (i.e., sub-menus).

It is intended that **Micro-Manager** be configured before connecting to a receiver. One can, however, change the configuration of the *receiver* while **Micro-Manager** is connected to that receiver. Special features have been built into **Micro-Manager** to change the GPS receiver’s parameters while **Micro-Manager** is connected to the GPS receiver. These will be described in later sections.

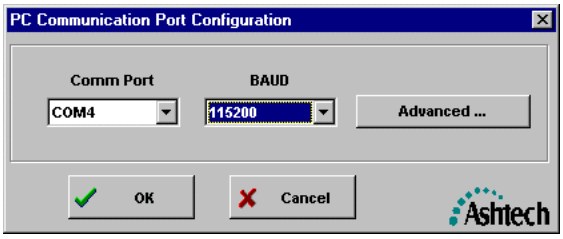
Earlier we stated that it is generally expected that **Micro-Manager** be configured before it is actually connected to a receiver. However, whenever a valid communication port is specified in its configuration files, **Micro-Manager** will, upon startup, open that communication port and attempt to determine the type of receiver, if any, that is connected on that port. For introductory users of this package, this may be a somewhat confusing point. However, experienced users will find this improves their productivity by requiring fewer steps to begin their work. This topic will be described in more detail later in this document (see Sections 3.1.1, 3.1.6.5, and 4.1.2)

3.1.1 PC Communication Port Settings

The PC (or Personal Computer) Communication Port Configuration window allows the operator to set the communications port parameters governing the connection with the GPS receiver. The items configured through this window affect the settings of the computer communication port over which **Micro-Manager** is communicating with the GPS receiver, and not the port settings of the GPS receiver (see Section 4.1.5.4.2).

The Communication Port Configuration window permits the editing of the following communication parameters:

1) The PC communication port (labeled "Comm Port");
2) The PC communication port speed (labeled "BAUD");
2) Advanced communication options (labeled "Advanced …");



When making configuration changes through this window (or the window reached by pressing the "Advanced …" button), keep in mind that you are configuring the communication port of the local PC (not the parameters of the device attached to that port). However, your configuration settings will depend on the device (i.e., either a modem or a GPS receiver) attached to the communication port.

Upon accepting the changes to this window, by pressing the OK button, **Micro-Manager** will immediately attempt to configure and open the communication port of the local PC. Please note that when you accept the port settings, if any of the receiver status windows are open (see Sections 4.1.4 through 4.1.4.7), **Micro-Manager** will immediately attempt to obtain that status data. This is important because if a live GPS receiver is not connected to that serial port (or that receiver's communication port is not operating at the same communication speed or the connection to the receiver is normally done through a modem), then **Micro-Manager** will begin generating error messages. In other words, when the receiver status windows are open, **Micro-Manager** expects the receiver to be connected and begins issuing commands to obtain the status data. Because the receiver is not attached (or is configured at a different communication speed), no responses are forthcoming and, thus, **Micro-Manager** believes that there are errors in communication. To avoid these problems, simply close the receiver status windows whenever changing the PC's communication port settings.

Upon pressing the OK button in this window and assuming **Micro-Manager** is currently aware that it is directly connected (i.e., not connected via modem) to a GPS receiver, **Micro-Manager** will perform some additional processing. To fully understand the discussion to follow,

some background information is required. There were two somewhat opposing design goals in the early stages of the **Micro-Manager** development effort:

1) To allow users to utilize some minimal features of the program with other Thales Navigation (i.e., non µZ-Family) GPS receivers and as a general terminal program; and
2) To boost the user's productivity by performing some behind the scenes processing.

These two goals are somewhat conflicting because, in order to reach the second goal, one must be communicating with the receiver (i.e., the communication rates of both the receiver's port and the computer's port must be the same). In order to reach this second goal, **Micro-Manager** must determine the receiver type whenever possible. **Micro-Manager** achieves this by issuing receiver specific query commands over the communication port. However, this conflicts with the first goal, particularly to the use of the program as a general terminal program. Thus, when you change the communication configuration of the local computer (through this window), the settings may not be compatible with those of the receiver.

When **Micro-Manager** is directly connected to a GPS receiver, and **Micro-Manager** knows that it is connected to a µZ-Family GPS receiver, as would be indicated by the lower-right portion of the status bar (see Section 4.1.1.4), any changes to the communication configuration will result in the issuance of the following prompt:

This prompt is really indicating that you are changing the communications settings of your local computer port such that you may not be able to communicate with the receiver. Furthermore, the point of the prompt is to determine if you want to attempt to automatically set the communication configuration of the receiver to match that of your computer. If you answer "Yes", **Micro-Manager** will first set its local port configuration, then go through a polling process to determine the receiver's type and communication parameters (because you may have, through this window, selected a different local computer port), and then command the receiver to desired communication speed.

Additionally, there are some slight hardware differences among the members of the µZ-Family of receivers. One should be aware of these hardware differences when making changes to the communication parameters. These should be only of concern when directly connected (i.e., NOT connected via modem) to the GPS receiver. Specifically, with the exception of Port A of µZ-CGRS receivers, the DTR/DSR hardware handshaking lines ARE NOT implemented. As such, **Micro-Manager** must be configured according to the availability of the DTR/DSR

handshaking of the receiver or receiver port. Section 3.1.1.3.5 describes the configuration of the DTR/DSR hardware handshaking for direct connections.

Finally, when **Micro-Manager** has established a modem connection to the receiver (see Section 4.1.2), you are strongly advised not to change the communication parameters of the local computer (i.e., you should avoid using this window). Changing these communication parameters when connected via modem may cause the modem to break the telephone connection. If you must change the communication speed, you are strongly encouraged to manually disconnect (see Section 4.1.3), change the configuration of the local PC as desired, and then re-dial the telephone number of the target GPS receiver (see Section 4.1.2).

3.1.1.1 Configuration | Port Settings / Comm Port

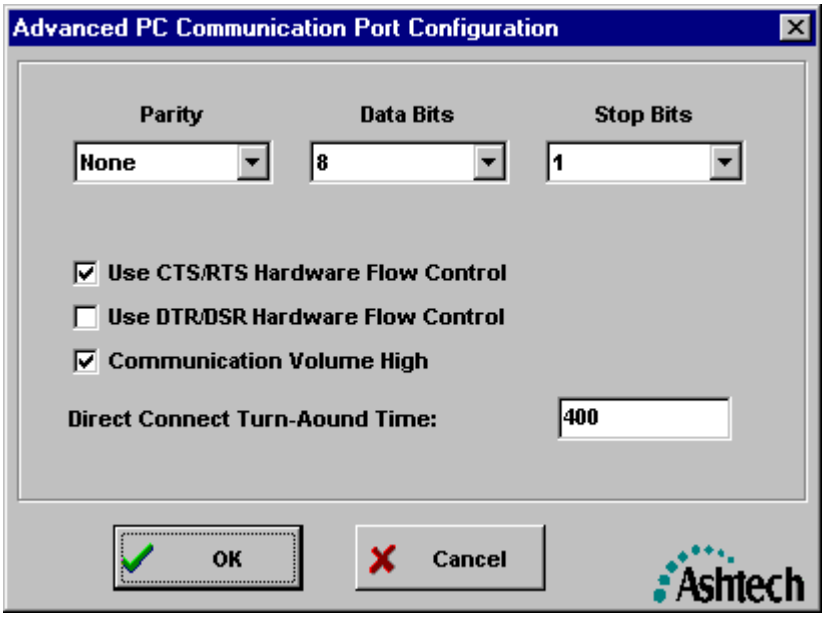
The port selection allows the operator to specify the communications port of the computer used to communicate with the Ashtech receiver. The selectable values are "COM1" to “COM16”.

3.1.1.2 Configuration | Port Settings / BAUD

The BAUD selection establishes the communications speed of the communications port of the computer used to communicate with the Ashtech receiver or the modem through which **Micro-Manager** communicates with the receiver. The selectable values are 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200.

3.1.1.3 Configuration | Advanced Settings

Pressing the “Addvanced…” button of the PC Communications Configuration window accesses the advanced communication settings. Upon pressing this button you will be presented with a window similar to the following:



Through this window, the following items can be configured:

1) Parity used in serial communications;
2) Data Bits used in serial communications;
3) Stop Bits used in serial communications;
4) RS-232 control line handshaking;
5) The level of Windows interaction; and
6) Turn-around wait time for direct connections.

3.1.1.3.1 Advanced Port Settings / Parity

The Parity selection allows the operator to specify the parity mode used over the selected serial port. To date, all Ashtech receivers communicate using the no parity mode (i.e., the "None" selection). The permissible values are Even, Odd, Mark, and None.

3.1.1.3.2 Advanced Port Settings / Data Bits

The Data Bits selection allows the operator to specify the number of data bits used when communicating over the selected serial port. To date, all Ashtech receivers communicate using 8 data bits. The permissible values are 7 and 8 data bits.

3.1.1.3.3 Advanced Port Settings / Stop Bits

The Stop Bits selection allows the operator to specify the number of stop bits used when communicating over the selected serial port. To date, all Ashtech receivers communicate using 1 stop bit. The permissible values are 1, 1.5, and 2 stop bits.

3.1.1.3.4 Advanced Port Settings / Use CTS/RTS Hardware Flow Control

The CTS/RTS Hardware Flow Control checkbox allows you to specify whether or not the normal CTS/RTS hardware flow control handshaking is enabled. In most configurations, this checkbox should be checked. Those who uncheck this checkbox should have clear rationale as to why they should eliminate the CTS/RTS hardware handshaking. For example, there are certain modems that do not employ the CTS/RTS hardware handshaking. In these cases, **Micro-Manager** needs to be made aware of the difference.

3.1.1.3.5 Advanced Port Settings / Use DTR/DSR Hardware Flow Control

The DTR/DSR Hardware Flow Control checkbox allows you to specify whether or not the normal DTR/DSR hardware flow control is enabled.

For direct connections with a GPS receiver (See Section 2.1) you will need to alter this depending on the receiver type or the port of the particular receiver that will be used. This is because there are some slight hardware variations between different models of µZ-Family receivers. **With the exception of Port A** of µZ-CGRS receivers, the DTR/DSR hardware handshaking lines ARE NOT implemented. As such, **Micro-Manager** must be configured

according to the availability of the DTR/DSR handshaking of the receiver or receiver port. For most users, this checkbox should be unchecked (i.e., disabling the use of the DTR/DSR handshaking for flow control).

For remote connections, you will need to set this configuration depending on the type of modem that will be used to establish the remote connection. For nearly all types of modems, you will need to disable this setting (i.e., have the checkbox unchecked). Please see the appropriate modem manual for details on its DTR/DSR signal use.

In most configurations, this checkbox should be unchecked (i.e., disabling DTR/DSR for flow control). Those who check this checkbox should have clear rationale as to why they should use the DTR/DSR hardware handshaking. For example, there are certain Ashtech receivers and modems that do not employ the DTR/DSR hardware handshaking for flow control. In these cases, **Micro-Manager** needs to be made aware of the difference.

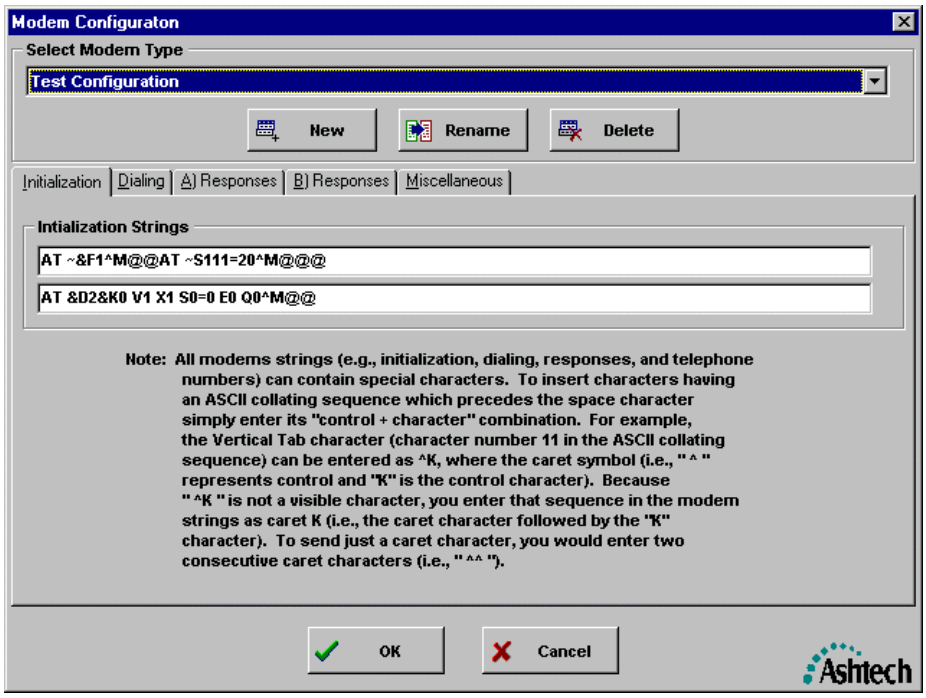
3.1.1.3.6 Advanced Port Settings / Direct Connection Turn-Around Time

Each **Micro-Manager** installation can exhibit slight variations in system performance, particularly in the area of RS-232 data communications. Poor communication links, operating system loads and other such factors can influence the RS-232 communication performance. The default configuration of **Micro-Manager** should handle nearly all of these variations.

The "Direct Connect Turn-Around Time" parameter specifies the maximum amount of time (in milliseconds) between the issuance of a command to the receiver and receipt of a response to that command. **Micro-Manager** permits 3 non-response failures for each command before reporting an error. Thus, if you tend to get a high number of errors during normal operations with a GPS receiver, particularly during a file download operation, then you will want to increase the turn around time. On the other hand, increasing the number to an overly large value will cause **Micro-Manager** to take a long time to report errors. For example, if you set the parameter to 9000 (or nine seconds), then when there are truly errors in data communications, it will take up to 27 seconds to start reporting the errors. In most cases, you will not need to modify this parameter.

3.1.2 Modem Settings

The Modem Configuration window allows the operator to configure a single or a set of modems used by **Micro-Manager**. By selecting the "Configuration | Modem Settings" menu option, you will be presented with the following window.



Through this window, you can perform the following tasks:

1) Add, Delete and Rename instances of modems;
2) Edit the modem initialization strings for each modem;
3) Edit the modem dialing and hang-up parameters for each modem;
4) Edit the expected modem command responses; and
5) Edit specialized control features used during communication with modem and GPS receiver using that modem.

Before continuing with the description of each edit field, it is important to note that there are two special character sequences that can be entered as part of the modem strings. Often strings sent to the modem to configure it and responses from that modem contain special (i.e., non-printable) characters. ASCII control codes (listed in Appendix B of this document) are used to represent these special characters. For example, the end of an initialization string often requires a carriage return character. The ASCII control code for this character is ^M (i.e., normally entered by pressing the keyboard “control” character and then, while holding the control key down, pressing the “M”). Because Windows uses these special control sequences for other purposes, one cannot enter these codes directly into the edit field. As such, we must represent the control character in the edit fields in another way. We have chosen to use caret character to represent the control character. Thus, to enter ^M, you enter the caret character (i.e., “^”) followed by capitol “M”. That is, ^M is entered as “^M”. To enter a single “^” symbol into the modem strings, enter “^^” (i.e., two caret characters).

It is also often desired to introduce a delay when sending characters to the modem. In the above window, you will see the "@" symbol in a modem initialization string. This character will not be transmitted to the modem. Rather, the characters preceding the @ character will be transmitted, **Micro-Manager** will delay an amount of time, and then the characters after the @ symbol will be transmitted. Both the character used to represent the delay and the duration of the delay are set by you using the "Miscellaneous" tab of this window (See Section 3.1.2.8). Please note that all instances of the delay character will be translated to delays. That is, there is no sequence through which you can send the character when it has been assigned the role of the delay character. If you need to send the character that is represented by the delay character, then change the delay character to something not used in the modem strings.

It is also important to note that the delay character that you select should not be confused with that used by the modem. To explain, most Hayes-compatible modems use the comma character to insert a delay. Consider the following examples of strings sent to the modem from **Micro-Manager**:

1) `ATDT 9@@@18005551212^M`
2) `ATDT 9,,,18005551212^M`

In both of the examples, we will assume that the "@" character is the **Micro-Manager** delay character and the comma character is the modem delay character. In case 1, **Micro-Manager** sends the string "`ATDT 9`", waits three times the delay programmed for the "@" symbol, sends the string "`18005551212`", and then sends a carriage return character in place of the ^M sequence. In case 2, **Micro-Manager** sends the string "`ATDT 9,,, 18005551212`" and then sends a carriage return character in place of the ^M sequence. The difference may not be obvious but it is important. For example, most modems do not process many commands until the receipt of the carriage return. The dialing command (i.e., "ATDT") is one such command. Therefore, in case 1, the modem would end up dialing "918005551212" immediately after receiving the carriage return (i.e., the @ symbol has no effect other than to increase the amount time to send the string). In case 2, the modem dials 9, waits 3 times the delay for the comma character (see your modem manual for details), and then dials the remaining characters. The latter case shows how one uses the dialing sequence first to obtain an outside line and then to dial the desired telephone number.

Finally, you will need to consult the manual for your modem to determine the how to and the strings required for configuring your modem. You can use the Terminal Window of **Micro-Manager** to test your modem strings (see Section 4.1.6).

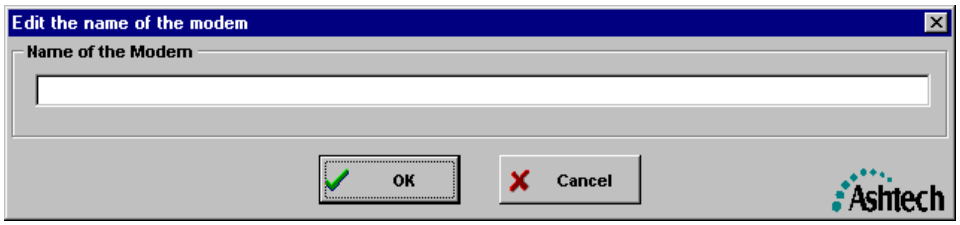
3.1.2.1 Selecting an Existing Modem

When you leave the "Modem Configuration" window using the OK button, the modem currently selected for use by the program will be shown as the selected entry in the drop-down list of modems in the window box entitled "Select Modem Type". To choose a different modem, simply select that modem from the drop-down list of modems. Upon selecting the desired modem, the configuration parameters for that modem will become immediately visible and

available for editing throughout the rest of the window. If the modem you desire to use is not in the list or the list is empty, you will have to make a new entry (see Section 3.1.2.2).

3.1.2.2 Adding a Modem to the List of Modems

To add a modem to the list of modems, simply press the "New" button. You will be presented with the following dialog window.



Here you simply enter a string of characters that identifies the modem and then press the "OK" button. After doing so, the "Modem Configuration" window will become active and will be loaded with initial data for each of the configuration items. You are then free to edit each of the configuration items for the newly created modem entry.

3.1.2.3 Deleting a Modem from the List of Modems

From the Modem Configuration window, you can delete a modem entry by first selecting that entry from the drop-down list and then pressing the "Delete" button. You will not be asked to confirm the deletion. All configuration information associated with that entry with be deleted as well.

3.1.2.4 Renaming a Modem in the List of Modems

From the Modem Configuration window, you can rename any modem entry by first selecting that entry from the drop-down list and then pressing the "Rename" button. Upon doing so, you will be provided with the same window as described in Section 3.1.2.2. Simply make changes to that name in that window and press the "OK" button of that window.

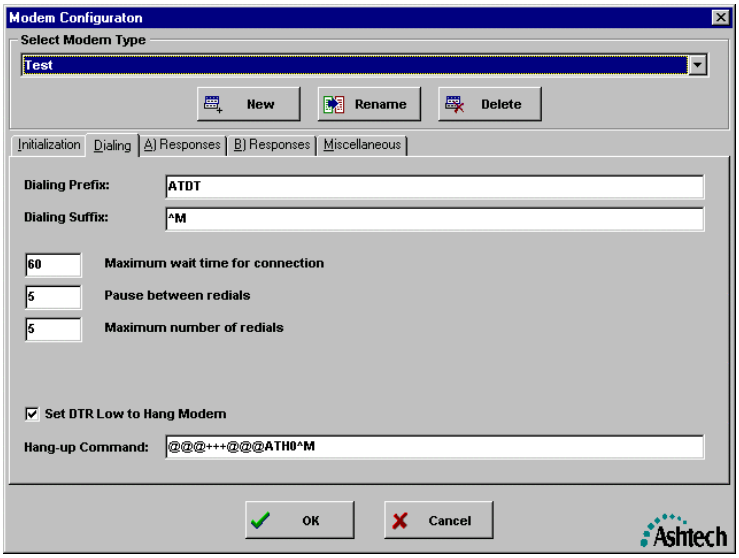
3.1.2.5 Entering/Editing the Modem Initialization Strings

The modem initialization strings are sent before each attempt to connect to the receiver through a modem. To obtain access to these strings, press the "Initialization" tab of the "Modem Configuration" window. Two lines of entry are permitted. These two strings will be sent back-to-back when **Micro-Manager** attempts to initialize the modem.

NOTES: 1) Consult the user's guide for your modem for specifics on configuring your modem.
2) Consult Section 3.1.2 for specifics on entering special character sequences.

3.1.2.6 Entering/Editing the Modem Dialing and Hang-up Strings

To get access to the dialing and hang-up parameters of the selected modem press the "Dialing" tab of the Modem Configuration window. The following provides an example of the window with the "Dialing" tab selected.



The "Dialing Prefix" contains the set of characters sent to the modem just before the actual telephone number is sent. The "Dialing Suffix" contains the set of characters sent to the modem just after the actual telephone number is sent. Section 3.1.3 and its sub-sections describe the entry of telephone numbers.

The "Maximum wait time for connect" defines the maximum number of seconds to allow the modem to actually establish the connection with the remote system. When attempting to establish a connection, **Micro-Manager** starts a timer just after sending the dialing suffix. If the modem does not report a connection (i.e., to the GPS receiver; see Section 4.1.2) within the specified time, then **Micro-Manager** terminates the connection attempt. It is important to note that this value only specifies how long **Micro-Manager** will wait for the modem to indicate that a valid connection with a remote modem has been established. That is, modems have their own parameters (i.e., independent of the "Maximum wait time for connect" parameter of **Micro-Manager**) and timers which govern how long the modem will wait for the detection of a remote modem carrier signal. For example, the S7 register of a US Robotics Sportster modem is typically set to 60 seconds by the factory. If a valid connection is not established within this amount of time, the modem will signal **Micro-Manager** that the connection attempt failed. In summary, when you change the "Maximum wait time for connect" within **Micro-Manager**, you also should set the associated register of the modem to the same value in the modem initialization strings (see Section 3.1.2.5).

The "Pause between redials" specifies the amount of time (in seconds) to wait between failed connection attempts. The "Maximum number of redials" defines the number of attempts to establish the connection before terminating. These two parameters are particularly important for

unattended operations (see Section 4.2). You should configure these parameters to suite your expected demands on your remote systems and the urgency to obtain the data. For example, if other users are dialing your remote receiver, then you should set the "Pause between redials" to a large value to account for possible file download times by other users.

The last two parameters of this tab section deal with how to hang-up the modem at the completion of communicating with the receiver. "Set DTR Low to Hang Modem", when checked, will cause **Micro-Manager** to drop the RS-232 DTR status line signal to terminate the connection. The "Hang-up Command" text box defines the modem string to be sent by **Micro-Manager** to terminate the connection. Using both approaches is acceptable but are dependent upon the specifics of your modem. Most Hayes-compatible modems support both.

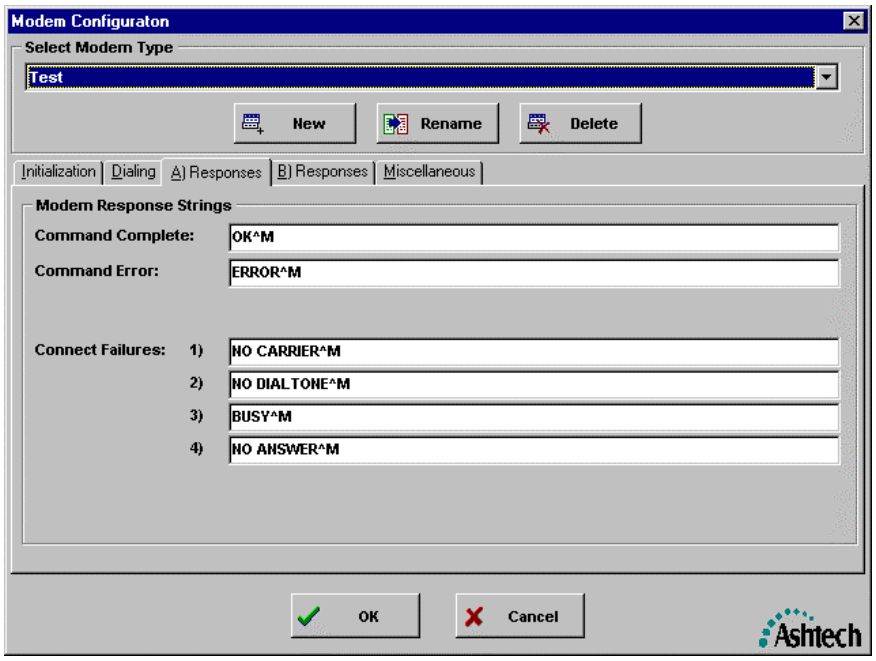
In the example provided in the above screen capture, **Micro-Manager** will send the Hayes-compatible "command attention sequence" (i.e., "+++"), delay 3 times the amount of delay for the delay character, and then send "ATH0" (i.e., to hang the modem) followed by the carriage return character. After sending the "Hang-up Command" **Micro-Manager** will drop the RS-232 DTR line signal for approximately one-half a second.

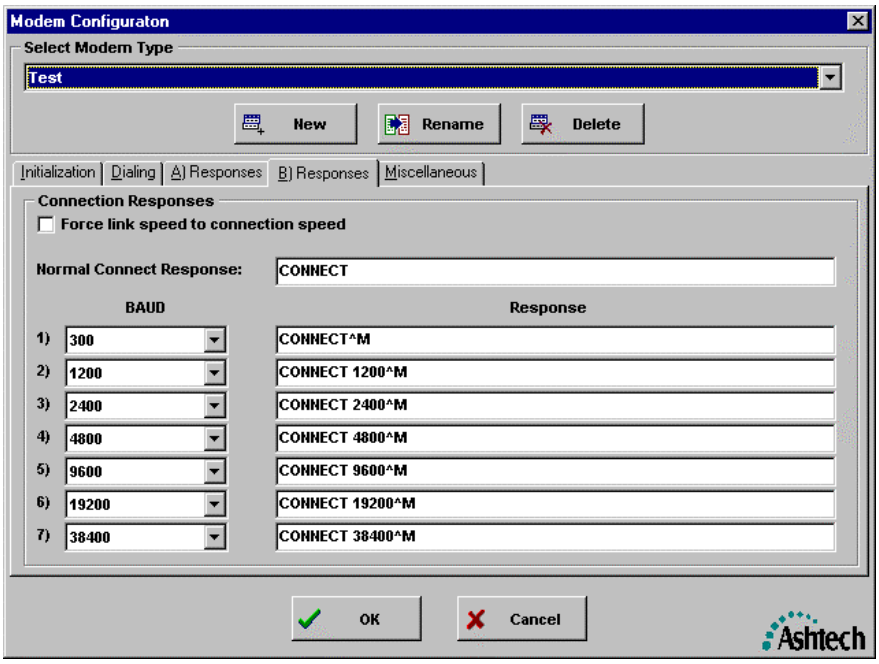
Again, the Dialing Prefix, Dialing Suffix, and Hang-up commands are modem strings subject to the same special characters discussed in Section 3.1.2. You will need to consult the user's guide for your modem to determine the settings of this window which are appropriate for your modem.

NOTES: 1) Consult the user's guide for your modem for specifics on configuring your modem.
2) Consult Section 3.1.2 for specifics on entering special character sequences.

3.1.2.7 Entering/Editing the Modem Response Parameters

Due to the volume of possible modem response parameters, the editable parameters span two tabbed sections of the Modem Configuration window. The following provides an example of each.





The first set of response parameters defines the general modem responses. The second set deals more with modem responses sent when the modem successfully establishes a connection with another modem. Each of the strings entered in this tabbed section are modem strings subject to the same special characters discussed in Section 3.1.2. You will need to consult the user's guide for your modem to determine the settings of this window that are appropriate for your modem.

The "Command Complete" and "Command Error" responses are important because they provide **Micro-Manager** with the expected positive responses for both valid and erroneous commands, respectively. The set of "Connection Failure" strings defines possible errors reported by your modem that occur when attempting to establish a connection with a remote modem. **Micro-Manager** will report only these errors to you. If a reported error does not fall into one of these four "Connect Failure" categories, **Micro-Manager** will not detect it.

The set of connection responses helps **Micro-Manager** detect when a connection is actually established. Older generation modems required that the computer to modem, modem to modem, and modem to receiver data links maintain the exact same communication speed. Newer modems do not have this requirement. When using older modems you must force **Micro-Manager** to change the PC communication port speed to that reported by the modem. You do this by selecting the checkbox labeled "Force link speed to connection speed" and then enter the correct modem responses for each possible modem speed. Again, newer modems do not have this requirement. Most modems will respond to the connection with strings like the following:

CONNECT 19200 Vbis

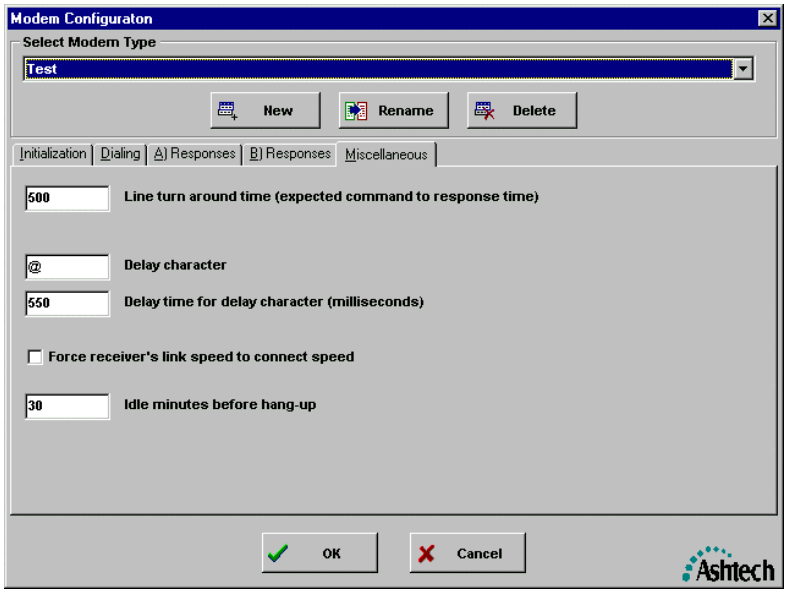
CONNECT 33600 Vbis/V90
CONNECT 53333

In each case, **Micro-Manager** does not need to obtain the full response from the modem to determine that the connection was successful. In the above example, we have simply encoded the string "CONNECT"; that is, we do not need to know the connection speed nor do we need to detect the carriage return character. We do not need to know the connection speed because with the newer modems the PC to modem speed can be independent of the speed over the other links. Thus, when the modem response string contains the word "CONNECT" we know that the connection was established.

NOTES: 1) Consult the user's guide for your modem for specifics on configuring your modem.
2) Consult Section 3.1.2 for specifics on entering special character sequences.

3.1.2.8 Entering/Editing the Miscellaneous Modem Configuration Items

The Miscellaneous Modem Configuration Items are reached by selecting the "Miscellaneous" tab of the Modem Configuration window. The following provides an example.



The first parameter (i.e., the "**Line turn around time**") is probably the most important parameter affecting communication performance. This parameter does not actually affect the configuration of the modem. Rather, it deals with the expected performance of the communication interface using this modem. The parameter specifies the maximum amount of time between the issuance of a command to the remote receiver and receipt of a response to that command. For example, if you are using a spread-spectrum radio modem that uses several repeater sites to reach the remote receiver, then you will want to set this parameter to the maximum amount of time required for the full round trip of messages through the network.

Micro-Manager permits three non-response failures for each command before reporting an error. Thus, if you tend to get a high number of errors during data transmission, particularly during a file download operation, then you will want to increase the turn around time. On the other hand, increasing the number to an overly large value will cause **Micro-Manager** to take a long time to report errors. For example, if you set the parameter to 10000 (or ten seconds), then when there are truly errors in data transmission, it will take up to 30 seconds to start reporting the errors.

The second and third parameters define the modem string character representing the delay and the duration of that delay. Section 3.1.2 describes how these two parameters are used.

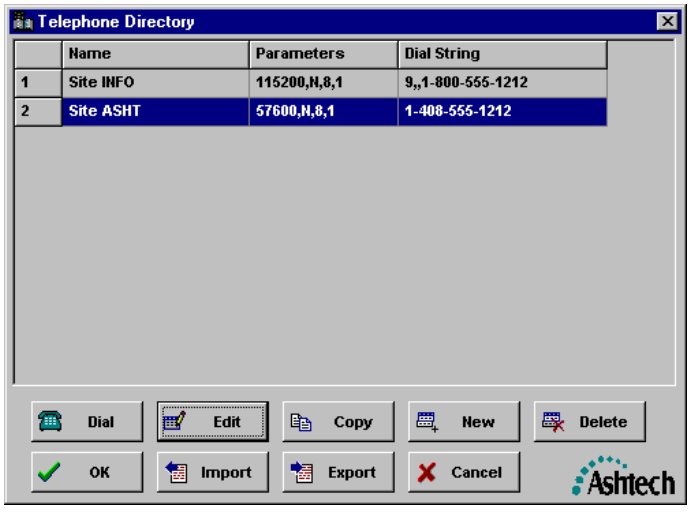
The fourth parameter (i.e., "Force receiver's link speed to connect speed") should only be used when employing older modems where the PC to modem, modem to modem, and modem to receiver link speeds should all be the same. See Section 3.1.2.7 for more information on this subject.

The final parameter of this section deals with 'dead time'. That is, one can easily forget to log off a remote system. When these connections are long distance, expensive telephone bills can result. The "Idle minutes before hang-up" specifies how long (in minutes) there can be no activity before an existing connection is terminated. The inactivity counter is disabled during file downloads. Otherwise, the user must make changes to the program or move the mouse to reset the inactivity counter to avoid automatic log-off. Please note that a value of –1 for this parameter disables the termination due to inactivity.

3.1.3 Telephone List

Micro-Manager allows one to enter dialing parameters needed to establish a connection with each of your remote receivers. The most notable parameter in these entries is the telephone number of the remote system. Note that some spread-spectrum radio modems still require a telephone-number-like means of identifying remote modems. For example, one TDMA spread-spectrum modem vender uses the ATDT prefix but uses the remote modem's serial number in place of the telephone number.

Upon selecting the "Phone List" submenu entry of the Configuration menu, you will be provided with a display similar to the following.



With this window you can perform the following operations:

1) Dial a remote system;
2) Edit an entry in the telephone directory list;
3) Create a new entry from and old entry;
4) Create a new entry not based upon an old entry;
5) Delete an entry;
6) Import an exported telephone directory; and
7) Export your telephone directory.

To perform an operation on any entry in the directory list, you must first select that entry and then press the button of the operation related to that entry. You can immediately invoke the Dial operation simply by double-clicking that entry. The remainder of Section 3.1.3 will describe the operations of this window in more detail.

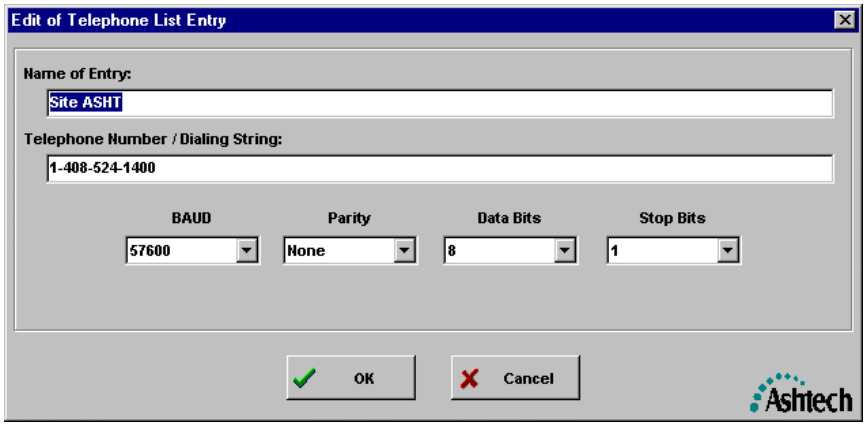
The appearance of the Telephone Directory window is also configurable by the operator. Not only can you resize the window, you can resize the columns within the directory list. To resize the columns of the directory list simply place your cursor over the column divider in the column heading, wait for the mouse pointer style to change, press down and hold the left mouse button, move the mouse left or right to resize the column as desired, and then release the left mouse button.

3.1.3.1 Dialing a Telephone Directory Entry

By pressing the "Dial" button of the Telephone Directory window, **Micro-Manager** will attempt to establish a connection with a remote system by dialing the number listed for the selected entry. We defer the discussion of establishing a connection with a remote system until Chapter 4 (see Section 4.1.2: Connecting to the GPS Receiver).

3.1.3.2 Editing a Telephone Directory Entry

To edit a telephone directory list entry simply select the desired entry and press the "Edit" Button. Upon doing so, a dialog window similar to the following will be displayed.



The “Name of Entry” field is simply a text string you wish to use to identify the telephone directory entry. This field will not be passed to the modem during dialing operations; nor will it be used for any other configuration purposes.

The “Telephone Number / Dialing String” allows you to specify the telephone number of the remote system to be dialed. Please note that this is a modem string which is subjected to the same special character rules described in Section 3.1.2.

The last four parameters (i.e., BAUD, Parity, Data Bits, and Stop Bits) of the window describe the communication link between the PC and the modem when establishing a connection to the remote system identified by this entry. Specifics on the values of these parameters are the same as is described in Sections 3.1.1.2 through 3.1.1.6. The comm port used to establish the connection is that which you chose in the Communication Port Configuration window (see Section 3.1.1).

3.1.3.3 Copying an Existing Telephone Directory Entry

To copy an existing telephone directory list entry simply select the desired entry and press the “Copy” Button. Upon doing so, the same dialog window presented in Section 3.1.3.2 will be displayed. This time, however, **Micro-Manager** will have created a new entry and copied the values from the selected entry.

3.1.3.4 Creating a New Telephone Directory Entry

To create a new telephone directory list entry, simply press the “New” Button. Upon doing so the same dialog window presented in Section 3.1.3.2 will be displayed. The strings providing the entry ID and telephone number will initially be blank.

3.1.3.5 Deleting a Telephone Directory Entry

To delete an existing telephone directory list entry simply select the desired entry and press the “Delete” Button. **Micro-Manager** does not confirm your desire to delete the entry. If you have erroneously selected the “Delete” button, simply press the “Cancel” button of the Telephone Directory window, thereby causing **Micro-Manager** to discard all changes to the telephone directory.

3.1.3.6 Importing a Telephone Directory List

You can import a previously exported telephone directory list by simply pressing the “Import” button of the Telephone Directory window. Upon doing so, you will be provided with a dialog box requesting the name of the file to be imported. After selecting the file, you will be ask whether or not you want to replace your existing telephone directory with that which you are importing or whether you wish to append to your current list.

3.1.3.7 Exporting the Current Telephone Directory List

You can export your entire telephone directory by simply pressing the "Export" button of the Telephone Directory window. Upon doing so, you will be provided with a dialog box requesting the name of the export file to be created. **Micro-Manager** will create the export file after clicking the OK button. The file created through this operation is an ASCII file which can be edited using any normal ASCII file text editor. Appendix D describes the format of the exported Telephone Directory List.

3.1.4 Configuring RINEX Site/Header Tables

Micro-Manager can be configured to convert downloaded data files to RINEX (see Section 4.1.5.1). Appendix E provides information about RINEX and the program XYZAshRx.exe. These sections (i.e., Section 4.1.5.1 and Appendix E) basically describe how to get **Micro-Manager** to create RINEX files from data downloaded from the GPS receiver. In this section we concentrate more on the concept of how to configure the various documentation information that will be contained in the RINEX files created by **Micro-Manager**. Furthermore, we describe options for naming RINEX data files.

Before beginning, however, some background information is in order to help with the understanding as to why one needs to configure this "RINEX Site/Header Table". At the top of each RINEX file is header data. This header data is intended to be specific about each site from which the data are collected as well as information about each collection period. However, **Micro-Manager** can be configured to connect with and download data from numerous different remote sites (one at a time). Therefore, a single configuration of this RINEX header data is not sufficient.

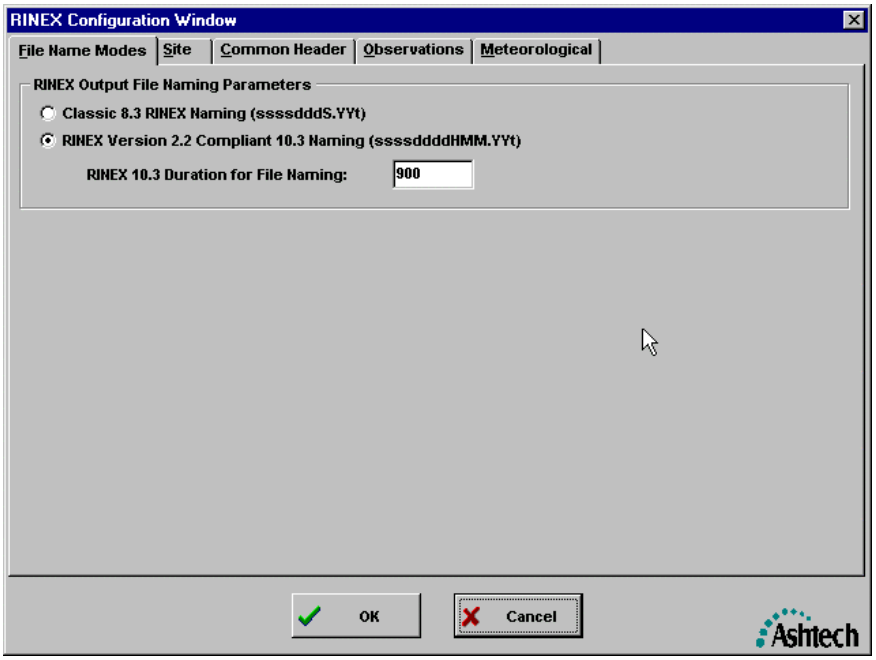
Micro-Manager maintains a table, that is configured by the user, and which is indexed by site name and contains the pertinent information needed by the RINEX converter for each site. One gains access to this configuration table using the "RINEX Site/Header Tables" sub-menu selection of the "Configuration" main menu selection or through the "RINEX Config." button of **Micro-Manager**'s "Receiver Files" Window (see Section 4.1.5.1). After using either approach, the RINEX Configuration Window will be presented. The sub-sections that follow provide a description of each tabbed section of this window.

Included in the header configuration parameters are options for naming RINEX output files. That is, μZ-CGRS receivers are capable of recording up to 96 files per day. The standard RINEX 8.3 naming convention does not support more that 35 files in a day. A newer 10.3 RINEX file naming convention was developed to address this problem. As such, **Micro-Manager** allows users to select the form of the naming convention desired for output (either 8.3 or 10.3).

NOTE: The RINEX Site/Header Table feature is a **Micro-Manager Pro** only feature.

3.1.4.1 File Name Modes of RINEX Configuration Window

The following shows an example of the “File Name Modes” tab of the RINEX Configuration Window.



Through this tab, one configures the options related to naming RINEX files. That is, µZ-CGRS receivers are capable of recording up to 96 files per day. The standard RINEX 8.3 naming convention does not support more that 35 files in a day. A newer 10.3 RINEX file naming convention was developed to address this need.

The following shows the RINEX 8.3 file naming convention:

nnnnddds.yyt

where,	nnnn	represents the 4-character station name,
	ddd	represents the day of the year.
	s	represents the session code,
	yy	represents the last two digits of the year, and
	t	represents the file type (O for RINEX Observation File, N for RINEX Navigation File, and ‘M’ for a RINEX Meteorological File).

The RINEX 10.3 convention follows:

nnnndddhmm.yyt

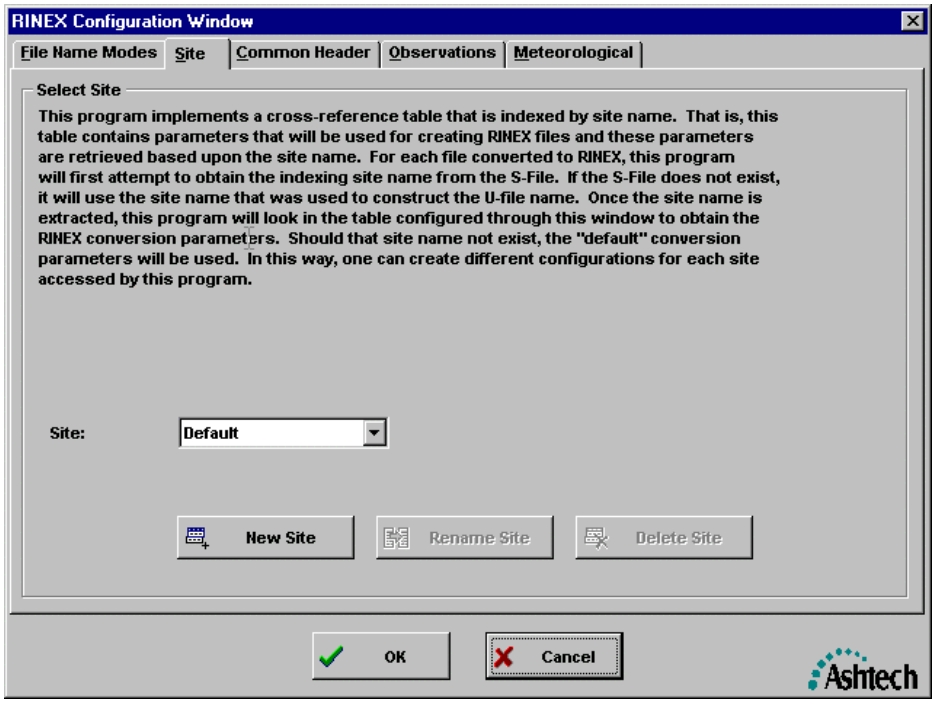
where,	nnnn	represents the 4-character station name,
	ddd	represents the day of the year.
	h	represents the start hour of the data (‘A’ for 0, ‘B’ for 1, …, ‘X’ for 23),

mm	represents the start minute of the data,
yy	represents the last two digits of the year, and
t	represents the file type (O for RINEX Observation File, N for RINEX Navigation File, and 'M' for a RINEX Meteorological File),

The two radio buttons allow one to select which form should be used. When the 10.3 form is selected, an additional parameter (i.e., "10.3 Duration for File Naming") is used. This "Duration" parameter specifies how long the RINEX files are intended to be (i.e., it specifies an expectation) and is used to generate the "mm" part of the file name. The "mm" part indicates how many divisions within an hour and **Micro-Manager** will only generate file names that fall into one of those divisions. For example, when the parameter is set to 900 (seconds), which means 15 minutes, the "mm" parameter can take on only 4 values: "00", "15", "30", and "45". In generating the file names, **Micro-Manager** will determine which code should be used. For example, if the file actually starts at 16 minutes into the hour, "mm" will be "15". Likewise, if the file actually starts at 29 minutes into the hour, "mm" will still be "15" (because the data does not belong in the file that starts 30 minutes into the hour).

3.1.4.2 Site Tab of RINEX Configuration Window

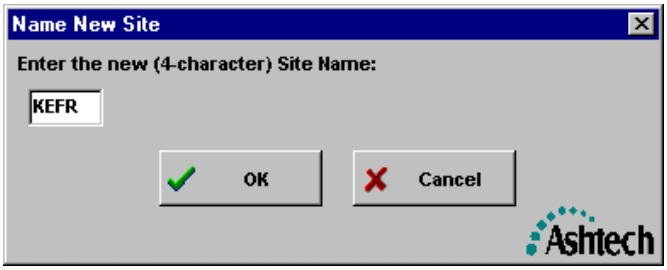
The following shows an example of the "Site" tab of the RINEX Configuration Window.



As was stated earlier, **Micro-Manager** maintains a table of RINEX configuration data that is indexed by site name. It is through this tab section that one manipulates (i.e., adds, removes, or

changes) the names of each site. To select a particular site, choose the desired site using the drop down list box labeled “Site:”. Once the desired site is selected, the remaining edit fields of the window (i.e., in the other tabbed sections of the window) will be set to display and edit the RINEX configuration data associated with that site.

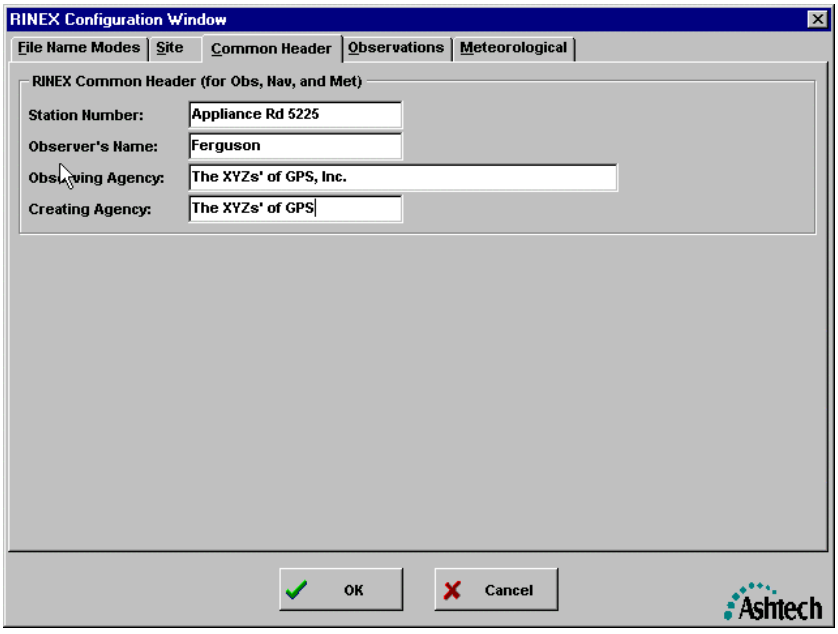
If the desired site is not in the list, simply press the “New Site” button to create a new table entry for the site. Upon doing so, a prompt menu similar to the following will be displayed.



Simply enter the 4-character site name and press the OK button. Pressing the OK button creates a new entry in the RINEX Site/Header Table.

3.1.4.3 Common Header Tab of RINEX Configuration Window

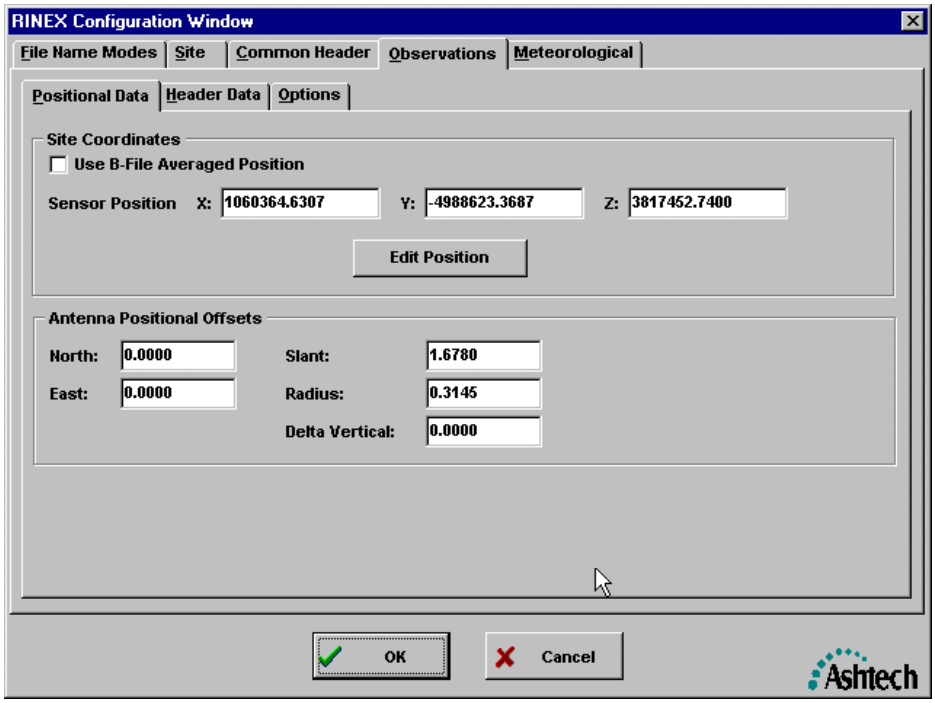
The following shows an example of the “Common Header” tab of the RINEX Configuration Window.



In this area one enters header data that is common among RINEX files (e.g., RINEX Observation, RINEX Navigation, and RINEX Meteorological files). The fields of this tabbed section are defined and described in the RINEX standard documentation (a reference to which can be found in Appendix E).

3.1.4.4 Observations Tab of RINEX Configuration Window

The following shows an example of the "Observations" tab of the RINEX Configuration Window.



Notice that the Observation tabbed section contains three sub-tabs: 1) Positional Data; 2) Header Data; and 3) Options. These three control the RINEX conversion parameters and header fields of the RINEX Observation files.

3.1.4.4.1 RINEX Observation File Positional Data

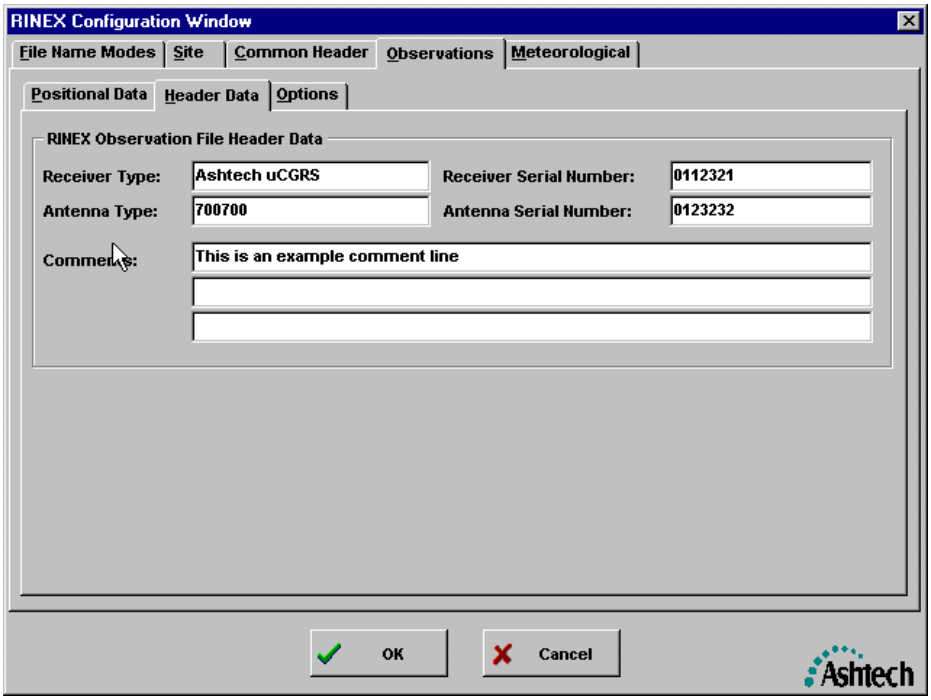
The RINEX Observation file header contains site positional data. The conversion program (i.e., XYZAshRx) will be instructed as to how it should obtain the positional data. Normally, one will leave the "Use B-File Averaged Position" unchecked and enters a fixed antenna position (most users will use **Micro-Manager** with fixed reference stations). When this checkbox is unchecked, one can enter the Earth-Centered Earth-Fixed X, Y, and Z coordinates directly into the fields provided in the window. One can also push the "Edit Position" button and be given an opportunity to provide the fixed coordinates in other coordinate representations (e.g.,

Latitude, Longitude, and Height) through a pop-up window. However, by checking the checkbox, one can have an averaged B-File position placed into the RINEX site position header record (for details on averaged B-File position, see Appendix E).

Through the "Positional Data" tab, one can also enter antenna height and antenna positional offset information. All units of the antenna offsets are meters.

3.1.4.4.2 RINEX Observation File Header Data

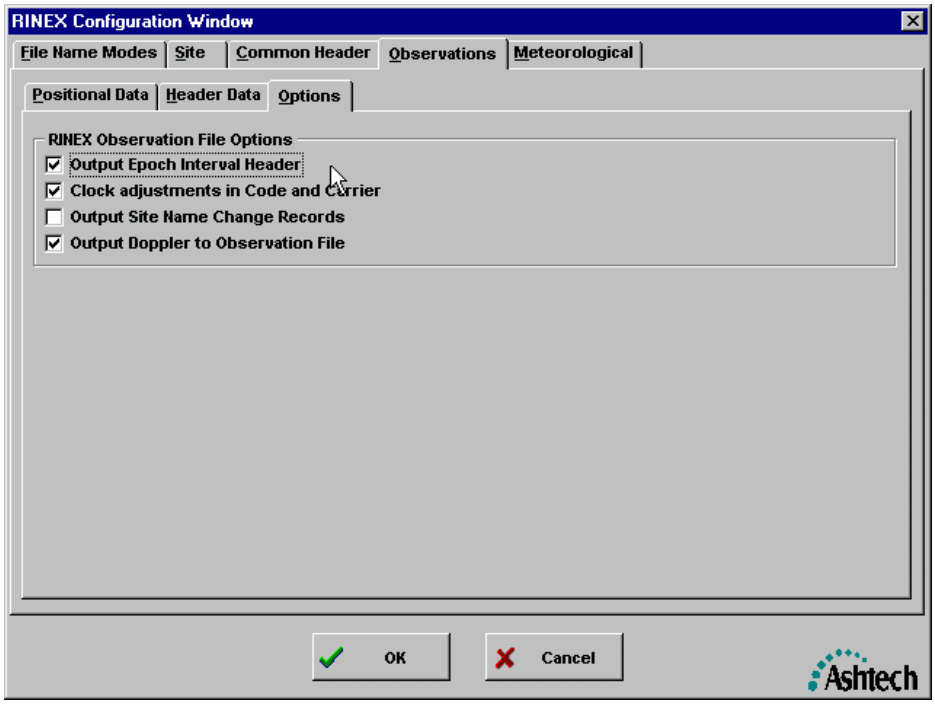
When the "Header Data" tab of the "Observations" tab of the RINEX Configuration window is pressed, the window will have an appearance similar to the following.



In this area one enters header data that is specific to RINEX Observation files. The fields of this tabbed section are defined and described in the RINEX standard documentation (a reference to which can be found in Appendix E).

3.1.4.4.3 RINEX Observation File Options

When the "Options" tab of the "Observations" tab of the RINEX Configuration window is pressed, the window will have an appearance similar to the following.



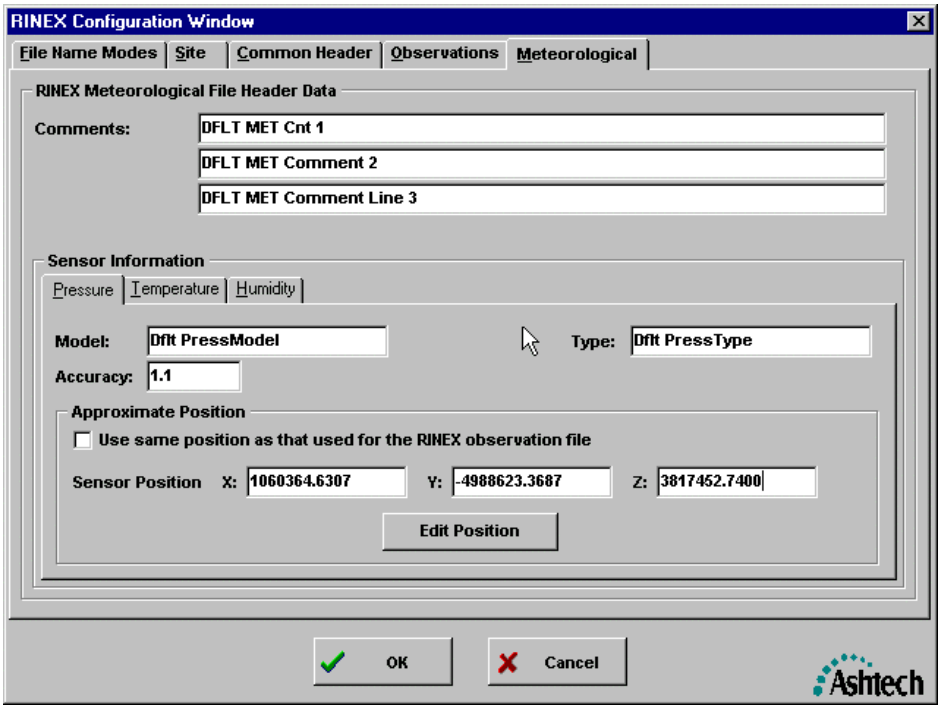
The following table describes each of these checkboxes.

CheckBox	Description
Output Epoch Interval Header	In the RINEX Observation header is an optional epoch interval header. Checking this checkbox will cause the RINEX converter to create such a header whenever an RINEX observation file (for the site being configured) is created.

CheckBox	Description
Clock Adjustments in Code and Carrier	The clocks in some Ashtech receivers are permitted to drift at their normal rates. As time progresses, this drift normally causes a larger separation between the receiver clock and the GPS time system. When this drift reaches a predetermined magnitude (e.g., 1 millisecond), the receiver firmware will perform a local clock adjustment. While this is a normal condition, when one compares the current epoch of data with that of previous epochs one can see that the codephase observations exhibit a jump (equal in magnitude to that of the clock adjustment). The RINEX standard places restrictions on how one should handle this clock jump when creating RINEX observation files. This checkbox controls two options related to this topic. When checked, the codephase and carrier phase observations output to the RINEX file will show this jump. The clock offset will also show this jump but it will NOT accumulate the corrections in the clock offset field. When unchecked, the codephase observations appear smoothed out because they are adjusted by the clock adjustment. The clock offset will also show the jump but it WILL accumulate the corrections in the clock offset field.
Output Site Name Change Records	In the RINEX file is an optional record that can be output each time the site name changes. To output these records, check the checkbox. Otherwise, these records will not be output.
Output Doppler to Observation File	The Ashtech receivers also report Doppler observations. This checkbox is used to select whether or not these observations are to be output to the RINEX Observation file.

3.1.4.5 Meteorological Tab of RINEX Configuration Window

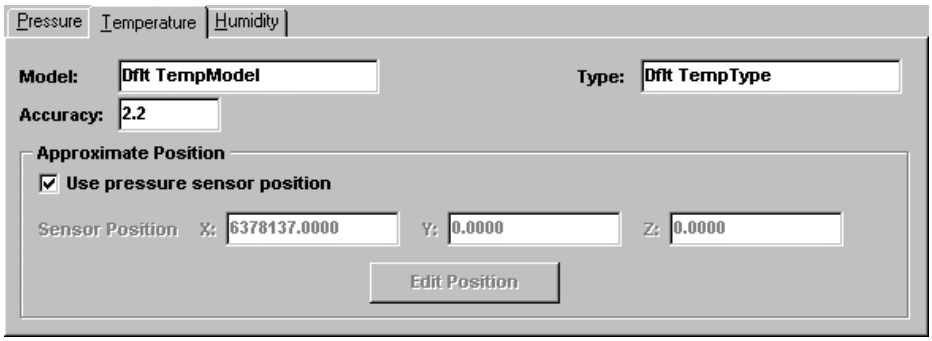
The following shows an example of the “Meteorological” tab of the RINEX Configuration Window.

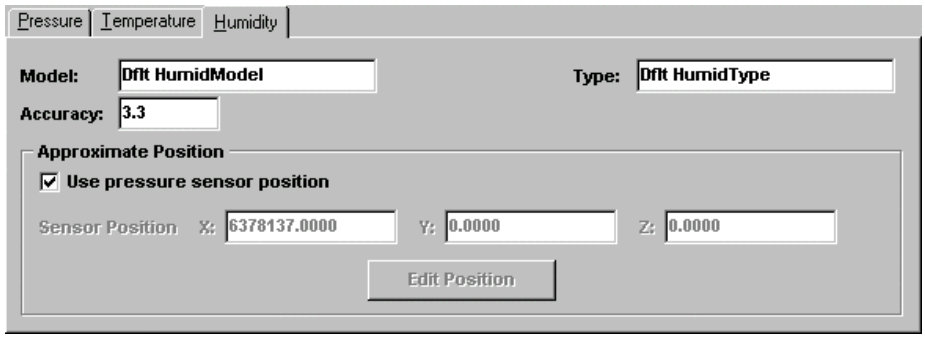


Important Note: RINEX Meteorological data files are only created when the GPS receiver reports meteorological data in its output D-File (i.e., one must have a met. sensor attached to the GPS receiver).

In the top section of the Meteorological tab are comment lines that will be added to the Meteorological file header (in a comment record). The standard header data for this file is entered through the Common Header tab of this window (i.e., see Section 3.1.4.3).

In the bottom section of this window, one enters information about the sensors that are used to collect the meteorological data. An example of the Pressure sensor tab is shown above. The other two are shown below.





Notice in each of the three tabbed areas related to meteorological sensors (i.e., Pressure, Temperature, and Humidity) that the data entry fields are essentially the same with the exception of the sensor position checkbox (i.e., in the Approximate Position area of each). For the pressure sensor, the checkbox labeled as "Use same position as that used for the RINEX observation" is used, when checked, to set the pressure sensor location (for the RINEX Meteorological file header data) to the same position as that used for the observing site. When unchecked, you are given an opportunity to enter the coordinates of the sensor (the "Edit Position" button can be used to enter the coordinates in other coordinate representations). For the temperature and humidity

sensors, the equivalent checkbox is labeled as “Use pressure sensor position”. When checked, the RINEX Meteorological data file header record for the temperature and/or humidity sensor position(s) will be the same as that specified for the pressure sensor. When unchecked, you are given an opportunity to enter the coordinates of the sensor (the “Edit Position” button can be used to enter the coordinates in other coordinate representations).

The “Model” and “Type” fields are textual while the “Accuracy” is numeric. The accuracy of the sensor will be entered in units reported by that sensor (e.g., pressure accuracy is entered in mbar, temperature accuracy is entered in unit of Celsius, and the humidity accuracy is entered in percentage of humidity). For details on these fields, please consult the appropriate RINEX standard documentation (see Appendix E for a reference).

3.1.5 Editing Post-Download Commands

Micro-Manager allows you to specify programs to be called at the completion of a download and conversion process. That is, in Section 4.1.5.1 we describe the process of downloading receiver files and options related to their conversion (from the receiver format to Ashtech format file and RINEX files). Post-Download commands, once configured, will be executed AFTER the completion of the download and conversion process. To reduce redundancy in the documentation that follows, we will refer to the point at which post-download commands execute as after the download completes. In this, we really mean that these commands are executed after the download and file conversions complete.

Through this feature you can have **Micro-Manager** pass information created from within **Micro-Manager** to other programs. For example, you can have **Micro-Manager** call an FTP program to distribute all of the files just collected (and/or converted) to several Internet FTP sites. This simple feature provides you with a very powerful system integration capability that exploits programs supporting command-line parameters or scripting.

Before continuing, however, it is important to state that the Post-Download Command feature provides users with great flexibility and power. With this flexibility and power comes the potential for users to incorrectly call programs external to **Micro-Manager**. This is because **Micro-Manager** has **NO** knowledge of correct vs. incorrect calls to external programs and cannot, therefore, provide any checks of correctness before the calls to these external programs are actually made. In short, only advanced/knowledgeable users should exploit the Post-Download Command feature. Presented in Section 3.1.5.3 of this document is an additional set of warnings regarding the Post- Download Command feature that should be reviewed.

Basically a post-download command is a call to an external program using a command-line structure. That is, many programs can be run automatically through command-line arguments. For example, to run the MS-DOS version of PKZIP one normally types something like the following at the MS-DOS prompt:

```
PKZIP MYZIPDAT UREMDA99.123
```

When PKZIP is called in this way, all of the information it needs is provided in the command-line call and PKZIP can then run without human interaction. The basic problem is “how can **Micro-**

Manager call these programs and provide information that these programs need?" For example, how can **Micro-Manager** call PKZIP with the name of the receiver data file just downloaded? After all, with each file downloaded, the name of the receiver file changes. The answer is Mnemonics.

A Mnemonic is a placeholder for an entity that will later be replaced by an actual value. For example, **Micro-Manager** maintains a mnemonic for the name of a U-File as "UF". Notice that the Mnemonic both starts and ends with a '$' (dollar) character. This is because **Micro-Manager** must recognize the entities (i.e., mnemonics) that will later be substituted with actual values. To re-write the above example in a **Micro-Manager** mnemonic form, we would write the following:

```
PKZIP MYZIPFIL $UF$
```

Later, when this post-download needs to be executed, the name of the downloaded receiver file (for example, UHARNA01.233), will be substituted for the UF mnemonic. That is, the post-download command is first translated and then executed. In this example, the post-download command would be translated as follows:

```
PKZIP MYZIPFIL UHARNA01.233
```

Again, the mnemonics act as placeholders for actual values that will be substituted just before the command is executed. For those readers that have never written a program, this is a form of programming (i.e., you will be writing instructions, in a predefined language, that will accomplish the tasks you need).

The following is a list of the mnemonics, and their descriptions, that were implemented within **Micro-Manager** at the time this section was written.

Mnemonic	Description
$SESC$	Single character session code as extracted from the name of the downloaded receiver file name.
$RXSSC$	RINEX Session Code. This will be a single character when 8.3 RINEX file naming format is selected and 3-characters when the 10.3 RINEX naming format is selected. For the 10.3 form, this session code will be equivalent to the "hmm" portion of the RINEX name described in Appendix A.
$SSSS$	4-Character Site Name as extracted from the name of the downloaded receiver file name.
$GPWS$	GPS Week of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$GPSS$	Seconds of GPS Week of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$GPWE$	GPS Week of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$GPSE$	Seconds of GPS Week of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.

Mnemonic	Description
YS	The last digit of the year of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
YE	The last digit of the year of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
YYS	The last two digits of the year of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
YYE	The last two digits of the year of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$YYYYS$	The 4-digit year of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$YYYYE$	The 4-digit year of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$RXYY$	The last two digits of the year of the start of the data used in naming any RINEX files.
MMS	The 2-digit month of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
MME	The 2-digit month of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$MMMS$	The 3-character month name of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$MMME$	The 3-character month name of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
DDS	The 2-digit day of the month of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
DDE	The 2-digit day of the month of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$DDDS$	The 3-digit day of the year of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$DDDE$	The 2-digit day of the year of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$RXDDD$	The 3-digit day of the year used in naming any RINEX files.
HHS	The 2-digit hour of the GPS day of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
HHE	The 2-digit hour of the GPS day of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.

Mnemonic	Description
HCS	A single character that represents the start GPS hour of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
HCE	A single character that represents the end GPS hour of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
MNS	The 2-digit minute of the GPS hour of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
MNE	The 2-digit minute of the GPS hour of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
MQS	The 2-digit minute (truncated to the quarter hour) of the GPS hour of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
MQE	The 2-digit minute (truncated to the quarter hour) of the GPS hour of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
SSS	The 2-digit second of the GPS minute of the start of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
SSE	The 2-digit second of the GPS minute of the end of the data for the downloaded receiver file as reported by the receiver in the File Information related to the downloaded file.
$FPOP$	The full output path configured for **Micro-Manager** (See section 3.1.6.3), includes drive and path.
OP	The full output path configured for **Micro-Manager** (See section 3.1.6.3), includes path but not drive letter (and no colon after the drive letter).
$FPUF$	The name of the raw receiver file just downloaded (includes full drive name path).
UF	The name of the raw receiver file just downloaded (does not include drive letter and pathname).
$FPBF$	The name of the B-File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.
BF	The name of the B-File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.

Mnemonic	Description
$FPCF$	The name of the C-File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a C-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no C-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
CF	The name of the C-File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a C-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no C-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
$FPDF$	The name of the D-File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a D-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no D-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.

Mnemonic	Description
DF	The name of the D-File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a D-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no D-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
$FPEF$	The name of the E-File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a E-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no E-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
EF	The name of the E-File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, a E-File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no E-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
$FPSF$	The name of the S-File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.

Mnemonic	Description
SF	The name of the S-File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.
$FPALMF$	The name of the Almanac File converted from the downloaded receiver file (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, an Almanac File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no Almanac File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
$ALMF$	The name of the Almanac File converted from the downloaded receiver file (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, an Almanac File may not be output through the conversion process. **Micro-Manager** has no way to verify this when the command is created. If no Almanac File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
$FPRXOF$	The name of the RINEX Observation Data file created from the converted Ashtech data files (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert Ashtech formatted files to RINEX files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.

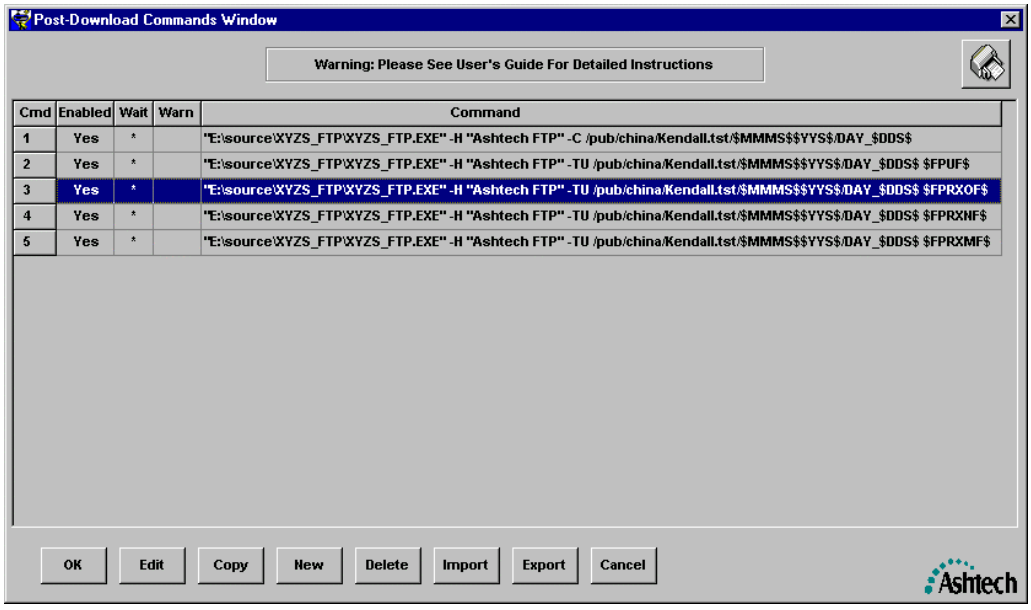
Mnemonic	Description
$RXOF$	The name of the RINEX Observation Data file created from the converted Ashtech data files (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.
$FPRXNF$	The name of the RINEX Navigation Data file created from the converted Ashtech data files (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert Ashtech formatted files to RINEX files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.
$RXNF$	The name of RINEX Navigation Data file created from the converted Ashtech data files (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message.
$FPRXMF$	The name of the RINEX Meteorological Data file created from the converted Ashtech data files (includes full path). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert Ashtech formatted files to RINEX files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, an Ashtech Met-File may not be output through the conversion process. These Met-Files normally contain data collected by external sensors. **Micro-Manager** has no way to verify this when the command is created. If no Met-File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.

Mnemonic	Description
$RXMF$	The name of RINEX Meteorological Data file created from the converted Ashtech data files (does not include drive letter and pathname). See Sections 4.1.5.1 for a discussion on receiver file conversion after download. Notes: 1. Whenever the option to convert downloaded receiver files to Ashtech formatted files HAS NOT BEEN selected (i.e., checked), entering this mnemonic will elicit a warning message. 2. Depending upon the receiver configuration, an Ashtech Met-File may not be output through the conversion process. These Met -Files normally contain data collected by external sensors. **Micro-Manager** has no way to verify this when the command is created. If no Met -File is created during the conversion process, the post-download command containing this mnemonic will still be launched but it effect on the system depends upon the application being called by the post-download command.
"$$"	The mnemonic will be translated to a single '$' (dollar) character. That is, the dollar character is normally used to mark the start and end points of a mnemonic. However, the mnemonic $$ means that the final translated command-line command will contain an actual dollar character.

On a final and **important note**, we said that the Post-Download Commands are launched at the completion of a download and translation process. This is true, but we need to add the idea that one can ask the receiver to download many files in a single download and conversion operation. When multiple files are selected for download (and conversion), the Post-Download Commands will be executed for each receiver file download, but only after all downloads and conversions have occurred without error.

3.1.5.1 Post-Download Commands Window

The Post-Download Command Window is basically the window through which users enter, modify, order, and delete post-download commands. The following provides an example of this window:



Note: You can resize this window by grabbing its lower-right corner and dragging the window to expand/contract it.

This window provides the set of commands that will be launched upon completion of a download operation. The order in which the commands are listed is the order in which the commands will be translated and launched. Notice that each command has the following components:

Column Label	Description
"Cmd"	The command number. The order of the commands specifies the order in which each post-download command will be launched.
"Enabled"	Indicates whether or not the command is enabled for execution at the end of the download.
"Wait"	Indicates whether or not the command processor of **Micro-Manager**, when it is executing that particular post-download command, is to wait for that command to complete before launching the next command.
"Warn"	Indicates whether or not there are any detected warnings in the post-download command. Note: whenever a command is enabled and a warning exists, the post-download commands will not be permitted to launch.
"Command"	The text of the post-download command in mnemonic form.

The following describes the functionality of each button of this window:

Accepts changes made to the post-download commands (including any imported commands).

Begins the editing of a highlighted post-download command. Simply use the mouse cursor to select the command to be edited and then press this button. You can also begin editing a command by double-clicking on the desired command. The actual editing of a command takes place using the "Post-Download Command-Line Editor" window described in Section 3.1.5.2.

Copies the highlighted post-download command to the end of the set of commands and begins editing that command by launching the "Post-Download Command-Line Editor" window described in Section 3.1.5.2. Up to 100 post-download commands are supported by **Micro-Manager**.

Creates a new command at the end of the list of post-download commands. After creating the new command you immediately begin editing the new command using the "Post-Download Command-Line Editor" window described in Section 3.1.5.2. Up to 100 post-download commands are supported by **Micro-Manager**.

Deletes the highlighted post-download command.

Upon pressing this button, you will be presented with a file selection window in which you will enter and/or browse for the name of the file containing post-download commands to be imported.

Upon pressing this button, you will be presented with a file selection window in which you will enter and/or browse for the name of the file in which to write the exported post-download commands.

Cancels all changes to the post-download commands.

The order of the commands can be changed through this window by selecting (with the mouse) the command to be moved and then dragging that command to the desired location within the list of commands. **Micro-Manager** supports up to 100 post-download commands.

The wait flag indicates whether or not the command directly following the current command will be launched immediately after launching the current command or only after the current command has completely finished its execution. That is, the command-wait feature is used to enforce a dependency of one command upon another, in terms of when they are launched. The wait flag is changed through the "Post-Download Command-Line Editor" window (see Section 3.1.5.2), which is launched by selecting the desired command and pressing the Edit Button.

Whenever **Micro-Manager** detects any warnings associated with a particular command-line, the column labeled "Warn" for the command contains the value "Yes". When **Micro-Manager** detects no errors with the Post-Download Command, the "Warn" entry for that command is blank. However, one should not be lulled into a false sense of security with respect to the lack of any warning indication. Specifically, **Micro-Manager** can only perform limited checks on the commands. Furthermore, some checks cannot occur until the command is actually launched. Therefore, the command may contain errors that **Micro-Manager** cannot detect. To determine the rationale for the warnings detected by **Micro-Manager** one should highlight the offending command, press the "Edit" button and then press the "Verify" button of the displayed "Post-Download Command-Line Editor" window.

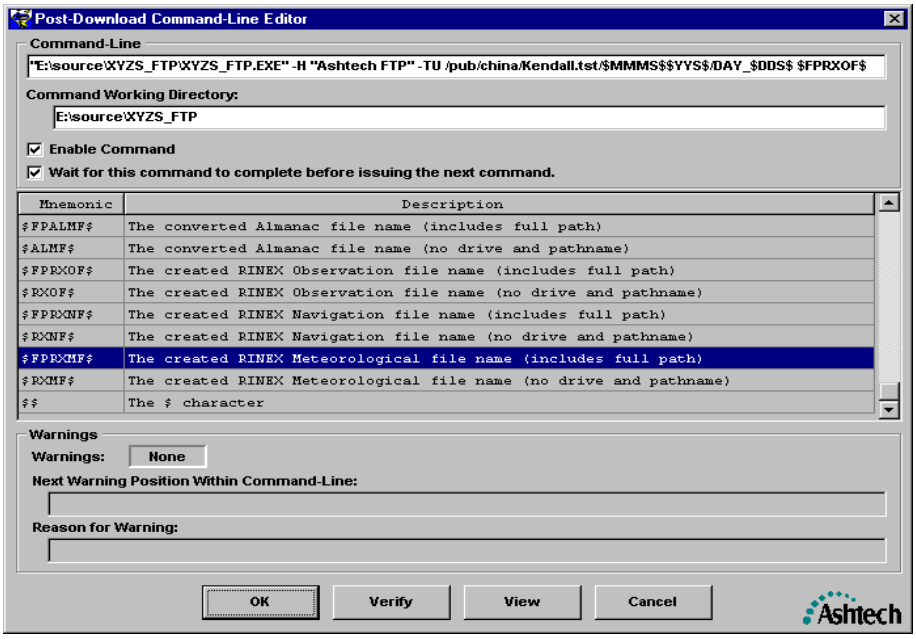
During run-time, **Micro-Manager** records information about the post-download commands in the output Log File when it is enabled (see Section 3.1.6.2). This information will include the fully expanded post-download command or the rationale as to why the post-download command failed. The post-download commands will only launch if, at run-time, there are no warnings in the set of enabled post-download commands. Additionally, **Micro-Manager** will terminate the set of post-download commands upon receiving an error from the operating system on any command.

If you enabled the **Micro-Manager** Log File (see Section 3.1.6.2), information on all post-download commands will be written to that file. The Log File can be very helpful in testing and debugging your entered post-download commands. That is, when testing your post-download commands, it is suggested that you enable the Log File. The rationale for this suggestion is that

the fully expanded (i.e., translated) command is written to the Log File. Users can then cut and paste the command to a batch file and then test variations of the command in the batch file. Again, the Log File will contain the fully expanded commands for those commands that properly executed and any errors detected for those commands that failed to launch.

3.1.5.2 Post-Download Command-Line Editor Window

The Post-Download Command-Line Editor window allows one to edit post-download commands and perform basic checks of the commands. The following shows an example of this window:



Note: You can resize this window by grabbing its lower-right corner and dragging the window to expand/contract it.

There are basically four parts of a command-line command:

1) The command-line command text in mnemonic form;
2) The working directory of the command;
3) The command enable/disable indication; and
4) The "wait for complete" indication.

When entering the text of the command, you are free to use the **Micro-Manager** command-line mnemonics. The valid mnemonics are listed in the scroll box of the window. Mnemonics are placeholders for actual values that can only be definitively determined at the completion of a download. For example, the B-File mnemonic, inclusive of the directory in which the file is stored, is "$FPBF$". When the post-download command is entered, the placeholder for the B-

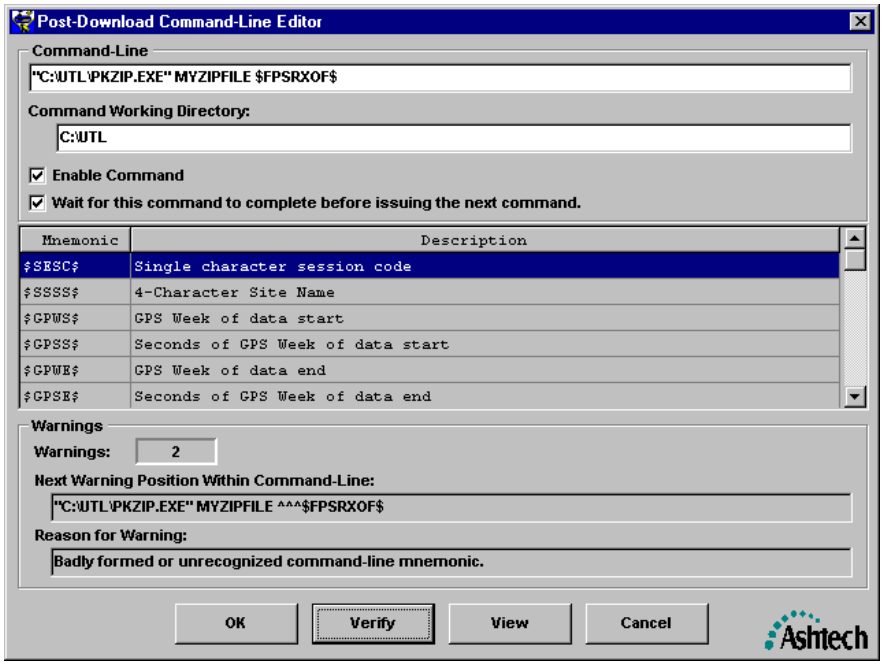
File name and directory is entered as $FPBF$. Just before the command is executed at the end of a download operation, **Micro-Manager** substitutes the mnemonic with the actual name of the B-File, including the drive and directory in which it is stored.

The working directory is the directory you want passed to Windows as the working directory of the command. For most calls it is the same directory as the directory in which the program you are calling is stored. In the above window example, the program is stored in the directory "`D:\Source\XYZs_FTP`". As such, we set this directory as the working directory. All text entered for the working directory is treated verbatim. More specifically, **Micro-Manager** does not interpret/translate any mnemonics found in the entry of the working directory field.

The "Enable Command" checkbox is used to enable/disable selected commands. This feature is particularly useful when you are testing your post-download commands because you can disable the commands that are **not** directly part of your test.

The wait for complete indication is used to indicate whether or not **Micro-Manager** will wait for the current command to complete before launching the next command in the set of post-download commands. Checking this checkbox allows you to specify the dependency of later commands upon the completion of the current command. If there are no later dependencies upon the command you are editing, uncheck the checkbox labeled "Wait for this command to complete before issuing the next command". However, if you want to ensure that each command is launched only after the completion of the last command, make sure that the wait for complete checkbox is checked on each command.

The lower half of this window displays any warnings detected by **Micro-Manager** as a result of pressing the OK or Verify Buttons. Again, the verification that **Micro-Manager** performs on the entered commands is limited. The lack of a negative indication regarding a command does not imply that it is error free. When **Micro-Manager** detects an error, it will attempt to show the location of the violation in the text box labeled "Next Warning Position Within Command-Line". The location is indicated using 3 carat symbols (i.e., "^^^"). The rationale for the warning will be displayed in the text box labeled "Reason for Warning". The following provides an example of the window with a warning indication:



Notice in the above example that the position of the warning appears to be the mnemonic $FPSRXOF$ (i.e., a non-existent mnemonic).

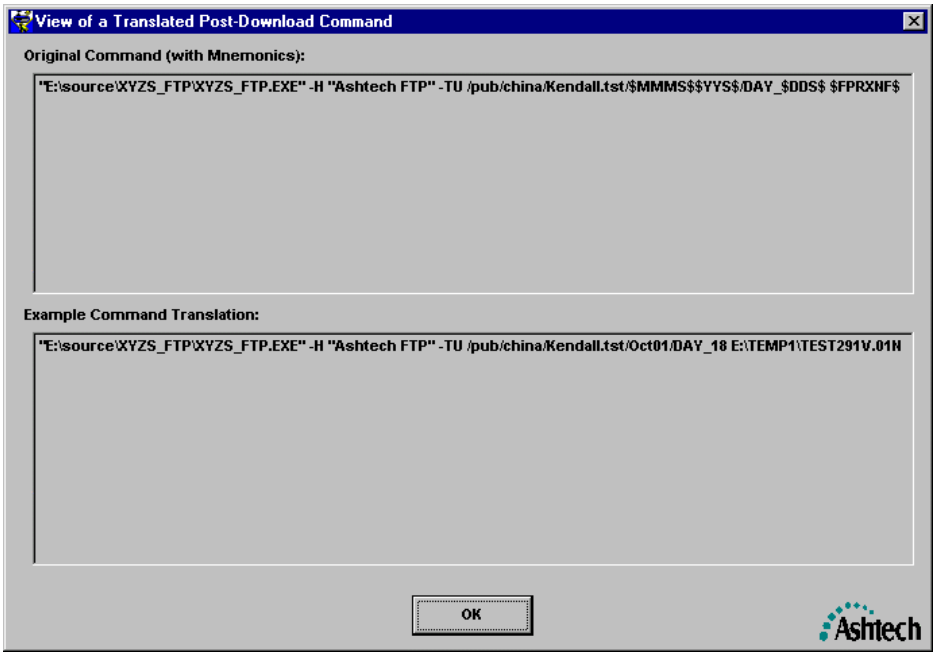
Currently there are only four warnings displayed by **Micro-Manager**. These are:

1) Expansion of mnemonics causes command-line length to exceed maximum.
2) Mnemonic does not agree with selected configuration.
3) Badly formed or unrecognized command-line mnemonic
4) Invalid working directory for the program

The first warning occurs when the expanded form of the command-line causes the command-line to exceed 256 characters (i.e., 256 characters is the maximum per command-line command). The second warning occurs when the current configuration of **Micro-Manager** conflicts with the command-line mnemonic. For example, your command-line uses a mnemonic that represents RINEX Data files, yet no RINEX data conversion options have been selected. The third warning occurs when the **Micro-Manager** does not recognize an entered mnemonic (i.e., the characters between two, and including, the "$" characters). The final warning occurs when you specify a working directory that does not exist on disk.

Note that even though a command contains a warning, **Micro-Manager** permits the acceptance and storage of that command. If by run-time the cause of that that warning is not corrected and that command is enabled, **Micro-Manager** will cancel all post-download commands and will not permit any further running of post-download commands. Additionally, **Micro-Manager** can detect other warnings/errors at run-time. When any such warnings/errors are detected, **Micro-Manager** will display the rationale for the warning/error in the Diagnostic Message Window, echo that warning/error in the Log File, and terminate any and all post-download commands for the current download operation.

The "View" button of this window is used to provide an example of the post-download command as it would be translated during at the completion of a download operation. Upon pressing the "View" button, **Micro-Manager** performs a cursory verification process on the mnemonic form of the command. If the command fails this cursory verification, then a warning message is displayed. If, however, the command passes the verification a new window will be displayed. The following is an example of such a displayed window.



3.1.5.3 **Micro-Manager** and Post-Download Commands

The purpose of this section is to provide miscellaneous information regarding the Post-Download command feature of **Micro-Manager**. Before continuing with the discussion, it is important for the reader to understand what it means for a command to be "completed". The completion of a command is dependent upon the perspective from which you view the command. That is, from the perspective of the operating system (i.e., Windows) a command is viewed as completed when the program actually finishes. However, there are cases where the command will be completed from the **Micro-Manager** perspective even though it has not completed from the perspective of Windows. For example, if the Post-Download Command-Line Editor window dialog item "Wait for this command to complete before issuing the next command" was NOT checked for a command, when **Micro-Manager** launches the command it will not wait for Windows to return a "complete" indication before launching the next command. From the perspective of **Micro-Manager** the command has completed. However, from the perspective of Windows, the command may still be executing and has not, therefore, completed execution from the perspective of Windows.

When **Micro-Manager** completes the download and conversion of selected files (see Section 4.1.5.1) it begins launching the Post-Download Commands. The command being executed, or any errors encountered while attempting to start the command, will be sent to the Diagnostic Message Window and the Log File. That is, if you encounter errors in your post-download commands, ensure that the Log File is turned on (see Section 3.1.6.2) and then run **Micro-Manager** again. Any errors will be reported in the Log File and in the Diagnostic

Message Window. Successful command launches will be displayed in the Post-Download Command Summary Window, in the Diagnostic Message Window, and in the Log File. The CPU clock time at which the command was launched will be reported to the Diagnostic Message Window and the Log File.

The following lists some miscellaneous topics and warnings related to the Post-Download Command feature:

1) **Micro-Manager** will permit 100 post-download commands.
2) **Micro-Manager** cannot verify the complete correctness of any Post-Download Command. As such, users should fully checkout their post-download commands and the impacts of these commands upon other components of their system before allowing the post-download commands to become part of operational environments.
3) Users should fully check out their post-download commands before allowing them in operational environments. The checkout should include implementing the commands in the **Micro-Manager** environment.
4) Programs that access the communications port to which **Micro-Manager** is connected must not be used.
5) When the user manually terminates a file download or convert operation, the post-download commands for those downloaded files (i.e., both those fully downloaded and those partially downloaded) will NOT be launched.
6) If there are any commands that have not completed, from the perspective of **Micro-Manager**, at the manual termination of post-session commands processing (i.e., by pressing the "Cancel" button or terminating **Micro-Manager**), the currently running command(s) will continue. That is, the manual cancellation of Post-Download Commands simply causes **Micro-Manager** to stop issuing any new commands.
7) When a download or conversion operation is terminated due to a system failure (such as a power failure), **Micro-Manager** will not launch the post-download commands for the terminated download/conversion operation.
8) When the post-download commands for a download and convert operation are terminated due to a system failure (such as a power failure), **Micro-Manager** will not restart those commands on the restart of **Micro-Manager**. The commands, however, will be started (but with new mnemonic substitutions) at the completion of the subsequent download and convert operation (i.e., basically, the set of commands that were scheduled to execute, but have not executed, at the time of the system failure, are lost).
9) It is recommended that you not use post-download commands with embedded spaces in the paths. For examples, many programs are automatically installed in the "\Program Files" directory. While **Micro-Manager** has been tested with and does operate properly with paths containing spaces, this author has seen the Windows command processor become confused with paths containing spaces. For this reason, it is recommended that you not use paths with embedded spaces (i.e., copy or move programs to paths that do not contain spaces). Additionally, you can assist the command interpreter by placing quotes around the executable program name or batch file name (including path) in the command-line text. You should not place quotes around the working directory of the post-download command. For example, C:\Program Files\Ashtech\MicroMger\Utls\AshFTPMD.exe

contains a space. To assist the interpreter, enclose the entire program path in quotes: e.g., "C:\Program Files\Ashtech\MicroMgr\Utls\AshFTPMD.exe".

10) MS-DOS Batch files can be called from **Micro-Manager** as well. When batch files are called from within **Micro-Manager**, Windows creates a command interpreter window and runs the batch file in that environment. You must, however, clearly state in the text of the command-line call that the file being executed is a batch file. You do this by appending the file type to the execution command. For example, suppose you had a batch file named "RENAMER.BAT" in the directory C:\BATCHES. Your command-line text should look something like the following:

    C:\BATCHES\RENAMER.BAT

    Notice that the ".BAT" extent has been added.

15) Intrinsic MS-DOS functions cannot be directly called from the command-line of **Micro-Manager**. Intrinsic MS-DOS functions have no associated .EXE file on your hard drive. Examples of these functions are "`del`", "`rename`", "`copy`" and "`mkdir`". If you wish to use an intrinsic MS-DOS functions, you must embed them in a batch file and execute the batch file using a post-download command.

3.1.5.4 Post-Download Command-Line Examples

In this section, several post-download command examples are presented. Many assumptions are made in these examples and will, therefore, not necessarily work in your environment. These assumptions include such things as hard drive letters and directories in which files are stored. Thus, if you wish to use the examples, you must edit and tailor them to your computer/system environment.

3.1.5.4.1 Moving Data Files to a Date Based Directory

Micro-Manager outputs data to a fixed output directory. However, using the Post-Download feature of **Micro-Manager** we can easily put data in desired target directories. In the following example we will seek to output files to the top-level directory "E:\GPSDATA" and then formulate a sub-directory based upon year and month (i.e., we will create the sub-directory if it does not exist). Within that sub-directory, we then attempt to formulate another subdirectory that is based upon the day of the month (again, we will create the sub-directory if it does not exist). For example, if the receiver data being downloaded were collected on October 16, 2001, we would want the following directory structure created.

```
E:\GPSData\Oct01\DAY_16
```

To do this, we created a batch file named MOVER.BAT. Its contents are as follows:

```
REM
REM  DESCRIPTION:
REM       This Batch file is intended to be used with the MicroManager
REM       Post-Download commands.  It moves a single file from directory
REM       to another.  The name of the target directory is formulated from
REM       the year month and day of month (passed via arguments to this
REM       batch file).  If the target directory does not exist, it will create
REM       that directory sequentially.
REM
REM  PARAMETERS
REM       %1  ==> THE FULL PATHNAME OF THE FILE TO BE MOVED.
REM       %2  ==> ROOT LEVEL OF THE TARGET
REM       %3  ==> THE 2-DIGIT YEAR OF THE DATA START TIME.
REM       %4  ==> THE 3-CHARACTER MONTH OF THE DATA START TIME.
REM       %5  ==> THE 2-DIGIT DAY OF THE MONTH OF DATA START TIME.
REM
REM  EXAMPLE MICROMANAGER POST-DOWNLOAD COMMAND (IN MNEMONIC FORM)
REM        "D:\MicroMgr\Batches\Mover.bat" $FPBF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$
REM     WHICH WILL BE TRANSLATED, AS FOLLOWS, BY THIS BATCH PROGRAM
REM        "D:\MicroMgr\Batches\Mover.bat" $FPBF$
E:\GPSDATA\$MMMS$$YYS$\DAY_$DDS$\
REM
REM  SPECIAL NOTES:
REM    1) WE FIRST ATTEMPT TO MAKE DIRECTORIES.  IF THEY ALEARDY EXIST, THE
REM       mkdir COMMAND WILL FAIL BUT THIS BATCH WILL NOT.
REM    2) WE WILL FIRST COPY THE FILE FROM THE SOURCE TO THE TARGET AND
REM       THEN DELETE THE SOURCE FILE.  THE RATIONALE IS SIMPLY TO ENSURE
REM       THE SOURCE FILE IS "moved" WITHOUT NAME CONFLICTS.
REM
mkdir %2
mkdir %2\%4%3\
mkdir %2\%4%3\DAY_%5
copy %1 %2\%4%3\DAY_%5\
del %1
```

Notice that there are only 5 executable lines within this batch file (i.e., the last five lines). The remaining lines document the file. It is suggested that (if you are interested in this example) you read the batch file documentation. Notice though that there are three make directory commands (i.e., mkdir). These commands create each directory and sub-directory in sequence. If the directory already exists, no harm is done as the mkdir command will fail but the batch program will not.

Now let us look and the command-line calls in **Micro-Manager** mnemonic form.

1) `“D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPUF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

2) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPBF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

3) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPCF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

4) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPDF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

5) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPEF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

6) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPSF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

7) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPALMF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

8) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPRXOF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

9) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPRXNF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

10) `"D:\source\MICROMGR\PSTCMDEX\BATCHES\MOVER.BAT" $FPRXMF$ E:\GPSDATA $YYS$ $MMMS$ $DDS$`

Notice that each of the Post-Download Commands differs from the others in only one parameter: i.e., the value that will be substituted for %1 within the batch file MOVER.BAT. In this case, the parameter is the name file (full path including drive) that will be moved to the desired target directory. The target directory is constructed from the latter 4 parameters of each post-download command (which are substituted in for %2 through %5) in the batch file when it executes.

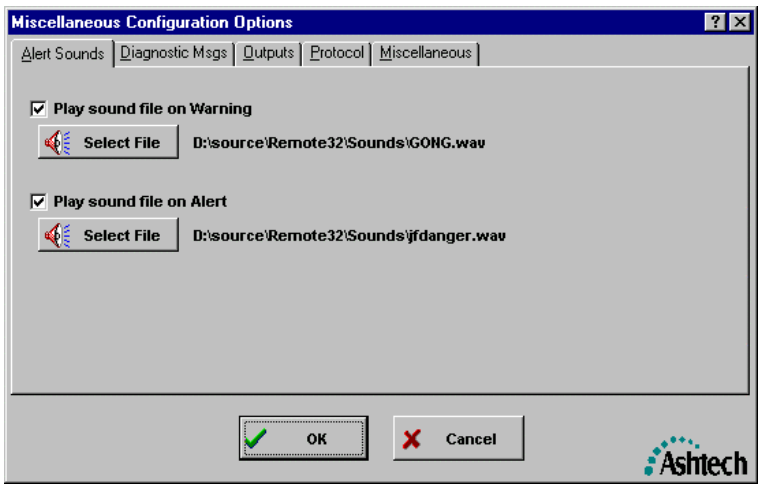
3.1.6 Miscellaneous Configuration Items

The Miscellaneous Configuration Options window allows you to configure the following options:

1) Sounds played to indicate warning and alert conditions;
2) How diagnostic messages are displayed and printed to the Log File;
3) The directory in which to store output files;
4) Parameters describing maximum errors during a file download operation; and
5) Other miscellaneous configuration items.

The Miscellaneous Configuration Options window is divided into tabbed sections, each of which relates to the topics described above.

3.1.6.1 Configuring Alert Sounds



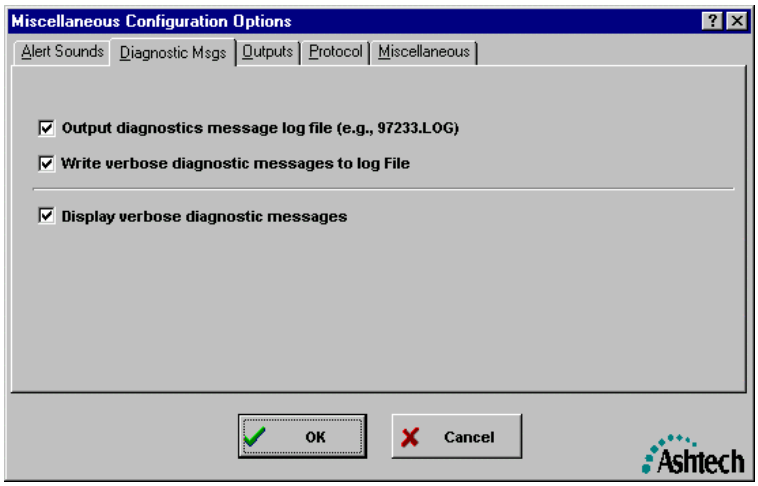
Micro-Manager is capable of playing audio WAV files when an alert or warning condition arises. IT IS IMPORTANT TO NOTE THAT **Micro-Manager** DOES NOT CHECK TO ENSURE THAT A) YOU HAVE A SOUND CARD AND B) THAT YOUR SOUND CARD IS CAPABLE OF PLAYING WAV FILES. If your computer does not have a sound card, it is suggested that you not attempt to play any sounds: i.e., that you leave the "Play sound file on Warning" and "Play sound file on Alert" checkboxes unchecked.

To play a sound file on the Warning condition, ensure that the "Play sound file on Warning" checkbox is checked and you use the associated "Select File" to select the desired WAV file. Upon making your file selection, **Micro-Manager** will test play that selected sound file.

To play a sound file on the Alert condition, ensure that the "Play sound file on Alert" checkbox is checked and you use the associated "Select File" to select the desired WAV file. Upon making your file selection, **Micro-Manager** will test play that selected sound file.

When either a warning condition or an alert condition exists, **Micro-Manager** will attempt to play the selected sound files repeatedly with about a 2-second cycle time. While **Micro-Manager** will play sound files longer than 2 seconds, you are advised to keep your warning and alert sound files shorter than 2 seconds.

3.1.6.2 Configuring Output Diagnostic Messages



When the "Output diagnostics message log file" checkbox is checked, the Log File will be written to the directory specified under the "Outputs" tab of this window (see Section 3.1.6.3). Also when checked, diagnostic messages will be written to the Log File. Some of these diagnostic messages may not be of interest to some users. For this reason you are provided a means of reducing the diagnostic messages to ones that are critical. The checkbox labeled "Write

verbose diagnostic messages to log file", when unchecked, keeps the diagnostic messages to their minimum.

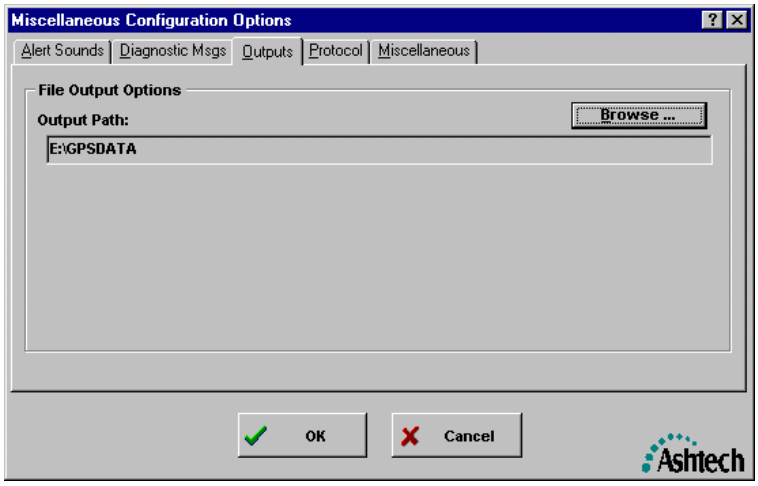
Log Files contain the diagnostic messages generated by **Micro-Manager** for an entire GPS day. The format of the Log File name is described in Appendix A.2.

The "Display verbose diagnostic messages" checkbox controls the level of diagnostic messages written to the Diagnostic Messages window (see Section 4.1.4.1). Some users may not be interested in seeing all of the diagnostic messages. Leaving this checkbox unchecked keeps the diagnostic messages to a minimum (i.e., displaying only critical messages).

The system resources (e.g., CPU time) of some older computers may be unnecessarily taxed when updates occur in the Diagnostic Messages Display window. Leaving this checkbox unchecked will help to free up some of these resources.

3.1.6.3 Specifying the File Output Directory

Upon selection of the "Outputs" tab of the "Miscellaneous Configuration Options" a window similar to the following will be displayed.



The currently selected output path is displayed in this window. You cannot directly edit the output path (hence the grayed background color of the edit box for the current path). However, you can use the "Browse…" button to locate an exiting target directory and/or create new directories. Upon selecting a new output path, and closing this window with the "OK" button, the diagnostics Log File (see Section 3.1.6.2), if open at the time of the directory change, will close and a new one will open in the target directory.

3.1.6.4 File Transfers Protocol Parameters

Micro-Manager uses a Z-Modem protocol for file transfers. The Z-Modem protocol is used for file downloads and firmware file uploads. There are seven parameters that govern the handshaking during a Z-Modem file transfer (three of which are the same for both file upload and file download operations). The settings of these parameters normally need not be changed. However, they can be altered to improve the performance of file transfers, particularly when bad telephone connections are expected. In order to understand how to change these parameters, one must be somewhat familiar with how the Z-Modem file-transfer protocol functions.

To start the file transfer, the Z-Modem participants exchange several specialized packets of information. Through these packets the sender and receiver negotiate the rules governing the transfer. This negotiation can take several packets of information and is completely transparent to you, the user. The Z-Modem protocol definition, in and of itself, does not specify any timeouts for this initial negotiation. However, we have provided such a timeout through the "Protocol Start-Up Timeout" parameter. This parameter specifies the maximum amount of time (in seconds) that **Micro-Manager** will permit for a transfer to start once the first negotiation packet is exchanged. If the protocol transfer does not start within the timeout period the transfer will be terminated.

The "Protocol Start-Up Timeout" parameter is important for two primary reasons:

1) Once **Micro-Manager** enters the file transfer mode, all other functions of the program are disabled (with the exception of the "Exit" program function) until after the transfer completes or is terminated; and
2) During unattended operations (such as downloading using the command-line approach), **Micro-Manager** could theoretically never terminate once a file transfer operation has been started.

Again, you should never need to alter this parameter, but you are given control in case some condition, unforeseen to the developer of this program, arises that may cause you to need to alter this parameter.

The Z-Modem file transfer protocol breaks the object to be transferred up into blocks (or packets). The size of these packets is established by the "Transfer Block Size" parameter. Each packet of data is sent individually. These packets contain overhead information. Among this information is a CRC (like a checksum) for validating the integrity of the individual block. The recipient of these packets first validates the packets using the supplied CRC, then strips the packet of the overhead information, and then assembles them into a contiguous file. Unlike older generation transfer protocols, the Z-Modem protocol uses a "stream data until interrupted" philosophy. That is, the sender will send out packets continuously (and in order) until the recipient detects an error or becomes confused. At that point, the recipient will send the sender a special packet that tells the sender where in the file transfer it lost track. The sender, upon receiving this information, will start the transfer back at the point specified by the recipient.

To safeguard against the potential for the loss of the recipient's stream interruption signal, the protocol also permits a negotiated synchronization point. That is, at various and

predetermined points during the transfer of large files, the sender and receiver of the data streams agree that streaming will be halted so that both the sender and receiver can acknowledge their progress to one another. The "Synchronization Window Size" parameter is used to govern how often, in number of packets, this synchronization process occurs. The smaller the number, the more frequent these synchronization events occur. This parameter, like most other parameters controlling the Z-Modem protocol should be altered only by advanced users.

The "Inter-Frame Timeout" parameter governs the maximum amount of time (in seconds) between two consecutive packets in the transfer. This parameter is another that helps to safeguard against confusion in the protocol transfer. During the transfer, communication errors induced in the communication medium (e.g., static in the telephone lines) can cause the loss of packet information. In these instances, the recipient can become confused and not recognize any packet information. This parameter indicates the maximum amount of time the recipient will "stay confused" before asking the sender to start sending from a designated point on the file.

During a Z-Modem file transfer, the sender and receiver may need to send specialized commands. The exact purposes of these commands are not important for this discussion as they relate to how the transfer functions and what information is exchanged. The recipient of these commands has a specified amount of time to respond to these commands (i.e., the "Frame Command Response Timeout"). This parameter, like most other parameters controlling the Z-Modem protocol, should be altered only by advanced users.

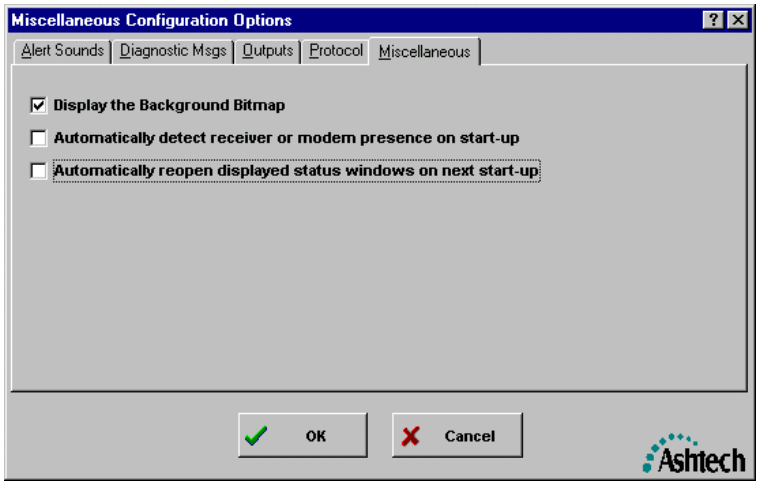
Thus far we have discussed the protocol transfer parameters and what they mean. We have cautioned against changing most of the parameters. We have not cautioned against changing the "Transfer Block Size" parameter simply because this parameter can affect the overall throughput of your file transfers. The "Transfer Block Size" parameter indicates how many actual data bytes (i.e., no overhead bytes) will be included in each packet. The larger the packet, the more susceptible an individual packet is to errors induced in the communication medium. Remember that the Z-Modem protocol operates on a streaming basis. This is important because by the time the recipient detects a block error, the sender is already sending the next packet of information. By the time the sender can respond to the recipient's interruption packet, the sender has already sent the next packet (which will be discarded). The larger the "Block Size", the longer it will take to recover from an error. On the other hand, the larger the "Block Size" the fewer the overhead bytes required to transfer the file.

The question still remains as to how one should set the "Transfer Block Size" parameter. The answer is really quite simple. Use the default settings as a baseline for normal (relatively noise free) installations. During file transfer operations, observe the status information presented, particularly when the status indicates transfer errors. When the transfer errors occur, **Micro-Manager** and the receiver will, through the Z-Modem protocol mechanism, enter a recovery process. Observe the amount of time required to recover from the error (not the number of errors that have occurred). If your connection is relatively noisy and file transfers seem to spend a large amount of time in the error recovery process, then consider decreasing the "Transfer Block Size" by a factor of 2. In general, decreasing the block size increases the total amount of overhead required but promotes a faster recovery from communication errors, while increasing the block

size decreases the overhead requirements but causes the error recovery processing time to increase.

The last parameter of this window deals with “partial firmware file uploads”. Thales Navigation has implemented a multi-tiered firmware validation process that safeguards against incorrectly uploaded firmware files. In many remote locations where communications are very difficult, and often noisy, it becomes increasingly difficult to get firmware files uploaded to the receiver in a single upload. Because of these potentially harsh communication environments, we have allowed parts of the firmware to be uploaded at different times. In this way, you can begin a firmware file upload, allow the upload to continue until the environment makes it difficult to continue, stop the upload process, and continue where you left off at another time. The “Automatic recovery mode enabled on firmware uploads” parameter, when checked, allows this partial firmware upload processing to take place. Please keep in mind that regardless of the state of this “recovery” parameter, the receiver employs its multi-tiered validation process before allowing uploaded firmware files to replace the existing receiver firmware. That is, once a full firmware file is uploaded to the receiver (whether uploaded over a single or multiple attempts), there are several quality and validation checks that take place before the receiver permits the actual “burning” of the firmware program into flash memory.

3.1.6.5 Miscellaneous Configuration Items



There are three parameters in this section. The first parameter (i.e., the “Display the Background Bitmap” checkbox), when checked, displays the program’s background bitmap. When unchecked, the background bitmap will not be displayed. It is important to note that changes made to this parameter will only have an effect once you restart the program: i.e., you will need to terminate **Micro-Manager** and then restart it for the change to take effect.

The second parameter (i.e., the “Automatically detect receiver or modem presence on start-up” checkbox) defines two startup modes of **Micro-Manager**. In the first mode (i.e., the

checkbox is unchecked) **Micro-Manager** simply attempts to open the configured communication port (see Section 3.1.1). Under the second mode, **Micro-Manager** attempts to detect the presence of a GPS receiver or modem attached to the configured communication port. In this latter mode, **Micro-Manager** first attempts to detect the GPS receiver and, if one is not detected, then proceeds to detect the presence of a modem. To detect a GPS receiver, **Micro-Manager** issues the Ashtech receiver port configuration command "$PASHQ,PRT" attempting all possible BAUD rates. Upon receipt of a valid response to this query command, **Micro-Manager** has established that it is connected to a valid Ashtech GPS receiver. When detecting a modem, the program uses the "Modem Initialization" string (Section 3.1.2.5) and the expected "Command Complete" string (Section 3.1.2.7) of the modem configured for the program (see Section 3.1.2). If the modem responds with the proper "Command Complete" string, then **Micro-Manager** concludes that a valid modem is attached to the computer on the specified communications port.

The third parameter (i.e., the "Automatically reopen displayed status windows on next start-up") establishes the behavior of the receiver status windows at the next start of the **Micro-Manager** program. When checked, any receiver status windows that were displayed when **Micro-Manager** was exited will automatically be reopened when **Micro-Manager** is started again. When unchecked, none of the receiver status windows will be displayed on the next start of **Micro-Manager**. The selection of this parameter depends upon your operating environment. For example, if you normally connect to the same receiver at the same BAUD over the same communication ports (receiver and personal computer), then you will probably want this parameter CHECKED. If this is not the case, then you probably want this box unchecked. The rationale is simply that, whenever a receiver status window is displayed, **Micro-Manager** assumes that it is connected to a receiver and that the BAUD rate has been established between the receiver and your computer. Following this assumption, **Micro-Manager** attempts to obtain status window information from the receiver. After making several attempts, **Micro-Manager** will begin reporting errors. These reports will persist while the receiver status windows are active.

Chapter 4

Running Micro-Manager

4.0 RUNNING Micro-Manager - OVERVIEW

This chapter provides a description of **Micro-Manager** once it has been configured. Before actually running **Micro-Manager**, you will need to have installed the software sentinel key and then have configured **Micro-Manager**. Chapter 3 provides a description of the configuration process.

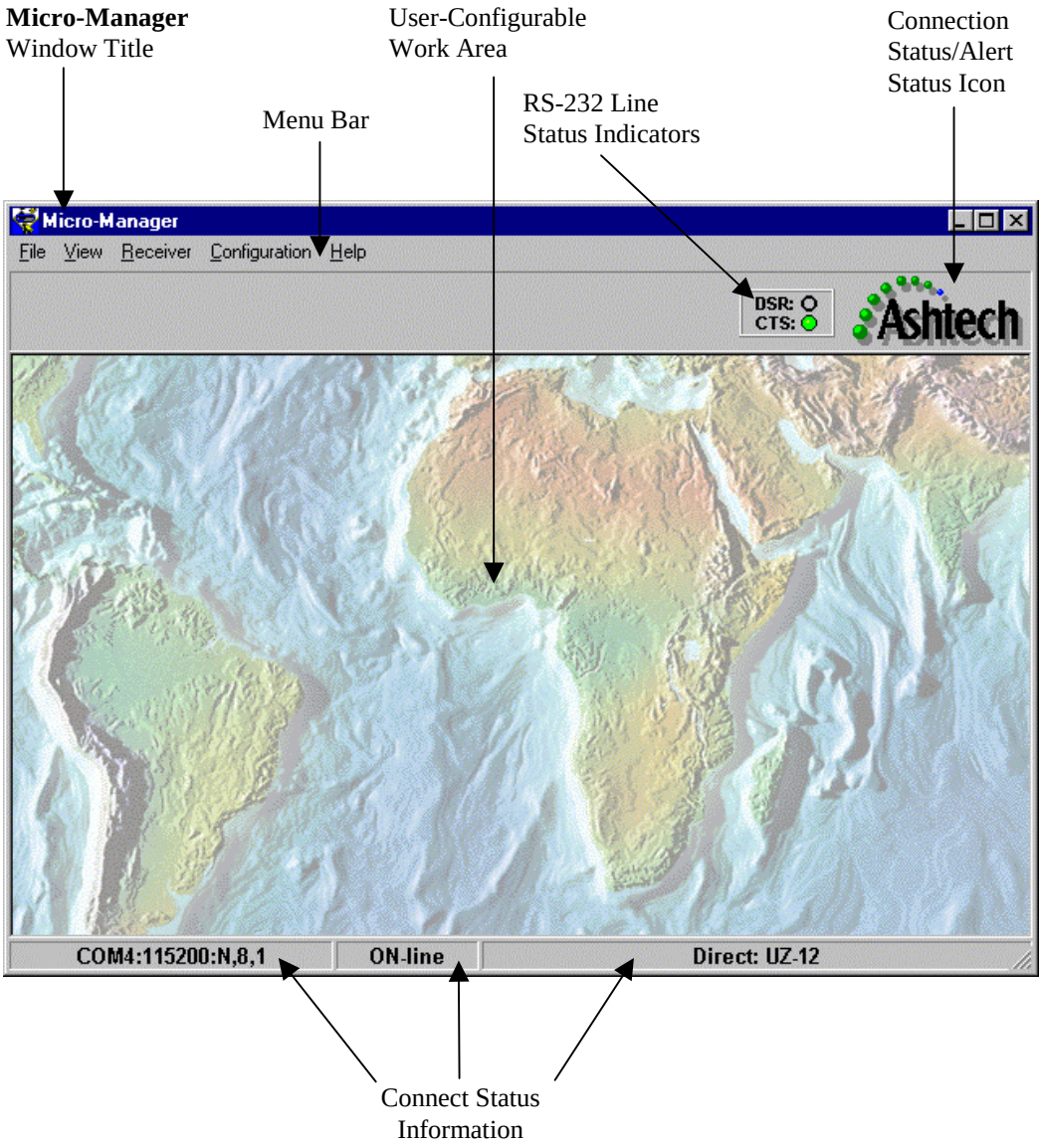
Micro-Manager provides two main modes of operation: 1) user interactive mode and 2) command-line mode. In user interactive mode, described in Section 4.1, users are free to interact with the program through its extensive Graphical User Interface (GUI). When it is desired to operate the program in an automated fashion (e.g., using a batch file), the command-line mode is used. The command-line mode, described in Section 4.2, utilizes all of the configuration information entered by the user during the previous GUI-mode run of the program. That is, one uses the GUI mode to configure the program to suit particular needs and then subsequently launches **Micro-Manager** in command-line mode. It is important to note there are no software protections within **Micro-Manager** to prohibit you from interacting with the program when it is in command-line mode. However, you are strongly urged not to do so unless you have a specific reason to do so. **Micro-Manager** does not implement this software protection because there may be some limited reasons to interact with the program when it is in command-line mode. For example, suppose that during a periodic check on an automated run of the program, you discover that a particular file transfer is experiencing an unusually large number of errors. You may want to abort the transfer operation, terminate **Micro-Manager**, and then diagnose the problem.

4.1 User Interactive Mode

In the user interactive mode, the user is free to interact with the program through the normal GUI methods. **Micro-Manager** is placed in the user interactive mode simply by launching the program with no command-line options. In this section, we describe all of the features that can be exploited to gain the most benefit from the program.

4.1.1 Main Display Window

Below you will find an annotated example of the main window displayed when **Micro-Manager** is started in its interactive mode.


Micro-Manager
Window Title
Menu Bar
User-Configurable
Work Area
RS-232 Line
Status Indicators
Connection
Status/Alert
Status Icon
Micro-Manager
File View Receiver Configuration Help
DSR:
CTS:
Ashtech
COM4:115200:N,8,1
ON-line
Direct: UZ-12
Connect Status
Information

With the exception of the “Main Window Title” and the “Menu Bar” items, the sub-sections which follow describe each of the above labeled items.

4.1.1.1 User-Configurable Work Area

The user-configurable work area of the main window is used to display all of the status windows described under Sections 4.1.4 and 4.1.6. You are free to move all of the sub-windows within this area. Moving a window beyond the display region of this area will cause scroll bars within the work area to be displayed. These scroll bars will allow you to “scroll” through the display area.

4.1.1.2 RS-232 Line Status Indicators

The RS-232 Line Status Indicators are located in the upper right area of the **Micro-Manager** window and are used to provide a positive indication of the RS-232 status lines. They become active as soon as a valid communications port has been specified (see Section 3.1.1).

For remote connections (i.e. via modem), both the CTS indicator is normally green while the DSR does not fill with a color. For direct connections, the status of the DSR and CTS indicators depends upon the type receiver connected (or the port of certain receiver types) and whether or not the associated hardware flow control lines have been enabled **in Micro-Manager**. In Section 3.1.1, we described the slight hardware variations in the µZ-Family of receivers and how to configure the Local PC’s communication port according to the hardware capabilities of the port of the GPS receiver. Again, with the exception of Port A of µZ-CGRS receivers, the DTR/DSR hardware handshaking lines ARE NOT implemented. This implies that, with the exception of being connected to Port A of µZ-CGRS receivers, the DSR indicator should be blank (i.e., neither green nor red).

If you do enable the DTR/DSR hardware handshaking (see Section 3.1.1.3.5) and the receiver port does not support it, the DSR indicator will likely become green when connected to the receiver. This is because the port of the receiver (i.e., all but Port A of µZ-CGRS receivers) ties the CTS line to the DSR line. However, you will get erratic communication behavior when the communication volume becomes high. The rationale is really quite simple. When the local PC gets too busy it will use the CTS/RTS hardware handshaking to slow the data sent by the GPS receiver. But because the receiver’s port has tied two handshaking lines together, the DSR/DTR handshaking will be affected and cause confusion. To overcome these problems you should avoid using the DTR/DSR hardware handshaking unless you have a clear rationale for doing so.

4.1.1.3 Connection Status/Alert Status Icon

The Connection Status/Alert Status Icon is used to represent the current state of the link connection and alert states of the program. What follows provides a description of each state.

When the icon is steady and unchanging, then a valid communication port has not yet been opened.

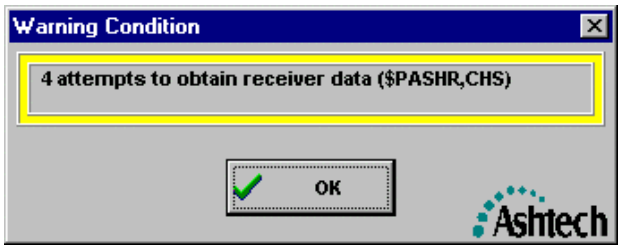
The circles above the lettering rotate between green and blue. This state indicates that **Micro-Manager** is operating normally and without any reported alert or warning conditions.

The letters of the icon toggle between yellow and black. This state indicates a warning condition and is accompanied by a window, which details the warning.

The letters of the icon toggle between red and black. This state indicates an alert condition and is accompanied by a window, which details the alert.

There are two levels of error conditions reported through this program: 1) Warnings and 2) Alerts. Warnings (i.e., the yellow flashing icon) are used to designate conditions that require your attention but are not potentially fatal to proper execution of the program. Alerts (i.e., the red flashing icon), on the other hand, are used to designate conditions that may arise that have a potentially adverse effect on the continued operation of the program and you are advised to immediately terminate the program upon receiving such an alert. During command-line mode (see Section 4.2), **Micro-Manager** will terminate the program when Alert (i.e., not Warning) conditions arise.

As mentioned earlier, when an alert or warning condition arises, **Micro-Manager** will display a window explaining what would cause the condition. The following is an example of a window displayed during a warning condition.



Each of these windows, announcing alert and warning conditions, are controlled by a timer. If you fail to respond with the "OK" button within that window and the timer expires, then the window will be removed. We have taken this approach because error conditions may arise during the command-line (i.e., unattended) mode of the program. When this occurs, these windows will still be displayed and removed when the timer runs out. The error condition will be written to the Log File (see Section 3.1.6.2) and the Diagnostic Message Window (see Section 4.1.4.1.).

Micro-Manager can be configured to play a sound file when the alert or warning conditions occur. A separate sound file can be played to distinguish the warning and the alert

conditions. Refer to Section 3.1.6.1 for more details on configuring **Micro-Manager** to play sound files.

4.1.1.4 Connection Status Information

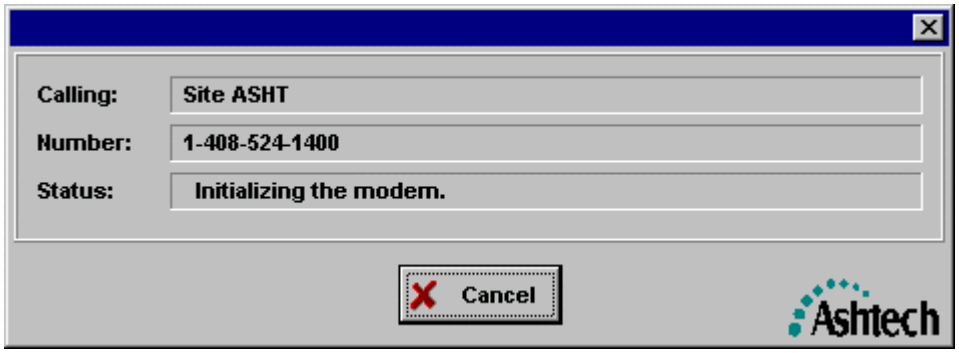
The lower status bar of the **Micro-Manager** main window contains additional connection status information. When a valid communication port has been opened, the left-most field of this area will contain the port connection information. The center field of this area will contain an On-line or Off-line status. **Micro-Manager** is considered to be "On-Line" when either the DSR or RTS RS-232 status line indicators are active. Otherwise, **Micro-Manager** is considered to be "Off-Line". The right-most field of the status bar reports whether or not **Micro-Manager** is directly connected to the GPS receiver or connected to the receiver via modem. This field also indicates whether or not **Micro-Manager** recognizes a GPS receiver and, if so, what type of receiver is recognized.

4.1.2 Connecting to the GPS Receiver

Micro-Manager can be connected to the GPS receiver either directly or through a modem.

When **Micro-Manager** is started, it immediately attempts to open the specified communications port (see Section 3.1.1). If the receiver is directly connected to the specified port (i.e., the receiver is connected via RS-232 cable to the computer), then the connection is established simply by opening the communication port. At this point, however, **Micro-Manager** does not know the communication parameters of the GPS receiver. If the receiver is configured with the same values specified in **Micro-Manager** (i.e., under Section 3.1.1), then no further work is needed to connect with the receiver. However, if you are unsure of the receiver's communication settings (or the lower right corner of the status bar indicates that **Micro-Manager** does not know the type of receiver connected), simply select the "File" menu option of the main window and then select the "Poll Receiver Baud" sub-menu option. This will force **Micro-Manager** to detect the receiver's communication parameters.

A modem connection can be initiated using one of two approaches. In the first case, select the main program's "File" menu item and then select the "Dial" submenu item. In the second case, select the main program's "Configuration" menu item and then select the "Phone List" sub-menu item. In either case, the "Telephone Directory" window (described in Section 3.1.3) will be displayed. Simply select the desired target system's telephone number and then press the "Dial" button. During the attempt to establish a modem connection a status window will be displayed reporting the progress. An example is provided below.



Once the connection is established, the window will be removed.

4.1.3 Terminating a Remote Connection with the GPS Receiver

To terminate a remote connection (i.e., a modem connection) to a receiver you can either terminate the program or select the "File" main menu option followed by the "Disconnect" sub-menu option. If you issue these commands during a file download or firmware upload operation, you will be asked to confirm the termination of the link.

4.1.4 Status and Display Sub-Windows

Micro-Manager provides the following sub-windows that can be displayed while connected to a receiver:

1) Diagnostic Messages window
2) Receiver Tracking Status window
3) Earth-Centered Earth-Fixed Position and Time window
4) Geodetic Position and Time window
5) Receiver Information window
6) RTCM Status window
7) Satellite Visibility window

Each of these windows is accessed via the "View" menu selection from **Micro-Manager** and then selecting the appropriate display. You can also access the latter six windows by selecting the "Receiver" main menu option and then selecting the "View Receiver Status" sub-menu option. Once a status window is displayed, you are free to resize any one of them to suite your individual layout preferences. To return any window to its default size, with the exception of the Diagnostic Messages window, simply right-click within the display area of the window and choose the "Window Size to Default" option.

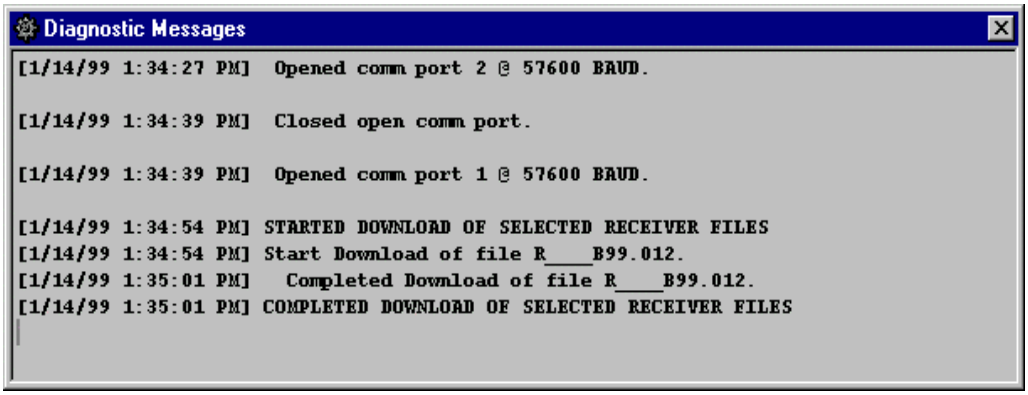
It is important to note that when any of the latter six windows are displayed, **Micro-Manager** will attempt to query the receiver for the information needed. This may seem obvious but it is important. It is important because even if you do not have a receiver attached to the computer, either directly or through a modem, **Micro-Manager** will attempt to request the data from the receiver. Because no receiver would be responding to the query, **Micro-Manager** will begin reporting errors. To circumvent the error reporting, you will need to close the window and then re-open it after you have established a connection.

If you exit the program and have not closed these sub-windows, then the next time you start **Micro-Manager**, the windows will still be in their opened state. If, at that moment, a receiver is not attached, the program will again begin reporting errors. Section 3.1.6.5 describes how to have these windows automatically suppressed at the start of **Micro-Manager**. Suppressing these windows at program start-up will ensure that **Micro-Manager** does not attempt to obtain the status data immediately and will, therefore, not report the aforementioned start-up errors when a receiver is not connected.

It is also important to note that if any of these status windows are displayed when any of the receiver interfacing windows (see Section 4.1.5) become active, then the status windows will become disabled and will not update. This is because **Micro-Manager** disables all status updates during the interfacing activities described in Section 4.1.5. Once the interfacing windows are closed, any visible status windows are then re-activated and resume their normal updating operations.

4.1.4.1 Diagnostic Message Window

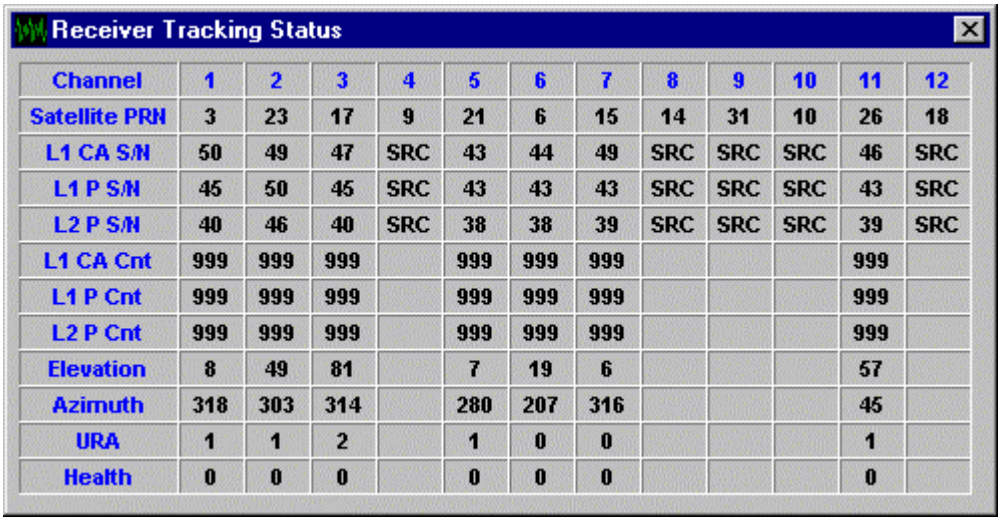
The Diagnostic Messages window displays real-time textual messages providing information regarding current activities of **Micro-Manager**. Most messages are time tagged with the current CPU time (i.e., not the current GPS time). These time tags are enclosed within bracket characters (i.e., "[" and "]"). The following is an example of the Diagnostic Message window.



If you have selected the Log File output option, some or all of these messages will be written to the Log File (see Section 3.1.6.2).

4.1.4.2 Receiver Tracking Status Window

The following is an example of the Receiver Tracking Status window.



Channel	1	2	3	4	5	6	7	8	9	10	11	12
Satellite PRN	3	23	17	9	21	6	15	14	31	10	26	18
L1 CA S/N	50	49	47	SRC	43	44	49	SRC	SRC	SRC	46	SRC
L1 P S/N	45	50	45	SRC	43	43	43	SRC	SRC	SRC	43	SRC
L2 P S/N	40	46	40	SRC	38	38	39	SRC	SRC	SRC	39	SRC
L1 CA Cnt	999	999	999		999	999	999				999	
L1 P Cnt	999	999	999		999	999	999				999	
L2 P Cnt	999	999	999		999	999	999				999	
Elevation	8	49	81		7	19	6				57	
Azimuth	318	303	314		280	207	316				45	
URA	1	1	2		1	0	0				1	
Health	0	0	0		0	0	0				0	

The receiver tracking status display is based upon channel numbers, which are shown across the top of the window.

The row labeled “Satellite PRN” is used to show which satellite, by its Pseudo-Random Noise number, is being tracked on each channel. Columns which are mostly empty and have the “SRC” status below the PRN ID show channels which are not actually tracking satellites, however tracking is being attempted (i.e., the receiver is in a search mode on those channels).

The rows labeled “L1 C/A S/N”, “L1 P S/N”, and “L2 P S/N” display the signal to noise value reported by the receiver for that satellite on the L1 C/A Code tracking loop, the L1 P-Code tracking loop, and the L2 P-Code tracking loop, respectively. For specifics on the exact meaning of the reported signal to noise values, you should consult your receiver manual.

The rows labeled “L1 C/A Cnt”, “L1 P Cnt”, and “L2 P Cnt” display the continuous tracking count values reported by the receiver on the L1 C/A Code tracking loop, the L1 P-Code tracking loop, and the L2 P-Code tracking loop, respectively. These continuous tracking counters are used to indicate how long the tracking loop has maintained “lock”. The counters will reset to zero when “loss-of-lock” occurs and increase while continuous tracking is maintained. Once a counters reaches 999, it will stay at 999 until a “loss-of-lock” is reported by the receiver. Again, for specifics on the exact meaning on the continuous tracking counters, consult your receiver manual.

The “Elevation” row displays the elevation (degrees) of the satellite being tracked. The “Azimuth” row displays the azimuth (degrees) of the satellite. When the receiver cannot compute a position (e.g., when there are too few satellites to compute a position), the reported satellite elevations and azimuths will be zero.

The reported “URA” (User Range Accuracy) and “Health” are obtained from the most recent broadcast navigation message transmitted by the satellite. For specifics on the exact meaning of the URA and Health indicators, consult your receiver manual.

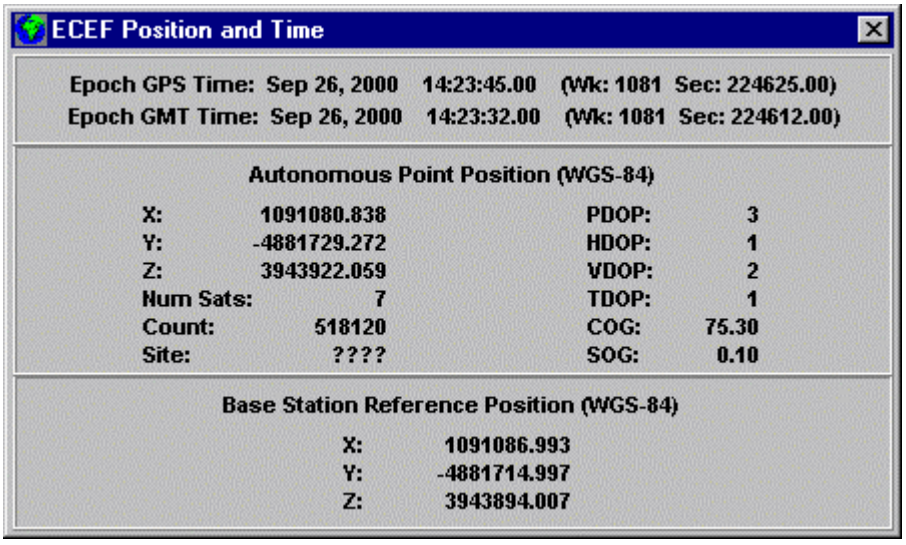
As with all other windows in the program, **Micro-Manager** will show the units of a displayed field if you rest the cursor over that field for a couple of seconds. Also, please see the Section 4.1.4 note on how **Micro-Manager** queries data for this window from the receiver.

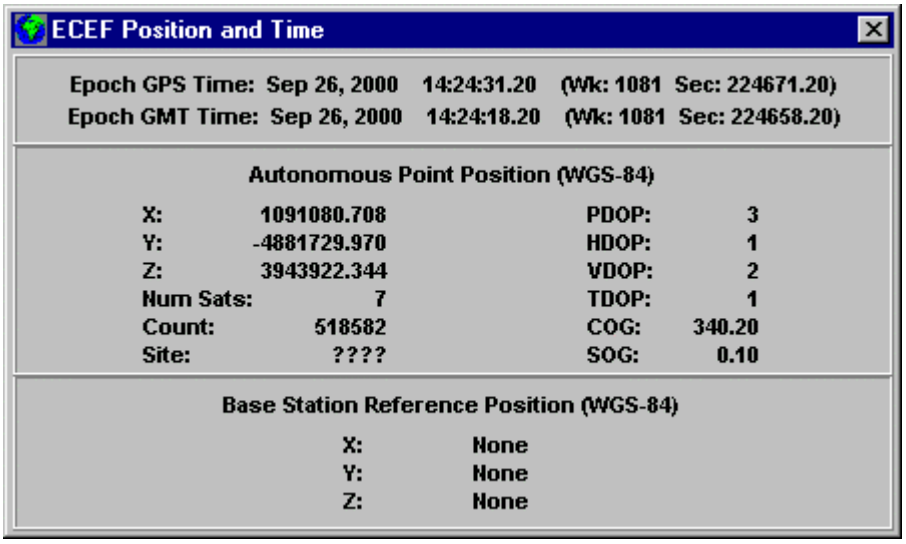
4.1.4.3 Earth-Centered Earth-Fixed Position and Time Window

The Earth-Centered Earth-Fixed (ECEF) Position and Time window displays the following information:

1) The current GPS time as reported by the receiver;
2) The current GMT time reported by the receiver;
3) Information on the current position computed by the receiver; and
4) Information on the fixed receiver position stored in the receiver.

The following are two examples of this window.





In the first example, a reference position has been set in the receiver (see Section 4.1.5.4.3). In the second example, a reference position has not been set in the receiver.

The ECEF Position and Time window is divided into three parts: 1) The current GPS and GMT time reported by the receiver; 2) the current point position computed by the receiver; and 3) the reference station position. The upper area of the window contains the GPS and GMT time reported by the receiver. The middle portion contains information obtained from the most recent point position solution reported by the receiver. The lower portion of the window contains the

reference position information configured for the receiver (see Section 4.1.5.4.3). When no reference station position information has been stored by the receiver, all components of the lower portion of the window will be displayed as “none” (i.e., no fixed position entered).

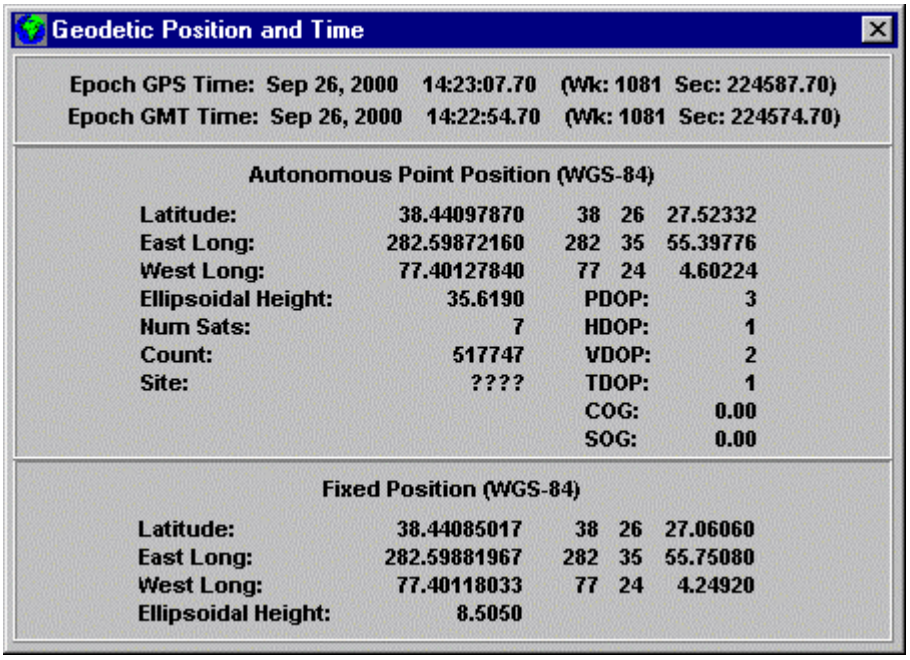
As with all other windows in the program, **Micro-Manager** will show the units of a displayed field if you rest the cursor over that field for a couple of seconds. Also, please see the Section 4.1.4 note on how **Micro-Manager** queries data for this window from the receiver.

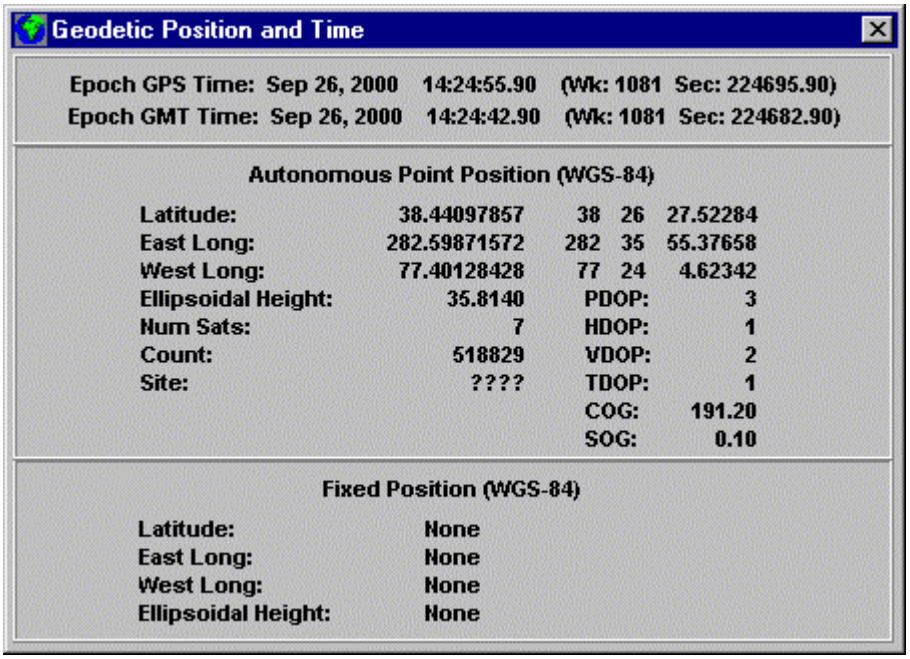
4.1.4.4 Geodetic Position and Time Window

Like the Earth-Centered Earth-Fixed (ECEF) Position and Time window, the Geodetic Position and Time window displays the following information:

1) The current GPS time as reported by the receiver;
2) The current GMT time reported by the receiver;
3) Information on the current position computed by the receiver; and
4) Information on the fixed receiver position stored in the receiver.

The following are two examples of this window.





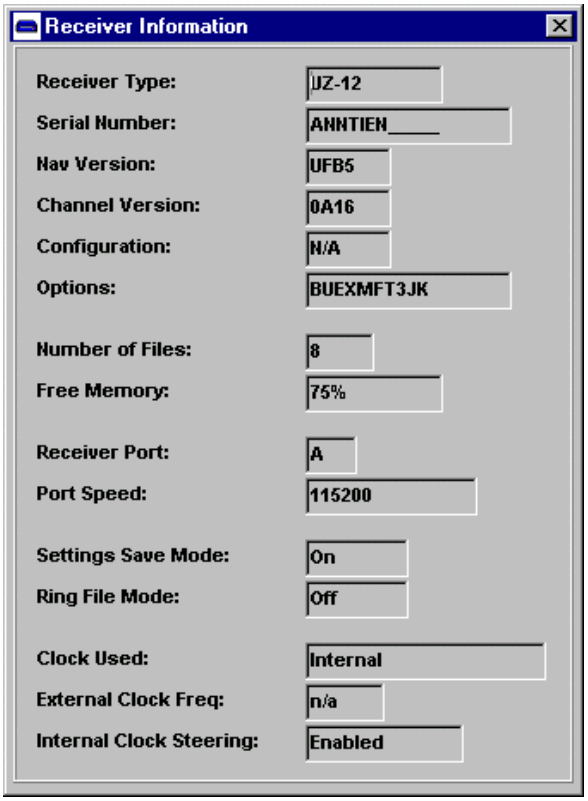
In the first example, a reference position has been set in the receiver (see Section 4.1.5.4.3). In the second example, a reference position has not been set in the receiver.

The Geodetic Position and Time window is divided into three parts: 1) The current GPS and GMT time reported by the receiver; 2) the current point position computed by the receiver; and 3) the reference station position. The upper area of the window contains the GPS and GMT time reported by the receiver. The middle portion contains information obtained from the most recent point position solution reported by the receiver. The lower portion of the window contains the reference position information configured for the receiver (see Section 4.1.5.4.3). When no reference station position information has been stored by the receiver, all components of the lower portion of the window will be displayed as “none” (i.e., no fixed position entered).

As with all other windows in the program, **Micro-Manager** will show the units of a displayed field if you rest the cursor over that field for a couple of seconds. Also, please see the Section 4.1.4 note on how **Micro-Manager** queries data for this window from the receiver.

4.1.4.5 Receiver Information Window

The Receiver Information window displays various information about the receiver; an example of this follows.



The table that follows provides a description of each of the values in this window.

Field	Description
Receiver Type	Describes the type of receiver currently connected to **Micro-Manager**.
Serial Number	Provides the receiver's serial number.
Nav Version	The receiver's navigation firmware version number.
Channel Version	The receiver's channel firmware version number.
Configuration	The receiver's configuration options (consult the Receiver Operations Manual for details). The µZ-Family receivers do not currently report this parameter.
Options	The current options supported by the receiver (consult the Receiver Operations Manual for details).
Number of Files	The number of data files stored in the receiver's memory.
Free Memory	The percentage of memory remaining (i.e., unused receiver memory).
Receiver Port	The communications port of the receiver over which **Micro-Manager** is currently communicating.

Field	Description
Port Speed	The speed of the communications port over which **Micro-Manager** is currently communicating.
Settings Save Mode	Indicates whether or not various receiver parameters (e.g., satellite elevation mask and epoch interval) will be saved between receiver power cycles (i.e., turned off and then later turned back on). For µZ-CGRS receivers, this parameter will always be "On": i.e., the receiver is always in "Save Mode". For other µZ-Family receivers, the save mode is selectable and can be configured through **Micro-Manager** (see Section 4.1.5.4.6). The value reported here is the value set by the receiver command "$PASHS,SAV,…" command. Please consult your receiver manual for details on that command and the receiver parameters affected by the receiver parameters save mode.
Ring File Mode	Indicates whether or not the receiver's Ring Buffer File Mode is enabled. When this mode is enabled, the receiver is designed to always make room for the most recent data by deleting older files. When in this mode, the receiver manages the files automatically (i.e., deleting the oldest file when more room is needed to store recent data). When the Ring Buffer File Mode is not enabled, the receiver will stop recording data once the receiver's memory becomes full. For complete details on the Ring Buffer File Mode, please consult the receiver manuals. **Micro-Manager** does permit the changing of this mode (see Section 4.1.5.4.6).
Clock Used	Indicates the clock in use. That is, the µZ-Family receivers support the use of external clocks. The receiver can be configured (see Section 4.1.5.4.1) such that it will utilize the internal clock, utilize an external clock, or to automatically switch between the two clocks. Values displayed in this field indicate the current clock use mode: "Internal" — Implies that the internal clock is being used. "External (locked)" — Indicates that an external clock is configured and that the receiver has locked onto its clock signal. "External (unlocked) — Indicates that an external clock is configured and that the receiver is not able to, or has not yet, locked onto its clock signal. "Auto-switch (locked)" — Indicates that the automatic clock-switching mode has been enabled and that the receiver has locked onto the external clock signal (and, therefore, the external clock is in use). "Auto-switch (unlocked)" — Indicates that the automatic clock switching mode has been enabled, but also that the receiver is not able to, or has not yet, locked onto its clock signal (and, therefore, the internal receiver clock is in use). For more details on the use of external clocks, please consult the appropriate receiver operations manual.

Field	Description
External Clock Freq.	When the "Clock Used" field indicates that the external clock is configured for the receiver (i.e., indicating either "External" or "Auto-switched"), this field will contain the frequency of the configured external clock (see Section 4.1.5.4.1 for configuration details).
Internal Clock Steering	This field is used to indicate whether the steering of the receiver's internal clock is enabled or disabled. This parameter has no meaning (and is therefore displayed as "n/a") when an external clock is being used. However, when in an Auto-switch external clock mode, an "Enabled" status means that the clock steering will be used whenever the receiver switches to the internal clock When "Enabled" is displayed, the receiver's internal clock is steered such that its clock offset remains close to zero (i.e., the receiver's clock will remain very closely aligned with the GPS time system). When "Disabled" is displayed, the receiver's clock will not be steered and be permitted to drift with respect to the GPS time system. In this mode, the receiver's clock offset (and pseudo-range observations) will experience 1 millisecond jumps. These jumps occur when the receiver's clock offset has been computed to be approximately 1 ms offset from GPS time. For further details on this subject, please consult the appropriate receiver operations manual.

As with all other windows in the program, **Micro-Manager** will show the units of a displayed field if you rest the cursor over that field for a couple of seconds. Also, please see the Section 4.1.4 note on how **Micro-Manager** queries data for this window from the receiver.

4.1.4.6 RTCM Status Window

The RTCM Status window provides RTCM status information provided by the GPS receiver. The appearance of the window and the general meaning of the parameters differ depending upon the RTCM mode of the receiver. That is, when the GPS receiver is configured as an RTCM base station (see Section 4.1.5.4.7) the RTCM Status window displays status information about the base station and information about RTCM messages output by the base station. When the GPS Receiver is configured as an RTCM remote station (see Section 4.1.5.4.7) the RTCM Status window displays status information about the remote station and information about RTCM messages received by the remote station. The receiver can also be configured such that its RTCM mode is disabled (i.e., it is not an RTCM participant).

The RTCM Status window consists of two major sections. The upper section of the window deals with RTCM status of the receiver and contains information about the most recently sent or received RTCM message (depending upon base or remote RTCM mode of the receiver). The lower section of the window provides information on each type of RTCM message sent or received by the receiver.

In the previous paragraph, we indicated that the RTCM status windows display information about the RTCM message that was most recently sent or received by the GPS receiver. When one of the RTCM status windows shows information about the last message sent

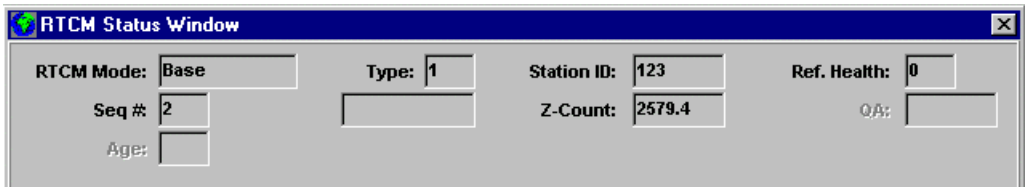
(or received), including the time of that message, this information is obtained from the valid RTCM status information messages reported by the GPS receiver.

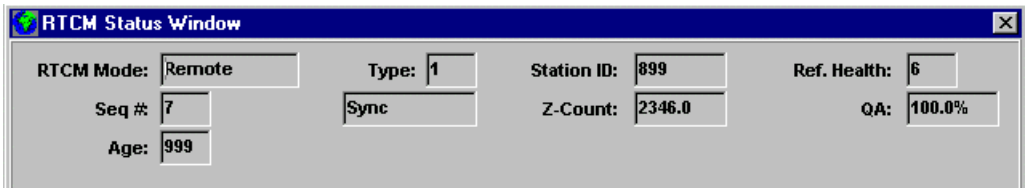
Please note that the GPS receiver reports what has been sent to Micro-Manager and that Micro-Manager does not get an actual copy of the message sent (or received) over the receiver's RTCM port. That is, Micro-Manager is monitoring the receiver's indication of the messages, not the actual messages themselves. When the GPS receiver is configured for RTCM (base or remote), one of its communication ports is used to transmit or receive the RTCM data. Micro-Manager communicates with the receiver using one of its other communication ports. The GPS receiver provides Micro-Manager with RTCM-related status messages. These status messages contain information about what was sent (or received).

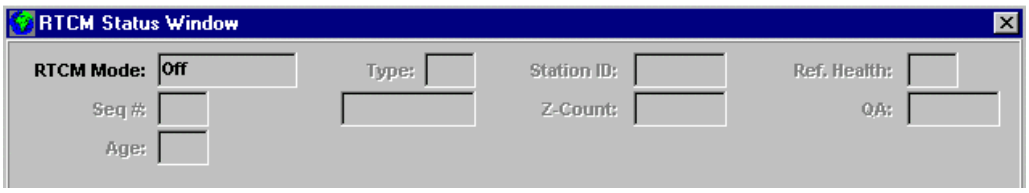
Because of normal data communication delays and errors that can occur between two communicating devices, some status messages can be lost or delayed. Micro-Manager continuously senses the communication load between it and the GPS receiver and adjusts the frequency at which it requests status messages from the GPS receiver to avoid overrunning the communication link. Therefore, Micro-Manager may not always obtain all of the current RTCM status information from the GPS receiver.

It is important to note that **Micro-Manager** supports the configuration and display of µZ-Family receivers participating as RTCM remote receivers. However, at the time of the publication of this document, Thales Navigation had not fully tested the support of the µZ-Family receivers as RTCM remote stations in the **Micro-Manager** environment. In this document we will nevertheless fully describe the information displayed by remote RTCM participants but caution the user that they use this option at their own risk.

To distinguish which mode the receiver is in, one must view the upper section of the RTCM status window. In particular, one should pay attention to the value of the "RTCM Mode" parameter. Below are screen captures from **Micro-Manager** when the receiver is in each of the three RTCM modes (Base Station Mode, Remote Station Mode, and non-participating, respectively).







Notice in the above windows examples that some fields are disabled (denoted by the light gray) in different modes. This is because these fields are not applicable under those modes. For example, the QA parameter, a parameter that describes the quality of communications based upon received RTCM messages, is reported only by an RTCM remote station.

The following table contains a description of each parameter displayed in the upper section of the RTCM Status Window.

Field	Description
RTCM Mode	Provides an indication of the RTCM mode of the receiver (Base/Remote/Off).
Type	The RTCM message type of the most recent message sent (Base mode) or received (Remote mode).
Station ID	The RTCM identifier of the reference station (0 to 1023), also known as the RTCM STID. When the receiver is in Base mode, this indicates the station ID of the receiver as an RTCM reference station. When the receiver is in the Remote mode, this field indicates the reference station from which the RTCM messages are being received.
Ref. Health	The health flag being reported by the Reference RTCM receiver. When the receiver is an RTCM base station, this value indicates the health that the station is broadcasting in its RTCM messages. When the receiver is an RTCM remote station, this value indicates the health of the participating reference station as is reported in the RTCM messages received from the participating RTCM base station.
Seq #	The RTCM Sequence Number (SQNU) attached to the RTCM messages being sent (Base mode) or received (Remote mode).
Field under Type	The field under the "Type" field represents the RTCM Synchronization Flag and is only reported when the receiver is participating as an RTCM remote site. The flag is used to indicate synchronization with the RTCM messages. The three possible values and their meanings are as follows: Value — Description No Msg — No RTCM Messages have been received. Not Sync. — The RTCM Messages are not synchronized: i.e., the received RTCM message appears to be older than the maximum RTCM age parameter (see Section 4.1.5.4.7). Sync. — The received RTCM messages are synchronized and fit within the maximum age parameter (see Section 4.1.5.4.7).
Z-Count	The RTCM message Z-Count (ZCNT). The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
QA	The communication quality factor and is displayed/enabled only when the receiver is a participating RTCM remote station. This factor is defined as 100 times the number of good messages divided by the total number of messages.
Age	Used in remote mode to indicate the age (in seconds) of the received RTCM messages.

As with all other windows in the program, **Micro-Manager** will show the units of a displayed field if you rest the cursor over that field for a couple of seconds. Also, please see the Section 4.1.4 note on how **Micro-Manager** queries data for this window from the receiver.

Section 4.1.5.4.7 describes the **Micro-Manager** window used to configure the receiver RTCM mode.

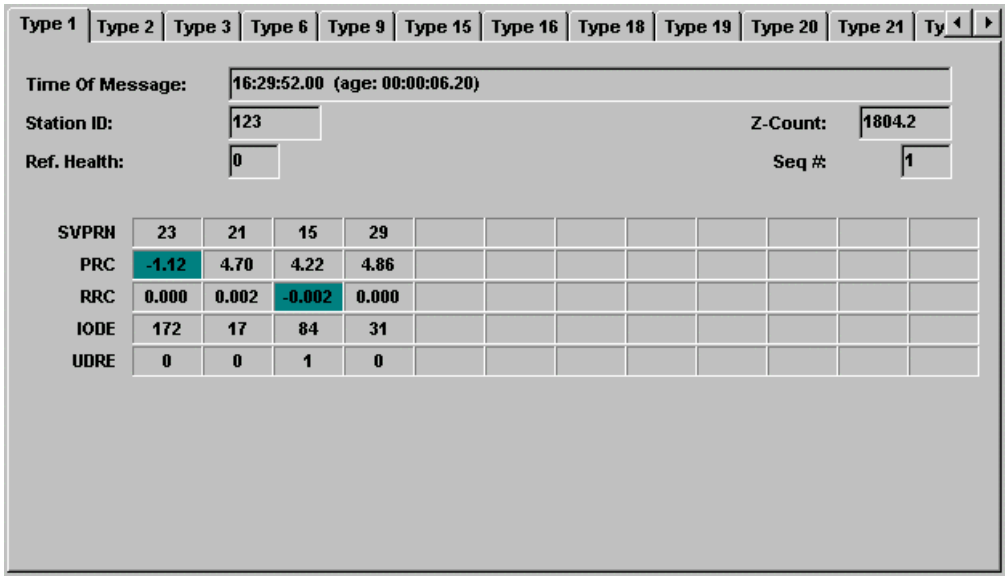
The following subsections provide a description of the lower portion of the RTCM Status Window. In each of these subsections, we will refer to the messages as being sent by the RTCM base station even though the contents of the message could have been received by the participating RTCM remote station. We do this only in the interest of reducing the redundancy in this document. Therefore, unless otherwise noted, we will be referring to both messages sent and received (by the RTCM base and RTCM remote stations, respectively).

Additionally, this document was written when Version 2.2 of the RTCM standard was in effect and implemented by the receiver firmware. Should your receiver not implement this standard then the descriptions that follow may or may not be applicable. For complete details on the RTCM standard, please contact:

Radio Technical Commission for Maritime Services
655 Fifteenth Street, NW, Suite 300
Washington, D.C. 20005 (USA)

4.1.4.6.1 RTCM Type 1 Display

RTCM Type 1 messages communicate Differential GPS Corrections. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 1 messages. The display shows the last RTCM Type 1 message sent.

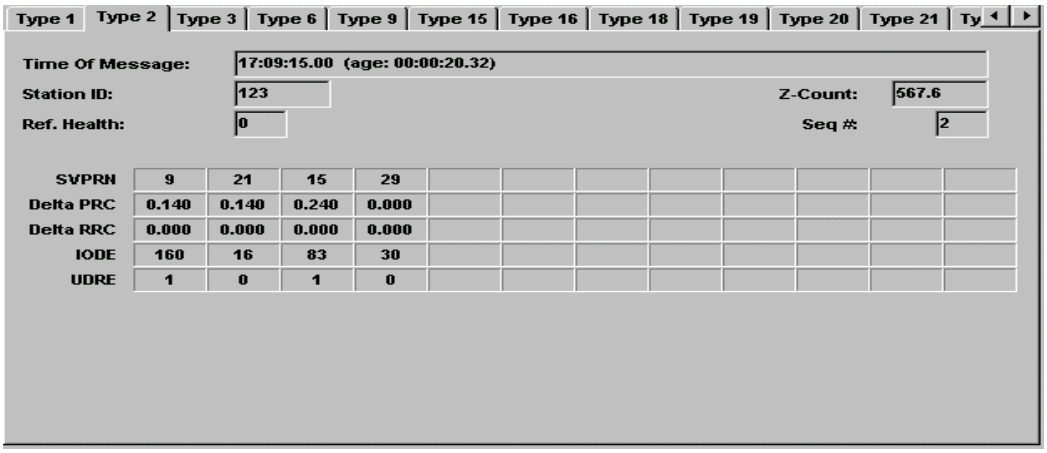


The following table contains a description of each parameter displayed in the RTCM Type 1 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 1 message was sent (for Base station) or received (for Rover stations). If the message is over one second old, then the time will also contain an age display. If such a message has not yet been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 1 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 1 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 1 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 1 message.
SVPRN	The SVPRN row displays the GPS satellite numbers for which there are RTCM correctors in the Type 2 message.
PRC	The Pseudo-Range Correctors (meters) for each satellite contained in the Type 1 message.
RRC	The Range-Rate Correctors (meters/second) for each satellite contained in the Type 1 message.
IODE	The Issue of Data Ephemeris for each satellite corrector contained in the Type 1 message.
UDRE	The User Differential Range Error for each satellite corrector contained in the Type 1 message.

4.1.4.6.2 RTCM Type 2 Display

RTCM Type 2 messages communicate Delta Differential GPS Corrections. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 2 messages. The display shows the last RTCM Type 2 message sent.

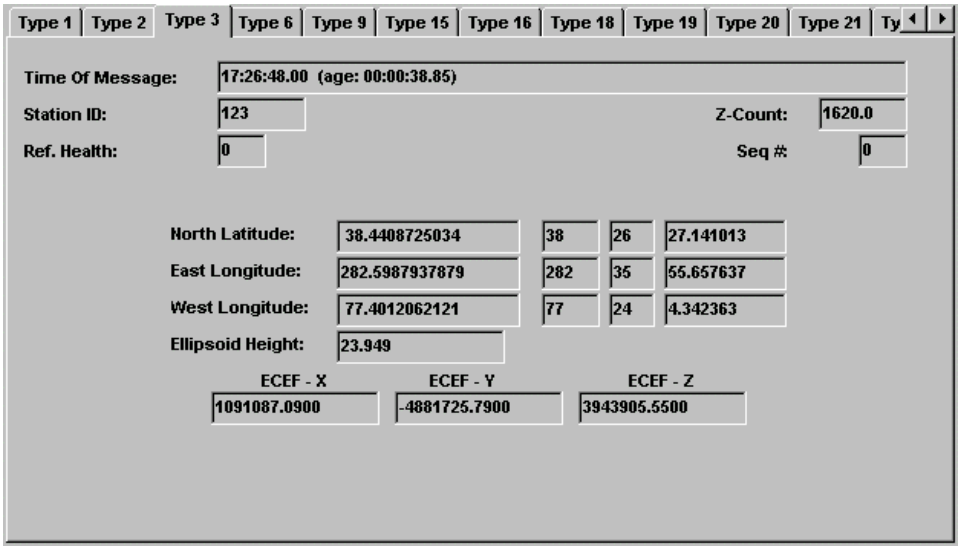


The following table contains a description of each parameter displayed in the RTCM Type 2 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 2 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 2 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 2 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 2 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 2 message.
SVPRN	The SVPRN row displays the GPS satellite numbers for which there are RTCM correctors in the Type 2 message.
PRC	The change in the Pseudo-Range Correctors (meters) for each satellite as caused by a change in the satellite navigation message.
RRC	The change in Range-Rate Correctors (meters/second) for each satellite as caused by a change in the satellite navigation message.
IODE	The Issue of Data Ephemeris for each satellite prior to the change in the satellite navigation message.
UDRE	The User Differential Range Error for each satellite corrector as obtained with the navigation data prior to the change.

4.1.4.6.3 RTCM Type 3 Display

RTCM Type 3 messages communicate the Reference Station Parameters (i.e., the position of the reference receiver). The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 3 messages. The display shows the last RTCM Type 3 message sent.

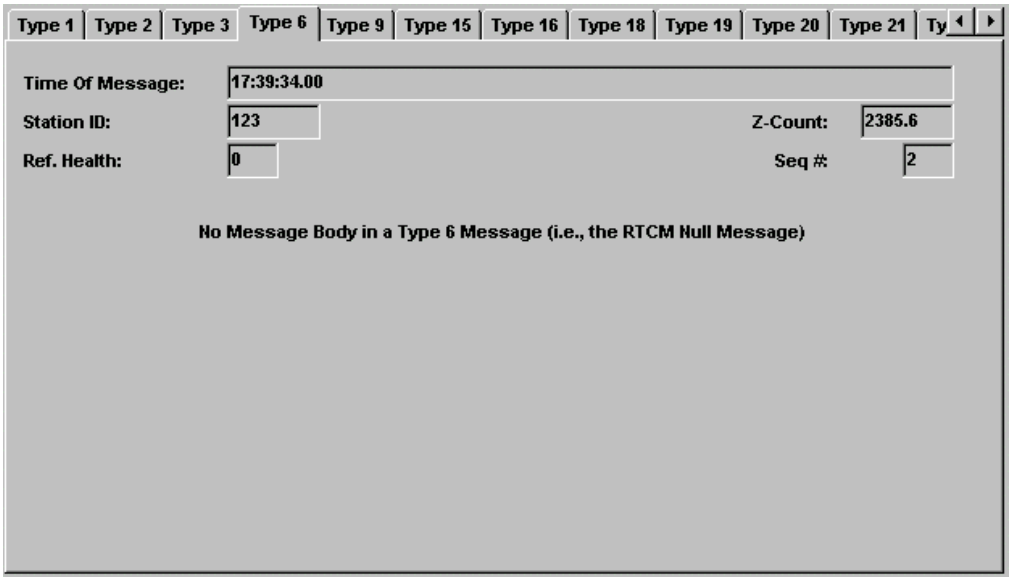


The following table contains a description of each parameter displayed in the RTCM Type 3 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 3 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 3 message
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 3 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 3 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 3 message.
North Latitude, East Longitude, West Longitude, and Ellipsoid Height	The geodetic position (WGS-84) of the reference RTCM receiver identified by the "Station ID" field of the Type 3 message.
ECEF-X, ECEF-Y, and ECEF-Z	The Earth-Centered Earth-Fixed coordinates (WGS-84) of the reference RTCM receiver identified by the "Station ID" field of the Type 3 message.

4.1.4.6.4 RTCM Type 6 Display

RTCM Type 6 messages are the RTCM Null Frame messages. These messages contain no parameters and are used as a transmission fill. According to the RTCM standard, they are used to "provide messages when the Reference Station has no other messages ready to be sent". The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 6 messages. The display shows the last RTCM Type 6 message sent.



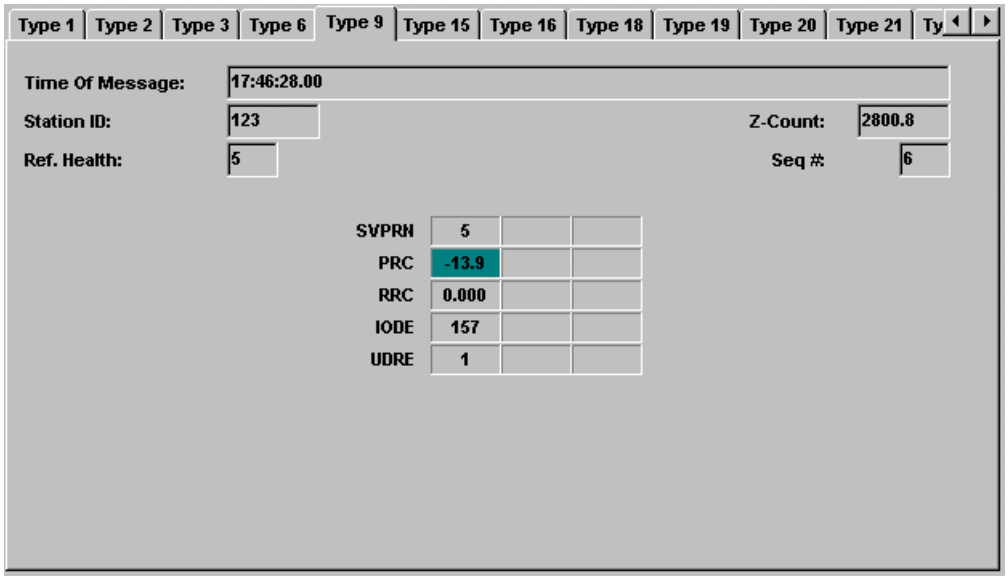
The following table contains a description of each parameter displayed in the RTCM Type 6 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 6 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 6 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 6 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 6 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 6 message.

4.1.4.6.5 RTCM Type 9 Display

RTCM Type 9 messages communicate a partial set of Differential GPS Corrections. The contents of the message are the same as that for Type 1 messages. The only difference between the two messages is that Type 1 was designed to contain correctors for all visible satellites in a single message, while Type 9 was designed to interleave the correctors over several messages. Ashtech µZ-Family receivers will send up to 3 sets of correctors per Type 9 message.

The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 9 messages. The display shows the last RTCM Type 9 message sent.



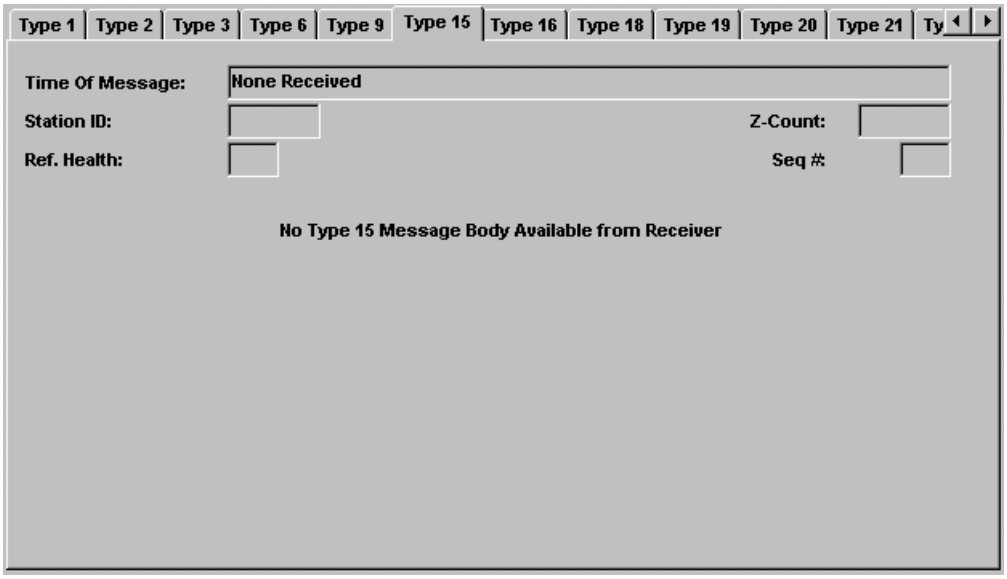
The following table contains a description of each parameter displayed in the RTCM Type 9 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 9 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 9 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 9 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 9 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 9 message.
SVPRN	The SVPRN row displays the GPS satellite numbers for which there are RTCM correctors in the Type 9 message.
PRC	The Pseudo-Range Correctors (meters) for each satellite contained in the Type 9 message.
RRC	The Range-Rate Correctors (meters/second) for each satellite contained in the Type 9 message.
IODE	The Issue of Data Ephemeris for each satellite corrector contained in the Type 9 message.
UDRE	The User Differential Range Error for each satellite corrector contained in the Type 9 message.

4.1.4.6.6 RTCM Type 15 Display

RTCM Type 15 messages communicate Ionosphere and Troposphere parameters. However, the µZ-Family receivers do not currently report this message to **Micro-Manager**. As such, this section simply maintains a placeholder for future developments.

The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 15 messages. The display shows the last RTCM Type 15 message sent.

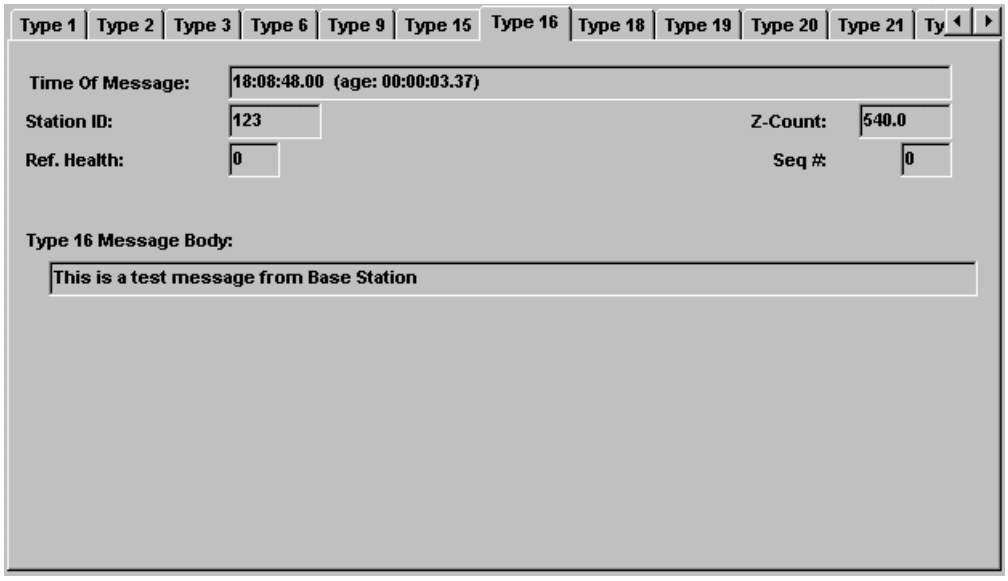


The following table contains a description of each parameter displayed in the RTCM Type 15 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 15 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 15 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 15 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 15 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 15 message.
	No message body as the μZ-Family receivers do not yet communicate the contents of Type 15 messages to **Micro-Manager**.

4.1.4.6.7 RTCM Type 16 Display

RTCM Type 16 messages communicate a special text message. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 16 messages. The display shows the last RTCM Type 16 message sent.

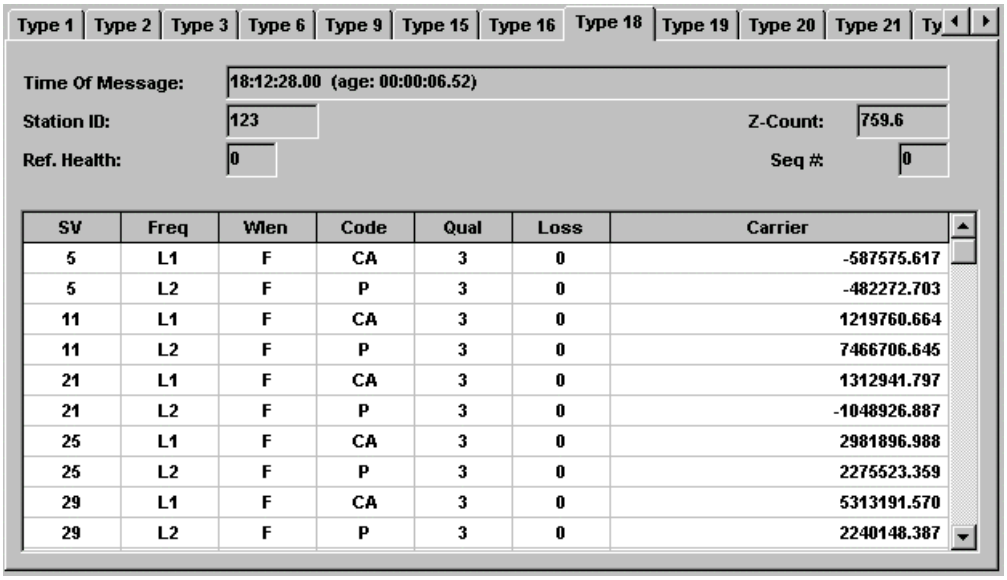


The following table contains a description of each parameter displayed in the RTCM Type 16 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 16 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 16 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 16 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 16 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 16 message.
Type 16 Message Body	The text of the special message in the Type 16 message.

4.1.4.6.8 RTCM Type 18 Display

RTCM Type 18 messages communicate uncorrected carrier phase measurements typically used in Real-Time Kinematic applications. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 18 messages. The display shows the last RTCM Type 18 message sent.



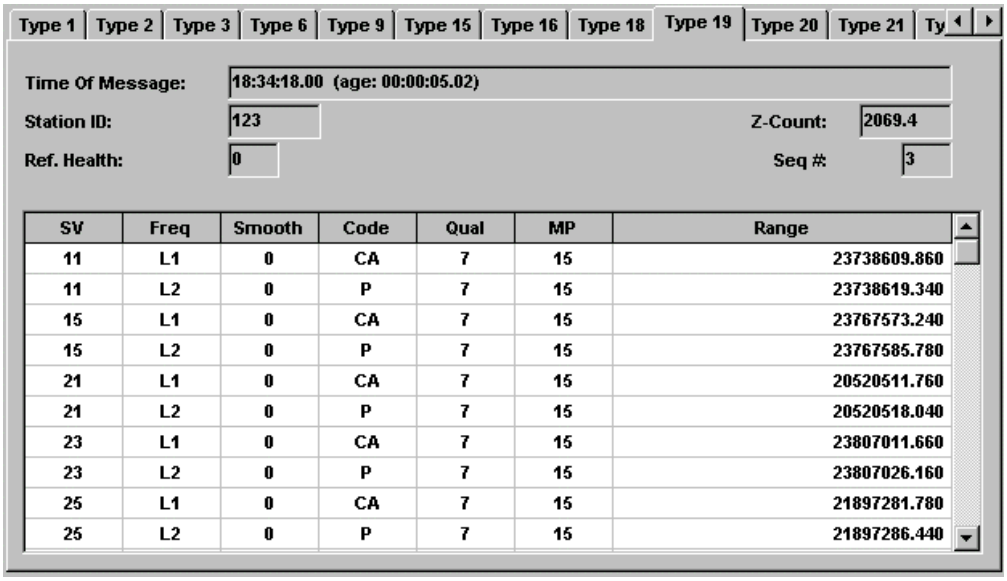
The following table contains a description of each parameter displayed in the RTCM Type 18 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 18 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 18 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 18 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 18 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 18 message.
SV	Each element *SV* column contains satellite number pertaining to that row.
Freq	Each element of the *Freq* column contains the frequency (L1 or L2) of the carrier phase observation for the satellite on that row.
Wlen	Each element of the *Wlen* column contains the wavelength (F=Full, H = Half) of the carrier phase observation for the satellite on that row.
Code	Each element of the *Code* column contains the codephase tracking loop (CA = C/A, P = P-Code) of the carrier phase observation for the satellite on that row.

Field	Description
Qual	Each element of the *Qual* column contains the quality indicator for the carrier phase observation for the satellite on that row. According to the RTCM standard (Version 2.2), the carrier phase quality indicator is the one sigma phase measurement error as indicated below: Value Description 0 Phase Error ≤ 0.00391 Cycles 1 Phase Error ≤ 0.00696 Cycles 2 Phase Error ≤ 0.01239 Cycles 3 Phase Error ≤ 0.02208 Cycles 4 Phase Error ≤ 0.03933 Cycles 5 Phase Error ≤ 0.07006 Cycles 6 Phase Error ≤ 0.12480 Cycles 7 Phase Error > 0.12480 Cycles
Loss	Each element of the *Loss* column contains the cumulative loss of continuity indicator for the carrier phase observation for the satellite on that row. According to the RTCM standard (Version 2.2), the cumulative loss of continuity indicator will be incremented each time there is an unfixed cycle-slip or loss of lock. Once the counter reaches its maximum value (i.e., 32) it will roll over to 0.
Carrier	Each element of the *Carrier* column contains the carrier phase observation (cycles) for the satellite on that row.

4.1.4.6.9 RTCM Type 19 Display

RTCM Type 19 messages communicate uncorrected pseudorange measurements typically used in Real-Time Kinematic and differential applications. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 19 messages. The display shows the last RTCM Type 19 message sent.



The following table contains a description of each parameter displayed in the RTCM Type 19 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 19 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 19 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 19 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 19 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 19 message.
SV	Each element *SV* column contains satellite number pertaining to that row.
Freq	Each element of the *Freq* column contains the frequency (L1 or L2) of the pseudorange observation for the satellite on that row.
Smooth	Each element of the *Smooth* column contains the smoothing interval of the pseudorange observation for the satellite on that row. According to the RTCM standard (Version 2.2), the smoothing interval indicates the interval for carrier smoothing of the pseudorange observation. Value — Smoothing Interval (minutes) 0 — 0 to 1 1 — 1 to 5 2 — 5 to 15 3 — Indefinite
Code	Each element of the *Code* column contains the codephase tracking loop (CA = C/A, P = P-Code) from which the pseudorange observation is obtained.

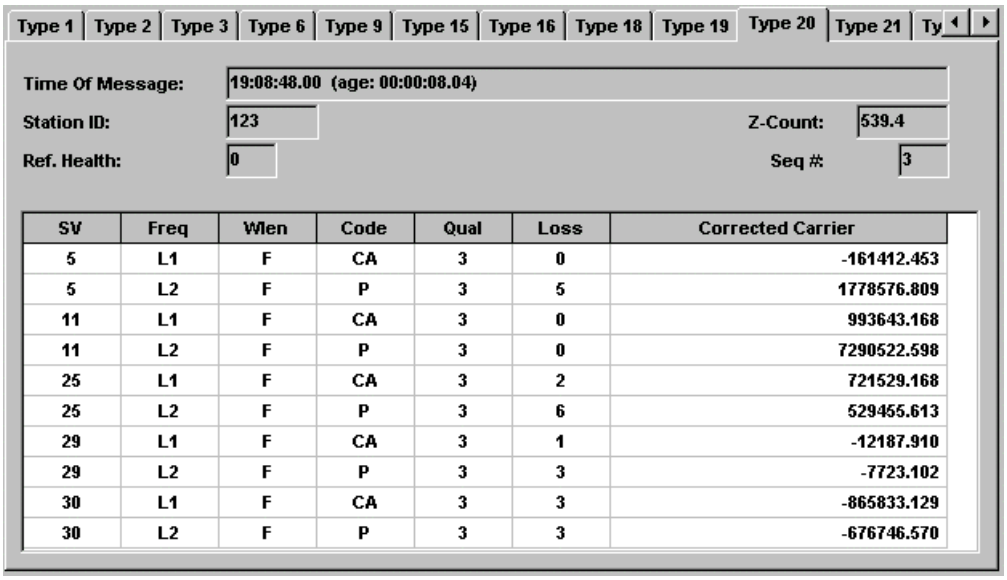
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>Qual</td><td>Each element of the Qual column contains the quality indicator for the pseudorange observation for the satellite on that row. According to the RTCM standard (Version 2.2), the pseudorange quality indicator is the one sigma pseudorange measurement error as indicated below:

<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>0</td><td>Pseudorange Error ≤ 0.020 meters</td></tr>
<tr><td>1</td><td>Pseudorange Error ≤ 0.030 meters</td></tr>
<tr><td>2</td><td>Pseudorange Error ≤ 0.045 meters</td></tr>
<tr><td>3</td><td>Pseudorange Error ≤ 0.066 meters</td></tr>
<tr><td>4</td><td>Pseudorange Error ≤ 0.099 meters</td></tr>
<tr><td>5</td><td>Pseudorange Error ≤ 0.148 meters</td></tr>
<tr><td>6</td><td>Pseudorange Error ≤ 0.220 meters</td></tr>
<tr><td>7</td><td>Pseudorange Error > 0.329 meters</td></tr>
<tr><td>8</td><td>Pseudorange Error ≤ 0.491 meters</td></tr>
<tr><td>9</td><td>Pseudorange Error ≤ 0.732 meters</td></tr>
<tr><td>10</td><td>Pseudorange Error ≤ 1.092 meters</td></tr>
<tr><td>11</td><td>Pseudorange Error ≤ 1.629 meters</td></tr>
<tr><td>12</td><td>Pseudorange Error ≤ 2.430 meters</td></tr>
<tr><td>13</td><td>Pseudorange Error ≤ 3.626 meters</td></tr>
<tr><td>14</td><td>Pseudorange Error ≤ 5.409 meters</td></tr>
<tr><td>15</td><td>Pseudorange Error > 5.409 meters</td></tr>
</table></td></tr>
<tr><td>MP</td><td>Each element of the MP column contains the estimated multiplath error indicator for the pseudorange observation for the satellite on that row. The following lists the error associated with the MP value according to the RTCM standard (Version 2.2).

<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>0</td><td>Multipath Error ≤ 0.100 meters</td></tr>
<tr><td>1</td><td>Multipath Error ≤ 0.149 meters</td></tr>
<tr><td>2</td><td>Multipath Error ≤ 0.223 meters</td></tr>
<tr><td>3</td><td>Multipath Error ≤ 0.332 meters</td></tr>
<tr><td>4</td><td>Multipath Error ≤ 0.495 meters</td></tr>
<tr><td>5</td><td>Multipath Error ≤ 0.739 meters</td></tr>
<tr><td>6</td><td>Multipath Error ≤ 1.102 meters</td></tr>
<tr><td>7</td><td>Multipath Error > 1.644 meters</td></tr>
<tr><td>8</td><td>Multipath Error ≤ 2.453 meters</td></tr>
<tr><td>9</td><td>Multipath Error ≤ 3.660 meters</td></tr>
<tr><td>10</td><td>Multipath Error ≤ 5.460 meters</td></tr>
<tr><td>11</td><td>Multipath Error ≤ 8.145 meters</td></tr>
<tr><td>12</td><td>Multipath Error ≤ 12.151 meters</td></tr>
<tr><td>13</td><td>Multipath Error ≤ 18.127 meters</td></tr>
<tr><td>14</td><td>Multipath Error > 18.127 meters</td></tr>
<tr><td>15</td><td>Multipath error not determined</td></tr>
</table></td></tr>
<tr><td>Range</td><td>Each element of the Ranger column contains the pseudorange observation (cycles) for the satellite on that row.</td></tr>
</table>

4.1.4.6.10 RTCM Type 20 Display

RTCM Type 20 messages communicate RTK Carrier Phase Corrections. That is, corrections to the carrier phase observations. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 20 messages. The display shows the last RTCM Type 20 message sent.

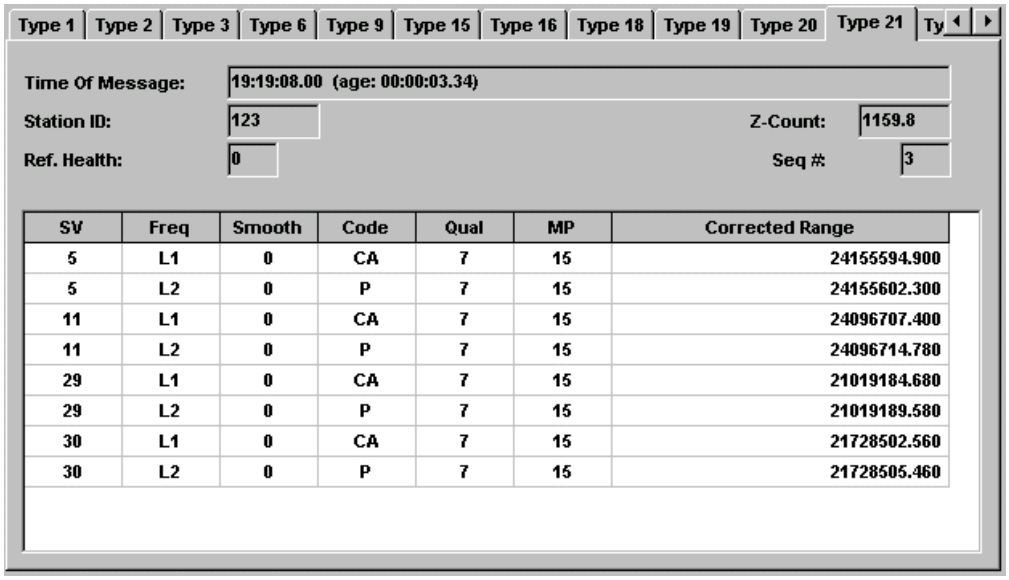


SV	Freq	Wlen	Code	Qual	Loss	Corrected Carrier
5	L1	F	CA	3	0	-161412.453
5	L2	F	P	3	5	1778576.809
11	L1	F	CA	3	0	993643.168
11	L2	F	P	3	0	7290522.598
25	L1	F	CA	3	2	721529.168
25	L2	F	P	3	6	529455.613
29	L1	F	CA	3	1	-12187.910
29	L2	F	P	3	3	-7723.102
30	L1	F	CA	3	3	-865833.129
30	L2	F	P	3	3	-676746.570

For Type 20 messages, the displayed fields and their meanings, with the exception of the *Corrected Carrier* column, have the exact same meaning as that discussed for Type 18 messages (and therefore you should refer to Section 4.1.4.6.8 for a description of these fields). The primary difference between Type 18 and 20 messages is that Type 18 messages contain uncorrected carrier phase observations while Type 20 messages contain corrections to the carrier phase observations. **Micro-Manager**, in its *Corrected Carrier* field, displays the remote's carrier phase observation as corrected by the correctors supplied in the Type 20 message.

4.1.4.6.11 RTCM Type 21 Display

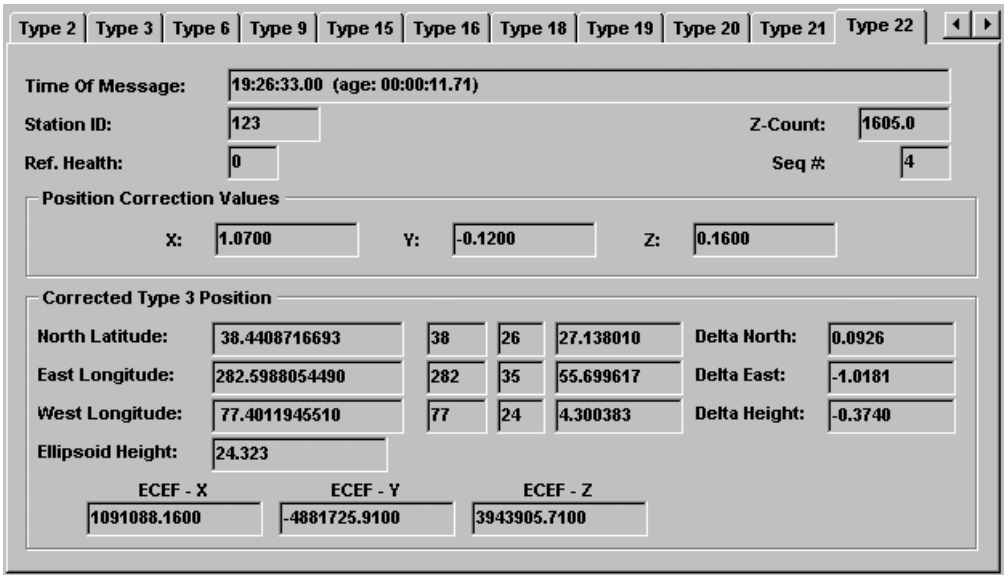
RTCM Type 21 messages communicate RTK Pseudorange Corrections. That is, corrections to the pseudorange observations. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 21 messages. The display shows the last RTCM Type 21 message sent.



For Type 21 messages, the displayed fields and their meanings, with the exception of the *Corrected Range* column, have the exact same meaning as that discussed for Type 19 messages (and therefore you should refer to Section 4.1.4.6.9 for a description of these fields). The primary difference between Type 19 and Type 21 messages is that Type 19 messages contain uncorrected pseudorange observations while Type 21 messages contain corrections to the pseudorange observations. **Micro-Manager**, in its *Corrected Range* column, displays the remote's pseudorange observation as corrected by the correctors supplied in the Type 21 message.

4.1.4.6.12 RTCM Type 22 Display

RTCM Type 22 messages communicate corrections to the Base station position communicated in the Type 3 message. These corrections in the Type 22 messages are to provide a more accurate position than can be reported in the Type 3 message. The screen capture that follows shows an example display generated by **Micro-Manager** to report RTCM Type 22 messages. The display shows the last RTCM Type 22 message sent.



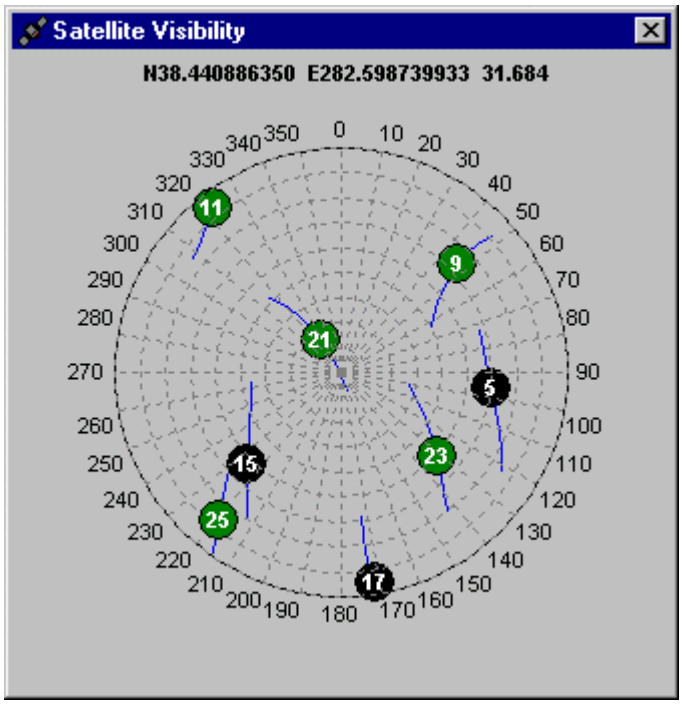
The following table contains a description of each parameter displayed in the RTCM Type 22 message display.

Field	Description
Time Of Message	The GPS time (expressed as time of GPS day) at which the Type 22 message was sent (for Base station) or received (for Rover stations). If the message is over a second old, then the time will also contain an age display. If such a message has not been sent or received, then this field will contain "None Received".
Station ID	The RTCM Base Station ID contained in the Type 22 message.
Z-Count	The RTCM message Z-Count (ZCNT) of the Type 22 message. The RTCM Z-Count is the time tag of the message and is displayed as seconds of the hour (GPS time frame).
Ref. Health	The health flag being reported in the Type 22 message.
Seq #.	The RTCM Sequence Number (SQNU) attached to the RTCM Type 22 message.
Position Corrections for X, Y, and Z	The Earth-Centered Earth-Fixed coordinate correction values (WGS-84) that are to be applied to the position reported in the Type 3 message.
North Latitude, East Longitude, West Longitude, and Ellipsoid Height	The geodetic position (WGS-84) of the reference RTCM receiver identified by the "Station ID" field of the message. The values presented in these fields are the corrected receiver coordinates (i.e., Type 3 message position plus the Type 22 position corrections).

Field	Description
ECEF-X, ECEF-Y, and ECEF-Z	The Earth-Centered Earth-Fixed coordinates (WGS-84) of the reference RTCM receiver identified by the "Station ID" field of the message. The values presented in these fields are the corrected receiver coordinates (i.e., Type 3 message position plus the Type 22 position corrections).
Delta North, Delta East, and Delta Height	Provides the change to the Geodetic coordinates of the Type 3 message (in meters of North, East and Height, respectively) due to the correction supplied in the Type 22 message.

4.1.4.7 Satellite Visibility Window

The Satellite Visibility Window provides a polar plot of the satellites in view (i.e., above the horizon) of the receiver.



The polar plot is an Azimuth/Elevation plot. All displayed satellites are displayed with respect to the position reported by the GPS receiver. Azimuth (0 to 360 degrees) should be obvious. Elevation is represented by the position of the satellite with respect to the center and outermost ring. That is, if the satellite is displayed exactly at the center, then its elevation is 90 degrees. If the satellite is displayed on the outermost ring, then its elevation is 0 degrees. Examples from the window above are:

Satellite	Elevation	Azimuth
9	27˚	47⁰
11	6⁰	324⁰
17	6⁰	173⁰
21	76⁰	325⁰

It is important to note that when the GPS receiver does not provide enough information to generate the display (which is a rare event), the display will remain blank. The information required by **Micro-Manager** for this display includes the receiver's position, tracking information, and satellite almanac information. There are several reasons why the receiver may not be able to report its position. The most common occurrences are:

1) The receiver is initially turned on and has not acquired enough satellites to compute a position.
2) You have either not attached an antenna to the receiver or have placed the antenna where it cannot track enough satellites to compute a position.

The satellite almanac contains information about every satellite in the constellation. Normally the receiver keeps a copy of this almanac in memory, even between power cycles. However, when you reset the receiver (see Section 4.1.5.2) or load new firmware (see Section 4.1.5.3), the receiver may not contain the necessary almanac information. Once the receiver begins to track satellites, however, it can obtain the required almanac information for all GPS satellites from any one satellite being tracked. This almanac collection process can take up to 12.5 minutes or longer. This is how long it takes to transmit one cycle of the entire broadcast message.

4.1.5 Receiver Interfacing Windows

The receiver interfacing windows are separate from the "Status and Display Sub-Windows" described in Section 4.1.4 because they provide you with the ability to **configure the receiver**, **download data from the receiver**, **delete data from the receiver**, and/or **upload firmware to the receiver**. These receiver-interfacing windows can be activated through the use of the "Receiver" main menu option. Upon selecting this option, you will be presented with the following pull-down menu.

All of the options of the pull-down menu, with the exception of the "View Receiver Status" option, are directly related to these receiver-interfacing windows. The "View Receiver Status"

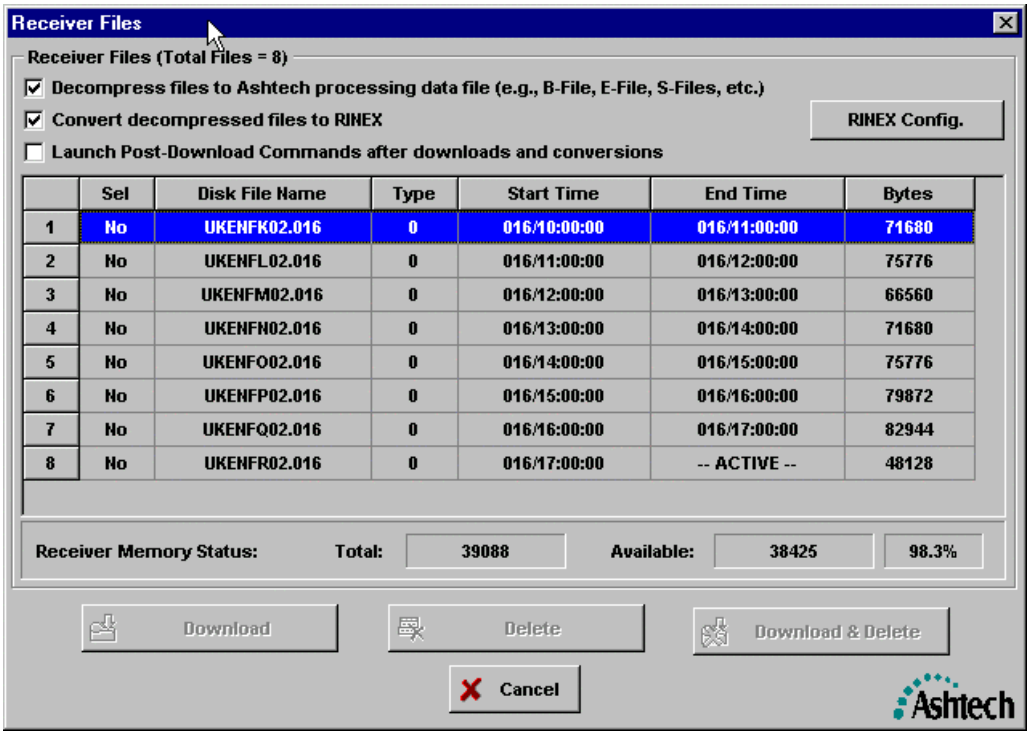
option provides access to the windows described under Section 4.1.4 (and is provided here to make a logical relationship with other "receiver" functions).

Selecting the first sub-menu item (i.e., "Files") will provide you with a window that permits download and deletion of files stored by the receiver. The "Reset Receiver" selection will provide you with a window that allows you to select various levels of receiver firmware (including a full reset, which resets the firmware back to the factory default settings and fully initializes the file storage area). The "Upload Firmware" option permits you to upload firmware to the receiver. Selecting the "Settings" option will cause **Micro-Manager** to provide you with another menu that lists all of the windows that control the parameters of the receiver. That is, upon selecting the "Settings" menu option you will be presented with the following sub-menu:

Each of these menu options allow one to gain access to windows which control various settings of the receiver. Selecting the "Port Settings" option will cause the Receiver Port Settings Configuration window to be displayed. The "Position" menu option will give you access to the receiver's reference position (which is used when the receiver is an RTK or RTCM base station). The "Project Information" menu option gives one access to various information that is used to document the project information stored with each observation file (including the 4-character site ID). Selecting the "Program Sessions" option gives one access to the receiver's session programming features. The "RTCM Setup" option provides a window through which you can configure the RTCM modes and capabilities of the receiver. The "Satellite Tracking" option provides a window through which you control the satellites tracked by the receiver.

4.1.5.1 Downloading and Deleting Receiver Files

By selecting the "Files" sub-menu option of the "Receiver" main menu you will be provided with a window similar to the following:

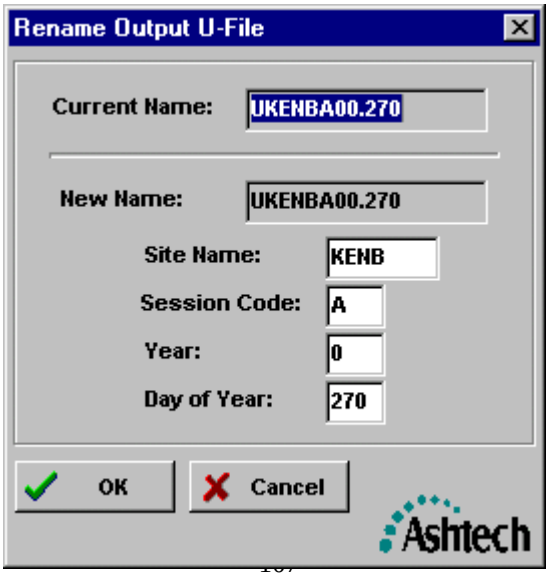


The displayed window provides information about the receiver memory and the files stored in that memory. In the above example, there are four files stored in the receiver's memory – the last of which is still active (i.e., still collecting data). Additionally shown, toward the bottom, is the amount of free receiver memory available. The file list shows each of the files stored in the receiver's memory. The columns of this list are described in the following table.

Column Label	Description
Sel	Indicates whether or not a file has been selected for a particular operation. To select a file, put the mouse cursor over that row and click. With each click, you will see the "Sel" column for that file toggle between No and Yes and you will see that row displayed with a green background. The download and delete operations will act upon those files having their "Sel" flag set to "Yes".
File Name	The name of the file as generated by **Micro-Manager**. The file name is generated using the other file information displayed in the directory listing and depends upon whether the "Use file start time to name files" checkbox is checked. When checked, the file names generated are based upon the start times of the files. When unchecked, the file names are based upon the end times of the files. The file naming approach is described in Appendix A.

Column Label	Description
Type	The format of the data being collected. These are often referred to as "Ranger Modes". Please consult your Receiver Operations Manual for the meanings of the values displayed.
Start Time	Describes the start time of the file in the following format: DDD/HH:MM:SS Where, DDD is the day of the year, HH is the hour of the data, MM is the minutes of the hour, and SS is the seconds of the minute. All times and days are based upon GPS time.
End Time	Describes the end time of the file in the following format: DDD/HH:MM:SS Where, DDD is the day of the year, HH is the hour of the data, MM is the minutes of the hour, and SS is the seconds of the minute. All times and days are based upon GPS time. When a file is currently open, for collecting more data, the receiver reports the file to be "—ACTIVE—".
Bytes	Provides the number of bytes (in receiver memory) currently being used by the file. Note that this field describes the number of bytes required by the receiver's [compressed] internal storage format (i.e., it does not reflect the number of bytes required to store the file in B-, E- and S-File formats-which are less efficient.).

Upon selecting a file, thereby changing its "Sel" status to "Yes", **Micro-Manager** performs a file name duplication check. That is, **Micro-Manager** checks the output file directory (see Section 3.1.6.3) to see if the file already exists. If a duplicate name is detected, **Micro-Manager** will display a window indicating the duplication and present an opportunity to rename the output U-File (i.e., the file that will contains an exact image of the file from the receiver's memory). The following is an example of the "Rename Output U-File" window.



Through this window, you can edit the components used to create the U-File name. Appendix A describes the file naming convention employed by **Micro-Manager**.

You can also force the rename of any U-File before it is downloaded. Simply click on the desired row (which will highlight that row) and then press the right mouse button. A pop-up menu will appear giving you the opportunity to rename the output U-File.

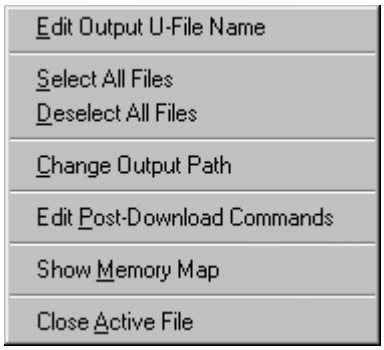
At the top of the Receiver Files window are two checkboxes. The "Decompress files to Ashtech processing data file" checkbox is used to control whether or not the B-, E-, S-, etc. files will be created immediately following the download of the associated receiver file image U-File. **Micro-Manager** will decompress the U-File by using an automated call to UpackU12.exe (see Appendix F). The automated call ensures that the created decompressed files will have the same file name form and output directory as that of the U-File. The decompression program UpackU12.exe is supplied, installed, and made available for use when the installer for **Micro-Manager** is used to install **Micro-Manager**. If you intend to use the decompression option of **Micro-Manager** (i.e., you check the subject checkbox), then the program UpackU12.exe must be located in the same directory in which the MicroMgr.exe program resides. If UpackU12.exe is not there, **Micro-Manager** will generate an error message.

The "Convert decompressed files to RINEX" checkbox allows you to automatically convert the decompressed B-, E-, S- and D-Files to their RINEX counterparts (for the **Micro-Manager** Professional version, D-Files that contain meteorological data are used to create RINEX meteorological files). **Micro-Manager** performs this conversion by an automated call to XYZAshRx.exe. The automated call ensures that the created RINEX files will have the same file name form and output directory as that of the original U-File. This RINEX conversion program is supplied, installed, and made available for use when the installer for **Micro-Manager** is used to install **Micro-Manager**. If you intend to use the RINEX conversion option of **Micro-Manager** (i.e., you check the subject checkbox), then the program XYZAshRx.exe must be located in the same directory in which the MicroMgr.exe program resides. If XYZAshRx.exe is not there, **Micro-Manager** will generate an error message. When using this automatic decompression option of **Micro-Manager** it is important that you configure the RINEX options as desired (see Section 3.1.4). There are several RINEX headers and conversion options that may specific to each receiver site (such as selecting the 'agency' creating the RINEX file).

If you make a copy of the **Micro-Manager** program files for the purpose of running multiple copies on a single computer, please ensure that you also copy all of the support program files (i.e., .EXE and .INI files) associated with programs UpackU12 and XYZAshRx.

As described in Section 3.1.5, **Micro-Manager** implements a Post-Download Command feature. Checking the checkbox labeled "Launch Post-Download Commands after downloads and conversions" enables the execution of these commands (if there are any entered). See Section 3.1.5 for details on Post-Download commands.

There are several other attributes of the receiver files that one can control by right clicking in the file list area. Upon right clicking in this area, a pop-up menu like the following will be displayed:



Selecting the "Edit Output U-File Name" menu option will activate the previously described "Rename Output U-File" window, which enables one to rename the currently selected U-File. The "Select All Files" menu option will cause **Micro-Manager** to set the "Sel" status of all files to "Yes". The "Deselect All Files" menu option will cause **Micro-Manager** to set the "Sel" status of all files to "No". Selecting the "Change Output Path" option will present the output path selection described in Section 3.1.6.3. The "Edit Post-Download Commands" option activates the post-download commands editing described in Section 3.1.5. The "Show Memory Map" shows a detailed view of the receiver's memory map. The "Close Active File" will instruct **Micro-Manager** to issue the active file closure command to the receiver (i.e., the "$PASHS,FIL,C" command). After issuing the file closure command, **Micro-Manager** will immediately attempt to re-load the receiver file directory information.

Two additional items will affect the receiver files window:

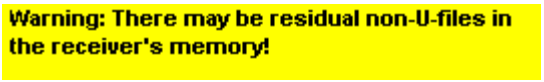
1) The μZ-Family of receivers have been designed to allow firmware uploads; and
2) The μZ-Family of receivers treats the receiver memory in a manner similar to the way your computer handles hard disks.

Both of these items affect the memory use reported in the Receiver Files window.

Firmware uploads are discussed in more detail in Section 4.1.5.3. However, some aspects of firmware uploads affect the Receiver Files window. Specifically, when a firmware upload takes place, part of the receiver's memory is used as a staging area for the upload. To ensure separation between GPS data files and firmware files, the firmware files are stored differently from normal GPS data files: these non-GPS data files are called "non-U-files". If the firmware upload terminates prematurely (e.g., a user cancels the operation) or you have forgotten to erase an uploaded firmware file, that firmware file will remain in the receiver's memory (and will occupy space). Because of the separation between GPS data files and firmware files, the receiver does not report these non-U-Files in its directory listing.

As we said earlier, the µZ-Family of receivers treats the memory in a manner similar to the way your computer handles hard disks. When you request a directory listing of the files on your computer, the computer does not normally respond with the number of bad sectors flagged on its hard disk. Like that of your computer, the µZ-Family of receivers does not report these bad sectors in their directory listings. Furthermore, like that of your computer's hard disk, some amount of bad sectors is normal. Also like that of your computer's hard disk, the receiver's memory can degrade over time and extended use. Memory card degradation is rare and normally occurs from extreme age, extreme use, and/or extended operation of the receiver outside of its specified operating environments (e.g., extremely hot environments which are outside the specified operation temperature range).

When total memory utilized by non-U-files and bad sectors surpasses a pre-defined amount, which is editable by you as explained later, the following message will be displayed in the lower-left area of the Receiver Files window:



When this message is displayed, you can instruct the receiver to delete any non-U-files from the receiver's memory. This is accomplished by right clicking in the directory listing area of the Receiver Files window. The right-click operation will cause a pop-up menu to be displayed, and by selecting the "Delete Non-U-files" entry (which is displayed in the pop-up menu only when the above warning message is displayed) **Micro-Manager** will issue a command to the receiver instructing it to delete all non-U-files. After the non-U-file delete command is issued, **Micro-Manager** will re-request the receiver's directory information and the warning message should be removed.

If, after the directory information is reloaded, the warning message has not been removed, there can only be two causes:

A) The receiver did not receive and process the non-U-file deletion command (because of communication errors); or
B) There are a rather large number of bad blocks (or bad sectors) flagged in the receiver's memory.

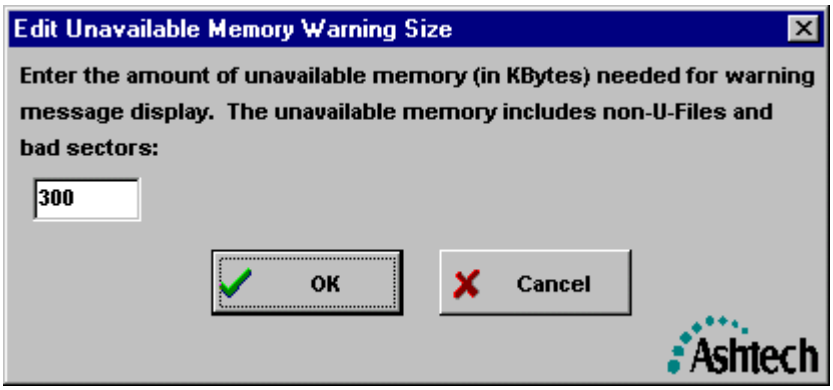
When either occurs, the following procedure is recommended:

1) Reissue the non-U-file delete process several times.
2) Completely reset the receiver's "Internal" and "External" memory (see Section 4.1.5.2). This will cause the receiver's memory card to be reformatted.

If, after you have performed the above procedure, the Receiver Files window still displays the warning message, it is possible that your receiver's memory card has begun to degrade. This is because the above procedure should completely remove the non-U-files from the receiver's memory, leaving only bad blocks as the cause of the warning message. At this point, you have the option to raise the criterion used to display the warning message. The rationale for changing the

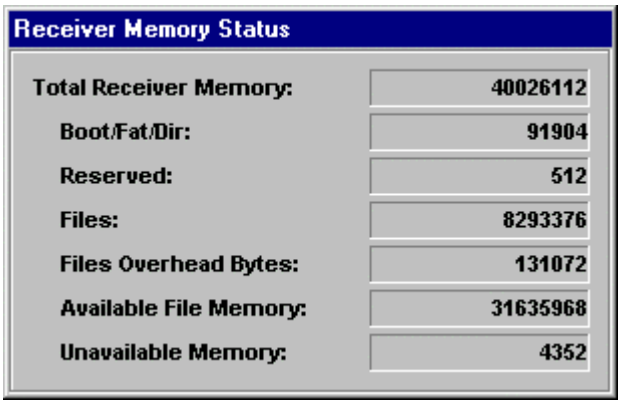
criterion is simply to remove the warning message from the display, and should the card begin to degrade further, the message will be redisplayed (based upon the new criterion). Use the procedure that follows to change the criterion controlling the display of the warning message.

1) Position the mouse pointer over the above warning message and right-click. Upon doing so **Micro-Manager** will display a pop-up menu with the single menu entry entitled "Edit Memory Warning Size". Upon selecting that menu entry the following edit window will be displayed:



2) Increase the value of the Unused Memory Warning Size through the above edit window. The maximum value accepted by **Micro-Manager** is 1024 KBytes (or 1 Mbyte).

Additionally, you can monitor the receiver's memory and observe any degradation through the "Unavailable Memory" field of the following pop-up window:



(Note: The above window will automatically be displayed simply by resting the mouse pointer over the warning message described above. This window will automatically close when you move the mouse pointer outside of the warning message display area or when the window is displayed for 15 seconds.).

The “Unavailable Memory” field of the Receiver Memory Status window displays the number of bytes occupied by the non-U-files and bad memory blocks (or sectors). If there are no non-U-files in the receiver’s memory and the receiver’s memory card begins to degrade, then the “Unavailable Memory” may begin to increase rapidly.

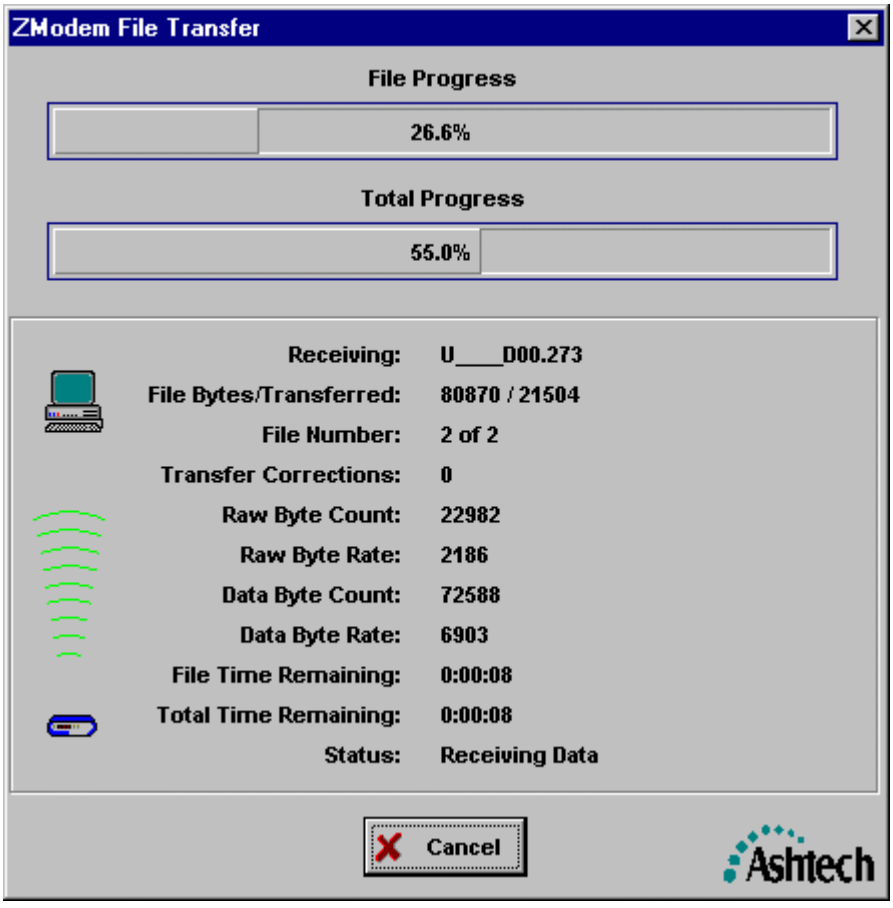
4.1.5.1.1 Downloading Selected Files

To download a given file, or set of files, select the appropriate files and then press the “Download” button. You will be prompted to continue or to abort the current download operation when the available disk space on the target disk drive (see Section 3.1.6.3) may not be enough to accommodate the selected files. The values calculated for the required disk space are merely estimated because of the following:

A) The Log File may have data written to it which **Micro-Manager** cannot predict; and
B) When a file is created on the target disk, the amount of space used by Windows for that file on disk differs from disk type to disk type.

As such, the amount of space required can only be estimated and you are warned when it appears that the disk **may** become too full.

During the download operation you will be provided with a display which reports the download progress. This window, shown below, describes the progress of a single download operation (that has more than one download file selected).



The fields of the download window are described in the table that follows.

Field	Description
File Progress Bar	The File Progress Bar shows the percentage of the "Receiving" file transferred thus far.
Total Progress Bar	The Total Progress Bar shows the percent complete of the total number bytes of all the files selected for download.
Receiving	Describes the target file name (i.e., the local computer disk file name). The output directory is not displayed but all downloaded files are output to the directory specified under Section 3.1.6.3.
File Bytes / Transferred	Displays the ratio of total bytes required by the file over the total number of bytes of the file transferred thus far. Sometimes the word "Extended" will appear in this field. When this occurs, **Micro-Manager** is currently downloading the "Active" receiver file (i.e., the file that the receiver is currently storing data to) and has detected that the file size exceeds that reported by the receiver when the transfer started. This is NOT an erroneous condition. Rather **Micro-Manager** is simply indicating that it will download more bytes for this file than it originally indicated.
File Number	Displays the file number in an *X* of *Y* format, where *Y* is the total number of files selected for download and *X* is the number of the current file being downloaded.
Transfer Corrections	Whenever the file transfer process detects any error and is able to recover from that error, the "Transfer Corrections" value will increment by one. This number is provided as a communication quality measure to you, the user. Normally, this number will stay very small (say less than 10 for a 4 Mb file). Should you see larger values for this number, you should consider decreasing the communication speed (see Sections 3.1.1.2 and 4.1.5.4.2) because the likely cause is a noisy data link (which is normally improved by decreasing the data communication rate).
Raw Byte Count and Raw Byte Rate	These fields provide information about the raw data communicated between the receiver and **Micro-Manager**. That is, the protocol used for the file transfer requires some overhead bytes. These numbers include these overhead bytes as well as actual file data byte (i.e., they deal with all data bytes communicated). The "Raw Byte Count" is the actual count of the bytes required thus far to transmit the file. The "Data Byte Rate" provides an indication of the effective throughput (in bytes per second) of the transfer including protocol overhead bytes. These numbers are provided only as status information that lets you know that **Micro-Manager** and the GPS receiver are communicating data.

Field	Description
Data Byte Count and Data Byte Rate	These fields provide information about the data bytes of the file being transferred between the receiver and **Micro-Manager**. That is, the protocol used for the file transfer requires some overhead bytes. These numbers provide counts of actual file bytes transmitted thus far (and do not include the overhead bytes of the protocol used). The "Data Byte Count" is the actual count of the file bytes transferred thus far (including any re-transmits that the protocol has requested). The "Data Byte Rate" provides an indication of the effective throughput (in bytes per second) of the file transfer. These numbers are provided only as status information that lets you know that **Micro-Manager** and the GPS receiver are communicating data.
File Time Remaining	This field provides an estimated time to complete the transfer of the current file that is based upon the data transferred thus far (and the time required to transfer that data). Sometimes you may see this estimated time suddenly change. This IS normal and CAN be caused by such factors as communication delays, noisy communication lines, delays caused by the handshaking mechanisms of the file transfer protocol and recovery from transfer errors.
Total Time Remaining	This field provides an estimated time to complete the transfer of all selected files that is based upon the data transferred thus far (and the time required to transfer that data). Sometimes you may see this estimated time suddenly change. This IS normal and CAN be caused by such factors as communication delays, noisy communication lines, delays caused by the handshaking mechanisms of the file transfer protocol and recovery from transfer errors.
Status	This field provides a short text description of what the protocol transfer is doing and any errors it is trying to recover from.

The downloaded files are stored in the Ashtech U-File format. The U-File format is also referred to as the μZ-Receiver image format. This is based upon a proprietary compression formulation. To convert these files to normal receiver data files (such as the Ashtech B-, E-, and S-Files) you will need to run UpackU12 either automatically (see Section 4.1.5.1) or manually (see Appendix F).

It is important to note that if an image file is partially downloaded, it will not be automatically decompressed or converted to RINEX. Partially downloaded files occur when you press the "Cancel" button of this window or too many errors occur in the transfer. Furthermore, if you attempt to manually decompress partial receiver image files (i.e., using UpackU12), the unpacking program will report checksum errors and only decompress a portion of that file.

4.1.5.1.2 Deleting Selected Files

To delete a given file, or set of files, select the appropriate file, or files, and then press the "Delete" button. Upon pressing the "Delete" button **Micro-Manager** issues a command to the receiver which will delete all selected files. **Micro-Manager** will then re-request the directory listing of the receiver and re-display that listing in the window described in Section 4.1.5.1.

4.1.5.1.3 Download and then Delete Selected Files

To download and then delete a given file, or set of files, select the appropriate files and then press the "Download & Delete" button. After doing so, **Micro-Manager** will begin the download of the selected files and will show the window described in Section 4.1.5.1.1. Only after the files are successfully downloaded (and converted, when appropriate) will **Micro-Manager** begin the process of deleting the selected files. The deletion process operates as described under Section 4.1.5.1.2.

The downloaded files are stored in the Ashtech U-File format. The U-File format is also referred to as the µZ-Receiver image format. This is based upon a proprietary compression formulation. To convert these files to normal receiver data files (such as the Ashtech B-, E-, and S-Files) you will need to run UpackU12 either automatically (see Section 4.1.5.1) or manually (see Appendix F).

It is important to note that if an image file is partially downloaded, it will not be automatically decompressed or converted to RINEX. Furthermore, **Micro-Manager** will not perform the deletion processing. Partially downloaded files occur when you press the "Cancel" button of this window or too many errors occur in the transfer. Furthermore, if you attempt to manually decompress partial receiver image files (i.e., using UpackU12), the unpacking program will report checksum errors and only decompress a portion of that file.

4.1.5.2 Resetting Receiver Firmware

Built into **Micro-Manger** is the ability to reset the receiver's firmware. There are various reasons why one would want to reset the receiver's firmware, examples of which include the following:

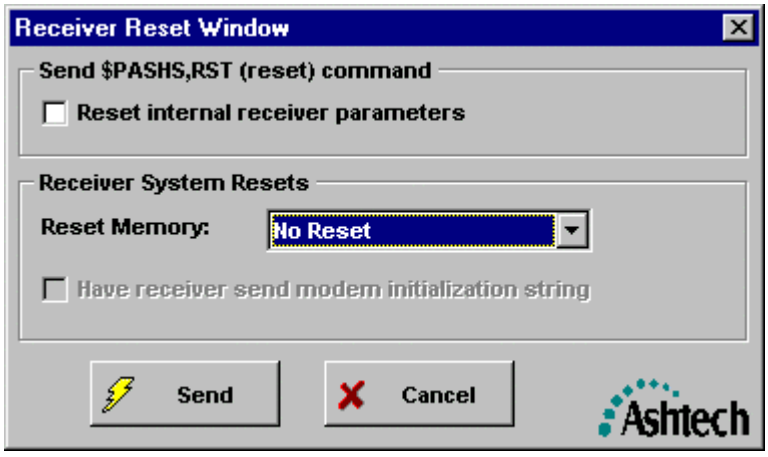
1) You have just loaded firmware and want to reset the receiver to the factory default settings associated with this new firmware.
2) You simply want to reset the firmware back to the factory default settings.
3) You suspect that you had a power supply problem that has corrupted the operation of the receiver.
4) You want to reset the file storage memory, which erases it but gives you a positive response on the health of the memory board.

Firmware resets DO NOT alter options currently set in the receiver. For example, if your receiver was initially shipped without the RTK mode enabled and you later received an update that enabled the RTK mode, a firmware reset WILL NOT disable the RTK mode. Or said differently, a firmware reset can reset the firmware back to the factory defaults for the receiver options that are currently available for that receiver.

There are two general types of reset operations that can be performed, one of which permits several options. The type of reset operation, and its options, depends upon what exactly you wish to accomplish. All of these choices have been merged into one convenient window that will prevent incorrect or confusing reset modes. It is important to note that while this window

does impose logic to avoid these incorrect or confusing modes, you can still use the terminal window of **Micro-Manager** (see 4.1.6) to perform any type of reset allowed under the receiver command structure.

The Receiver Reset Window (shown below) is divided up into two primary sections.



The first section of the window deals with a relatively simplistic reset of receiver parameters. By selecting the "Reset internal receiver parameters" check box (and then pressing the "Send" button), you will be sending the receiver the $PASHS,RST command. This command will, with a few listed exceptions, reset all receiver parameters (not data file memory) back to their factory default values. The following table lists these exceptions.

Receiver Command Mnemonic	Description
POW	Receiver battery capacity and voltage parameters.
MET	External Meteorological Sensor device interfacing configuration parameters.
TLT	External Tilt Sensor device interfacing configuration parameters.
MDM	Modem configuration parameters.

The second half of the window deals with firmware resets and file memory storage resets. The following table lists the choices of the drop-down list box and description of each:

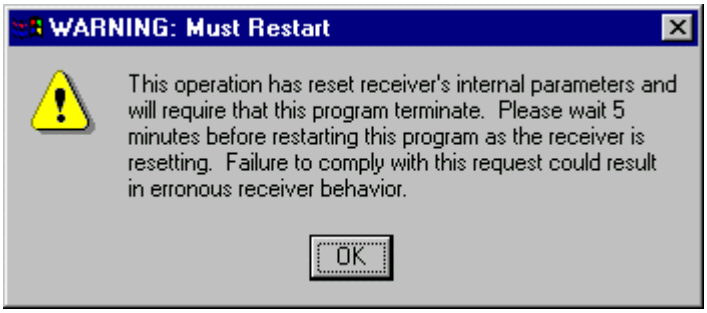
Choice	Description
No Reset	No memory or firmware reset will occur. This is supplied only to avoid possible confusion when you have selected the "Reset internal receiver parameters" checkbox in the first half of the window.
Internal	Reset the receiver's internal memory (i.e., the battery backed up memory) that stores the configuration parameters of the receiver (e.g., epoch intervals, session programming, and elevation masks). This option, unlike the "Reset internal receiver parameters" checkbox of this window, will reset all of the parameters of the receiver. There is one exception, however, which deals with the modem options. This will be described toward the end of this section.

Choice	Description
External	Reset the receiver's file memory storage. This operation will send a command to the receiver that instructs it to fully erase its file storage memory area and then validate that that memory area is operating properly.
Int. & Ext.	Selecting this option (and then pressing the OK button) will result in the issuance of a receiver command instructing the receiver to perform a full Internal and External reset. That is, the above operations described for both Internal and External will be performed.

As was indicated in the above table, whenever the "External" or "Int. & Ext." operations are selected, and you press the OK button, the external memory reset operation will take place. This reset operation will clear the receiver's data file storage memory and, in that process, validate that memory area. You can observe the validation results by Opening **Micro-Manager**'s Terminal window (see Section 4.1.6) before opening the Receiver Reset Window. If the terminal window is open when one performs this reset operation, the terminal window will display the response given by the receiver. This response could take several minutes depending upon the amount of memory your GPS receiver has installed. The following is an example response you would see in the Terminal window:

$PASHR,ACK
$PASHR,CLM,WAIT*11
$PASHR,CLM,SIZE,03912KB*33
$PASHR,CLM,PASSED*0A

Whenever any one of the above reset operations is selected you will be presented the following window.



This window indicates that the reset operation will cause a loss of communication with the GPS receiver. When you acknowledge this window (via pressing the OK button**), Micro-Manager** will terminate. This loss of communication will occur during the period that the receiver is executing the reset command. But, you are advised to disconnect from the receiver for 5 minutes to ensure that the receiver has been fully reset before you attempt to reconnect with it. Please note that we previously stated that you could use the Terminal Window to watch the response to the commands that reset the receiver's file storage memory area. But as soon as you issue the reset command (by pressing the OK button in the Receiver Reset Window) this restart warning window is displayed. You may wait for the status of the memory clear operation to be reported

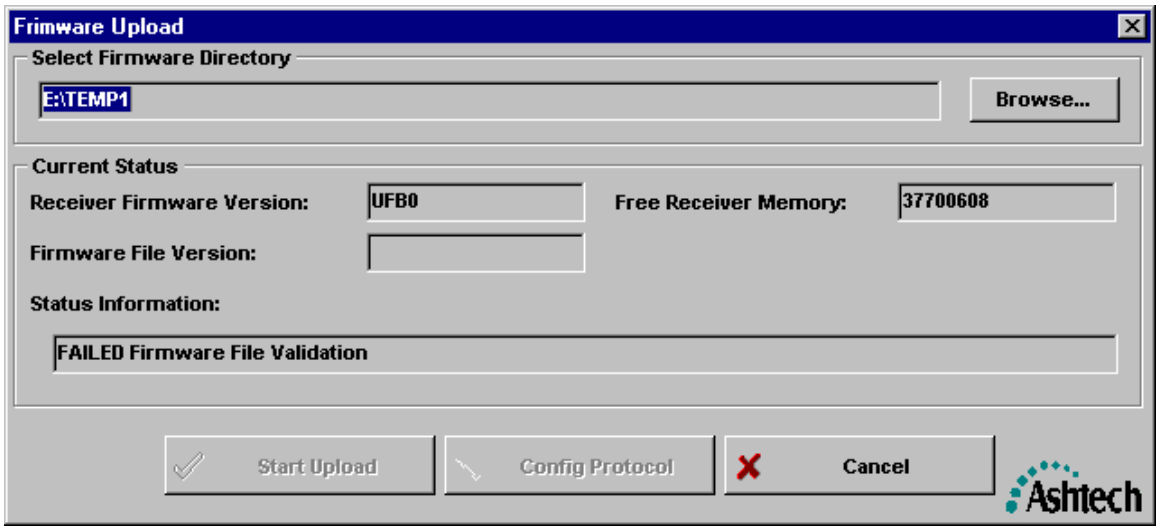
since the terminal window will still show any responses output by the receiver. If so, do not press the OK button of this restart warning message until after the memory clear operation is reported and you want to exit the program.

The one parameter of this window not yet described is the checkbox labeled as “Have receiver send modem initialization string”. The rationale for this is quite simple. If you are connected to the receiver via a modem or you have configured the receiver such that it will have a modem attached, you will want to re-initialize that modem whenever the receiver is reset. This will ensure that the modem is fully reset and ready to accept incoming calls. This last parameter will become active only when you have configured a modem to operate with the receiver (see Section 4.1.5.4.2). If you select a reset option and select the “Have receiver send modem initialization string”, then when you press the OK button, **Micro-Manager** will send a command that causes the desired reset operation and then the receiver will send the modem initialization string to the receiver.

4.1.5.3 Upload Firmware

Micro-Manager permits the upload of firmware to the µZ-Family of receivers. Thales Navigation has paid particular attention to providing reliable and stable firmware uploads. That is**, Micro-Manager** contains a built in firmware uploading capability that utilizes a protective firmware upload protocol, reliable firmware file formats, and very stringent firmware crosscheck procedures. The result is a reliable means of upgrading your receiver’s firmware either through a direct connection or a remote connection.

Upon selecting the “Upload Firmware” option, you will be presented with a window similar to the following:



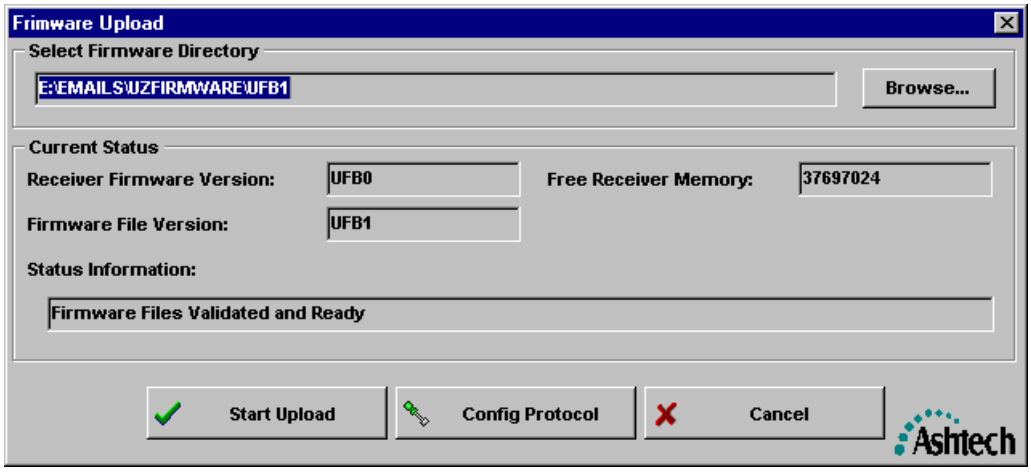
The field labeled as “Receiver Firmware Version” displays the version of firmware currently loaded into the receiver’s memory. The “Free Receiver Memory” field describes how much

memory (i.e., within the GPS receiver) is available for firmware uploads. The "Select Firmware Directory" will display the directory in which **Micro-Manager** will look for firmware files to be uploaded to the receiver. To select a different directory, press the "Browse" button and you will be given the opportunity to find the directory that contains your firmware files.

Once you have selected the directory containing the firmware files**, Micro-Manager** will automatically begin scanning and validating those files. During this scanning and validation process, the "Status Information" line will show the status of the validation process. As can be seen in the above example window, the status "FAILED firmware File Validation" was reported. In fact, selection of the above directory also yielded the following message from **Micro-Manager**.

This message and the status displayed in the Firmware Upload window imply that the firmware directory selected (i.e., "E:\TEMP1") contains no valid firmware files to be uploaded to the receiver. Notice also in the Firmware Upload window that the "Start Upload" and "Config Protocol" buttons are not enabled, as indicated by their slightly grayed-out appearance.

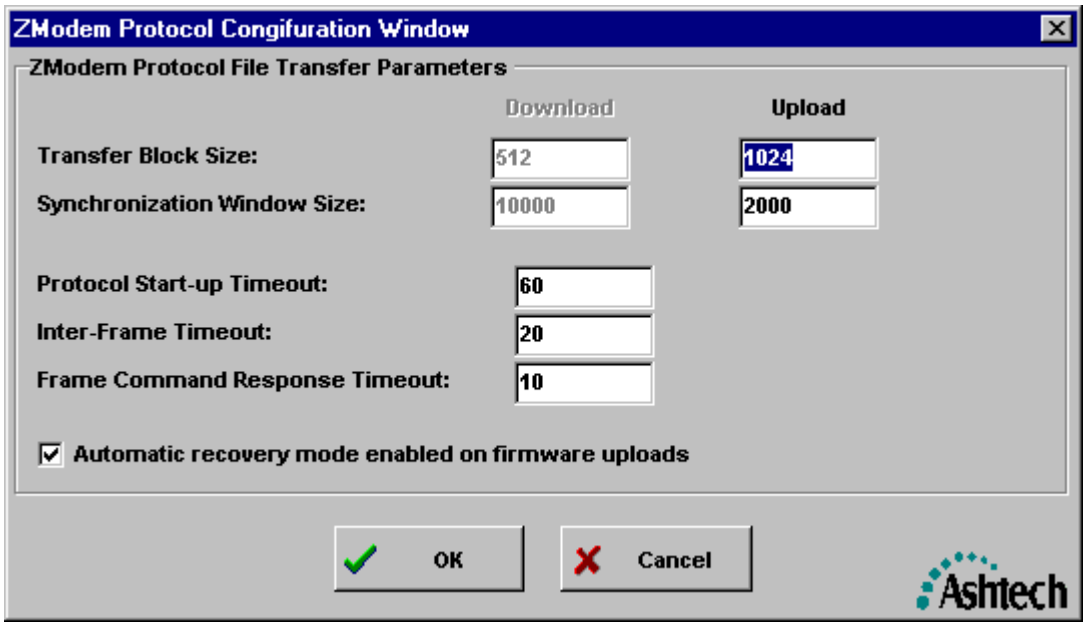
Consider the following window in contrast to the last window example.



In the above example window, the selected firmware path does contain valid firmware files. This is confirmed by the displayed status (i.e., "Firmware files Validated and Ready") and by the now-

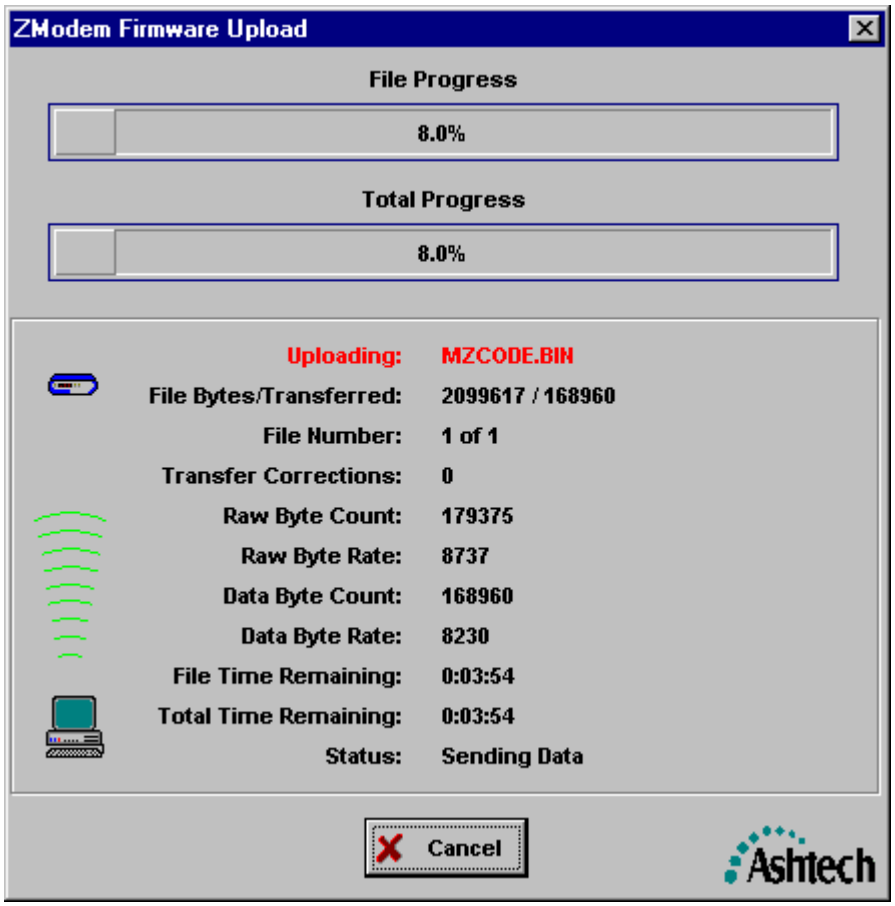
enabled “Start Upload” and “Config Protocol” buttons. When the window has this appearance, **Micro-Manager** is indicating that it has validated the firmware files in the selected directory and is ready to begin the firmware uploading process.

At this point, you could choose to alter the parameters that govern the transfer of the firmware files to the receiver. By pressing the “Config Protocol” button you will be presented with the following window:



The parameters of this window are described in Section 3.1.6.4.

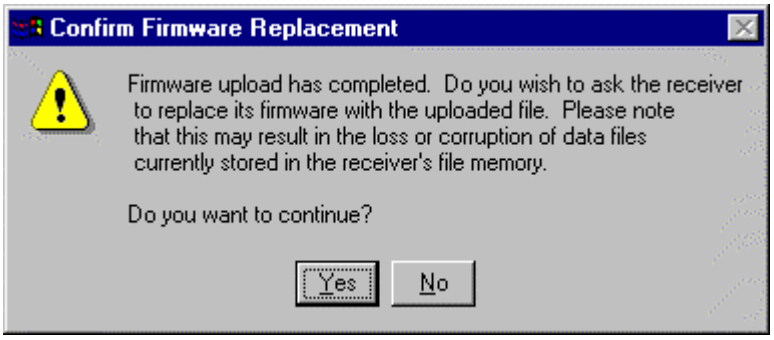
To begin uploading firmware, press the “Start Upload” Button on the Firmware Upload window. Once the upload starts you will be given an upload status window similar to the following:



You may have noticed that the window used for firmware uploads looks very similar to the window used for receiver file downloads (i.e., to the PC). This is true. In fact you can refer to Section 4.1.5.1.1 for a complete description of the parameters displayed in this window. Just keep in mind when reading those descriptions that they are ***now*** describing the transfer of files to the receiver.

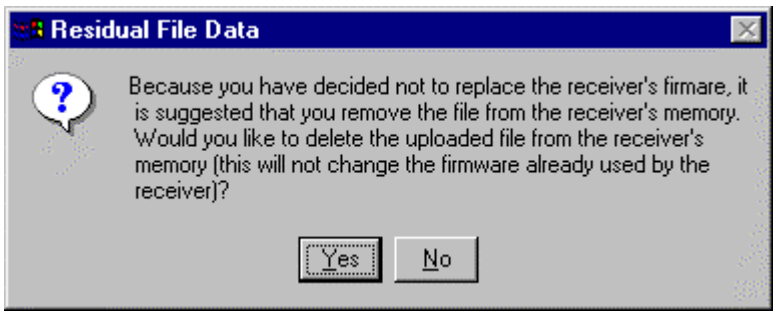
As said earlier, firmware uploads are protected by a multi-tiered mechanism. Should the uploading process fail or be canceled at any stage, the uploaded firmware will not be used by the receiver (i.e., it would continue to use the firmware resident before the firmware upload process was started). This is important because at this point in the upload process, the firmware file being uploaded is being written safely to a staging area. Should this upload be interrupted for any reason and assuming you have selected the "Automatic recovery mode enabled on firmware uploads" option, you can later continue the firmware upload where you left off.

Once the firmware is fully uploaded **Micro-Manager** will ask you to confirm the replacement of the existing firmware with the newly uploaded firmware file.



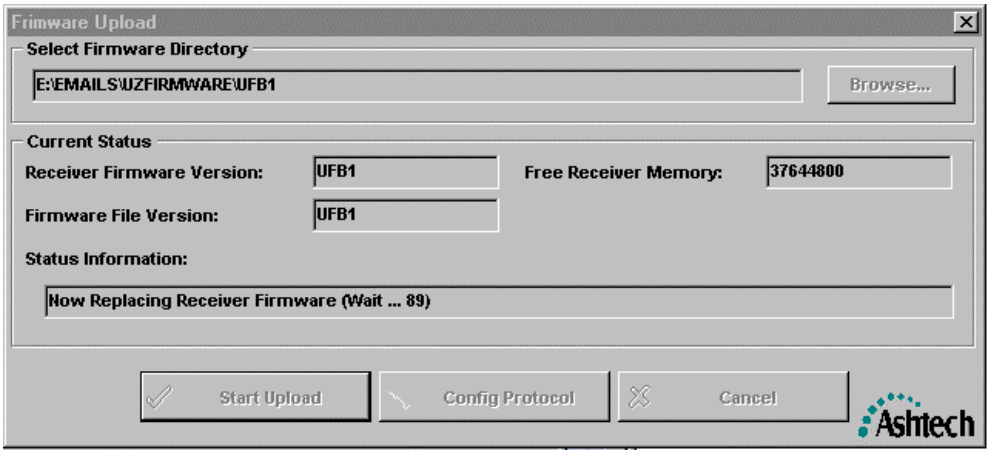
Notice that the Firmware Replacement prompt window warns of the possibility of lost or corrupted data files. For this reason you should download all important files from the receiver memory prior to attempting a firmware change. This is because the new firmware may invoke a new file storage format and it may not recognize the old storage format. Such a change should happen very rarely, but we encourage you to NEVER trust the data files stored in the receiver immediately after a firmware loading operation. Thales Navigation strongly recommends that after loading any new firmware into the receiver, you issue a full "Internal and External" memory reset (as described in Section 4.1.5.2).

If you answer "No" to the above prompt, **Micro-Manager** will issue another prompt window.

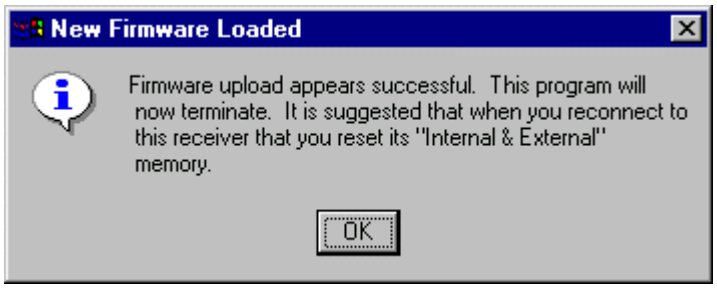


This window is simply indicating that you have left a firmware file in the same memory area as is used for normal data file storage. Because the file is occupying valuable data storage memory, you should delete that file. However, you can leave the firmware file in receiver's memory (by answering "No") and then later burn that firmware using the firmware burn command (i.e., the "$PASHS,FSH,…" command described in your receiver manual) from the Terminal Window of **Micro-Manager** (see Section 4.1.6).

If you answer "Yes" to the "Confirm Firmware Replacement" prompt, the firmware upload window will be redisplayed and show a count-down timer in the status information area.



During this step, the receiver validates the receiver firmware file before it actually replaces its operating firmware with the newly loaded firmware. While the count-down timer (shown in the Status Information message "Now Replacing Receiver Firmware (Wait...89)") is counting, **Micro-Manager** is awaiting a positive acknowledgement from the receiver that the firmware file is valid. If the acknowledgement is received, **Micro-Manager** will display the following message:



This message indicates that the receiver has acknowledged the validity of the firmware files and is now actually burning that firmware for later use. Because the burn operation will cause the receiver to restart, communications with that receiver will be lost. Thus, **Micro-Manager** will have to be terminated; this will happen when you press the OK button of this window. Notice also that the displayed message includes a suggestion about resetting the receiver's internal and external memory. This is suggested for two reasons:

1) This type of reset will erase the staging area used for the firmware upload; and
2) As mentioned earlier, firmware replacement can potentially cause loss or corruption of previously collected data files as the new firmware may invoke a new file storage format and may not recognize the old storage format.

Therefore, you are strongly encouraged to perform a full internal and external reset (see Section 4.1.5.2) on your next connection with the receiver.

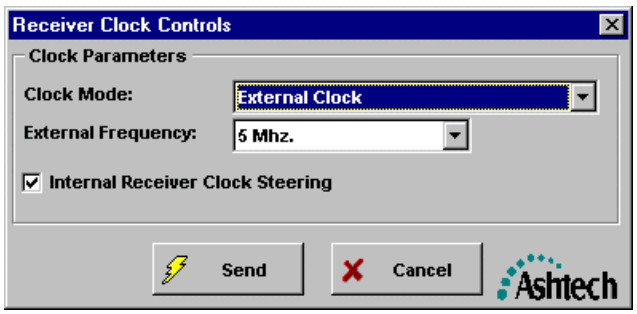
4.1.5.4 Receiver Settings

There are seven windows of **Micro-Manager** that deal with the configuration of the receiver. By selecting the "Settings" sub-menu of the "Receiver" main menu item you will be given the following pop-up menu.

From this menu, you can select the aspect of receiver configuration desired. For the parameters you edit through each of these windows, **Micro-Manager** will not permit you to enter values outside the range of permissible values for your particular receiver. Once you have made your desired changes in these windows, simply press the "Send" button of the window and the changes will be sent to the receiver. In all cases, **Micro-Manager** will await validation responses from the receiver to verify that the parameters sent are actually accepted by the receiver. Any failures will be reported.

4.1.5.4.1 Receiver Clock Parameters

The µZ-Family of receivers support the use of external clocks as well as an optional steering of the receiver's internal clock. The "Receiver Clock Controls" window provides access to these receiver clock parameters.



The table that follows describes the fields of the Receiver Clock Controls.

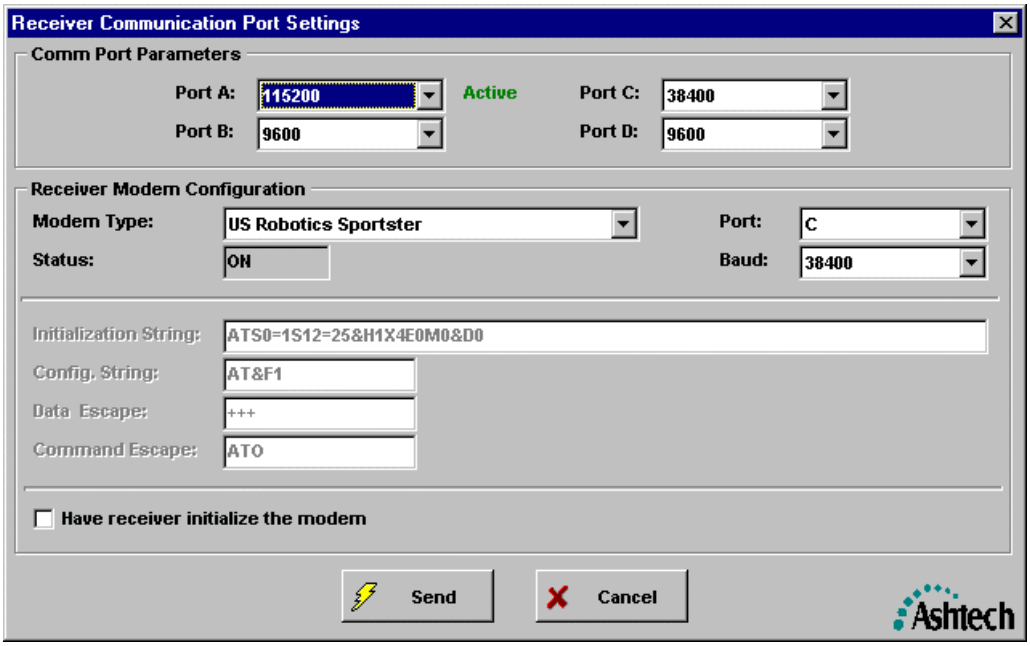
Parameter	Description
Clock Mode	Describes the desired clock to be used. "Internal" When the internal receiver clock will be used. "External" When an external clock will be attached to the receiver and used. "Automatic Switch" When the receiver will automatically switch to an external clock when one is detected, but will use the internal receiver clock whenever an external clock is not detected.
External Frequency	This field can only be edited when the Clock Mode parameter is set to either "External" or "Automatic Switch". This field is used to specify the frequency of the external clock.
Receiver Clock Steering	This checkbox is used to specify whether or not the receiver internal clock steering should be enabled when the internal receiver clock is used. When selected, the receiver's internal clock will be steered such that its clock offset remains close to zero (i.e., the receiver's clock will remain very closely aligned with the GPS time system). When deselected, the receiver's internal clock will not be steered and be permitted to drift with respect to the GPS time system. In this mode, the receiver's internal clock offset (and pseudo-range observations) will experience 1 millisecond jumps. These jumps occur when the receiver's internal clock offset has been computed to be approximately 1 ms offset from GPS time. For further details on this subject, please consult the appropriate receiver operations manual. You are permitted to enable the clock steering whenever an external clock mode is used (i.e., "External" or "Automatic Switch"). However, enabling the clock steering when using an external clock is not recommended and will elicit a warning from **Micro-Manager**.

To check on the status of the receiver clock parameters, particularly to determine if the receiver recognizes a configured external clock, use the Receiver Information window (see Section 4.1.4.5)

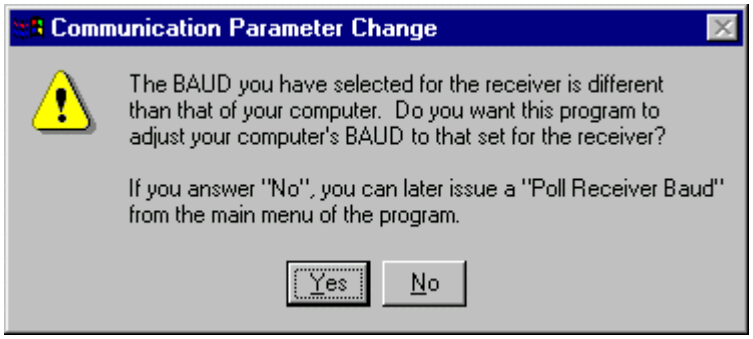
For more detailed information on the internal and external clock usage as well as the internal clock steering mode, please consult the appropriate receiver operations manual.

4.1.5.4.2 Receiver Port Settings

The following is an example Receiver Communication Port Settings Window.



Through this window you can configure the communication ports of the GPS receiver and any modem attached to the receiver. The window is divided up unto two areas. The first area deals with the communication speeds of each of the receiver's ports. You can use the drop-down list boxes to set the speed of each port individually. Notice in the example window that there is an "Active" flag next to the Port A field. This flag is used to indicate the receiver port that is currently being used to communicate with **Micro-Manager**. This is important because if you change the communication speed of that port, you may interfere with communication between **Micro-Manager** and the GPS receiver. When connected to the receiver by a modem, you are strongly discouraged from changing the "Active" port communication speed (because the effect on communications is modem dependent). If you are directly connected to the GPS receiver (i.e., not connected to the receiver via modem), if you change the "Active" port, and you press the "Send" button, **Micro-Manager** will issue the following prompt:



If you answer "Yes", then **Micro-Manager** will instruct the GPS receiver to change its communication speed (to that which you have selected) and then command your local computer to change its communication speed as well. If you answer "No", then **Micro-Manager** will command the receiver to change its communication speed but will not command the computer to change its speed. Thus, the two will be communicating at different speeds and you will be unable to communicate with the receiver until you either correct the computer's communication speed (see Section 3.1.1.3) or "Poll" the Receiver's Baud (see Section 4.1.2).

The second area of the "Receiver Communication Port Settings" window deals with the configuration of a modem attached to the GPS receiver. Through this area you can configure the type of modem and select the receiver port on which the modem is attached. There are several predefined modem types that can be selected through this window. When you select these predefined types, several edit fields (e.g., Initialization String, Config. String, Data Escape, and Command Escape) become disabled. This is because these fields are pre-defined and cannot be edited. If, however, your modem type is not listed or you want something different from the defaults, you can select the "USER DEFINED" modem type and provide the other parameters required to define your own modem type.

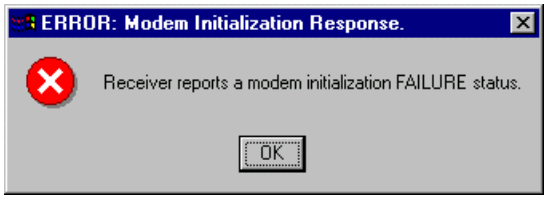
Shortly we will describe the parameter that you edit when you define a "USER DEFINED" modem type. Before doing so, some information about receiver modem strings needs to be discussed. In Section 3.1.2 we described how modem strings are entered for the configuration of the modem attached to the **Micro-Manager** computer. In that section we described special characters that are translated by **Micro-Manager** into delays and special control characters. Those special characters are not available through this window. That is, the modem strings entered through this window will NOT be translated as described in Section 3.1.2: what you enter will be sent to the modem. Also, you should avoid using spaces in your receiver modem strings, unless the initialization of that modem absolutely requires that they be present. The table that follows describes the modem parameters that can be defined when a "USER DEFINED" modem type is selected:

Parameter	Description
Initialization String	The string that will be sent to the modem to initialize the modem. This string will be sent whenever the receiver power is cycled or is commanded to initialize the modem. The contents of the string depend upon the modem being used and you should consult your modem manual for specifics. Finally, the receiver will attach the proper end-of-line sequence required by the modem.
Config. String	This string is another initialization string sent to the receiver. It is sent on the same events as is described for the "Initialization String" but will always be sent before the "Initialization String". Its purpose is to allow you to send another initialization string (because some modems actually need two initialization strings. Like that of the "Initialization String", the receiver will attach the proper end-of-line sequence required by the modem.

Parameter	Description
Data Escape	This is the sequence of characters the receiver will transmit to cause the modem to transition from the data transmission mode to the command mode. If these terms are not familiar to you, then you should consult your modem manuals for details.
Command Escape	This is the sequence of characters the receiver will send to the modem to cause it to transition from the command mode to data transmission mode. If these terms are not familiar to you, then you should consult your modem manuals for details.

We have stated elsewhere in this manual that there are slight hardware differences between members of the µZ-Family of receivers. That is, with the exception of Port A of µZ-CGRS receivers, the DTR/DSR hardware handshaking lines ARE NOT implemented. Most modems employ these lines as a signal to DROP the link (that is, when DTR drops, the modem will hang up the telephone connection). Therefore, unless you connect the modem to Port A of a µZ-CGRS receiver, you should configure your modem not to use the DTR signal. modems that support the Hayes-compatible command structure use the "&D0" setting to disable the use of the DTR signal.

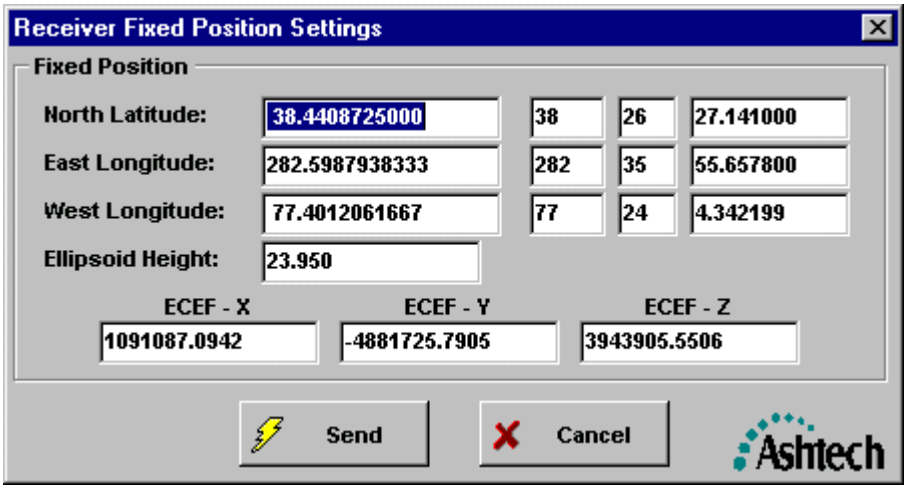
The final parameter of this window is labeled as "Have receiver initialize the modem". When this checkbox is checked and you press the "Send" button**, Micro-Manager** will not only send parameters according to the settings displayed in the window, but will ask the receiver to send the modem initialization strings to the modem. The receiver will report to **Micro-Manager** the success or failure to initialize the receiver's modem. **Micro-Manager** will pass that report on to you. When you get a failure, you will get the following message:



You can test your modem initialization string by directly connecting your Receiver's modem (via RS-232) to your computer, configuring **Micro-Manager** to use that port, and using **Micro-Manager**'s Terminal Window (see Section 4.1.6) to manually send the modem initialization string to the modem. The Terminal Window will report exactly what the modem responds with. Thus, you must be familiar with your modem manuals to have success with this test.

4.1.5.4.3 Receiver Fixed Position

The Receiver Fixed Position window is used to set the receiver reference position. This reference position is used, when the receiver is configured as an RTCM base station or an RTK base station, in the computations needed to support the base station. For example, when configured as an RTCM base station, the receiver needs to know the reference coordinates needed to compute the differential corrector values and other values transmitted in RTCM messages. The following is an example of this window.



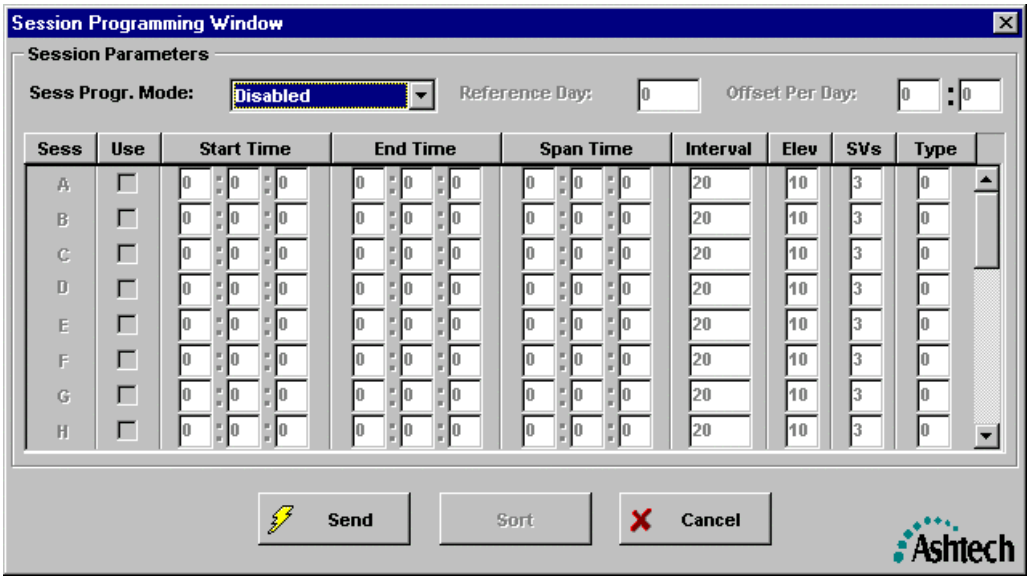
Parameter	Description
North Latitude East Longitude West Longitude Ellipsoidal Height	The reference station position in WGS-84 geodetic coordinates.
ECEF Position (X, Y, and Z)	The reference station position in WGS-84 Earth-Centered Earth-Fixed coordinates.

The positional data fields are very important. These fields, which allow you to enter a reference station position, are used by the receiver for such operations as creating differential correctors when the receiver is used as an RTCM differential base station. Any non-zero values will cause the receiver to use that positional data. When you set the Latitude, East Longitude and Ellipsoidal Height to zero, you are effectively deleting the reference position data. If you set these to zero, then the reference station position data in the Geodetic Position and Time Window, as well as the Earth-Centered Earth Fixed Position and Time Window, will indicate that there is no reference position set (see Sections 4.1.4.3 and 4.1.4.4, respectively).

4.1.5.4.4 Programming Sessions

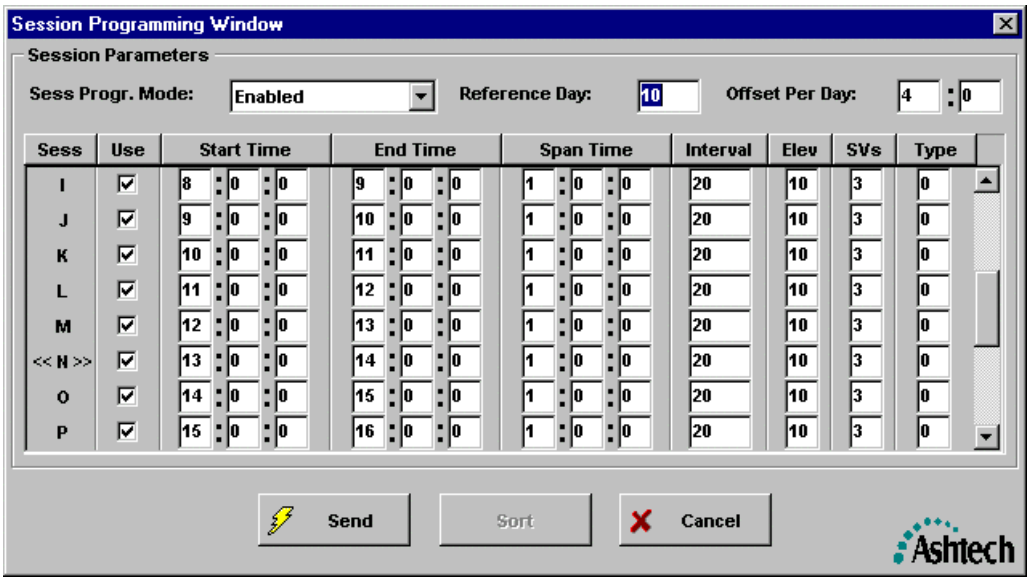
Using **Micro-Manager,** users can configure receiver-logging sessions. A session in this context is defined as a time period in which GPS data are collected. This ability to define numerous "sessions" is referred to as the Session Programming capability. These sessions delimit the times and provide the parameters governing the collection of GPS data. For example, the user can define a data collection session beginning at 1:00 AM every day, collecting data for 1 hour, collecting 1-second epoch data during that period, and using an elevation mask of 5 degrees. The user could then define another data collection session beginning at 10:00 AM every day, collecting data for 4 hours, collecting 20-second epoch data, using an elevation mask of 10 degrees, and storing data only when there are 4 or more satellites.

To access the receiver's session programming through **Micro-Manager** simply select the "Program Sessions" pop-up menu option of the "Settings" sub-menu option of the "Receiver" main menu option. You will be provided with a window similar to the following:



The above window shows an example where the receiver's session programming feature has been disabled. You enable the session programming feature of the receiver by setting the "Sess Progr. Mode" to either "Enabled" or "Sleep Mode" and the "Reference Day" to some reference day of the year. This will be explained later. To disable the session programming feature within the receiver you set the "Sess Progr. Mode" to "Disabled".

The following provides an example where the session programming feature of the receiver has been enabled.



Notice that the "Sess Progr. Mode" has been set to "Enabled" and the "Reference Day" is set to a non-zero value. The "Reference Day" denotes the day of the year to which the programmed sessions are referenced. That is, the times are defined in the context of that day. The reference day is needed as a reference for the "Offset Per Day" field. These two fields describe the amount of time (i.e., minutes:seconds) to subtract per day since the reference day. In this way, you can design your sessions to nearly coincide with the periodicity of the satellite geometry: i.e., the current GPS satellite geometry will be approximately repeated 4 minutes earlier each day. Whereas this feature was once frequently used, we realize this is no longer so. Today users prefer to set the "Offset Per Day" to zero so that the session will cover the exact same time every day. In summary, the "Reference Day" and "Offset Per Day" give the user a second choice: the capability to slide the daily sessions in a manner which retains constant geometry.

We previously stated that the "Sess Progr. Mode" can take on the values of "Disabled", "Enabled" or "Sleep Mode". We have already discussed the "Disabled" and "Enabled" modes but have not presented the "Sleep Mode". The only difference between the "Enabled" and "Sleep Modes" is that much of the receiver's boards are shut down between sessions to conserve power. These boards will be reactivated a few minutes before the session is scheduled to come active to allow the receiver to fully acquire any satellites visible to the receiver. The power will also be reactivated when the receiver is connected to a modem and an incoming telephone call is detected.

The table that follows describes the fields of the session entries.

Column Title	Description
Sess	(Not editable.) The single character session code of the session. When the receiver reports an active session (i.e., currently recording data under that session), **Micro-Manager** in turn displays that active session by surrounding the session code with "<<" and ">>". In the example screen display above, the receiver indicated that session N was active.
Use	A check in a 'Use' box indicates that the receiver will use the entered session.
Start Time	The start time of the session (GPS time of day). This will be adjusted by the "Offset Per Day" for each day after that reference day.
End Time	The end time of the session (GPS time of day). This will be adjusted by the "Offset Per Day" for each day after that reference day.
Span Time	The time span of the session (i.e., end time minus start time).
Interval	The observation epoch interval for the session: i.e., the epoch data rate.
Elev	The satellite elevation mask used during the session to filter out low elevation satellites.
SVs	The minimum number of satellites required for the data to be recorded at an epoch.
Type	This parameter is typically referred to as the "Data Mode" of the receiver. It defines the format of the data stored by the receiver. Consult your Receiver Operations Manual for details on the Data Modes.

To delete a session, simply set its start and span times to zero or place your cursor on one of the fields and right-click (to bring up a special session programming pop-up menu) and select the "Delete Session" item. To add a new daily session, or to insert a new one on a one-time basis, add it in an empty slot at the end of the list of non-zero sessions (i.e., those without zeroed start and end times). You will be given an opportunity to sort the sessions in chronological order. This will be described in the following paragraph.

During the editing of the session programming data, **Micro-Manager** will verify that the enabled sessions do not overlap. Once verified, and **Micro-Manager** detects that the sessions are not in chronological order, you are given the opportunity to sort them. **Micro-Manager** indicates the need to sort the sessions by enabling the "Sort" button and displaying a message in the lower left corner of the Session Programming window. You then can sort the sessions by pressing the "Sort" button. Sorting the sessions simply makes them more readable. When sessions overlap, **Micro-Manager** reports the condition in the lower left corner of the Session Programming window and the "Send" button is then disabled.

After you have completed the changes to the session programming, including enabling and disabling the session programming feature, press the "Send" button to send the sessions to the receiver for programming. **Micro-Manager** will perform a validity check of the sessions programmed by the receiver to ensure that the data were transmitted properly. Any errors will be reported to you through error message windows.

Finally, there is a special session programming pop-up menu that you can use to perform a standard set of configuration options. This pop-up menu (shown below) is accessed by right clicking once when the mouse cursor is placed in a field of any session.

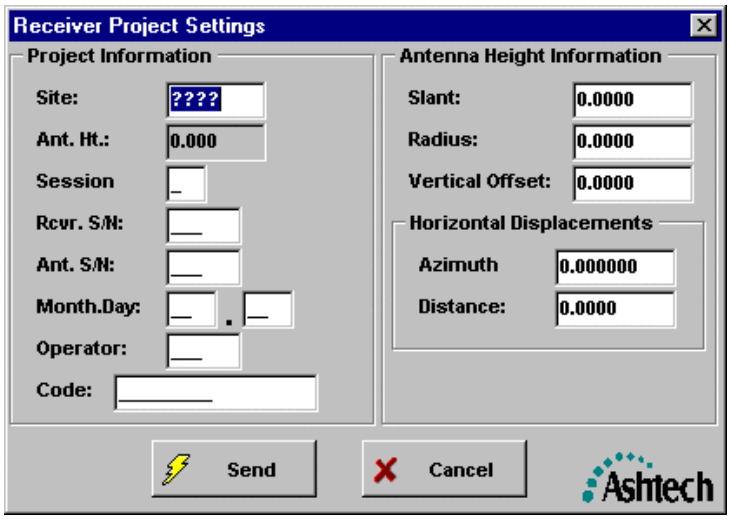
Selecting the "Delete Session" will cause the session that was being edited, when the right-click operation took place, to be deleted. The "Delete All Sessions", option deletes all sessions (which is the same as setting the "Sess Progr. Mode" to "Disabled"). The remaining items of the pop-up window allow you to auto-configure the receiver for several session configurations often used. For example, the "Auto Config 1 Hr Sessions", will cause **Micro-Manager** to create twenty-four 1-hour sessions, while the "Auto Config 6 Hr Sessions" will cause **Micro-Manager** to create four

6-hour sessions. These auto-configurations, like any other configuration set through the Session Programming Window, will not be sent to the receiver until you press the "Send" button.
NOTES:

1) Note that if you want to auto-configure sessions and you want to change the default values for sample rate, elevation mask or SV's, you can easily do this by changing these values in the first row, then right clicking on that row and select the Auto Config interval you desire. The edited values you entered in the first row will be copied into all of the other rows automatically.
2) The selections for 15 Minute and 30 Minute sessions are not available with pre-CJ10 receiver firmware versions.

4.1.5.4.5 Project Information

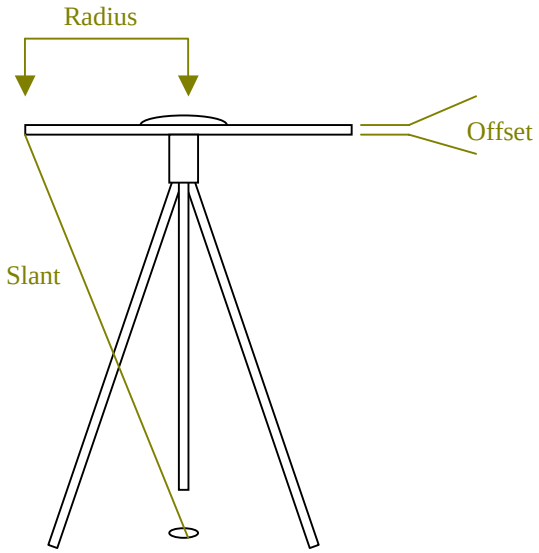
The "Receiver Project Settings" window allows you to edit data that is stored as part of the current file being recorded in the receiver's memory. Most of the information in this window is what is used to create the Ashtech Receiver Site file (or S-File).



Parameter	Description
Site	The 4 character Site ID. This ID will be written as the Site ID for each epoch recorded and part of the S-File information when recorded data are converted to normal Ashtech data files. Entries must be exactly four characters and contain no blank characters.
Ant. Ht.	The entered Height of Antenna (meters) above the mark. This field is not editable as it is derived from the other Antenna Height information available on the window. That is, it is derived using the following formula: Ant. Ht. = Vertical Offset + sqrt (Slant^2 - Radius^2) A drawing of these measurements is provided at the end of this table.

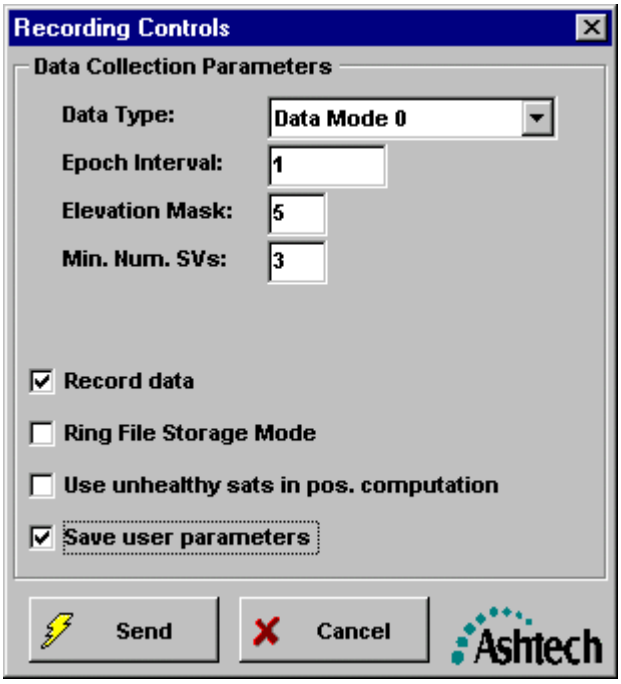
Parameter	Description
Session	A single character designating the session code. It is recommended that you leave this unchanged as **Micro-Manager** will automatically designate the sessions during download operations.
Rcvr. S/N	(Max. 3 non-blank characters) Usually used to record the last 3 digits of the receiver serial number.
Ant. S/N	(Max. 3 non-blank characters) Usually used to record the last 3 digits of the antenna serial number.
Month.Day	Month and Day. Used only for documentation purposes.
Operator	(Max. 3 non-blank characters) Usually the operator provides his/her initials.
Code	(Maximum of 13 non-blank characters) Any 13-character code sequence you may desire to be recorded as part of the file information.
Slant, Radius Vertical Offset	The three components that are used to compute the Antenna Height that is stored as part of the project information in the receiver (see the Ant. Ht.) parameter described earlier in this table.
Azimuth and Distance	These fields are placeholders for potential future efforts that may allow reference coordinates to be offset from some known mark.

The drawing that follows shows measurements used to compute the full antenna height information. Please note that if you have no slant and radius components, simply enter the antenna height into the field labeled as Vertical Offset.



4.1.5.4.6 Recording Controls

The Record Controls window allows you to set parameters that govern the general data recording controls and to set the “Save” mode of the receiver.



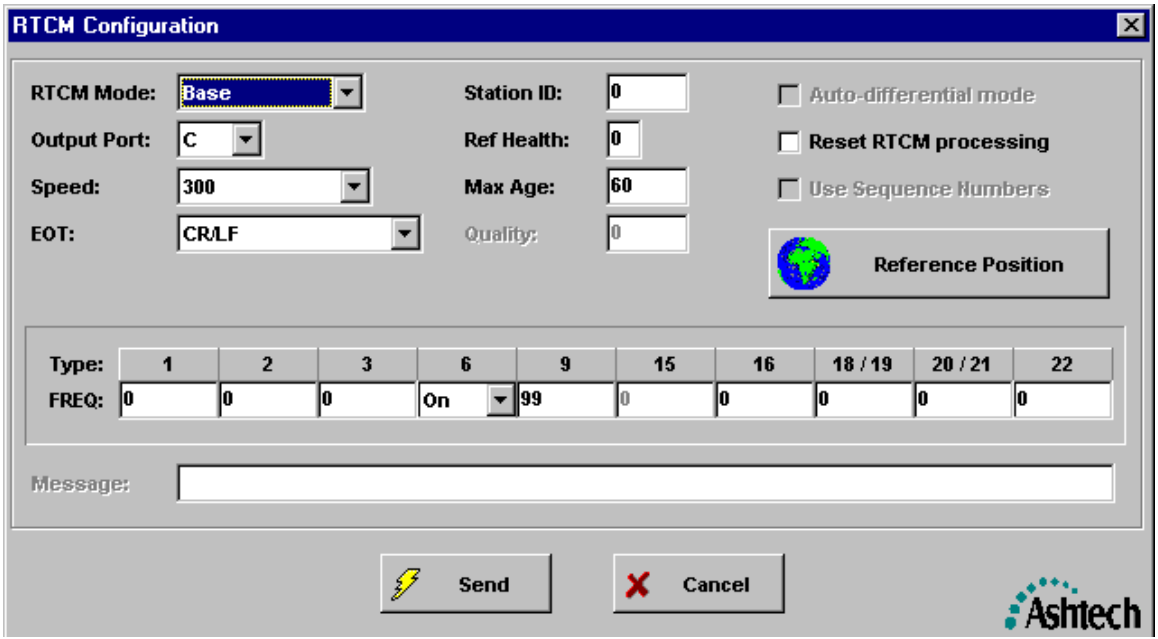
The following table explains the parameters of this window.

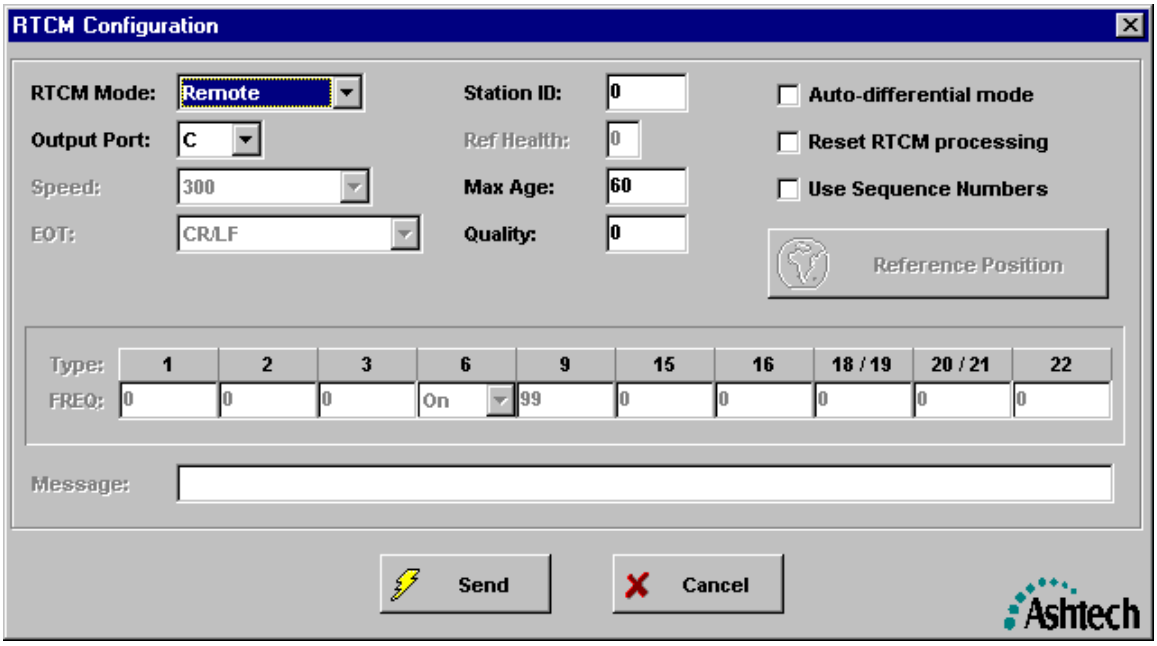
Parameter	Description
Data Mode	This parameter is typically referred to as the "Data Mode" of the receiver. It defines the format of the data stored by the receiver. Consult your Receiver Operations Manual for details on the Data Modes. This parameter takes affect in the general recording of GPS data when Session Programming is not in use (see Section 4.1.5.4.4).
Epoch Interval	Specifies the rate (in seconds) at which GPS data are recorded to memory files. This parameter takes affect in the general recording of GPS data when Session Programming is not in use (see Section 4.1.5.4.4).
Elevation Mask	Specifies the data recording and position computation elevation mask (0 to 89 degrees). That is, any satellites that fall below this elevation angle will not be recorded in the memory files nor will they be used in the receiver's position computations. This parameter takes affect in the general recording of GPS data when Session Programming is not in use (see Section 4.1.5.4.4).
Min Num SVs	Specifies the minimum number of satellites required to allow data recording. That is, when the number of tracked satellites falls below this value, the data observed by the receiver will not be recorded in the memory files. This parameter takes affect in the general recording of GPS data when Session Programming is not in use (see Section 4.1.5.4.4).
Record Data	This parameter can be thought of as a master recording control. When checked, the receiver is permitted to record data and will use other factors (such as Elevation Mask and the minimum number of satellites) to determine what is recorded. When unchecked, the receiver is not permitted to record data regardless of other parameters.

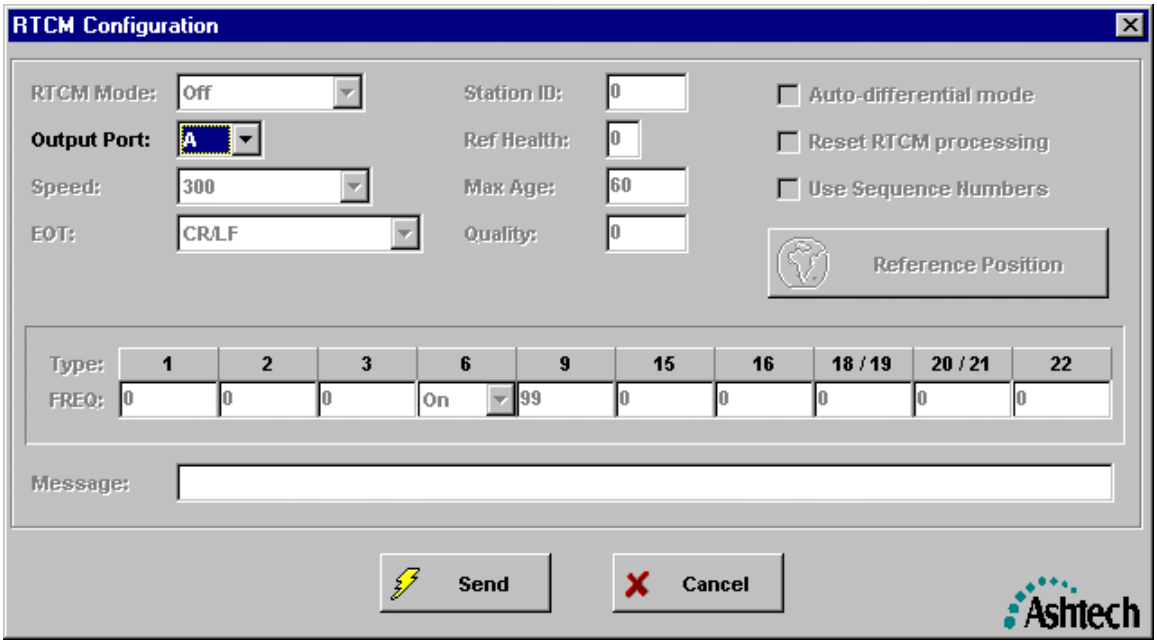
Parameter	Description
Ring File Storage Mode	When the receiver is in the Ring File Storage mode, the receiver is designed to always make room for the most recent data by deleting older files. When in this mode, the receiver manages the files automatically (i.e., deleting the oldest file when more room is needed to store recent data). When the Ring File Storage Mode is not enabled, the receiver will stop recording data once the receiver's memory becomes full. For complete details on the Ring File StorageMode, please consult the receiver manuals. It is important to note that when the receiver is in the Ring File Storage mode and you are downloading files (see Section 4.1.5.1), there is a possibility that the file being downloaded can be deleted by the receiver. When this occurs, the receiver will terminate the download operation. While **Micro-Manager** will report this as an error (and will not perform any automatic conversions of that file) the portion of the file downloaded will be resident on your hard drive. You can later manually convert this file (to other Ashtech file formats or RINEX) by using UpackU12.EXE (supplied with **Micro-Manager**).
Use unhealthy sats in pos. computation	This parameter, when checked, will instruct the receiver to use satellites, flagged as unhealthy in their broadcast orbit data, in the position computation.
Save user parameters	Indicates whether or not various receiver parameters (e.g., satellite elevation mask and epoch interval) will be saved between receiver power cycles (i.e., turned off and then later turned back on). For µZ-CGRS receivers, this parameter will always be "On": i.e., the receiver is always in "Save Mode". For other µZ-Family receivers, the save mode is selectable and can be configured through **Micro-Manager**. The value reported here is the value set by the receiver command "$PASHS,SAV,…" command. Please consult your receiver manual for details on that command and the receiver parameters affected by the receiver parameters save mode.

4.1.5.4.7 RTCM Configuration

Through the RTCM Configuration window, you can configure the RTCM settings employed by your receiver. The GPS Receiver can be configured as an RTCM Base station, an RTCM Remote station, or it can be configured as neither Base nor Remote (i.e., No RTCM mode). The sample windows that follow show the appearance of the window in each of these modes.







Notice in the examples provided above that, depending upon the mode selected, several of the edit fields are disabled (denoted by the graying of the entry field and its label). These disabled fields

are not applicable under the given mode. Also of note, in the example window shown for the disabled RTCM mode, is that the edit field for the mode itself is disabled. This occurs when the "Output Port" (i.e., the port that the receiver will attempt to communicate RTCM data) is set to the same receiver port that **Micro-Manager** using to communicate with the receiver. In other words, **Micro-Manager** will not permit you to configure RTCM operations on the same port that **Micro-Manager** is using to communicate with the receiver. This is because the messages exchanged between **Micro-Manager** and the receiver are not compatible with RTCM messages. Thus, to begin configuring the RTCM capabilities of the receiver, you must first change the receiver's RTCM Port to something different than what is being used by **Micro-Manager**. Likewise, the receiver will not permit you to set the RTCM port to the port configured for remote connections (i.e., the port on which the receiver's modem is attached and configured). If you do set the RTCM Port to either of these two ports and you press the "Send" button, the receiver will not accept the values (and **Micro-Manager** will give an error message indicating that the configuration values just sent to the receiver do match those reported by the receiver in its confirmation message).

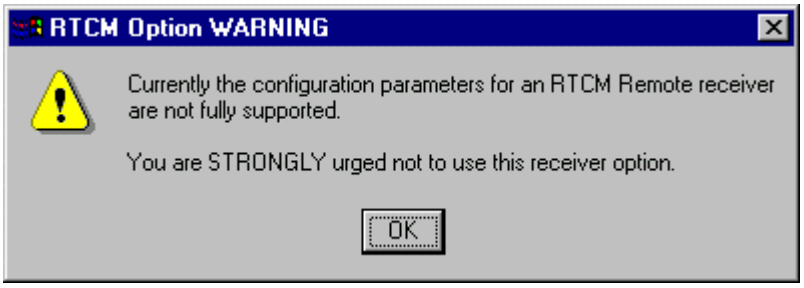
The table that follows describes the parameters of these windows in more detail. Later we will provide restrictions imposed by these parameters.

Parameter	Description
RTCM Mode	The current RTCM mode of the GPS receiver (Base, Remote, or Off). When the receiver is configured as an RTCM Base station, the position of the antenna must be entered into the receiver. To enter these parameters, you can press the "Reference Position" button. Upon doing so, the position entry window (described in Section 4.1.5.4.3) will be displayed. If you fail to supply a reference position when configuring an RTCM Base station, the receiver will reject many of the other RTCM configuration parameters. Under such a condition, **Micro-Manager** will give an error message indicating that the configuration values just sent to the receiver do match those reported by the receiver in its confirmation message.
Output Port	Identifies the receiver port over which RTCM messages are communicated. When the receiver port identified is the same as that used by **Micro-Manager** to communicate with the receiver, then all other edit fields of this window will be disabled (i.e., you will first need to change and "Send" the RTCM port assignment before configuring the RTCM mode of the receiver).
Speed	Sets the number of bits per second issuing from the assigned RTCM serial port. The selectable range is from 25 to 1500 Bits per second. There is also a "Burst mode" selection. In the burst mode, the receiver will output the data over the selected communication port at a rate no greater than the BAUD rate of that port (see Section 4.1.5.4.2). This field will only be enabled when the receiver is running under the Base RTCM mode.

Parameter	Description
EOT	Identifies the End-Of-Transmission sequence attached to the end of the RTCM messages. This field will only be enabled when the receiver is running under the Base RTCM mode.
Station ID	When in the Base Station mode, the receiver will use this information as its reference station ID (STID). When in Remote Station mode, the field identifies the RTCM Base station source for RTCM messages. This field will be disabled when not in Base or Remote RTCM mode.
Ref. Health	The health of the reference station (or STHE). This field is not editable when in the RTCM Remote mode or the Disabled mode. When set in Base mode, the receiver does not permit lower values of the reference station health unless the RTCM processing is reset. Thus, you will not be permitted to enter values lower than are currently entered in the field unless you check the "Reset RTCM Processing" checkbox in this window.
Max Age	The primary use of this field is to specify the maximum age (MAXAGE), in seconds, of RTCM Base station messages to be applied in a Remote station processing.
Quality	In Remote Mode, this field (QAFREQ) allows for the evaluation of the communication quality between the base station and the user equipment. The field is not applicable when in RTCM Base mode. To get a full meaning of this parameter, please consult your receiver operations manual.
Auto-differential Mode	When checked, permits the automatic differential mode of the receiver (Remote mode only). Allows the receiver to compute autonomous positions when no RTCM differential corrections are available or have exceeded the MAX Age parameter.
Reset RTCM Processing	Checking this checkbox and then pressing the "Send" button will reset the RTCM processing within the receiver. Consult your Receiver Operations Manual for more details.
Use Sequence Numbers	This checkbox instructs the RTCM Remote receiver to utilize the sequence numbers in the RTCM messages to enhance the communication synchronization checks. Consult your Receiver Operations Manual for more details.

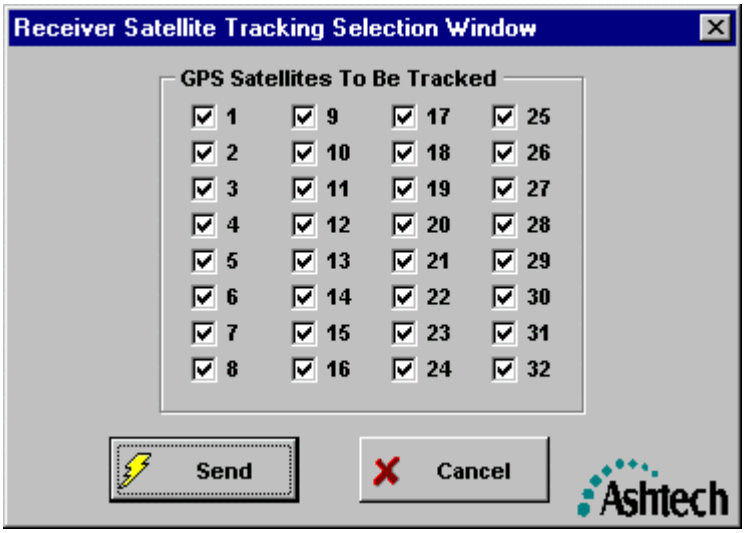
Parameter	Description
FREQ	In the RTCM window, there is a table that represents RTCM message types (labeled as ”Type”) and their output frequency (labeled as “FREQ”). With the exception of Type 6 messages (i.e., the Null filler message), the output frequencies are from 0 to 99. For Types 1, 9, 18/19, and 20/21 RTCM messages the frequency specifies the output rate in seconds. For Types 2, 3, 16, and 22 RTCM messages, the frequency specifies the output rate in minutes. In all of these cases, 0 implies that the message is turned off and 99 represents a continuous (i.e., as often as possible) output rate. Only one message type can be configured with an output rate of 99. The Type 6 RTCM message is a filler message that is, when enabled, output whenever there is spare communication bandwidth. Thus, the Type 6 message is either on or off. At the time this document was written, the µZ-Family of receivers did not implement Type 15 messages. This is why the frequency of Type 15 messages is disabled in all modes (Base, Remote, and neither Base nor Remote). The FREQ fields are only enabled when configured as an RTCM base.
Message	Contains the RTCM “Message” (up to 80 characters) sent as part of the RTCM Type 16 message from the Base station to the user equipment.

It is important to note that **Micro-Manager** supports the configuration and display of the µZ-Family of GPS receivers participating as RTCM remote receivers. At the time of the publication of this document, Thales Navigation had not fully tested the support of the µZ-Family receivers as RTCM remote stations in the **Micro-Manager** environment. Thus, when you make the Remote RTCM selection, **Micro-Manager** reports the following warning message.



4.1.5.4.8 Satellite Tracking Window

The Satellite Tracking Window allows you to alter the set of GPS satellites that the receiver is permitted to track. Below is an example of this window.



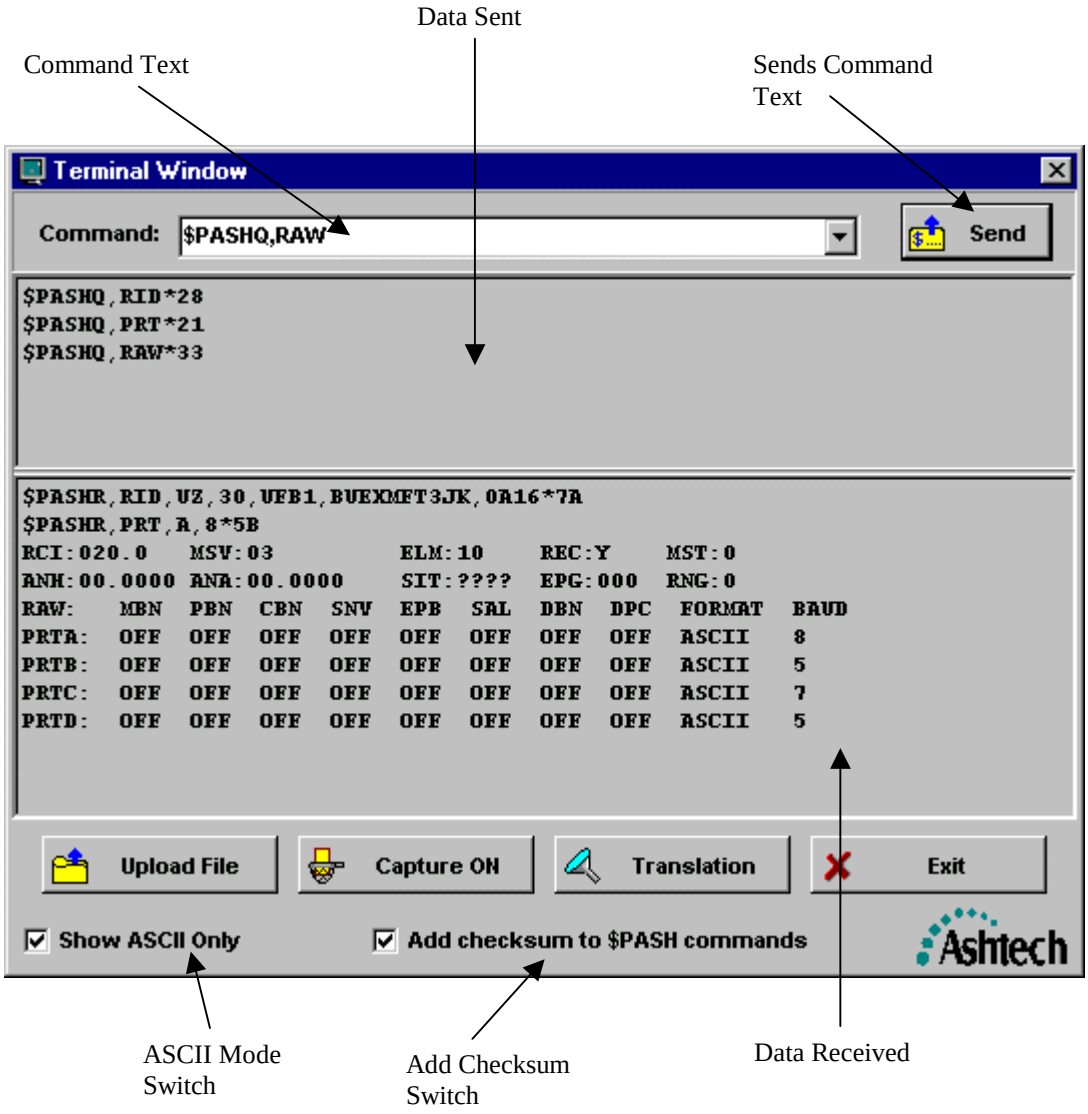
You can enable/disable the tracking of specific satellites by checking or unchecking the checkbox of the desired satellite (listed by pseudo-random noise code numbers).

As with the other receiver configuration windows, you press the “Send” button to send the changes to the receiver. Upon doing so, **Micro-Manager** will await validation responses from the receiver to verify that the parameters sent were accepted by the receiver. Any failures will be reported.

4.1.6 Terminal Window

Micro-Manager is equipped with a terminal window that allows you to send commands to the GPS receiver and view the responses. To launch this window, select “File” from the main menu bar and then select the “Terminal Window” sub-menu option.

The following provides an annotated example of the Terminal Window.



In the Command Text area (i.e., the area after the title labeled “Command:”), you can enter the command you wish to send to the receiver or you can use the drop-down list to select a message template. If you select a message template, you may need to edit it before sending the command to the receiver. For example, the template for the RCI command is “$PASHS,RCI,xxx.xx”. In this case, you will need to edit the “xxx.xx” part of the command to contain a valid epoch interval before sending the command. Entered commands are sent using the command “Send” Button. To determine valid commands, you must consult the appropriate receiver manual. You do not need to supply the <CR><LF> (i.e., carriage return/line feed) sequences required at the end of the messages, **Micro-Manager** will add those for you. If you have the “Add checksum to $PASH

commands" checked, then **Micro-Manager** will automatically add the checksums to $PASHS commands sent by pressing the "Send" button.

Another example is the template for enabling and disabling the tracking and use of selected satellites. The general template is "$PASHS,USE,d,x". In this case, you should replace the "d" with the two-digit satellite pseudo-random number. For example, satellite 8 should be entered as "08" (i.e., the zero character and the eight character). The "x" should be replaced with "Y" or "N" depending upon whether you want to enable or disable the use of the satellite, respectively.

Right-clicking in the Command Text area will cause **Micro-Manager** to display a pop-up menu that allows one to change the case of the letters that will be sent when the "Send" button is pushed. When the pop-up menu item indicating upper case has been selected (i.e., indicated by the check symbol next to the menu item), Micro-Manager will translate any lower-case characters to upper case before sending the command. To change the "Command" case handling, simply select the pop-up menu item. Selecting the menu item in this way will toggle the case handling to its opposite setting.

The "Data Sent" area of the window displays the commands that you have sent to the receiver. You can also click in this area and then start directly typing characters. As each character is typed, they are sent through the configured communication port (see Section 3.1.1). The primary differences between this approach and the "Command" approach are:

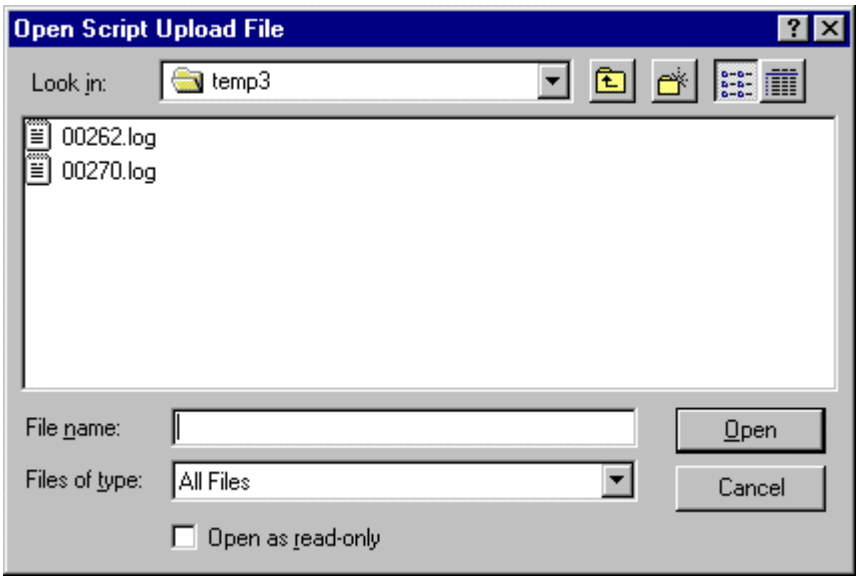
1) With the "Command" and "Send" approach, the entire entered command is sent once the "Send" button is pressed (and not until). Using the "Data Sent" area of the window, as each character is typed, it is sent over the communications port.
2) With the "Command" and "Send" approach, commands are sent with a <CR><LF> sequence at the end of each message. Using the "Data Sent" area of the window, you need to force the sending of special characters, such as <CR> and <LF>, by entering the proper control sequences. For example, to send an <LF> (i.e., the line feed character), press and hold the CTRL (i.e., the control) key and then press "J". Appendix B shows the special characters and their associated control key sequences.
3) Commands sent using the "Command" and "Send" approach can have the checksum automatically added to the $PASH commands when the "Add checksum to $PASH commands" is enabled.

The "Received Data" area of the window displays the data being received from the communications port. In some cases, messages sent from the receiver will not be in a normal human readable form. This is because these messages can contain non-printable/binary characters. **Micro-Manager** will show only the ASCII portions of those messages when the "Show ASCII only" checkbox is checked. When this checkbox is unchecked, the non-ASCII data are shown in a hexadecimal representation of the data (i.e., "0x' followed by the hexadecimal number of the character being represented).

It is important to note that **Micro-Manager** will display almost all of the traffic exchanged between the receiver and the computer. Some messages are not displayed because they are either too lengthy or too unimportant to review. These messages comprise a few file transfer related windows. All other messages are displayed in the Terminal window.

The "Upload File" button of the Terminal window is used to allow you to send the contents of a script file to the receiver. These script files are in a special format (described in Appendix C). These script files allow you to create sets of specialized commands you can use to configure the receiver in ways not directly supported by **Micro-Manager**. For example, you might define a script file named `MET.TXT` that contains the commands needed to configure the GPS receiver to interface with a meteorological sensor on a specified port and at a specified baud rate. This feature enables you to pre-define an unlimited number of configurations that are then always available for rapid use at a later date.

When you press the "Upload File" button, you will be presented with a window similar to the following:

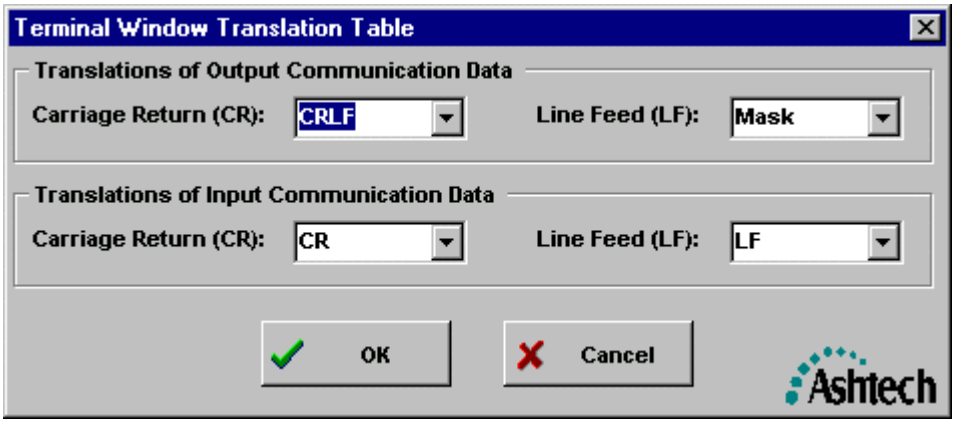


Using this window you browse to the directory containing the script file and then select the script file you would like to upload to the receiver. Again, Appendix C contains a description of the format of these script files.

The "Capture ON" button in the Terminal Window enables one to capture all received data to a file. Upon pressing the button, you will be given the opportunity to select/name a disk file into which the captured data can be stored. Upon successfully selecting/naming a capture file, **Micro-Manager** will begin capturing data to that capture file. At this point, the "Capture ON" button changes to "Capture OFF". You can terminate the capture of received data to a file by pressing the "Capture OFF" button.

While the capture feature is enabled, all data, displayed as received data in the terminal window, will be written to the named capture file. Your selected state of the "Show ASCII only" checkbox will have no effect on the data written to the capture file. That is, the capture file contains all data received in its binary format.

The "Translation" button enables you to enter/edit a character translation table that will be used when communicating with the receiver through the terminal window. For example, you can translate each received <CR> sequence into a <CR><LF> sequence. The same goes for output characters as well. For example, you can configure the outgoing translation table to transmit a <CR><LF> sequence in response to a simple <CR> character (i.e., which is generated when you hit the carriage return on your keyboard). The following display is an example of the Terminal Window Translation Table window.



4.2 Command-Line Mode

Micro-Manager was designed to run without the need of user interaction (i.e., in an unattended mode). This is accomplished through the command-line mode. **Micro-Manager** enters the command-line mode when the program is launched with command-line parameters. These parameters follow a strict pattern. Failure to comply with the requirements will cause **Micro-Manager** to reject the commands and terminate.

Micro-Manager will also terminate the command-line mode when the estimated amount of disk space required for download operations exceeds, or nearly exceeds, the amount of available disk space for the disk drive specified in the output file directory (see Section 3.1.6.3). The values calculated for the required disk space are only estimated because of the following:

A) The Log File may have data written to it that **Micro-Manager** cannot predict;
B) When a file is created on the target disk, the amount of space Windows uses for that file on disk differs from disk type to disk type; and
C) There is not a direct means of calculating the disk space required by the ring buffer file (so a worst-case scenario is estimated).

When the command-line mode terminates the download operation prematurely, and you have configured (i.e., enabled) the output Log File (see Section 3.1.6.2), **Micro-Manager** will attempt to output a termination rationale in the Log File. Clearly, **Micro-Manager** will not be able to make this notation in the Log File if the disk containing it is full.

It is also important to note that when in command-line mode, **Micro-Manager** makes no attempt to protect files already stored on disk. If it generates a name for a file that is already stored on disk, **Micro-Manager** will overwrite that file when the named file is downloaded and provide no preventative screen messages. This is consistent with the automated nature of the command-line mode so beware.

The command-line arguments follow the general form:

MicroMgr.exe [option_list secondary_args]

The options list and secondary arguments are as follows:

-c *num*

For automatic call and download of receiver data using a modem. Here *num* represents the phone list entry number from the Telephone List window described in Section 3.1.3. If you are going to direct connect to the receiver using the command-line mode, you should not use the –c option.

-g *hh.h*

Automatically download files that have closed less than *hh.h* hours prior to the current receiver time: i.e., get the most recent files closed less than *hh.h* hours ago. Note: this command-line option cannot be used with the –o option.

-o *hh.h*

Automatically download files that have closed over *hh.h* hours prior to the current receiver time: i.e., get the files that have closed over *hh.h* hours ago. Note: this command-line option cannot be used with the –g option.

-d *hh.h*

Automatically delete downloaded files from receiver's memory. Files over *hh.h* hours old (by time of closure) will be deleted. Note: if the –g and –d options are both specified, the deletion operation will not occur when there are any unrecovered errors resulting from the download operation.

-s *y1*/*d1*/*h1*:*m1 y2*/*d2*/*h2*:*m2*

For automatic download of files having closure times between two specific times (in the GPS time system).

y - the year(4 digits),
d - day of year,
h - hour (optional),

m - minute (optional).

-x *y1*/*d1*/*h1*:*m1 y2*/*d2*/*h2*:*m2*

For automatic deletion of selected files bounded by two specific closure times (in the GPS time system). Note: if this parameter is used with any automatic download command, then the deletion will only occur if all files are successfully downloaded.

y - the year(4 digits),
d - day of year,
h - hour (optional),
m - minute (optional).

-u *uploadname*

For automatic upload of a script file to the receiver, where *uploadname* is the name of the script file, including drive and path, to be uploaded. The format of script files is provided in Appendix C. Note: this parameter should not be used with any other download and delete command-line parameters (but it can be used with the –c parameter). **Micro-Manager** performs no checks to validate compliance with these restrictions.

Example 1: `MicroMgr.exe -c 5 -g 6.0 -d 12.0`

In this example, **Micro-Manager** has been instructed to establish a remote modem connection using telephone list entry number 5. It then obtains files that have been closed less than 6 hours prior to the current receiver time. Upon successful download of those files, **Micro-Manager** then attempts to delete files from the receiver's memory that have been closed more than 12 hours before the current receiver time.

Example 2: `MicroMgr.exe -g 6.0 -d 12.0`

In this example, **Micro-Manager** has been instructed to establish a direct connection with a receiver. It then obtains files that have been closed less than 6 hours prior to the current receiver time. Upon successful download of those files, **Micro-Manager** then attempts to delete files from the receiver's memory that have been closed more than 12 hours before the current receiver time.

Example 3: `MicroMgr.exe -c 2 -u E:\scripts\Met.txr`

Here, **Micro-Manager** has been instructed to establish a remote modem connection using telephone list entry number 2. After establishing the connection, it will perform an upload of the script file at “E:\scripts\Met.txt”.

Appendix A

File Naming Approach

Almost every Ashtech file is named based upon some value of GPS time. **Micro-Manager** will create the receiver-sourced data file names based upon times stored for those files in the receiver. Status files, such as the logging summary (or Log File) are created based upon the CPU clock time. This is because these files are opened and closed independently of the receiver data files. For example, the Log File contains information about the entire remote session (not to be confused with a data collection session). During that session, you may download files from numerous days. The Log File will record all of the activities that occurred during that remote session, including an entry for each file downloaded.

It is also important to note that when in command-line mode, **Micro-Manager** makes no attempt to protect files already stored on disk. If **Micro-Manager** generates a name for a file that is already stored on disk, the **Micro-Manager** will overwrite that file when the named file is downloaded and provide no preventative screen messages. When in its GUI (or manual) mode, you will be warned of potential file overwrites.

A.1 U-File File Naming Approach

The µZ-CGRS receiver generates the names of the U-Files that **Micro-Manager** writes to disk. When **Micro-Manager** obtains a directory listing of the files stored in the receiver (see Section 4.1.5.1), the names of the files are communicated to **Micro-Manager** as part of that directory information. These files names are generated by the receiver according to a convention, which is described in the µZ-CGRS receiver manuals (please see those manuals for details). The naming convention follows the general form described below.

tnnnnsyy.ddd

where,	t	represents the file type (U for a µZ-Family receiver image file),
	nnnn	represents the 4-character station name,
	s	represents the session code,
	yy	represents the last two digits of the year, and
	ddd	represents the day of the year.

For example, a file named UASHTD99.005 is an Ashtech U-File (µZ-Family receiver image file) for site ASHT taken in session D of day 5 of 1999. Using this convention, the

receiver generates the names of the files that **Micro-Manager** will use when creating disk resident U-Files that are downloaded from the receiver (See Section 4.1.5.1).

NOTE: When the μZ-CGRS receiver stores more than 24 files in a single day, the naming convention is slightly altered. In this case, the first digit of the "yy" portion of the file name becomes an incrementor (and starts at 'A' and can roll to 'C'). For example, UASHTAA9.005 is a valid file name, and would normally be the 25th file stored on that day. Likewise, UASHTDC9.005 is also a valid file name for the same day. The conversion programs (UpackU12.exe and XYZAshRx.exe) will accept input files with these names and produce like names. However, when the 10.3 RINEX file naming mode has been selected (see Section 3.1.4), XYZAshRx.exe will produce the 10.3 RINEX names. For complete details on the U-File names generated by the μZ-CGRS, please consult the appropriate receiver manual.

A.2 LOG File Naming Approach

The **Micro-Manager** Log File names are of the following form:

yyddd.LOG

where,	yy	represents the last two digits of the year, and
	ddd	represents the day of the year.

For example, a file named 97233.LOG is a **Micro-Manager** Log File for day 233 of 1997. In the year 2000 the file name would begin with '00'. Unlike the R-File names, these file names are based upon the CPU clock as is indicated in the introduction to this Appendix.

Appendix B

ASCII Control Characters

The table which follows shows the character sequences entered into **Micro-Manager** to represent the special ASCII control characters. In the table, the "Sequence" column denotes the characters that should be entered to obtain the desired control characters.

When entering these sequences into the modem configuration strings for the computer side modem (Sections 3.1.2.5 through 3.1.2.8) the caret character (i.e., "^") should be entered as the caret character (i.e., you should not press the CTRL key and the specified key simultaneously). The reason behind this was given in Section 3.1.2 on Modem Settings.

Alternatively, when entering control sequences into the terminal window (Section 4.1.6) the sequence is entered by pressing the CTRL key and the specified key simultaneously.

Sequence	Character Name	Decimal Value	Octal Value	Hexadecimal Value	Description
^A	SOH	1	001	0x01	Start of Header
^B	STX	2	002	0x02	Start of Text
^C	ETX	3	003	0x03	End of Text
^D	EOD	4	004	0x04	End of Transmission
^E	ENQ	5	005	0x05	Inquiry
^F	ACK	6	006	0x06	Acknowledge
^G	BEL	7	007	0x07	Bell
^H	BS	8	010	0x08	Backspace
^I	HT	9	011	0x09	Horizontal Tab
^J	LF	10	012	0x0A	Line Feed
^K	VT	11	013	0x0B	Vertical Tab
^L	FF	12	014	0x0C	Form Feed
^M	CR	13	015	0x0D	Carriage Return
^N	SO	14	016	0x0E	Shift Out
^O	SI	15	017	0x0F	Shift In
^P	DLE	16	020	0x10	Data Link Enable
^Q	DC1	17	021	0x11	Device Control 1
^R	DC2	18	022	0x12	Device Control 2
^S	DC3	19	023	0x13	Device Control 3
^T	DC4	20	024	0x14	Device Control 4
^U	NAK	21	025	0x15	Negative Acknowledge
^V	SYN	22	026	0x16	Synchronize Idle

Sequence	Character Name	Decimal Value	Octal Value	Hexadecimal Value	Description
^W	ETB	23	027	0x17	End Transmission Block
^X	CAN	24	030	0x18	Cancel
^Y	EM	25	031	0x19	End of Medium
^Z	SUB	26	032	0x1A	Substitute
^[	ESC	27	033	0x1B	Escape
^\	FS	28	034	0x1C	File Separator
^]	GS	29	035	0x1D	Group Separator
^_	US	31	036	0x1F	Unit Separator

Appendix C

Upload File Format

Section 4.1.6 and 4.2 of this document describe the process of uploading script files to the µZ-Family of receivers using **Micro-Manager**. This section describes the format of those script files.

The general format of the Upload File is ASCII text. However, some messages sent to an Ashtech receiver may need to contain binary data. In fact, almost every message sent to an Ashtech receiver requires the <CR><LF> (carriage return, line feed) sequence at the end of the message. For these reasons we need a means of entering binary data into the upload file. There are also cases where it is helpful to have the upload process pause during the upload of data to the receiver. To accommodate all of these needs, the upload is sent through an interpreter imbedded in **Micro-Manager**. This interpreter sends all ASCII text until it meets with a special escape character. Immediately after these escape characters will be other characters describing the special characters to be sent or which describe other processing that must take place. Once the escape processing is handled, **Micro-Manager** will resume sending the ASCII data in the file.

The special escape character is '\'. If this character is followed by a "+" character, then the escape sequence is considered to be delay processing. A delay sequence is of the form \+*time*+, where *time* is the number milliseconds the interpreter should delay before continuing with the upload. If the character following the escape character is '0' (i.e., the zero character), then **Micro-Manager** will translate the octal escape sequence into a binary character. For example, \015 is the octal representation of the carriage return character. To send a '\' character, the character immediately following the '\' must be a '\'. Finally, the carriage returns (or any line feed characters) that are normally part of an ASCII file are not sent as part of the uploaded data, to send these characters you must use the octal representation of the characters.

The following provides an example upload file:

```
$PASHS,RCI,5.0\015\012
\+100+
$PASHQ,RID\015\012
\+100+
$PASHQ,RAW\015\012
\+100+
$PASHS,RCI,15.0\015\012
\+1000+
```

The interpreter translates the above file as follows:

```
$PASHS,RCI,5.0<CR><LF>
wait 100 milliseconds
$PASHQ,RID<CR><LF>
wait 100 milliseconds
$PASHQ,RAW<CR><LF>
wait 100 milliseconds
$PASHS,RCI,15.0<CR><LF>
wait 1000 milliseconds
```

Appendix D

Dialing Directory Export File Format

Sections 3.1.3 through 3.1.3.7 of this document describe the process of exporting **Micro-Manager**'s dialing directory. This section describes the format of these exported files.

The following is an example of an exported dialing directory file:

```
0001 Site JK13
     123-4567
     115200,0,8,0
0002 Site JK23
     123-4568
     57600,0,8,0
0003 Site JK99
     1-010-987-6543
     38400,0,8,0
```

The general format of the dialing directory export file is ASCII text. Each record within the file contains 3 lines of text. The first line of each record is left justified while the remaining two lines are prefixed with 5 space characters. The following describes the format of each record:

```
enum Name_of_Entry
     Telephone_Number
     BAUD,Parity,Data_bits,Stop_bits
```

With the exception of the field labeled "enum", each element of this record is described in section 3.1.3.2. Nevertheless, a description of each is provided below.

Field	Max. Characters	Description
enum	4	The record number. The record numbers start at 1 and are incremented at one per record. Record numbers are written such that the full field width contains digits (i.e., zero padded to the left when appropriate).
Name_of_Entry	70	This field is simply a text string you wish to use to identify the telephone directory entry. This field will not be passed to the modem during dialing operations; nor will it be used for any other configuration purposes.
Telephone_Number	70	This field allows you to specify the telephone number of the remote system to be dialed. Please note that this is a modem string and is subjected to the same special character rules described in Section 3.1.2.
BAUD	6	Contains the speed of the link between the PC and the modem. Acceptable values are: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, and 115200
Parity	1	Contains the parity of the link between the PC and the modem. These values are coded as follows: Coded Value — Description: 0 — No Parity 1 — Odd Parity 2 — Even Parity 3 — Marked Parity
Data_bits	1	Contains the data bits used in the link between the PC and the modem. These values are coded as follows: Coded Value — Description: 7 — 7 Data Bits 8 — 8 Data Bits
Stop_bits	1	Contains the stop bits used in the link between the PC and the modem. These values are coded as follows: Coded Value — Description: 0 — 1 Stop Bit 1 — 1.5 Stop Bits 2 — 2 Stop Bits

Appendix E

Utility Program XYZAshRx

E.1 Introduction to XYZAshRx

XYZAshRx.EXE, written by The XYZ's of GPS, Inc., was designed to convert Ashtech raw GPS observation files to the Receiver INdependent EXchange format (RINEX). The program has been designed to operate on a Windows 95 or NT platform. To facilitate a wide variety of users, XYZAshRx can be configured and run through normal Windows Graphical User Interfaces (GUI) or launched directly from the command-line. That is, a user can use the conversion program just like most other Windows programs or the converter program can be executed, without need of human intervention, from other programs (such as Ashtech's **Micro-Manager** Software), from a DOS command line, or from batch files.

XYZAshRx currently supports the Ashtech GPS and GPS/GLONASS receivers. Data are output in the RINEX Version 2.0 format. The specification for this version of RINEX came from Dr. Werner Gurtner's paper, "RINEX: The Receiver Independent Exchange Format Version 2", Revised in July of 1998.

This document includes discussions pertaining to the Geodetic Base Station Software (GBSS) and the GBSS Meteorological Module. This is because this XYZAshRx is also used with those programs. We have included discussions pertaining to the features of XYZAshRx specific to those programs for completeness. Please be advised that the some of the documentation may not be applicable under **Micro-Manager**. However, whenever **Micro-Manager**, using UpackU12.EXE, creates an Ashtech D-File that contains meteorological data, then XYZAshRx will automatically create a RINEX meteorological data file from that D-File.

E.1.1 Minimum System Requirements

XYZAshRx requires the target platform to be a Windows 95 or Windows NT based computer. While XYZAshRx requires less than 1 megabyte of memory to run, Windows 95 and NT impose higher minimums. You should consult the appropriate Microsoft documentation to determine the minimum system requirements for Windows.

XYZAshRx requires less than 2 megabytes of disk space. However XYZAshRx creates ASCII output files from your Raw Ashtech Observation files. As a general rule, ASCII RINEX files require approximately 1.5 times the space required by Raw Ashtech Observation Files.

E.1.2 Demo Versions

There are two basic configurations of XYZAshRx: fully operational and demonstration versions. This document applies to both configurations. Demonstration versions, which are freely distributed over the Internet or provided on diskette without accompanying sentinel keys, are not nearly as capable as the operational versions. For example, demonstration versions will only create RINEX output files of 100 epochs or fewer. This document will not seek to delineate the specific differences between the demonstration and the operational versions. It is important to note, however, that the installation instructions documented herein apply to both configurations.

E.2 INSTALLATION OVERVIEW

XYZAshRx is currently distributed as part of **Micro-Manager**. The program will be installed in the same directory as that of MicroMgr.exe. For example, if during the installation of **Micro-Manager**, you chose to install **Micro-Manager** into the "D:\Program Files\ASHTECH\MicroMgr" directory, then XYZAshRx would be installed into the same directory.

The automatic installation of **Micro-Manager** does not put XYZAshRx into the Windows search path. One can add XYZAshRx to the Windows search path by right clicking on "My Computer", selecting the "Properties" menu item, selecting the "Environment" tab, selecting the "Path" system variable and then editing the "Value" field to include the directory in which XYZAshRx is stored.

Additionally, the automatic installation of **Micro-Manager** puts an icon neither onto the desk top nor in the Start Menu bar. To create a program icon on the desktop, simply find the program file XYZAshRx.EXE using "My Computer", right click and drag the icon to the desktop and select "Create Shortcut Here". For details on how to add a program to the Start Menu, consult Windows Help, searching on "Start Menu", and selecting the topic dealing with adding menu items to the Start Menu.

Finally, XYZAshRx is protected by a software sentinel key (the same key as is used by **Micro-Manager**). The software sentinel key is installed by attaching the end of the sentinel key labeled ↑COMPUTER↑ to a parallel printer port of your computer. Tighten the screws of the sentinel key to connect the key securely to your computer. If a printer was connected to your computer, attach that cable to the sentinel. If the sentinel cannot be installed because of an obstruction behind the computer, you can place the sentinel key later in the parallel sequence (for example, you could attach the sentinel key to a DB-25 male to DB-25 female cable which is connected to your computer's parallel port).

E.3 RUNNING XYZAshRx

XYZAshRx creates RINEX Version 2.0 files from Raw Ashtech Observation files (i.e., from Ashtech B-Files). The program can be manually instructed to convert files or can be called directly from the command-line. This latter method allows programs to invoke the converter

without the need of human intervention. Throughout the remainder of this documentation, we will call the former approach the Manual/GUI approach and the latter will be called the Command-Line approach.

Both the Manual/GUI and the Command-Line approaches rely upon configuration information contained in the INI file associated with the converter program. This INI file is called "XYZAshRx.INI" and is stored in the same directory as the main program. Changes to this configuration file occur whenever the user changes configuration using the Manual/GUI approach. That is, when desiring to use the Command-Line mode, you should pre-set the configuration using the Manual/GUI approach. Section E.3.1 will describe the Manual/GUI approach to using XYZAshRx and Section E.3.2 will describe the Command-Line approach to using XYZAshRx.

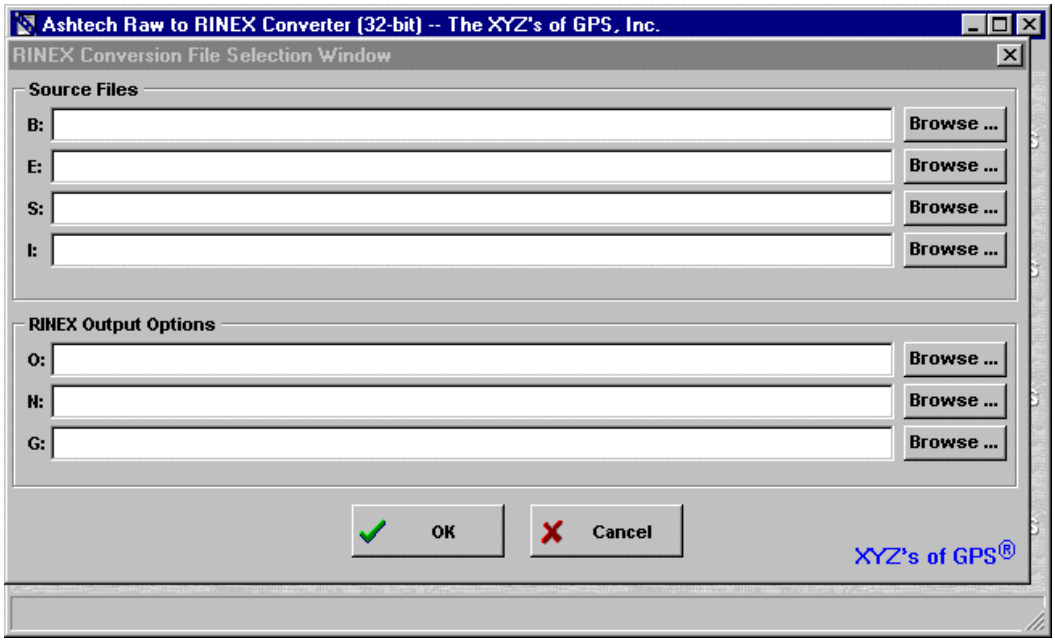
It is important to re-state the fact that the configuration information is stored in the file "XYZAshRx.INI" which is stored in the same directory as the program file (i.e., "XYZAshRx.EXE"). When you desire an alternative configuration, for example to support two **Micro-Manager** installations simultaneously, you should copy the following files to another directory:

XYZAshRx.INI
XYZAshRx.EXE
XYZAshRx.BMP

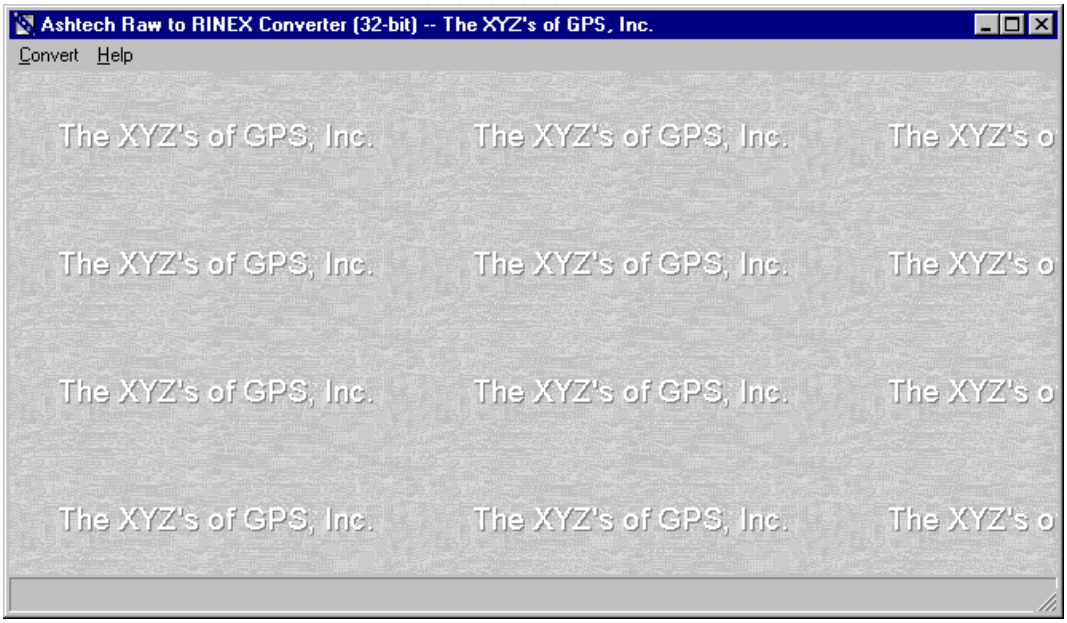
By doing this, you create an independent copy of the .INI file. Launching the program XYZAshRx.EXE in this copied directory causes the program to use the INI file in that directory. This copy would utilize a configuration that is independent of the other copy (i.e., the original copy) of XYZAshRx on your computer. In contrast, launching two copies of the XYZAshRx from the same directory accesses the same INI file. The configuration stored at the end of the runs of the programs is highly dependent upon which copy of the program terminated first. Needless to say, you are strongly advised not to launch more than one copy of XYZAshRx from the same directory (unless both copies will use the exact same configuration information). Launching several copies of XYZAshRx, each originating from its own directory, is perfectly acceptable and supported by the sentinel.

E.3.1 Manual/GUI Approach

Upon starting XYZAshRx without command-line parameters, the following is displayed:



Presented above are the Main Window of the program and the File Selection Window. The File Selection Window is presented automatically at the start of the program as a means of saving time and will be described in more detail in Section E.3.1.1. For now, we will assume that the File Selection Window has been closed to facilitate the description of the program's main window. The main window of the program has the following appearance:



Notice the program has only two main menu items. When you select the "Convert" menu item you will be presented with the following drop-down menu:

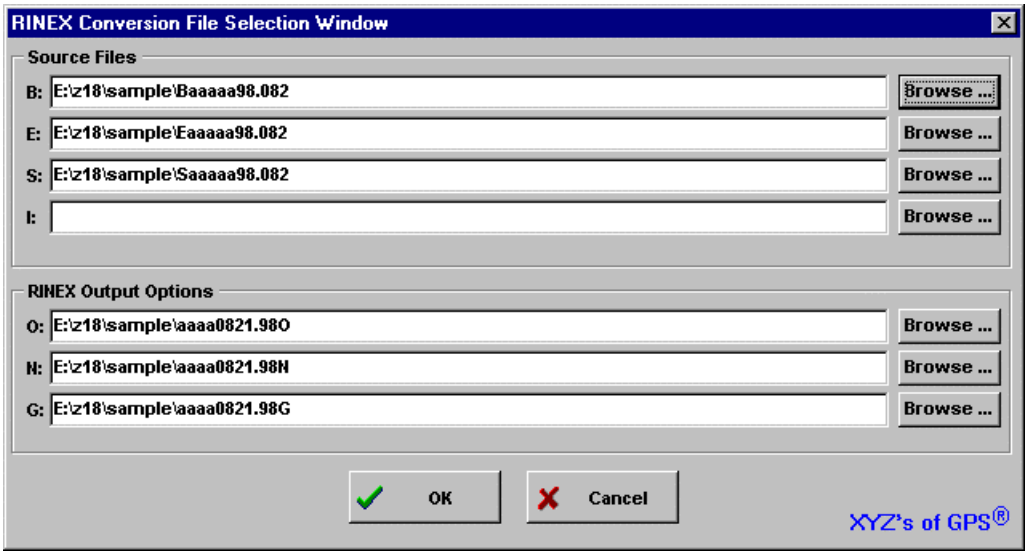
That is, you can only "Convert" "To RINEX" using XYZAshRx. Upon selecting the "Obs and Nav to RINEX" option, you will be presented with the File Selection Window presented in Section E.3.1.1. Upon selecting the "Met to RINEX" option, you will be presented with the RINEX Meteorological File Selection" Window presented in Section E.3.1.2. Through both of these windows, you will select the input and output files of a single conversion run.

When you select the "Help" menu item from the main menu, you will be presented with the following drop-down menu:

When you select the "About" menu item XYZAshRx will display a window containing information about the program. In response to selecting the "Command Line Parameters" item XYZAshRx will display a window describing how to invoke the Command-Line Mode of the program. The command-line mode is further documented in Section E.3.2 of this manual.

E.3.1.1 File Selection Window

The File Selection Window is displayed in response to the "Convert | To Rinex" selection from the program's main menu. The following provides an example of the File Selection Window:



There are seven edit fields in this window. The first four correspond to the following input file names:

Label	Description	Required
B:	Input Ashtech formatted B-File (raw observations)	Yes
E:	Input Ashtech formatted E-File (broadcast orbits)	Yes
S:	Input Ashtech formatted S-File (site file)	No
I:	Input Ashtech formatted I-File (ionospheric data)	Yes/No

The latter 3 edit fields correspond to the following output file names:

Label	Description	Required
O:	Output RINEX Observation File	No/Yes
N:	Output RINEX GPS Navigation File	No/Yes
G:	Output RINEX GLONASS Navigation File	No/Yes

XYZAshRx seeks to help with the file naming by keying off of the source B-File name. Each time the edit field of source B-File is changed and contains a valid B-File name (i.e., the file exists on disk), XYZAshRx will automatically fill in the other input file names for the files that exist on disk and will automatically create the output file names. In the sample window above, the user used the "Browse…" button of the B-File to select input B-File and XYZAshRx found associated E- and S-Files on the disk (but not an associated I-File) and automatically named the output RINEX Observation and Navigation files.

In the input file table above, notice that the S- and I-Files are optional. When these files are not specified XYZAshRx automatically makes changes necessary to output header data in the associated RINEX files. In particular, when the S-File is specified, XYZAshRx sets certain default values, for the output RINEX header, based on data contained in the S-File. When the S-File name is not provided, the site related header data is obtained from and saved to the configuration file. The RINEX header data affected by the presence of the S-File are as follows:

Station Name
Observer's Name
Receiver Serial Number
Antenna Serial Number
Antenna Offsets (Slant, Radius, and Delta Vertical)

Obviously, the above information would be obtained from the S-File if it where present.

Note: The S-File does not contain all of the antenna-offset information, but only the slant height. The S-file assumes that an antenna of a particular radius is being used. It is recommended that the S-file not be used as input for the RINEX header if there is an antenna height value in the S-file, since this will lead to erroneous entries in the RINEX header. Instead, the antenna height information should be entered into the RINEX Header/Data Options window.

Similarly, the presence of the I-File affects the header of the output RINEX Navigation File. For GLONASS RINEX conversions, the I-File is required. When the I-File is present,

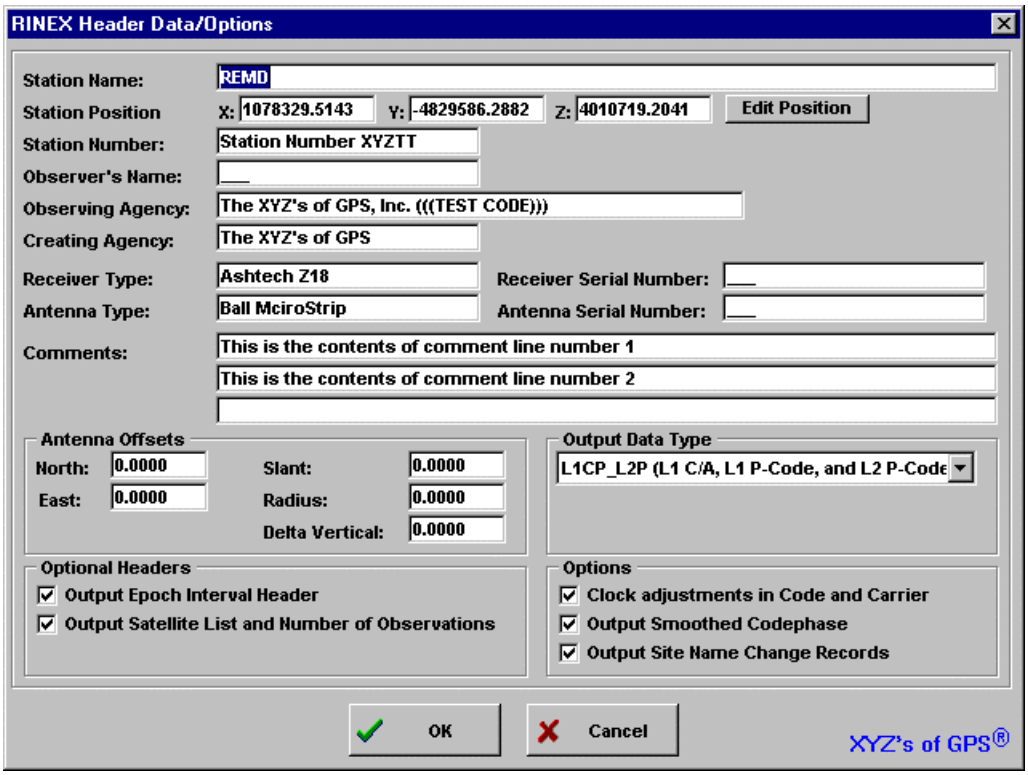
XYZAshRx places the ionospheric header data (containing the model alphas and betas) and the leap second header data (i.e., the data needed to determine the integer offset between GPS time and UTC) into the RINEX Navigation File. When the I-File is not present, these header components will not be output to the RINEX Navigation File.

Notice that in the output file table above, the output RINEX Navigation and Observation files appear to be both optional and required. This is because at least one of the output files is required by XYZAshRx.

Once the file names are entered, simply press OK and a window allowing you to edit/change the header data will be displayed (See Section E.3.1.1.1)

E.3.1.1.1 RINEX Header/Data Options Window

The RINEX Header/Data Options window is displayed in response to pressing the OK button on the File Selection Window (See Section E.3.1.1). The following provides an example of this window:



With the exception of the "Output Data Type" the data of each field comes from either the Site File or from the saved configuration data of the program (i.e., stored in the INI file of the program). When the Site File is not used as input to the program, all of the data for this window,

with the exception of the "Output Data Type", comes from the saved configuration data. When the Site File is used as input, the following fields come from that file:

Station Name
Observer's Name
Receiver Serial Number
Antenna Serial Number
Antenna Offsets (Slant, Radius, and Delta Vertical)

The "Output Data Type" field is used to specify which RINEX observation fields will be output to the RINEX Observation file. The "Output Data Type" can be one of the following:

Selection	Output Data Types
L1	L1 C/A Carrier and Code (includes Doppler)
L1CP_L2P	L1 C/A, L1 P-Code and L2 P-Code Carrier and Code (includes Doppler)
CDPHASE	L1 C/A Codephase only
L1CP	L1 C/A and L1 P-Code Carrier and Code (includes Doppler)
L1C_L2P	L1 C/A and L2 P-Code Carrier and Code (includes Doppler)

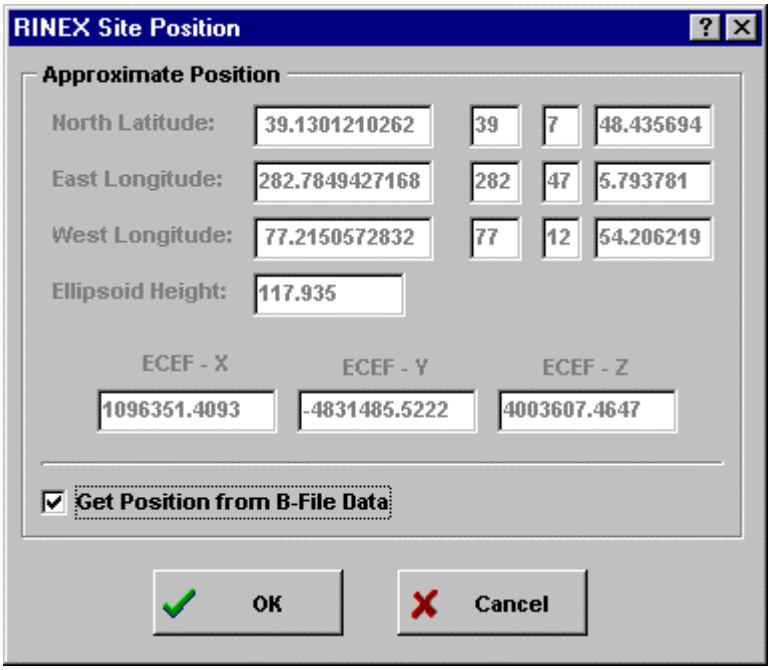
It should be clear that some selections are not available for some receiver types. For example, if the input data is from a G-12 receiver (a C/A L1 only Code and Carrier receiver), the selectable output data types for the receiver will not include any of the P-Code or L2 observables. By default, the selection will be set to output all possible observation types for the input receiver type.

The receiver position (labeled as "Station Position" on the window) will come from either the B-File data or from a user-entered position. This decision is made using the Site Position Window, which is accessed by pressing the "Edit Position" button (to the right of the station position) on this window. For further details on the Site Position Window see Section E.3.1.1.2.

Remember that the changes entered into this RINEX Header Data Edit Window will be saved as part of the program's configuration data (i.e., stored in the program's .INI file). In this way, the header data need only be configured once. Minor changes to the output header data can then be made during each subsequent run of the program.

E.3.1.1.2 RINEX Site Position Window

The RINEX Site Position Window permits you to select the source of the position data output as part of the RINEX header data. This window is accessed from the RINEX Header Data/Options Window (see Section E.3.1.1.1). The following is an example of the RINEX Site Position Window:



The RINEX Site Position Window allows you to specify the position of the receiver to be output as part of the RINEX header data. The RINEX specification indicates that this position need only be approximate and provides no specifics on the required accuracy of the approximation. The position written as part of the header data can come from a manually entered position or from a weighted average comprising the position and PDOP data of the B-File. To specify that the approximate position is to come from the weighted average of the B-File position data, check the "Get Position from B-File Data" checkbox. Otherwise, uncheck the box and enter the approximate position in the window.

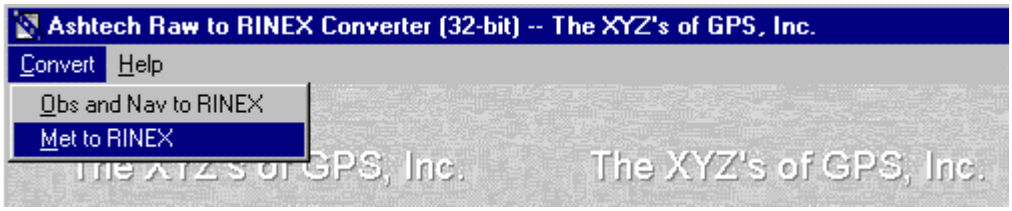
Like the RINEX Header/Data Options window, the data entered into this window will be saved as part of the configuration information for the program. If the "Get Position from B-File Data" checkbox is checked, then XYZAshRx will obtain the approximate position from B-File on the current and later runs.

E.3.1.2 RINEX Meteorological Files

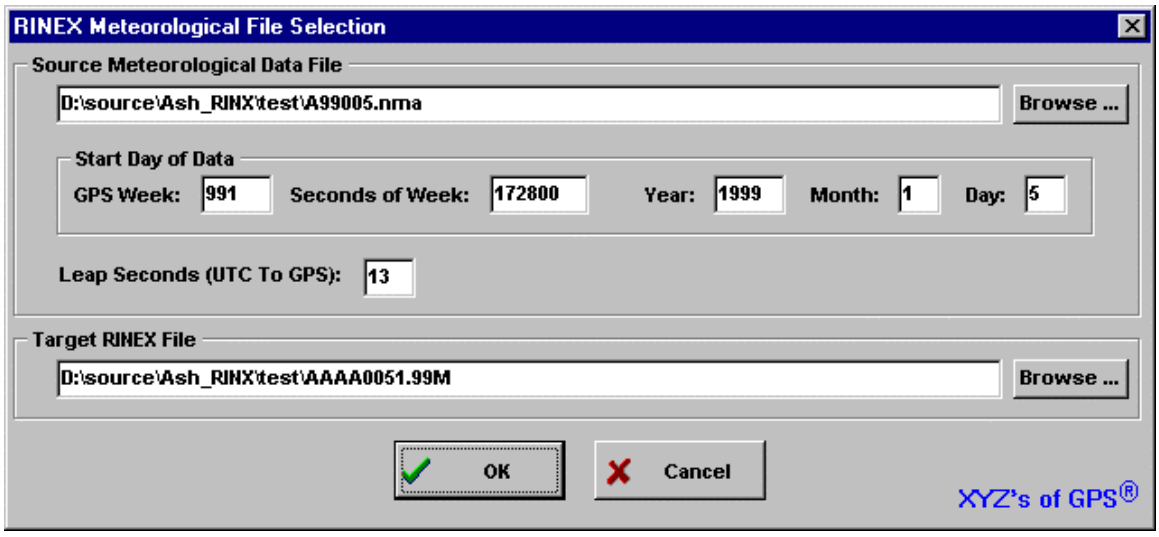
Before continuing, it must be noted that the meteorological option of the RINEX converter is not available unless the presence of a software sentinel key coded for **Micro-Manager** Professional or the GBSS (Ashtech's Geodetic Base Station software) Meteorological module can be found.

To convert collected meteorological data to RINEX using the manual approach simply launch the program XYZAshRx (with no command-line options). On doing so, you will be

provided with the main program screen. Using the main menu of the program select the "Convert" menu option and then select the "Met to RINEX" sub-menu option.



Selecting this sub-menu option will provide you with a screen that looks similar to the following:



The primary components of this screen are:

1) The source meteorological data file name.
2) Start day of the source meteorological data file.
3) Leap seconds for converting UTC to GPS times.
4) The target RINEX meteorological data file name.

Upon completing the edits, press the "OK" button to enter/edit the header data related to the output RINEX meteorological data (see Section E.3.1.2.5).

E.3.1.2.1 Specifying the Source Meteorological Data File

To select the source meteorological data file, simply type its name in the first prompt field provided or use the "Browse" button next to that field. By pressing the "Browse" button, you will be provided with a file selection window similar to that available in other Windows programs.

The file type you will be looking for will normally have either a ".NMA" extent or will have the form D*.* (for Ashtech D-Files). The .NMA files are Ashtech NMEA files created by GBSS. This is important because, if you are using GBSS, you must instruct GBSS to store the NMEA file (via its "Configuration | File Outputs" menu options). Furthermore GBSS must be configured to store the XDR and GXP NMEA messages. This is because the XDR message will contain the meteorological sensor data and the GXP message will contain the time tag associated with the XDR message. Please note that XYZAshRx assumes that the Meteorological data is sampled near the time stated in the GXP message. That said, it should be clear that the accuracy of the time tag as it relates to the XDR message is +/- the rate at which the GXP messages are being output. On the other hand, the D-Files created by **Micro-Manager** contain unambiguous time stamps.

E.3.1.2.2 Start Day of the Meteorological Data File

Two key facts must be considered when converting the NMEA capture file created by GBSS: 1) the NMEA GXP message contains only time-of-day time tags and 2) the NMEA GXP message contains UTC time tags. In this Section, we address item 1; item 2 is addressed in Section E.3.1.2.3.

Because the NMEA GXP message (i.e., the message used to time tag the meteorological data) contains only time of day, we must resolve the start day of the data file. It is for this reason that the "Start Day of Data" prompts are provide in the file selection window. You can specify the start day either through GPS time or through a Gregorian time. When you specify the GPS time, you need only be accurate to the day in which the data starts. If you specify a "seconds of GPS week" which falls within the day (i.e., it does not specify a time that is on the exact start of the day) the program will be able to resolve the actual start time of the file. That is, simply specify a time which falls within the correct day in which the start of the file belongs. If the file contains data from multiple days of data, the program will be able to resolve those day changes as well.

If the input .NMA meteorological data file name is in the Ashtech file-naming format, the program will be able to resolve the start time of the data without your assistance (but still giving you the chance to override the start time of the file). Once you specify the name of the file, the program will parse that name and determine if it fits the proper naming convention and, if so, it will fill in the fields with the start time of the file. Otherwise the program will default to a start time based upon the CPU clock (which you should override if it is not correct).

When the input file is an Ashtech D-File (and it contains meteorological data), the time stamps of the data are unambiguous. For this reason, when the input file is an Ashtech D-File the start time and Leap Second related prompts are disabled.

E.3.1.2.3 Leap Seconds: UTC to GPS Conversion

Two key facts must be considered when converting the NMEA capture file created by GBSS: 1) the NMEA GXP message contains only time of day time tags and 2) the message

contains UTC time tags. In this Section, we address item 2; item 1 is addressed in Section E.3.1.2.2.

The RINEX standard requires that the time tags of the meteorological data be in GPS time. The NMEA GXP message (i.e., the message used to time tag the meteorological data) contains UTC time stamps. As such, we must convert the times to GPS. The "Leap Seconds" data entry field of the window allows you to specify the delta between GPS and UTC. As of January 8, 1999, there are 13 leap seconds between UTC and GPS. That is, UTC + 13 = GPS time.

The value of the "Leap Seconds" field will be saved between runs of the program. Furthermore it will be used during the command-line conversion of meteorological data (see Section E.3.2).

When the input file is an Ashtech D-File (and it contains meteorological data), the time stamps of the data are unambiguous. For this reason, when the input file is an Ashtech D-File the start time and Leap Second related prompts are disabled.

E.3.1.2.4 Specifying the Output RINEX Meteorological Data File

The output file name is specified in one of 4 ways:

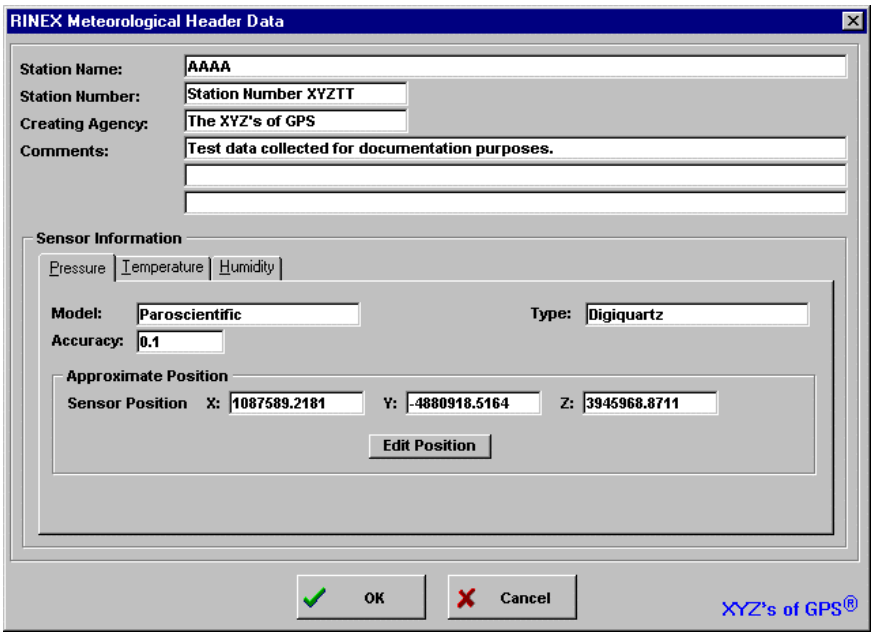
1) The input meteorological data file name complies with the Ashtech naming convention;
2) You cursor through or edit any of the "Start Day of Data" edit fields;
3) You manually enter the output file name; and
4) You use the "Browse" button next to the edit field pertaining to the output file name.

When either approach 1 or 2 is used, the output file name will comply with the RINEX file naming convention (for details on the file naming convention, see the GBSS User's Manual).

To select the source meteorological data file, simply type its name in the first prompt field provided or use the "Browse" button next to that field. By pressing the "Browse" button, you will be provided with a file selection window similar to that available in other Windows-type programs.

E.3.1.2.5 Entering the RINEX Header Data

After pressing the "OK" button of the window in which you specified the source and target files, you will be provided with a window similar to the following:



In this window you can edit all of the data related to the header data of the output RINEX meteorological file. To obtain the specifics of the meanings of each of these fields it is suggested that you consult the RINEX standard documentation.

The data of this window will be saved between runs of the program. Furthermore, this data will be used in the command-line mode when creating the output file.

E.3.2 Command-Line Approach

The Command-Line approach to running XYZAshRx is invoked by calling the program with the command-line parameters listed in this section. The Command-Line approach permits automatic conversion to RINEX of raw Ashtech data files without human intervention. In this way, programs or batch files can automatically convert Ashtech data files to RINEX.

Sections E.3.1.1.1, E.3.1.1.2, and E.3.1.2.5 discuss information that is written to the RINEX header when using the Manual/GUI approach. This RINEX header information is also written to the output files when using the Command-Line approach but it is assumed that you have pre-configured the program with the desired information. The pre-configuration is performed by using the Manual/GUI method described in Sections E.3.1.1.1, E.3.1.1.2, and E.3.1.2.5. Once the configuration has been entered using the menus of Sections E.3.1.1.1, E.3.1.1.2 and E.3.1.2.5 and you have exited the Manual/GUI run of the program, the configuration will be saved and usable from the Command-Line approach.

Before continuing, it is important to re-state that the S-File and I-File inputs are optional. However, the I-File is required when converting GPS/GLONASS data files. As is discussed in

Section E.3.1.1, the absence or presence of the S-File and/or the I-File affects header data that is output to both the RINEX Navigation and Observation Files. Please consult Section E.3.1.1 for the specifics in this area as they also apply under the Command-Line approach.

The general form of the command-line call to XYZAshRx is as follows:

XYZASHRX.EXE -I *bfile efile* [*sfile*] [*ionfile*] [*options*]

Notice that you are minimally required to use the "-I" option and specify the names of the B- and E-Files (parameters *bfile efile*, respectively). All items enclosed in "[" and "]" are optional. For example, the names of the S-File and I-File are optional. When specifying the input file names, it is assumed that either the current working directory contains the source data files or the full path to the files is specified as part of each file name. For example, the following call assumes that the input B-, E- and S- Files come from the current working directory:

Example 1:

```
XYZAshRx -I BN102A97.323 EN102A97.323 SN102A97.323
```

In the following example the B- file comes from the directory D:\BDATA and the S-file comes from the directory E:\EDATA (notice that no S-File is specified):

Example 2:

```
XYZAshRx -I D:\BDATA\BN102A97.323 E:\EDATA\EN102A97.323
```

The list of options for the program can be combined in any order and are as follows:

-O *obsfile*
-N *navfile*
-T *path*
-S *smooth*
-C *change*

When neither the "–N" nor the "-O" options are specified, XYZAshRx will automatically create the names of the output RINEX Navigation and Observation files. Additionally in this case, XYZAshRx will place these output files in the current working directory. When either the "–N" or the "–O" parameters are specified, XYZAshRx will only output the associated file type. Some examples are listed below.

Example 3:

```
XYZAshRx -I BN102A97.323 EN102A97.323 SN102A97.323
```

The converter uses the files BN102A97.323, EN102A97.323, and SN102A97.323, from the current working directory, as the input B-, E-, and S-Files, respectively. Because no -O or -N parameters were specified, XYZAshRx will automatically name the RINEX observation and navigation output files. The output files will be placed in the same directory as that of the B-File, which is the current working directory in this case.

Example 4:

```
XYZAshRx -I BN102A97.323 EN102A97.323 –O OBS.DAT –N NAV.DAT
```

The converter uses the files BN102A97.323 and EN102A97.323 from the current working directory as the input B- and E-Files, respectively. Because no S-FILE was specified, the converter will use the site related data stored in the program's configuration file for site related data. Because the -O parameter was specified, the converter will output the Observation data to the file OBS.DAT. The -N parameter specifies that the Navigation RINEX data will be output to the file NAV.DAT. The output files will be placed in the same directory as that of the B-File, which is the current working directory in this case.

The "-T" parameter allows you to specify the target path of the output RINEX files. Some examples are listed below.

Example 5:

```
XYZAshRx -I BN102A97.323 EN102A97.323 SN102A97.323 –T D:\RINEX.OUT
```

The converter uses the files BN102A97.323, EN102A97.323, and SN102A97.323, from the current working directory, as the input B-, E-, and S-Files, respectively. Because no -O or -N parameters were specified, XYZAshRx will automatically name the RINEX observation and navigation output files but will place these files in the directory D:\RINEX.OUT.

Example 6:

```
XYZAshRx -I BN102A97.323 EN102A97.323 –O OBS.DAT –N NAV.DAT –T
           E:\RINEX.OUT
```

The converter uses the files BN102A97.323 and EN102A97.323 from the current working directory as the input B- and E-Files, respectively. Because no S-FILE was specified, the converter will use the site related data stored in the program's configuration file for site related data. Because the -O parameter was specified the converter will output the Observation data to the file OBS.DAT. The -N parameter specifies that the Navigation RINEX data will be output to the file NAV.DAT. The output files will be placed in the directory E:\RINEX.OUT.

The "-S" option allows you to specify whether the converter will output smoothed or raw codephase measurements. Permissible values for this parameter are 0 and 1; the value 1 directs the program to output the smoothed codephase contained in the Ashtech B-File. When the –S option is not specified, XYZAshRx will apply the smoothing as if "–S 1" were specified on the command-line. The –C option is used to specify whether or not the site name change records are to be written to the output RINEX Observation file. Permissible values for this parameter are 0 and 1; the value 1 directs the program to output the site name change records. When the –C option is not specified, XYZAshRx will output site name change records as if "–C 1" were specified on the command-line. Some examples are listed below.

Example 7:

```
XYZAshRx -I BN102A97.323 EN102A97.323 SN102A97.323 –S 1
```

The converter uses the files BN102A97.323, EN102A97.323, and SN102A97.323, from the current working directory, as the input B-, E-, and S-Files, respectively. Because no -

O or -N parameters were specified, XYZAshRx will automatically name the RINEX observation and navigation output files. The output files will be placed in the same directory as that of the B-File, which is the current working directory in this case. Additionally, the -S parameter specifies that the converter will output Ashtech smoothed codephase observations.

Example 8:

```
XYZAshRx -I BN102A97.323 EN102A97.323 -p D:\RINEX.OUT -C 0
```

The converter uses the files BN102A97.323 and EN102A97.323 from the current working directory, as the input B- and E-Files, respectively. Because no -O or -N parameters were specified, XYZAshRx will automatically name the RINEX observation and navigation output files but will place these files in the directory D:\RINEX.OUT. Additionally, the -C parameter specifies that there will be no (i.e. 0) site change records written to the output RINEX observation file.

To convert a meteorological file (stored in a NMEA capture file) from the command-line, use the following form to call XYZAshRx:

```
XYZAshRx -M inmetfile outmetfile [gpswk gpswksec]
```

where,

inmetfile	The name of the input meteorological file. If no path is provided, it is assumed that the file will come from the current working directory.
outmetfile	The name of the output RINEX meteorological file. If no path is provided, it is assumed that the file will be output to **the same directory in which the input file is stored**.
gpswk	Specifies the start day of the input file. This field allows you to specify the GPS week component of time. This field will be ignored (if supplied) when the input meteorological data is an Ashtech D-File.
gpswksec	Specify the start day of the input file. This field allows you to specify the seconds of GPS week component of time. This field will be ignored (if supplied) when the input meteorological data is an Ashtech D-File.

Notice that the *gpswk* and *gpswksec* parameters are optional. However, if you specify either then you must specify both, even if *gpswksec* is zero. If you choose not to specify the start time of the file, the program will use the current CPU time to determine the start day of the data (you are strongly encouraged to avoid this approach). Both field will be ignored if the input file is an Ashtech D-File containing meteorological data (because the D-Files contain unambiguous time stamps).

All other parameters used in the conversion, such as leap seconds and header data (see Section E.3.1.2), will use values maintained from the **last GUI run of the program**.

The following provides an example:

```
XYZAshRx –M A99005.NMA N1020051.99M 991 176752
```

In this example the converter uses the file A99005.NMA from the current working directory as the input meteorological data file. The output RINEX meteorological data file will be placed in the file N1020051.99M. Furthermore the converter will use the GPS time 991, 176752 (i.e., the GPS week and seconds of GPS Week, respectively) to designate the start day of the source meteorological data. Notice that 176752 does not fall on an exact day boundary. This is acceptable because the source data is time stamped with time of day. Therefore, the specified GPS time need only be accurate to the day in which the data falls as the converter will resolve the time of day within that day. Again, the value stored for the leap seconds parameter from the **last GUI run of the program** will be used to convert UTC time tags to GPS time (see Section E.3.1.2).

Appendix F

Utility Program UpackU12

F.1 Introduction to UpackU12

Thales Navigation's µZ-Family of receivers maintains an internal data storage format that differs from normal processing files extracted from these receivers. Normally, users of these receivers process the Ashtech formatted B-, E-, and S-Files or RINEX files. However, the **Micro-Manager** program downloads the data from the µZ-Family of receivers in the format stored by the receiver (referred to as receiver image files). As a result, the downloaded receiver image files cannot be processed directly with normal processing packages.

UPackU12.EXE was designed to convert receiver image files extracted from the µZ-Family receivers. The program has been designed to operate on a Windows 95/98/ME/NT and 2000 platforms. To accommodate a wide variety of users, UPackU12 can be configured and run through normal Windows Graphical User Interfaces (GUI) or launched directly from the command-line. That is, a user can use the conversion program just like most other Windows programs or the converter program can be executed, without need of human intervention, from other programs (such as Ashtech's **Micro-Manager** Software), from a DOS command line, or from batch files.

UPackU12 currently supports the µZ-Family of Ashtech GPS receivers. Data are output in the Ashtech formatted processing data files. The specific types of files output include:

1) B-Files (i.e., raw observation files)
2) E-Files (i.e., broadcast navigation message files)
3) S-File (i.e., site files)
4) C-Files (i.e., corrected position output file)
5) Event Files
6) Almanac Files
7) Photo Files

F.1.1 Minimum System Requirements

UPackU12 requires the target platform to be a Windows 95/98/ME/NT or Windows 2000 based computer. While UPackU12 requires less than 1 megabyte of memory to run, Windows 95/98/ME/NT and 2000 impose higher minimums. You should consult the appropriate Microsoft documentation to determine the minimum system requirements for Windows.

UPackU12 requires less than 2 megabytes of disk space. However UPackU12 creates output files from your receiver image files. As a general rule, the output files will require up to

3.5 times the space required by the image files. The exact amount required depends highly upon the type of data stored in the receiver image files (which dictates the type and content of the output files).

F.1.2 Demo Versions

There are two basic configurations of UPackU12: fully operational and demonstration versions. This document applies to both configurations. Demonstration versions, which are freely distributed over the Internet or provided on diskette without accompanying sentinel keys, will not be nearly as capable as the operational versions. For example, demonstration versions will not allow the output of any data. This document will not seek to delineate the specific differences between the demonstration and the operational versions. It is important to note, however, that the installation instructions documented herein apply to both configurations.

F.2 INSTALLATION OVERVIEW

UPackU12 is currently distributed as part of **Micro-Manager**. The program will be installed in the same directory as that of MicroMgr.exe. For example, if during the installation of **Micro-Manager**, you chose to install **Micro-Manager** into the "D:\Program Files\ASHTECH\MicroMgr" directory, then UPackU12 would be installed into the same directory.

The automatic installation of **Micro-Manager** does not put UPackU12 into the Windows search path. One can add UPackU12 to the Windows search path by right clicking on "My Computer", selecting the "Properties" menu item, selecting the "Environment" tab, selecting the "Path" system variable and then editing the "Value" field to include the directory in which UPackU12 is stored.

Additionally, the automatic installation of **Micro-Manager** neither puts an icon onto the desktop nor in the Start Menu bar. To create a program icon on the desktop, simply find the program file UPackU12.EXE using "My Computer", right click and drag the icon to the desktop and select "Create Shortcut Here". For details on how to add a program to the Start Menu, consult Windows Help searching on "Start Menu" and selecting the topic dealing with adding menu items to the Start Menu.

Finally, UPackU12 is protected by a software sentinel key (the same key as is used by **Micro-Manager**). The software sentinel key is installed by attaching the end of the sentinel key labeled ↑COMPUTER↑ to a parallel printer port of your computer. Tighten the screws of the sentinel key to connect the key securely to your computer. If a printer was connected to your computer, attach that cable to the sentinel. If the sentinel cannot be installed because of an obstruction behind the computer, you can place the sentinel key later in the parallel sequence (for example, you could attach the sentinel key to a DB-25 male to DB-25 female cable which is connected to your computer's parallel port).

F.3 RUNNING UPackU12

UPackU12 creates typical Ashtech formatted processing data files from μZ-Family receiver image format files. The program can be manually instructed to convert files or can be called directly from the command-line. This latter method allows programs to invoke the converter without the need of human intervention. Throughout the remainder of this documentation, we will call the former approach the Manual/GUI approach and the latter will be called the Command-Line approach.

Both the Manual/GUI and the Command-Line approaches rely upon configuration information contained in the .INI file associated with the converter program. This .INI file is called "UPackU12.INI" and is stored in the same directory as the main program. Changes to this configuration file occur whenever the user changes configuration using the Manual/GUI approach. That is, when desiring to use the Command-Line mode, you should pre-set the configuration using the Manual/GUI approach. Section F.3.1 will describe the Manual/GUI approach to using UPackU12 and Section F.3.2 will describe the Command-Line approach to using UPackU12.

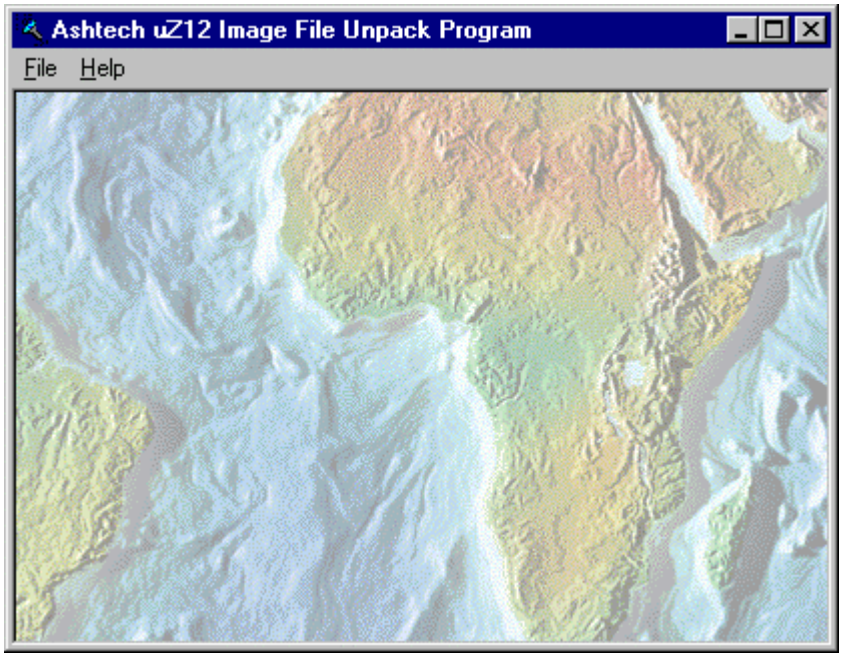
It is important to re-state the fact that the configuration information is stored in the file "UPackU12.INI" which is stored in the same directory as the program file (i.e., "UPackU12.EXE"). When you desire an alternative configuration, for example to support two **Micro-Manager** installations simultaneously, you should copy the following files to another directory:

UPackU12.INI
UPackU12.EXE
UPackU12.BMP

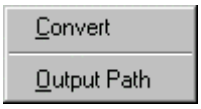
By doing this, you create an independent copy of the .INI file. Launching the program UPackU12.EXE in this copied directory causes the program to use the .INI file in that directory. This copy would utilize a configuration that is independent of the other copy (i.e., the original copy) of UPackU12 on your computer. In contrast, launching two copies of the UPackU12 from the same directory accesses the same .INI file. The configuration stored at the end of the runs of the programs depends on which copy of the program terminated first. Needless to say, you are strongly advised not to launch more than one copy of UPackU12 from the same directory (unless both copies will use the exact same configuration information). Launching several copies of UPackU12, each originating from its own directory, is perfectly acceptable and supported by the sentinel key.

F.3.1 Manual/GUI Approach

Upon starting UPackU12 without command-line parameters, the following is displayed:



Notice the program has only two main menu items. When you select the "File" menu item you will be presented with the following drop-down menu:



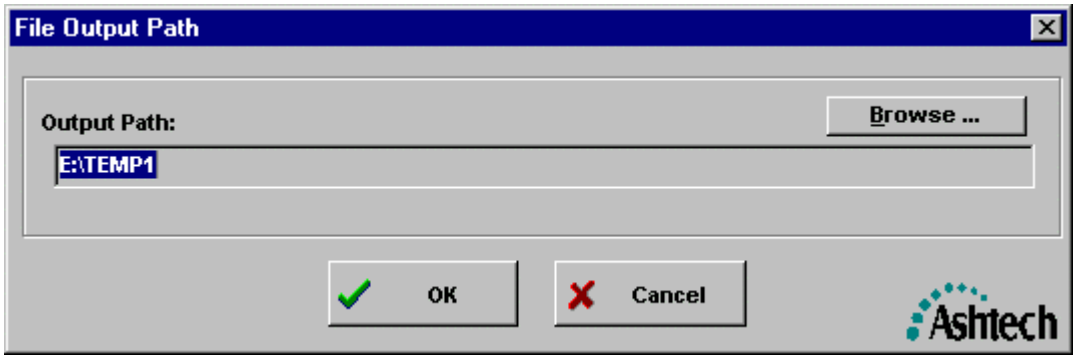
That is, you can only "Convert" to Ashtech processing using UPackU12 or set the output path. Upon selecting the "Convert" option, you will be presented with the File Selection Window presented in Section F.3.1.2. Through this window you will select the input and output files of a single conversion run.

When you select the "Help" menu item from the main menu, you will be presented with the following drop-down menu:

When you select the "About" menu item UPackU12 will display a window containing information about the program. In response to selecting the "Command Line Options" item UPackU12 will display a window describing how to invoke the Command-Line Mode of the program. The command-line mode is further documented in Section F.3.2 of this manual.

F.3.1.1 Output File Path

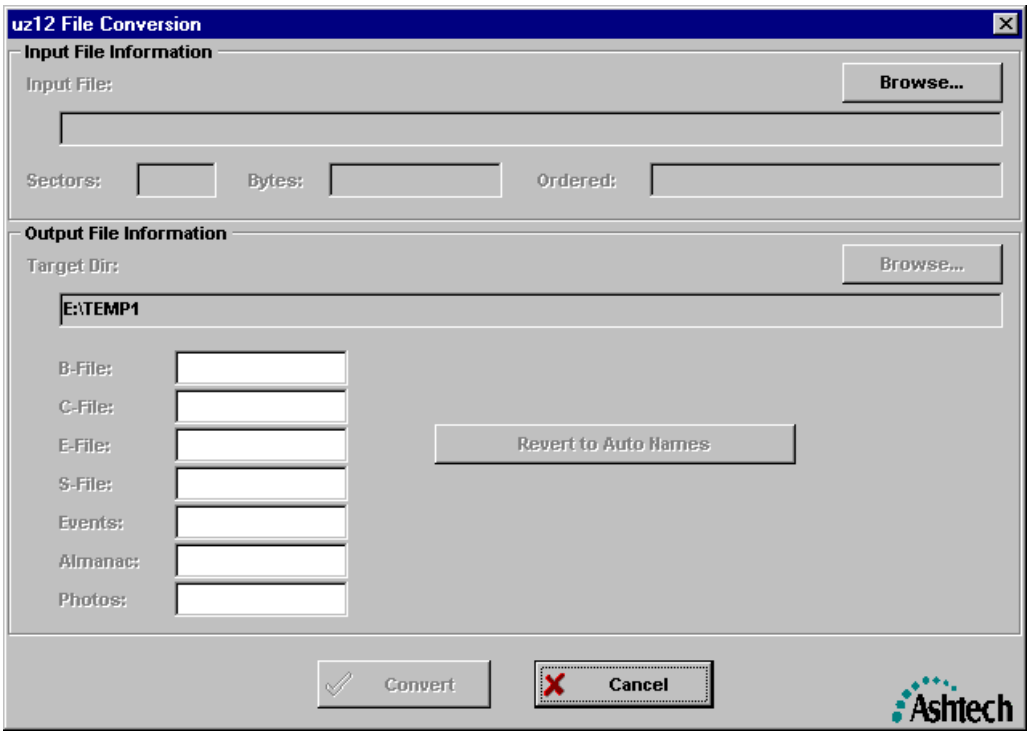
To set the default output path used by UpackU12, select the “Output Path” sub-menu item of the “File” main menu item. Upon doing so, you will be provided a window similar to the following.



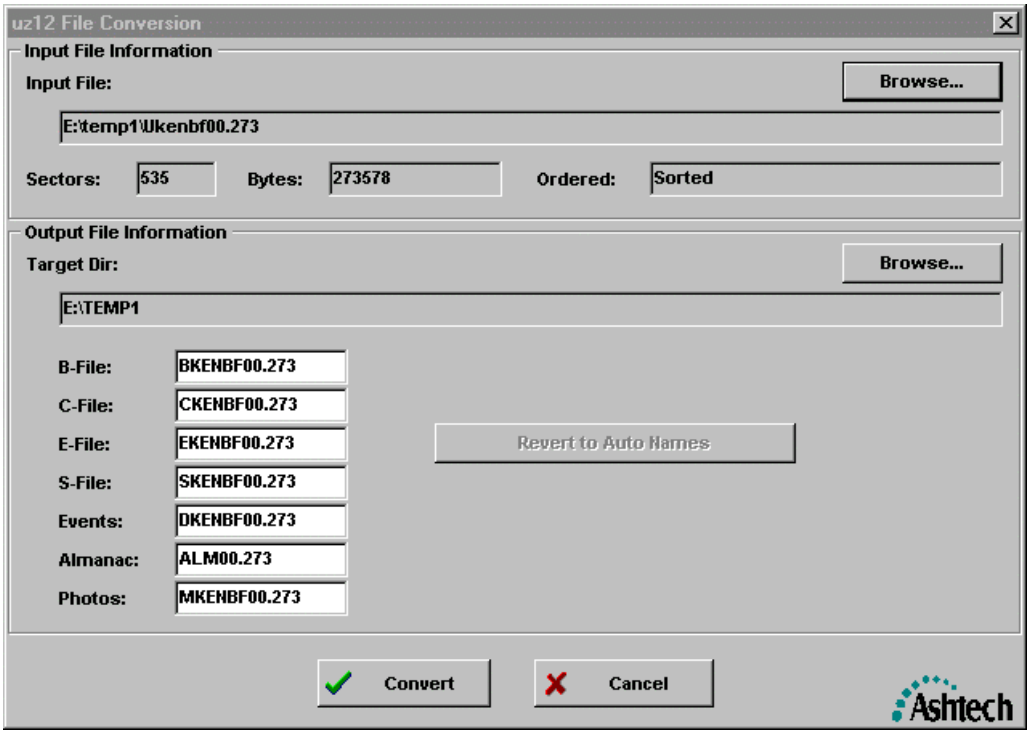
Through this window, you can “Browse” to locate the output directory used for the converted files.

F.3.1.2 File Selection Window

The File Selection Window is displayed in response to the “File | Convert” selection from the program’s main menu. The following provides an example of the File Selection Window:



Notice in the example that there are several fields and buttons disabled; disabled features are indicated by the light gray appearance of the labels and text contained in the fields. This is because there has been no input file selected. To select an input file (i.e., the image file to be converted), press the "Browse" button. You will be given a window that will allow you to browse through your file system to find and select the file to be converted. Upon selecting a valid receiver image file, the window will change to allow the editing of the disabled fields and will automatically create the names of the output files. These output file names, automatically generated by UpackU12, are based upon the time tag information stored in the image file. The screen capture that follows shows one such case.



The table that follows describes the contents of the Input file information.

Field	Description
Input File	The name of the input file (including drive and path) of the receiver image file to be converted.
Sectors	The number of 512 Byte sectors utilized by the image file. These sectors are the file storage sectors of the receiver image as it resided in the receiver's memory (not as stored on your disk).
Bytes	The size of the image file in bytes (not including the per sector overhead information stored as part of the file).

Field	Description
Ordered	This field was designed to provide a confidence level regarding the input file as an image file. That is, receiver image files are binary and follow a particular pattern. This pattern is mostly contained in the sector information of the image file. Image file sectors have a sorting order and are normally stored according to that sorting order. However, there are cases (such as a full receiver image download operation, which ignores the file boundaries) where the sorting order may not follow the normal pattern. For this reason, we don't just ignore files that do not follow the typical sorting order. Values displayed here are: Value — Description Sorted — High confidence that the file is a true receiver image file. Out or order (will be sorted) — Medium confidence that the file is a true receiver image file. Unsorted sectors will be sorted as part of the conversion process. Mostly Disordered (may not be U-File) — Low confidence that the file is a true receiver image file. Unsorted sectors will be sorted as part of the conversion process. Disordered (likely not a U-File) — Very Low confidence that the file is a true receiver image file. Unsorted sectors will be sorted as part of the conversion process.

The table that follows describes the fields of the "Output file Information" area. It is important to note that, while the output files are automatically named when the input image file is specified, you have the opportunity to change the output file names. Once you change any output file name, the "Revert to Auto Names" will become enabled. This button, when active and pressed, instructs UpackU12 to ignore all of your name editing changes and re-display the automatically generated names.

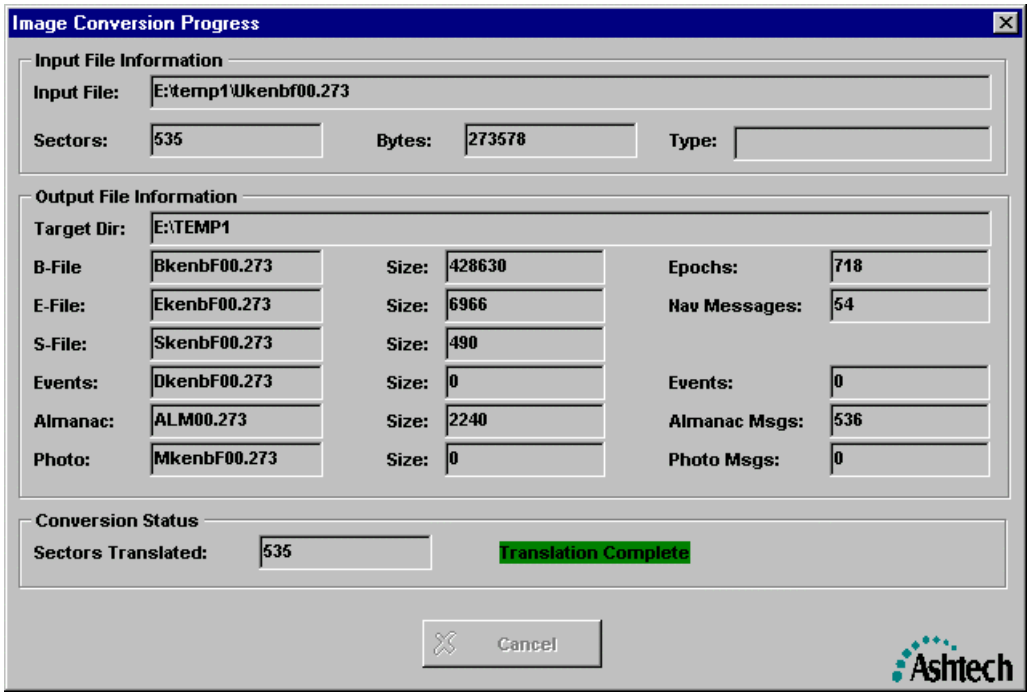
Field	Description
Target Dir	The path of the output files that will be created during the conversion process.
B-File	The name of the output observation file (called a B-File). This file is created when the image file was stored using Ranger Mode 0 (see your Receiver's Operations Manual for details).
C-File	The name of the output corrected position file (called a C-File). This file is created when the image file was stored using Ranger Mode 2 (see your Receiver's Operations Manual for details).
E-File	The name of the output broadcast navigation message file (called an E-File).
S-File	The name of the output site file (called an S-File).
Events	The name of the output event file which contains the events recorded by your receiver (see your Receiver's Operations Manual for details).
Almanac	The output satellite almanac file.

Field	Description
Photos	The output photogrammetry photo file (see your Receiver's Operations Manual for details).

To start the conversion process, press the "Convert" button. Please note that UpackU12 will create and open all of the output files specified through this window. However, if the conversion process yields no data for a given file, that file will be removed from the system upon completion of the conversion process. For example, not all receiver image files contain events. In these cases no data will be output to the Event file. When this occurs, UpackU12 will erase that file from the computer upon completion of the conversion process.

F.3.1.3 Image Conversion Progress Window

Upon pressing the "Convert" button in the File Selection Window, you will be presented with the Image Conversion Progress window. This window simply reports the progress of the conversion progress.



As the conversion progresses, this window will be updated.

As we stated earlier, if the conversion process yields no data for a given file, that file will be removed from the system upon completion of the conversion process. In the above example window, the conversion has completed and there were no records written for the Event and Photo files. As such, these files will be erased from the system.

F.3.2 Command-Line Approach

The Command-Line approach to running UPackU12 is invoked by calling the program with the command-line parameters listed in this section. The Command-Line approach permits automatic conversion to raw Ashtech data files without human intervention. In this way, programs or batch files can call UpackU12 to perform conversions.

Before continuing, it is important to re-state that there is a default output path. Sections F.3.1.1 described the setting of this default output path. This is important because the command-line mode of this program will use this default path unless the “output path” command-line option is specified. When the command-line “Output Path” option is specified, the default output path will be overridden for that run only.

The general form of the command-line call to UPackU12 is as follows:

UpackU12.exe [-C *Ufilename idx* [-N *template*] [-P *outpath*]]

Use the -C *Ufilename* for automatic decompression of an Ashtech U-XII receiver image file. These files are typically created by **Micro-Manager**. Here, the "Ufilename" is the full path name, including drive, directory, and name of the source receiver image file.

Use the -N *template* only in conjunction with the -C parameter. It is used to set the template name of the output files when you wish to override the automatic naming within the program. For example, if you desire the output B-File name to be BASHTA99.010 then set this parameter to "ASHTA99.010". That is, the file names will be created using the file type as the first character and the value of the template as the remaining characters.

Use the -P *outpath* only in conjunction with the -C parameter. It is used to set the output path of the converted files. When this parameter is not specified, the program will use the output path configured during the last interactive mode run of the program.

Example 1:

UpackU12.exe -C D:\NBS5\REMOTE.DAT\UNBS5A99.010

In this example, UPackU12 has been instructed to automatically convert the file D:\NBS5\REMOTE.DAT\UNBS5A99.010. The output file name will automatically be generated based upon the receiver file information stored in the image file. The output directory will be that configured during the last interactive mode run of the program.

Example 2:

UpackU12.exe -C D:\NBS5\REMOTE.DAT\UNBS5A99.010 -N XXXXA99.011

In this example, UPackU12 has been instructed to automatically convert the file D:\NBS5\REMOTE.DAT\UNBS5A99.010. The output file names will employ the template "XXXXA99.011". The output directory will be that configured during the last interactive mode run of the program.

Example 3:

UpackU12.exe -C D:\NBS5\REMOTE.DAT\UNBS5A99.010 -P E:\TEMP

In this example, UPackU12 has been instructed to automatically convert the file D:\NBS5\REMOTE.DAT\UNBS5A99.010. The output file name will automatically be generated based upon the receiver file information stored in the image file. The output directory will be "E:\TEMP".

Appendix G

Utility Program XYZs_FTP

G.1 Introduction to XYZs_FTP

XYZs_FTP.EXE, written by The XYZs' of GPS, Inc., is a generalized FTP program with command-line callable features. The program was designed to operate on Window 95/98/NT/2000 platforms. To facilitate a wide variety of users, XYZs_FTP can be configured and run through normal Windows Graphical User Interfaces (GUI) or launched directly from the command-line. In fact, a user can use the program just like most other Windows programs or the program can be launched, without need of human interaction, by other programs (such as Ashtech's **Micro-Manager Pro**), from a DOS command-line, or from batch files.

G.1.1 Minimum System Requirements

XYZs_FTP requires that the target platform be a Windows 95/98/NT/2000 based computer. While XYZs_FTP requires less than 1 megabyte of memory to run, Windows 95/98/NT/2000 impose higher minimums. Please consult the appropriate Microsoft documentation to determine the minimum system requirements for Windows.

XYZs_FTP requires less than 2 megabytes of disk space. The program does create ASCII output log files that contain a diagnostic/tracking history of FTP sessions, however the size of these files is normally very small (e.g., less than 200K per day).

A valid software sentinel key must also be present. XYZs_FTP was designed as a utility support program that supports other programs. As such, it was designed to utilize the sentinel keys of the programs that it supports. Currently, XYZs_FTP will operate using sentinel keys supplied with **Micro-Manager Pro** and 3D-Tracker.

G.2 INSTALLATION OVERVIEW

XYZs_FTP is currently distributed as part of **Micro-Manager Pro**. The program will be installed in the "Utils" sub-directory of **Micro-Manager Pro**. For example, if during the installation of **Micro-Manager Pro**, you chose to have **Micro-Manager Pro** installed into the "D:\Program Files\ASHTECH\MicroMgr" directory, then XYZs_FTP would be installed into the directory "D:\Program Files\ASHTECH\MicroMgr\Utils".

The automatic installation of **Micro-Manager Pro** does not put XYZs_FTP into the Windows search path. One can add XYZs_FTP to the Windows search path by right clicking on

"My Computer", selecting the "Properties" menu item, selecting the "Environment" tab, selecting the "Path" system variable and then editing the "Value" field to include the directory in which XYZs_FTP is stored.

Additionally, the automatic installation of **Micro-Manager Pro** neither puts an icon onto the desktop nor into the Start Menu bar. To create a program icon on the desktop, simply browse to the program file XYZs_FTP.EXE using "My Computer", right click and drag the icon to the desktop and select "Create Shortcut Here". For details on how to add a program to the Start Menu, consult Windows Help, searching on "Start Menu", and selecting the topic dealing with adding menu items to the Start Menu.

Finally, XYZs_FTP is protected by a software sentinel key (the same key as is used by **Micro-Manager Pro** or 3D-Tracker). The software sentinel key is installed by attaching the end of the sentinel key labeled ↑COMPUTER↑ to a parallel printer port of your computer. Tighten the screws of the sentinel key to connect the key securely to your computer. If a printer was connected to your computer, attach that cable to the sentinel. If the sentinel cannot be installed because of an obstruction behind the computer, you can place the sentinel key later in the parallel sequence (for example, you could attach the sentinel key to a DB-25 male to DB-25 female cable that is connected to your computer's parallel port).

G.3 RUNNING XYZs_FTP

XYZs_FTP was designed primarily to support the transfer of data files to and from an FTP server. There are other features available in this program that will be discussed shortly. Some of these features can be accessed through the Graphical User Interface (GUI) of the program or through command-line parameters. The command-line approach allows programs to invoke some of the features of this program without the need of human intervention. Throughout the remainder of this documentation, we will call the former approach the Manual/GUI approach and the latter will be called the Command-Line approach.

Both the Manual/GUI and the Command-Line approaches rely upon configuration information contained in the INI file associated with the converter program. This INI file is called "XYZs_FTP.INI" and is stored in the same directory as the main program. Changes to this configuration file occur whenever the user changes configuration using the Manual/GUI approach. In fact, when desiring to use the Command-Line mode, one should pre-set the configuration using the Manual/GUI approach. Section G.3.1 will describe the Manual/GUI approach to using XYZs_FTP and Section G.3.2 will describe the Command-Line approach to using XYZs_FTP.

It is important to re-state the fact that the configuration information is stored in the file "XYZs_FTP.INI" which is stored in the same directory as the program file (i.e., "XYZs_FTP.EXE"). When you require an alternative configuration, for example to support two simultaneously operating **Micro-Manager** programs, you should copy the following files to another directory:

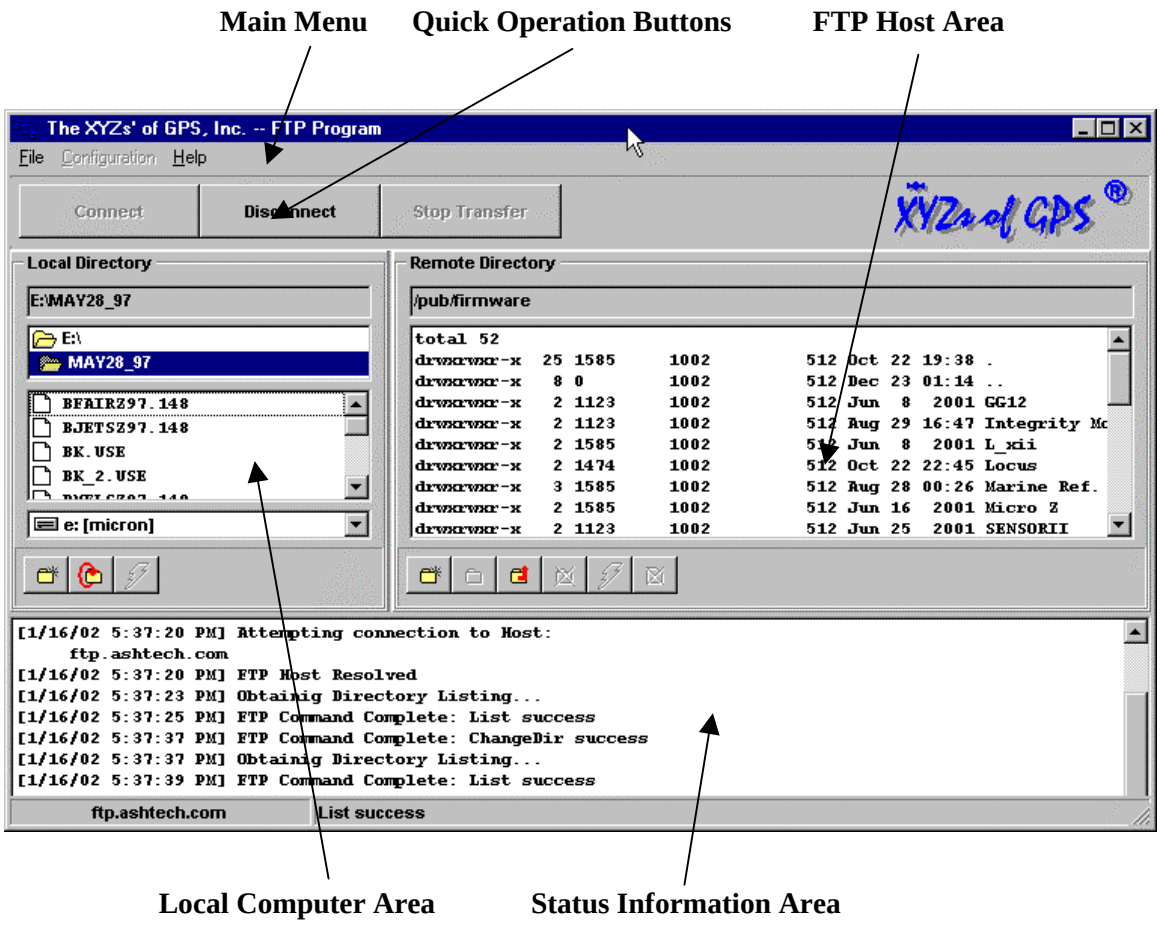
XYZs_FTP.INI

XYZs_FTP.EXE
XYZs_FTP.BMP

By doing this, you create an independent copy of the .INI file. Launching the program XYZs_FTP.EXE from this new directory causes the program to use the INI file from that new directory. This copy would, thus, utilize a configuration that is independent of the other copy (i.e., the original copy) of XYZs_FTP on your computer. In contrast, launching two copies of the XYZs_FTP from the same directory will result in the same INI file being accessed. The configuration stored at the end of the program runs is dependent upon which copy of the program terminated first. Needless to say, you are strongly advised not to launch more than one copy of XYZs_FTP from the same directory (unless you intend to have both copies use the exact same configuration information, which is what is the intent of the –Q option described in Section G.3.2). Launching several copies of XYZs_FTP, each originating from its own directory, is perfectly acceptable and encouraged.

G.3.1 Manual/GUI Approach

Upon starting XYZs_FTP without command-line parameters, the following is displayed:



Presented above is the main program window divided into sections - the names of which will be used for reference. These sections are briefly described in the table that follows:

Section	Brief Description
Main Menu	The main menu of the program. Through these, one accesses various information and settings of the program.
Quick Operation Buttons	These buttons are placed here to allow quick access to several features of the program. “Connect” is used to start the process of connecting to an FTP server. “Disconnect” will become available once a connection with an FTP host has been established. The button is used to break the connection with the connected host. “Stop Transfer” becomes available when an FTP (i.e.,

	file transfer) operation is in progress.
Local Computer Area	Within this section are information related to your local computer and GUI elements that allow one to interact with the local computer system. For example, the last drop-down list box in this area is used to select another drive on the local computer. Also within this area are context sensitive buttons that become enabled or disabled depending upon the current state of the program. For example, when the lightning button (i.e., the button with the lightning bolt icon) is enabled, one can press that button to cause the highlighted file to be transferred to the FTP host. When the button is disabled, the FTP transfer of files from the local computer to the FTP host is not permitted (e.g., you have not yet established a connection to the FTP host). These buttons are described in more detail in Section G.3.1.2.1.
FTP Host Area	Within this section are information related to FTP host system and GUI elements that allow one to interact with the FTP host computer system. The top pane of this area shows the current directory on the FTP Host system. The pane below that shows a directory listing of the current directory of the FTP Host system. At the bottom area of this window are a set of context sensitive buttons that become enabled or disabled depending upon the current state of the program. For example, the button with the red up-arrow folder is used to move up one directory level on the FTP Host system. When this button shows its icon in color, the button is enabled. When the button is disabled, it is displayed in faint gray. These buttons are described in more detail in Section G.3.1.2.2.
Status Information Area	The status information area is used to display diagnostic/status information about the connection and/or the operation in progress.

In the upper-right-hand corner of the window is an "XYZs of GPS" logo. The color of this logo is used to provide normal/alert level status information. What follows provides a description of each state.

This state indicates that XYZs_FTP is operating normally and without any reported alert or warning conditions. The satellite icon above the lettering will continuously be moving.

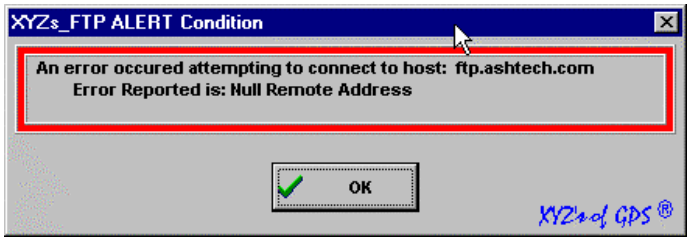
The letters of the icon toggle between yellow and blue. This state indicates a warning condition and is accompanied by a window, which explains the warning.

The letters of the icon toggle between red and blue. This state indicates an alert condition and is accompanied by a window, which explains the alert.

There are two levels of error conditions reported through this program: 1) Warnings; and 2) Alerts. Warnings (i.e., the yellow flashing icons) are used to designate conditions that require your attention but are not potentially fatal to proper execution of the program. Alerts (i.e., the red flashing icons), on the other hand, are used to designate conditions that may arise that have a potentially adverse effect on the continued operation of the program and you are advised to immediately terminate the program upon receiving such an alert. During command-line mode

(see Section G.3.2), XYZs_FTP will terminate the program when these Alert (i.e., but not Warning) conditions arise.

As mentioned earlier, when an alert or warning condition arises, XYZs_FTP will display a window explaining what would likely cause such a condition. The following is an example of a window displayed during an alert condition.



Each of these windows, announcing alert and warning conditions, are controlled by a timer. If you fail to respond using the "OK" button within that window and the timer expires, then the window will be removed. We have taken this approach because error conditions may arise during the command-line (i.e., unattended) mode of the program. When this occurs, these windows will still be displayed and removed when the timer runs out. The error condition will be written to the Log File (see Section G.3.1.1.2.3) and the Status Information Area described above.

XYZs_FTP can be configured to play a sound file when alert or warning conditions occur. A separate sound file can be played to distinguish between warning and the alert conditions. Refer to Section G.3.1.1.2.2 for more details on configuring XYZs_FTP to play sound files.

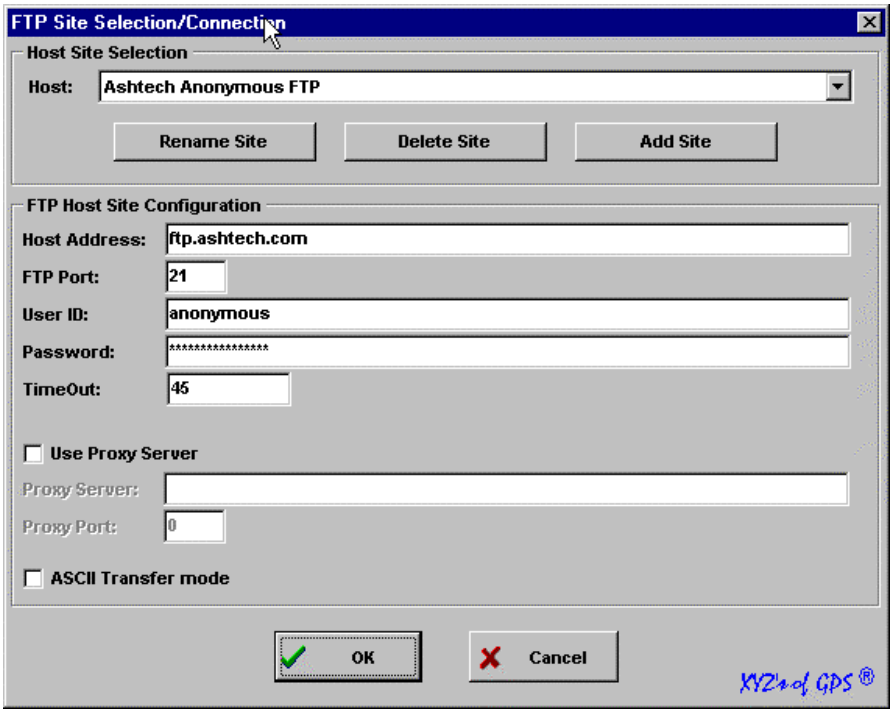
G.3.1.1 Configuring the Program

Before running the program, you are advised to set the configuration to meet your needs. The configuration options are accessed using the "Configuration" menu item of the main menu. Upon selecting the "Configuration" main menu item, a drop-down menu similar to the following will be displayed.

The "FTP Host Sites" menu option is used to configure (and/or connect to) Host FTP sites. The "Options" menu item is used to set various program options specific to your local system environment (and, as such, this will be described first).

G.3.1.1.1 Configuration/FTP Host Sites

Upon selecting the "FTP Host Sites" sub-menu item of the main menu "Configuration" item, a window similar to the following will be displayed.



That Host's system administrator controls access to an FTP Server. Consequently, in order to gain access to an FTP server, an account, password, and access permissions must be granted/created by the administrator of that system. This is important, especially with regard to access permissions.

XYZs_FTP is capable of uploading to and downloading files from an FTP Server as well as creating and deleting host server directories. However, the account that is setup by the system administrator must grant all of these capabilities or can restrict or deny any of them. Therefore, your ability to use features of the FTP program are highly dependent upon the account and whatever access privileges are granted when the system administrator creates/updates your account.

XYZs_FTP can store configuration information for several different FTP hosts. It can even store multiple configurations (say for different accounts) for the same host. The uniqueness is identified by a descriptive host name that you provide. Under the area of this window labeled as "Host Site Selection" there is a drop-down list of all the independent configurations. To add a new host, simply press the "Add Host" button. Upon doing so, you will be provided with a window through which you can provide a descriptive name of the host. You then create this descriptive host. To rename a host (i.e., to alter the descriptive name), select the host via the drop-down list box and then press "Rename Site". Upon doing so, you will be provided a prompt window through which you can change the name of the host. To delete a host configuration, simply select the host to be deleted (via the drop-down list box) and press "Delete Site".

The configuration of the currently selected host site is contained in the area of the window that is labeled “FTP Host Site Configuration”. The table that follows describes each of the elements this window area.

Field	Description
Host Address	Enter the URL or IP address of the FTP host.
FTP Port	TCP/IP connections consist of an address and a port number. One can treat each port number as a different virtual connection to the host site. By an industry-recognized convention, supplied port numbers are used for different networking services (e.g., TELNET, SMTP, and FTP). Port 21 is used by nearly all systems for FTP services. We provide an entry for the port number to allow FTP connections with servers that do not support the recognized convention. Again, normally Port 21 is used for FTP transfers.
User ID	This is the User ID (or login name) that is created by the System Administrator of the host site. That is, even though a host site exists and is accessible through the network (or internet), you cannot gain access to the FTP services until that host system allows you to log in. Even though an account has been set up for you (giving you a user name and password), you may not be able to access all of the FTP features (such as creating directories, deleting directories, uploading files, and/or downloading files) unless your account has been created with the appropriate access privileges. You must check with the host system administrator for account information and he/she must grant the access privileges.
Password	See “User ID” described above. To protect your password, the prompt field will always contain asterisk characters for each letter of the password. Additionally, the configuration information for each site is stored in a file. The passwords, however, are encrypted in that file. Backspace and correction is permitted.
TimeOut	This field specifies the maximum number of seconds to wait between the issuance of a command and the receipt of a reply before declaring a no response condition to the command. If the network over which you will be communicating routes a high volume of traffic, you may need to increase this number.
Use Proxy Server, Proxy Server, and Proxy Port	The use of a Proxy Server is highly dependent upon your connection to the FTP Host. Most FTP users will NOT need to enable the use of a proxy Server. To determine your need of proxy servers, please consult a network administrator for details. Enabling the “Use Proxy Server” checkbox enables the “Proxy Server” and “Proxy Port” fields. The “Proxy Server” field should contain the name or IP address of a proxy server if access is being carried out via a proxy port. The “Proxy Port” field should contain the port of the proxy server, if one is being used.

Field	Description
ASCII Transfer Mode	Various systems, such as UNIX and Windows, store ASCII files in slightly different formats (i.e., the End of Line and End of File markers can differ). When ASCII files are transferred between these systems, special handling of these special characters must occur to translate them to the appropriate form on the receiving end. Unfortunately, many systems do not tag files as either ASCII or binary and the special characters that are in a typical ASCII file are also in binary files. Therefore, in order to translate ASCII files properly during upload/download, you must set the ASCII Transfer Mode On (i.e., the checkbox should be checked). However, because this program was designed as a companion program for GPS binary data files, it is recommended that you leave this checkbox unchecked until it is needed.

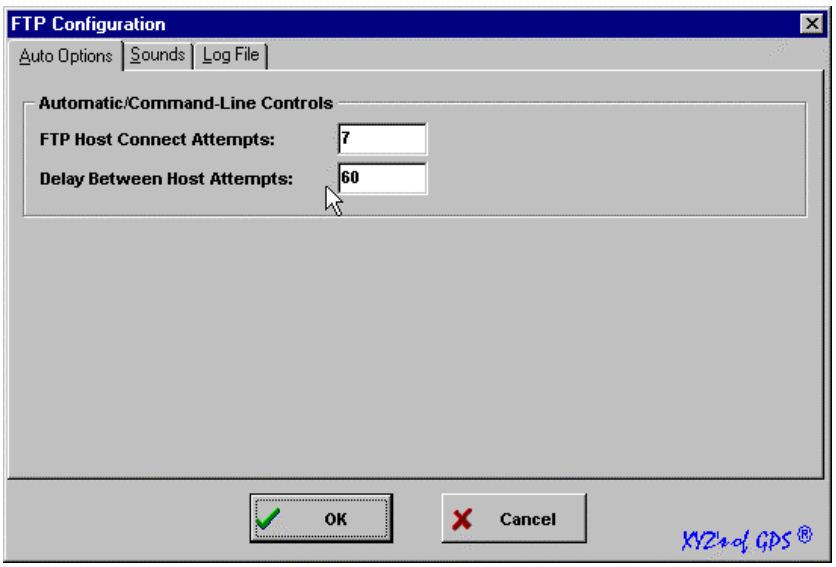
G.3.1.1.2 Configuration Options

There are several miscellaneous configuration options of XYZs_FTP that are reached by selecting the main menu "Configuration" item and then selecting the "Options" sub-menu item. The displayed window is divided into three categories, each of which are described in the following sub-sections.

G.3.1.1.2.1 Configuring Auto-Options

The "Auto-Options" tab of the FTP Configuration Window is used to set some parameters that will be used by the program when it is run in command-line mode (see Section G.3.2). That is, this program can be run from command-line mode and has been designed to operate with other programs in an unattended mode. For example, when this program is operated in the GUI mode and connection attempt to a server fails, the operator gets an immediate notification and he/she can decide to try again or wait until later. When this program is operated in a command-line mode and a connection to a particular host site fails, some action must be taken to try to re-connect to that server later. The "Auto-Options" tab of this window allows one to configure the parameters that govern the re-connect process.

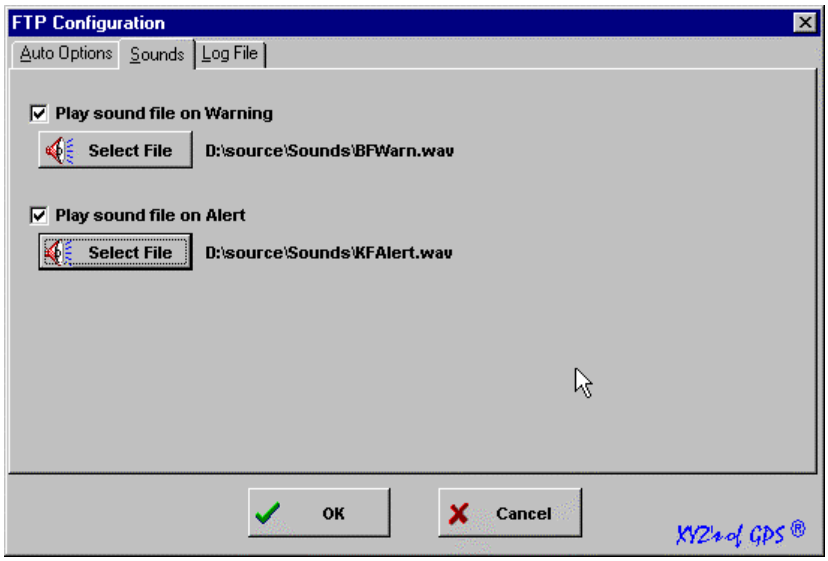
The following is an example of the “Auto-Options” tab.



The “FTP Host Connect Attempts” establishes the number of times that this program (when run from its command-line, see Section G.3.1.1.1) will attempt to re-connect with an FTP host site. The “Delay Between Host Attempts” parameter is used to specify the number of seconds between re-connect attempts. If XYZs_FTP never connects to the host, a notice will be written in the Log file created by the program (see G.3.1.1.2.3).

G.3.1.1.2.2 Configuring Sounds

XYZs_FTP is capable of playing WAV files when an alert or warning condition arises (see Section G.3.1 for an explanation of these conditions). The “Sounds” tab of the “FTP Configuration” window allows one to set the sound files that will be played when the alert or alarm condition arises. IT IS IMPORTANT TO NOTE THAT XYZs_FTP DOES NOT CHECK TO ENSURE THAT A) YOU HAVE A SOUND CARD AND B) THAT YOUR SOUND CARD IS CAPABLE OF PLAYING WAV FILES. If your computer does not have a sound card, it is suggested that you not attempt to play any sounds: i.e., that you leave the “Play sound file on Warning” and “Play sound file on Alert” checkboxes unchecked.

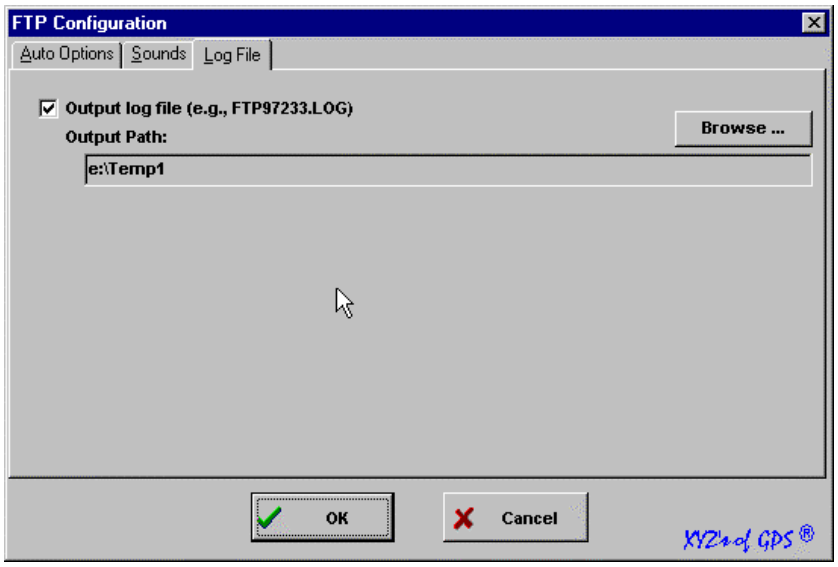


To play a sound file on the Warning condition, ensure that the "Play sound file on Warning" checkbox is checked and you use the associated "Select File" to select the desired WAV file. Upon making your file selection, XYZs_FTP will test play that selected sound file. Likewise, to play a sound file on the Alert condition, ensure that the "Play sound file on Alert" checkbox is checked and you use the associated "Select File" to select the desired WAV file. Upon making your file selection, XYZs_FTP will test play that selected sound file.

When either a warning condition or an alert condition exists, XYZs_FTP will provide a window describing the alert or alarm condition (which will stay visible for about 5 to 10 seconds) and then attempt to play the selected sound files every 1.5 seconds (i.e., repeating the sound file every 1.5 seconds while the window is visible). Because the XYZs_FTP starts to play these sound files at 1.5-second intervals, you are advised to keep your warning and alert sound files shorter than 1.5 seconds to avoid (annoying) overlaps.

G.3.1.1.2.3 Configuring Log File

The "Log File" tab of the FTP Configuration window is used to configure an output log file. Every message written to the "Status Information Area" (see Section G.3.1) will also be written to the configured log file (if the option has been enabled). Each separate log file entry will contain a time tag (enclosed in square brackets: i.e., "[" and "]"). This time tag is the CPU time associated with when the message was written. The following is a screen capture showing the log file configuration tab.



The checkbox labeled "Output log file" is used to enable/disable the log file output. When checked, the output log file option is enabled. Simply use the "Browse" button to select the directory within which the log files will be created.

Log files created when XYZs_FTP is run have the following naming convention:

FTP*yyddd*.LOG

where, *yy* Year of log file creation (2-digits)
ddd The day of the year of log file creation (3-digits)

The year and day of year values are obtained from the CPU clock. If the program is started and the log file name generated by the program matches one already on the system (in the specified output log directory), then XYZs_FTP will append to that file. Log files are opened when the program starts and close when the program ends. That is, if the program runs continuously for several days, only one log file will be active (and have a file name that corresponds to the time at which the program was started).

G.3.1.2 Performing FTP Functions

To begin FTP functions, one must be connected to an FTP host site. However, to connect to a site and to perform FTP functions two elements must already be in place:

1) Your computer must be capable of connecting to a network that communicates with the Host FTP site; and
2) An access account must be configured on the Host site that grants you FTP access.

The process of getting your computer connected to a network that communicates with the FTP host site is beyond the scope of this manual. For details in this area, it is suggested that you contact your MIS Department and/or your system administrator, or consult your computer manuals (e.g., Windows Remote Access Server).

XYZs_FTP is capable of uploading to and downloading files from an FTP Server as well as creating and deleting host server directories (these are example FTP functions). However, the account that is setup by the system administrator must grant all of these capabilities or can restrict any of them. Therefore, your ability to use features of the FTP program are highly dependent upon the account and access privileges granted when the system administrator creates/updates your account.

Once items 1 and 2 are in place, you can connect to an FTP site by pressing the button labeled “Connect” in the upper-left area of the main program window. Upon doing so, you will be presented with a window similar to that described in Section G.3.1.1.1 (please consult that section for other details on the editable window elements). The main difference between the window shown in Section G.3.1.1.1 and that which will be displayed when the “Connect” button is pressed is that the “OK” button will be labeled “Connect”.

Before pressing the “Connect” button on the displayed window, simply use the drop-down list box (labeled “Host”) to select the desired host site. Upon pressing the “Connect” button, XYZs_FTP will attempt to connect with the specified FTP host system. During the connection process, many of the display elements of the main window will be disabled. After the

connection is established, XYZs_FTP will attempt to load and display directory information of the host FTP site (in the main window "FTP Host Area" described in Section G.3.1).

The sub-sections that follow describe the window elements/features of the main window once a connection has been established.

G.3.1.2.1 Local Computer Area Window Elements

Section G.3.1 shows a breakdown of the major window elements of the main window. The elements labeled "Local Computer Area" (in Section G.3.1) will now be described.

Within the "Local Computer Area" is information related to your local computer and GUI elements that allow one to interact with the local computer system. The topmost element of this area contains the current working directory of the local drive. The next control element, below that, allows one to select the current path of the local hard drive. The next pane to follow contains the set of files stored in the selected path. This pane allows one to select a single file (upon doing so, the file transfer button of the Local Computer Area will be enabled – which will be described shortly). The next pane contains the device selection drop-down list box. Through this drop-down list box, one selects alternative devices/drives on the local PC.

The final pane of the window contains a set of context sensitive buttons that are related to the local computer system. These buttons are as follows:

This button allows one to create a new folder (or subdirectory) on the local computer system

This button is a refresh button for the local computer directory information. This button exists only because some operating systems do not auto-refresh the directory listing components of this window when a change to the files structure occurs (e.g., another program places a file into the directory which is currently being displayed in the Local Computer Area). Pressing this refresh button ensures that the directory information displayed is the latest.

This button is used to upload the currently selected local computer system file to the FTP host system.

G.3.1.2.2 FTP Host Area Window Elements

Section G.3.1 shows a breakdown of the major window elements of the main window. The elements labeled "FTP Host Area" (in Section G.3.1) will now be described.

Within the "FTP Host Area" is information related to FTP host system and GUI elements that allow one to interact with the FTP host computer system. The top pane of this area shows the current directory on the FTP Host system. The pane below that shows a directory listing of the current directory of the FTP Host system. Each entry within this pane that starts with a "d" is a sub-directory. To change to that sub-directory, two alternative methods can be used: 1) double-click the line containing the "d" or 2) Press the change directory button described below.

At the bottom area of this window are a set of context sensitive buttons that become enabled or disabled depending upon the current state of the program. An enabled button shows color and, when the mouse pointer is rested over and enabled button for a moment, a hint describing each button will be displayed. A disabled button is displayed in a grayed-out color and the button does not respond to button presses. The buttons are described below.

This button allows one to create a new folder (or subdirectory) on the FTP host system (assuming the account privileges grant this capability).

This button allows one to move one directory deeper into the directory tree on the FTP host system (assuming the account privileges grant this capability). One must first select a "d" entry in the FTP host directory-listing pane of the window.

This button allows one to move one directory up in the directory tree on the FTP host system (assuming the account privileges grant this capability and one is not at the top level directory).

This button, when pushed, will request the removal of the selected sub-directory on the FTP host system (assuming the account privileges grant this capability). One must first select a "d" entry in the FTP host directory-listing pane of the window.

This button is used to download the currently selected FTP host system file (in the FTP host directory-listing pane of the window). Like the other buttons of this area, this assumes that the account privileges grant this capability.

This button is used to request that the FTP host system delete the currently selected FTP host system file (in the FTP host directory-listing pane of the window). Like the other buttons of this area, this assumes that the account privileges grant this capability.

G.3.2 Command-Line Approach

The Command-Line approach to running XYZs_FTP is invoked by calling the program with the command-line parameters listed in this section. The Command-Line approach permits automatic FTP operations on a named Host FTP site without human intervention. In this way, programs or batch files can automatically perform FTP functions (such as uploading result files to an FTP server).

In Section G.3.1.1.2.1, FTP "Auto-Options" are described. The parameters, detailed in that section, govern some of the behavior of XYZs_FTP when invoked using the command-line approach. But before continuing, we need to describe two primary modes of the command-line approach.

Often, multiple programs and batch files in an unattended system will need to FTP files to an FTP host system. This presents a dilemma for XYZs_FTP. For example, suppose two copies of XYZs_FTP are launched by different programs (via the command-line) and they both attempt to connect to the same host FTP site. Often these sites allow only one connection on a given

account. Therefore, a race condition ensues and only one will be successful. To overcome this, we have implemented two features in XYZs_FTP: 1) the re-connection parameters described in Section G.3.1.1.2.1; and 2) the –Q command-line parameter.

The –Q command-line parameter enables what is termed a master/slave mode within XYZs_FTP. Accordingly, the first occurrence of XYZs_FTP to be run using the –Q command-line parameter will become the master. Any others that use the –Q command-line parameter will become a slave to the master. In this relationship, the slave will submit its FTP requests (inclusive of account information) to the master for processing. The master accepts these requests and places them into a queue of FTP operations to be performed. The slave then terminates leaving the master to process and handle each queued FTP operation one-by-one. When the master has completed processing the queued requests, it then enters a dormant state (i.e., it does not terminate) and awaits further requests by any slaves. The master stays resident as long the operator does not terminate it or the system is not shut down.

Thus, if it is desired that multiple programs launch and exercise XYZs_FTP functions, it is recommended that each and every occurrence use the command-line call containing the –Q parameter. When the –Q parameter is not used, the master/slave relationship is not used and the above mentioned race condition can occur.

The general form of the command-line call to XYZs_FTP is as follows:

XYZs_FTP.EXE [*options* [*secondary_args*]]

Many *options* require secondary arguments. Each option will now be described. The symbol for the option is not case sensitive.

-H *hostname*

This command-line option is used to specify the Host FTP site that you desire to connect with for the given command-line operation. Here you specify the unique-descriptive host name configured as described in Section G.3.1.1.1. Please note that if the configured host site name contains spaces, you should bound the name by double quote characters (e.g., “XYZs FTP Site”). Please note that it is intended that this command-line parameter be used in conjunction with either the –U or –C command-line parameters.

-C *newhostpath*

This command-line option is used for the automatic creation of a directory on the FTP host system (assuming that the access account grants such privileges) specified using the –H command-line parameter. Please note that as long as the top-level path in the specified *newhostpath* exists, XYZs_FTP will attempt to create any missing sub-directories in the path specified.

-M

This command-line option is intended to be used with other command-line options. The option instructs the XYZs_FTP program that it is to start-up as a minimized program.

-Q

This command-line is used for automatic FTP processing where one or more copies of XYZs_FTP can be running simultaneously (as described earlier in this section). For example, multiple copies of The Thales Navigation GBSS program can launch post-session commands simultaneously, each of which can contains calls that launch separate copies of this program simultaneously. To prevent the race condition, the –Q enables the master/slave relationship described above. Please note that it is intended that this command-line parameter be used in conjunction with –C or –U command-line parameters.

-T *targetpath*

This command-line option is used for automatic FTP uploads where it is desired to specify the target path on the host FTP system. The parameter *targetpath* specifies the desired FTP system target path. Please note that it is intended that this parameter be used in conjunction with the –H and –U parameters.

-U *fullpathname*

This command-line parameter specifies the full path and name of the local computer file to be uploaded to the remote FTP host site. Please note that it is intended that this parameter be used in conjunction with the –H command-line parameter.

Example 1:

XYZs_FTP.exe -H "XYZs FTP Site" -U D:\Test\TestFile.BIN

In this example, the program is instructed to establish a connection with the configured FTP host named "XYZs FTP Site" and upload the file “D:\Test\TestFile.BIN” into the FTP target directory set during the last GUI run of the program for that host site.

Example 2:

XYZs_FTP.exe -H "XYZs FTP Site" -U D:\Test\TestFile.BIN -T /web/plots

In this example, the program is instructed to establish a connection with the configured FTP host named "XYZs FTP Site" and upload the file “D:\Test\TestFile.BIN” into the FTP target directory "/web/plots".

Example 3:

XYZs_FTP.ex -H "XYZs FTP Site" -c /web/plots

In this example, the program is instructed to establish a connection with the configured FTP host named "XYZs FTP Site" and make the directory "/web/plots".

To reiterate, if any of your command-line FTP operations could cause multiple copies of XYZs_FTP to be running simultaneously, it is highly recommended that the –Q option be added to each of the command-line calls.