# WinADFM

## for ADFM/accQmin Flow Systems
## Software Instruction Manual


TELEDYNE ISCO
A Teledyne Technologies Company

Part #69-7003-025 of Assembly 60-7004-068

Revision B, June 29, 2011

# Foreword

This instruction manual is designed to help you gain a thorough understanding of the operation of the equipment. Teledyne Isco recommends that you read this manual completely before placing the equipment in service.

Although Teledyne Isco designs reliability into all equipment, there is always the possibility of a malfunction. This manual may help in diagnosing and repairing the malfunction.

If the problem persists, call or e-mail the Teledyne Isco Technical Service Department for assistance. Simple difficulties can often be diagnosed over the phone.

If it is necessary to return the equipment to the factory for service, please follow the shipping instructions provided by the Customer Service Department, including the use of the **Return Authorization Number** specified. **Be sure to include a note describing the malfunction.** This will aid in the prompt repair and return of the equipment.

Teledyne Isco welcomes suggestions that would improve the information presented in this manual or enhance the operation of the equipment itself.

**Teledyne Isco is continually improving its products and reserves the right to change product specifications, replacement parts, schematics, and instructions without notice.**

## Contact Information


*Customer Service*

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|---|---|---|
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*Technical Support*

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| Phone: | (800) 775-2965 | (Analytical) |
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| Return equipment to: | 4700 Superior Street, Lincoln, NE 68504-1398 | |

*Other Correspondence*

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| Mail to: | P.O. Box 82531, Lincoln, NE 68501-2531 |
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## *Section 1 Introduction*

### 1.1 Overview

WinADFM is designed to provide tools for programming the ADFM™ and accQmin™ flow meters, field deployment, diagnostic testing, data collection, and data review.

#### 1.1.1 System Requirements

The following are the minimum suggested computer requirements to run WinADFM. WinADFM will run on any system that supports Windows 95 and higher. However, a faster processor, more memory, and more available hard drive space will all combine to make the program run faster and more smoothly.

- IBM compatible PC
- 486 or higher CPU
- 16M RAM
- Windows 95 or higher
- Large hard drive (1 Gb or better)
  - Disk Space (or data storage / ZIP Drives) to hold the incoming data file.
  - Disk Space (or data storage / ZIP Drives) to hold the backup files
- Data backup system

WinADFM can be used in-house to create a station configuration file containing all parameters for setting up, programming, and starting the ADFM or accQmin. The software can also be used to program the flow meter in the field.

WinADFM can test the ADFM and accQmin after installation, initiate meter start-up, and collect and view flow data.

**☑ Note**

For the ADFM, the "Bench Test" function is for diagnostic purposes and is not required for routine operation. If for any reason the Bench Test *is* performed, regardless of the time interval between tests, first retrieve and save all recorded data before it is performed again. Prior to redeployment, select "Erase Recorder" and then "Restart."

**☑ Note**

The accQmin “Bench Test” function requires the connection of a sensor to the flow meter.

## 1.2 Software Installation

WinADFM is installed similarly to other Windows compatible programs. Double-click on the WinADFM Installation file and follow the instructions on the screen. After installation you can start WinADFM by clicking on Start > Programs > Teledyne Isco > WinADFM, or double-click the WinADFM icon on your desktop.

> ☑ ***Note***
>
> WinADFM versions 1.46 and above support the ADFM Pro-20 and the accQmin flow meters. These versions of WinADFM use a new station file format that is incompatible with WinADFM versions 1.12 and earlier, and WinADFMPro software. **If compatibility with WinADFMPro software is desired, upgrading to this version of software is not recommended.** If you do upgrade to this new version of software and want to maintain compatibility with WinADFMPro, when opening an existing station file or when creating a new station file, **do not save the station file in the new format.** You can choose to save the station file in the earlier version format, which WinADFMPro can open by selecting File, "save station version" and selecting "Old Version Station File" as the file type. If you use WinADFMPro to open a station file created with WinADFM 1.46 with the new format, WinADFMPro will corrupt the station file and it will not be usable with either WinADFM 1.46 or WinADFMPro.
>
> WinADFM 1.46 or later **must** be used with the accQmin.

## 1.3 Folders

During installation, a WinADFM folder is created with Config and Data subfolders.

### 1.3.1 WinADFM Folder

This folder contains the executable program and associated files, as well as the Config folder and the Data folder.

### 1.3.2 Config Folder

The Config subfolder is in the WinADFM folder. Programming configuration files, called Station files, are created for each flow meter and its associated flow monitoring site (location). These Station files are in the Config folder.

### 1.3.3 Data Folder

The Data folder is in the WinADFM folder, and contains a folder for each metering site, referred to as the Site ID folders.

### 1.3.4 Site ID Folder

When flow data is downloaded from the flow meter, these files, called Deployments, are automatically downloaded into a folder the software creates using the Site ID name of the station file. This Site ID folder containing downloaded data from the site is located inside the Data folder. Subsequent downloaded data is automatically placed in the Site ID folder.

## 1.4 File Types

Operating files are automatically placed in the WinADFM folder.

### 1.4.1 System Files

These files consist of the executable program and its associated files.

### 1.4.2 Station Files

These files contain the flow meter programming and application information for each site. The station file describes a flow monitoring site, site-specific application parameters, and the data collection parameters associated with it. The station file is used to program the flow meter for a specific application, collect and view flow data from the internal recorder, and run diagnostics.

The default file name for a Station file is the Site ID, followed by a ".stn" extension. You may change the file name by clicking File > Save As, and entering a new file name., but the first 8 or fewer alpha-numeric characters (letters or numbers only) will be used as the Site ID. If you change the first 8 characters in the file name from the default site ID name, then you have also changed the site ID name that will be programmed into the ADFM.

### 1.4.3 Group Files

This type of file contains one or more Station files together under a single Group name. You may, for example, want to group sites together that have common operating and polling parameters. The file name is the Group name followed by the extension ".sgr."

### 1.4.4 Log Files

A log file is a text document in the Config folder, containing a record of all communications between the program and the flow meter for a given site. The file name is the Station file name followed by the extension .log. Each successive communication session is added to the existing log file.

The information in the Log File can be valuable in determining the cause of a system failure.

### 1.4.5 Data Files

There are three types of data files used with both ADFM and accQmin meters: Real Time Data files, Quick Data files, and downloaded Data files. These files, called *Deployments*, contain the raw flow data collected from the flow meter. Deployments can be viewed in WinADFM.

> ☑ ***Note***
>
> The ADFM recorder must be cleared following data retrieval. Save all downloaded data and, prior to redeployment, **erase the recorder and restart the ADFM**.

The file naming format for accQmin data files (deployments) is different from that of the ADFM.

*ADFM Data Files*

Data files are written to and stored in the ADFM internal recorder (if the recorder is turned on). With the exception of "Listen Real Time", each time the WinADFM software communicates with the ADFM, the ADFM stops taking flow readings in order to talk to the computer, and when the communication ends, the ADFM starts taking readings again. When communication is established, the ADFM closes the existing data file, and when it starts taking readings again, a new data file is started in the recorder. There will be a time gap between the last reading of the previous deployment and the first reading of the new deployment

corresponding to the communication time. The internal recorder can hold up to 1,000 deployments with a combined total file size of 30 Mb.

When data deployments are downloaded from the ADFM, each deployment is saved inside the Site ID folder. During this process, each deployment is automatically named using the date of the collection and the following naming convention:

#### (ADFM serial number)
M (month 1-9 with a, b, c used for 10, 11, 12)
DD (day)
HH (hour, 24 hour format)
.xxx (deployment number - .001 to .099)

If the hour changes while downloading multiple deployments, the file name will change accordingly. The files will have different numbered extensions (.001 to .099), corresponding with the deployment number.

*ADFM Real Time Data Files*

Real time data files update at the sampling rate programmed into the meter, and contain flow data recorded during on-site communication with the ADFM. They are viewed live on-site during ADFM communication, and can also be viewed later (off-site) with WinADFM. Real Time data is written to the computer communicating with the ADFM during the on-site communication, and is written to the flow meter if the recorder is enabled. The Real Time data file is stored on the computer inside the Data subfolder in the Site ID folder. The naming convention used is as follows:

rt
YYYY (year)
MM (month)
DD (day)
.xxx (extension)

If Real Time recording is used more than once at the same site in the same day, each subsequent recording will have the same file name, with an incrementing extension (.001, .002, .003, etc).

*ADFM Quick Data Files*

The Quick Data feature is used in the field to view real-time data. Quick Data data files are created when the ADFM is placed in the Quick Data acquisition mode. Special measurement parameters are sent to the ADFM that allow flow data updates approximately every 15-20 seconds. The Quick Data feature is recommended for field evaluation and diagnostics.

Quick Data creates a data file of the readings and stores it in the computer. This file will contain data recorded during the time the real-time display screen is active, and contains the velocity beam raw data used for diagnostics. This file is automatically named **qd**, followed by the year, month, and day with numerical extension. To view the Quick Data file and for analytical data, refer to the WinADFM Quick Data Evaluation Section.

If Quick Time recording is used more than once at the same site in the same day, each subsequent recording will have the same file name, with an incrementing extension (.001, .002, .003, etc).

*accQmin Data Files*

Data files (deployments) are written to and stored in the accQmin (if the recorder is turned on). The recorder holds 2 Megabytes of data and can operate in either Slate or Wrap mode. In Slate mode, when the recorder is full, the accQmin will continue to take flow readings, but will not write the flow data to the recorder. In Wrap mode, when the recorder is full, the oldest flow data is replaced by the newest.

The recorder holds a single file, which may contain multiple deployments. Each time data is collected, the entire recorder contents are downloaded. Note: with a full recorder, the collection/download time is approximately 6 minutes. Each time data is collected from the recorder, it is saved inside the Data subfolder in the Site ID folder. During this process, each deployment is automatically named using the date of the collection and the following naming convention:

xxxxxxxx (site ID/name)
_SNxxx (accQmin serial number)
_YYYY (year of collection)
MM (month of collection)
DD (day of collection)
.000. (extension)

*accQmin Real Time Data Files*

Real Time data files are the same type of file as described above for the ADFM meter.

The Real Time data file is stored on the computer in the Data subfolder in the Site ID folder. The recording uses the date: year, month, hour, minutes, and seconds the recording is started as the file name with the following naming convention:

rt, YYYY, MM, DD, HH, SS, .001.

*accQmin Quick Data Files*

Quick Data files are the same type of files as described above for the ADFM meter. For the accQmin, Quick Data mode will update the data approximately every 45 seconds. The Quick Data file is stored on the computer inside the Data folder in the Site ID folder. The recording uses the date - year, month, hour, minutes, and seconds the recording is started as the file name with the following naming convention:

qd, YYYY, MM, DD, HH, SS .001.

# WinADFM Software

## *Section 2 ADFM*

### 2.1 Creating a Station File

In order to deploy the ADFM, you must first create a station file for setup and programming.

Click File > New, or click on the blank page toolbar button. The File New screen will give the options to either create a station file or group of existing station files. Click on the type of file to be created – e.g., ADFM Station. Enter the new Site ID in the Site ID box. The Site ID is limited to 8 alpha-numeric characters without spaces, or other punctuation or special characters. The Site ID must be entered before the station file (also known as a Configuration or Programming file) can be created.

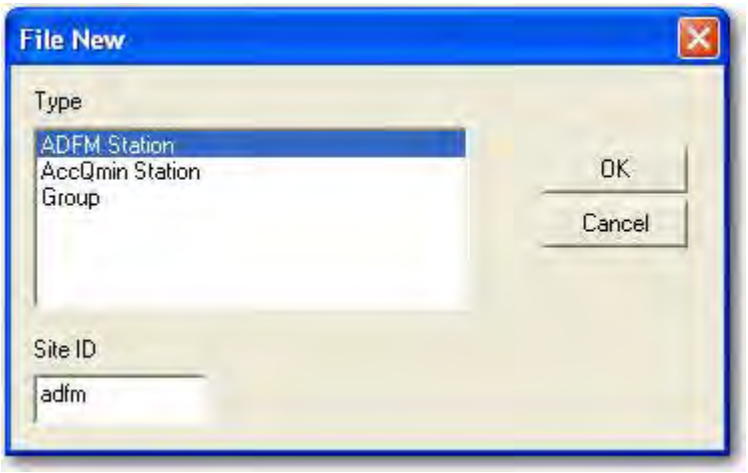




*Figure 2-1 New File*

After you enter the Site ID and select OK, a Save As dialog will appear. The Site ID will be the default file name. A longer or different name may be entered, but the first 8 or fewer alpha-numeric characters (letters or numbers only) will be used as the Site ID. If you change the first 8 characters in the file name from the default site ID name, then you have also changed the site ID name that will be programmed into the ADFM. Ensure that the file will be saved to the Config directory. When you save the file, a window with default program parameters will appear.

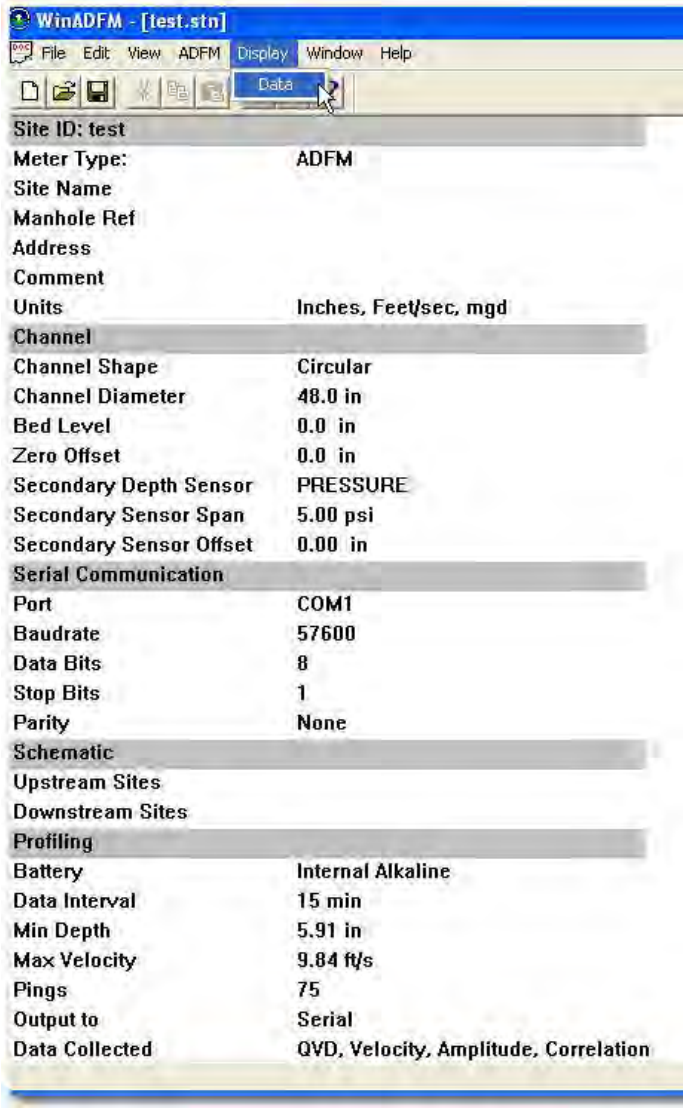



*Figure 2-2 Station File Window*

## 2.2 Setup


With the station file open, select ADFM in the menu bar and then select Setup.

This screen is for setting up or editing the ADFM operating parameters in the station file. The site-specific information in the station file will be used to program the ADFM. The Setup window has five tabs where you will enter the information: Site; Channel; Communication; Profiling; Collection Schedule.

### 2.2.1 Site tab

On the Site tab, enter site-specific information.

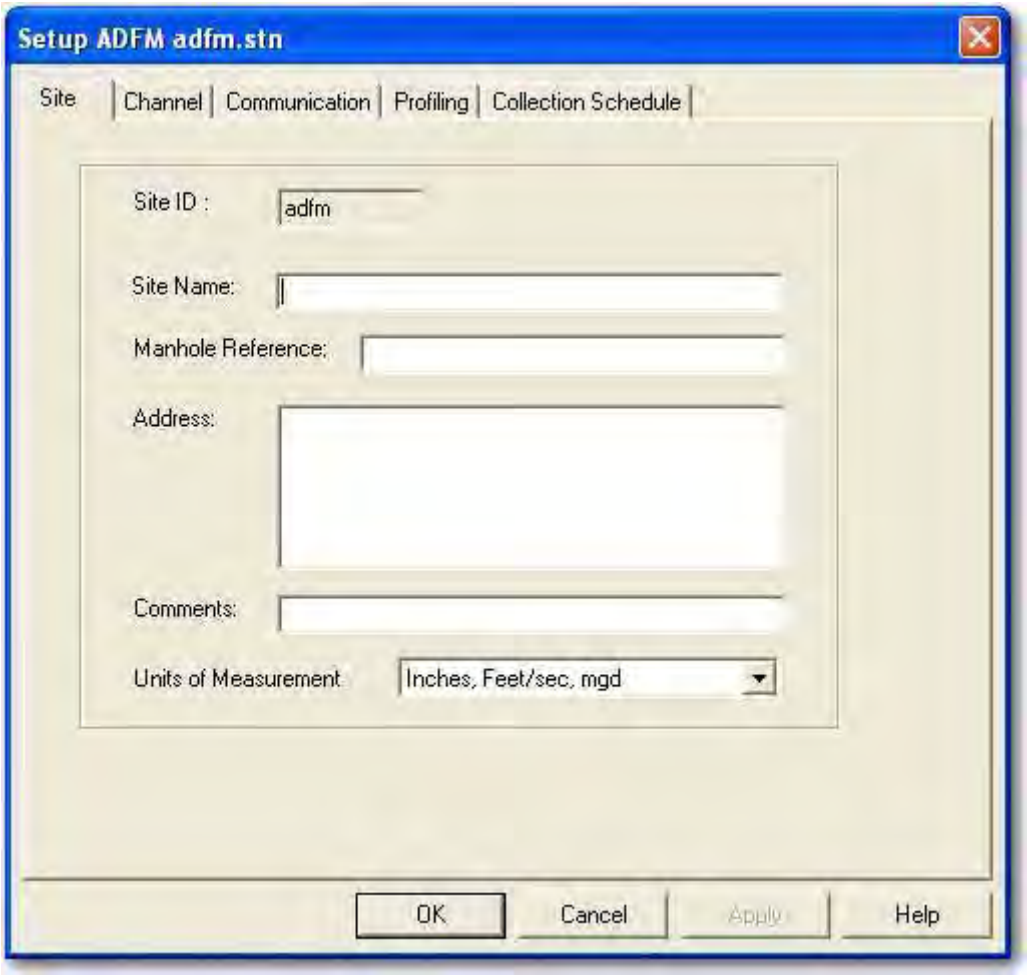



*Figure 2-3 Site tab*

*Site ID* — Site ID is used to name the station file, to create additional chart configuration files to name, and the station's data folder. This entry was made when the station file was created.

*Site Name* — This field contains the commonly used name for the site. This field can be up to 255 characters long.

*Manhole Reference* — Where applicable, this number identifies the manhole. This field can be up to 255 characters long.

*Address* — Where applicable, enter the street address for the site. This field can be up to 255 characters long. You can use multiple lines by hitting <Enter>.

*Comments* — Comments concerning the site or the installation may be documented in this field. This field may be up to 255 characters long.

*Units of Measurement* — Using the dropdown menu, select the units of measure for depth, velocity, and flow. These units will be used throughout the program. You can go back to this screen and change the units after entering pipe/channel dimensions in another screen. The dimension values are then rescaled to the new units of measure.

### 2.2.2 Channel tab

Use this tab to specify the appropriate channel geometry and dimensions.

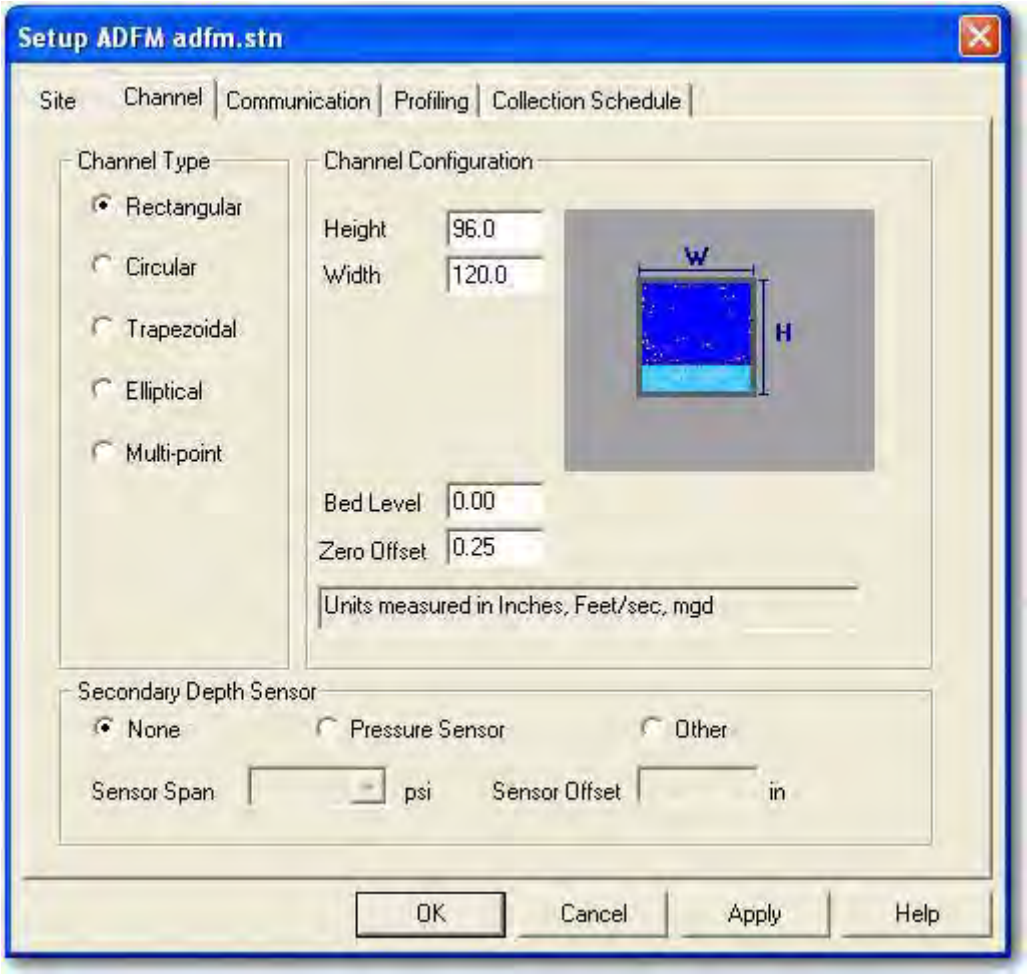



*Figure 2-4 Channel tab*

*Channel Type* — Select the appropriate channel shape from the column on the left of the screen. The right side of the screen will display a picture of the selected channel geometry under Channel Configuration, along with boxes for entering the channel dimensions.

**Rectangular –** Enter the width and height using the units of measure chosen in the Site Tab.

**Circular –** Enter the Diameter (pipe inside diameter) using the units of measure chosen in the Site Tab.

**Trapezoidal –** Enter the widths and heights (up to three) using the units of measure chosen in the Site Tab. H2 and H3 must not be zero (0), and H3 must be greater than H2.

**Elliptical –** Enter the three characteristic radii and angles of the ellipse using the units of measure chosen in the Site Tab. Teledyne Isco recommends using the multi-point channel type rather than elliptical channel type in most applications, since pipes or channels with a true elliptical shape are very rare.

**Multi-Point –** For irregular shapes, select Multi-Point and Configure Channel. The Multi-Point configuration assumes that the pipe/channel is symmetrical about the vertical center line. For other configurations, contact Teledyne Isco.

Enter the width ÷ 2 (half the width), and the corresponding height at that width, for ten different heights in the pipe/channel, beginning with Point 1 as the lowest point. The bottom is represented by the Origin of 0, 0. As you enter the width ÷ 2 and the height for each point starting with point 1, a drawing based on the dimensions you enter will appear on the screen. When all ten points are entered, if the drawing does not approximate the pipe/channel geometry, adjust the dimensions you have entered and click Update Display. The drawing will reflect any changes you make. When finished, click OK to return to the Channel tab (Figure 2-4).

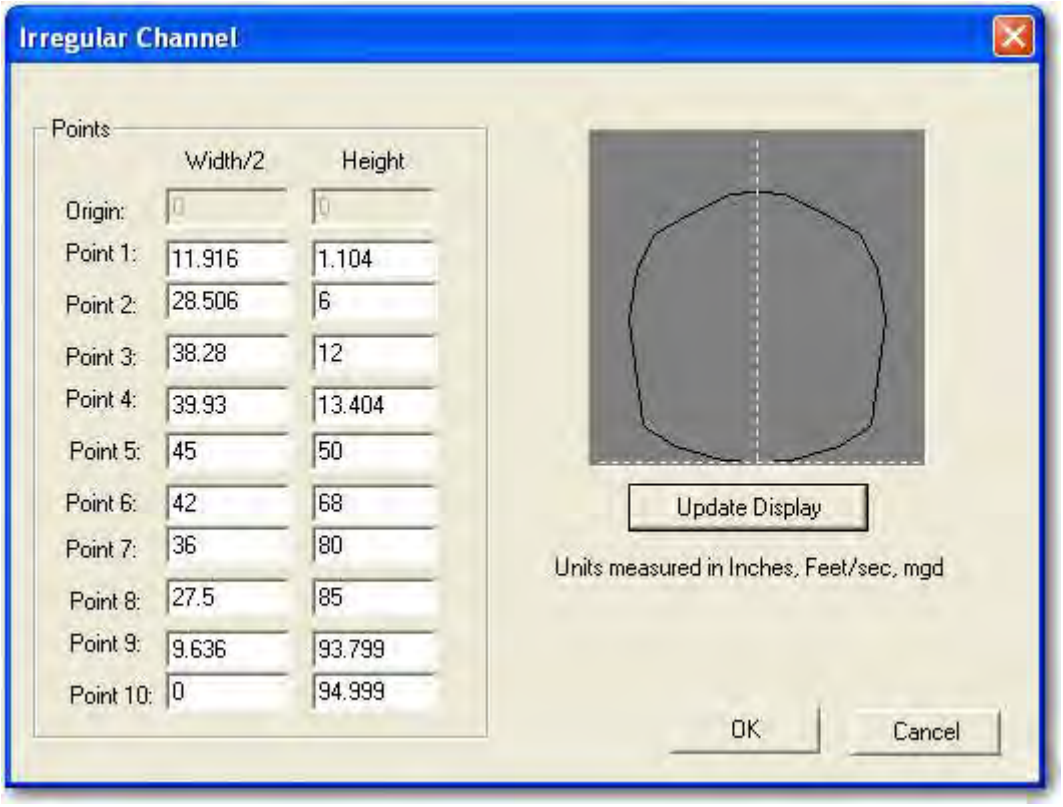



*Figure 2-5 Multiple Point Configuration for Irregular Channels*

(Continued from Figure 2-4.)

**Bed Level –** If there is a layer of permanent silt or debris in the bottom of the channel or pipe, enter its depth.

**Zero Offset –** Enter the distance from the bottom of the channel or pipe to the bottom of the ADFM sensor.

**Secondary Depth Sensor –** If a secondary depth sensor is not used, select None. Otherwise, select the Pressure Sensor radio button or Other if a depth device other than a pressure sensor is used. Enter the Sensor Span – the full scale range (in psi for a pressure sensor). Enter the sensor offset. The sensor offset is the distance from the bottom of the channel or pipe to the top of the sensor or the sensing element in the sensor.

### 2.2.3 Communication Tab

This tab is used to enter the appropriate communications protocol.

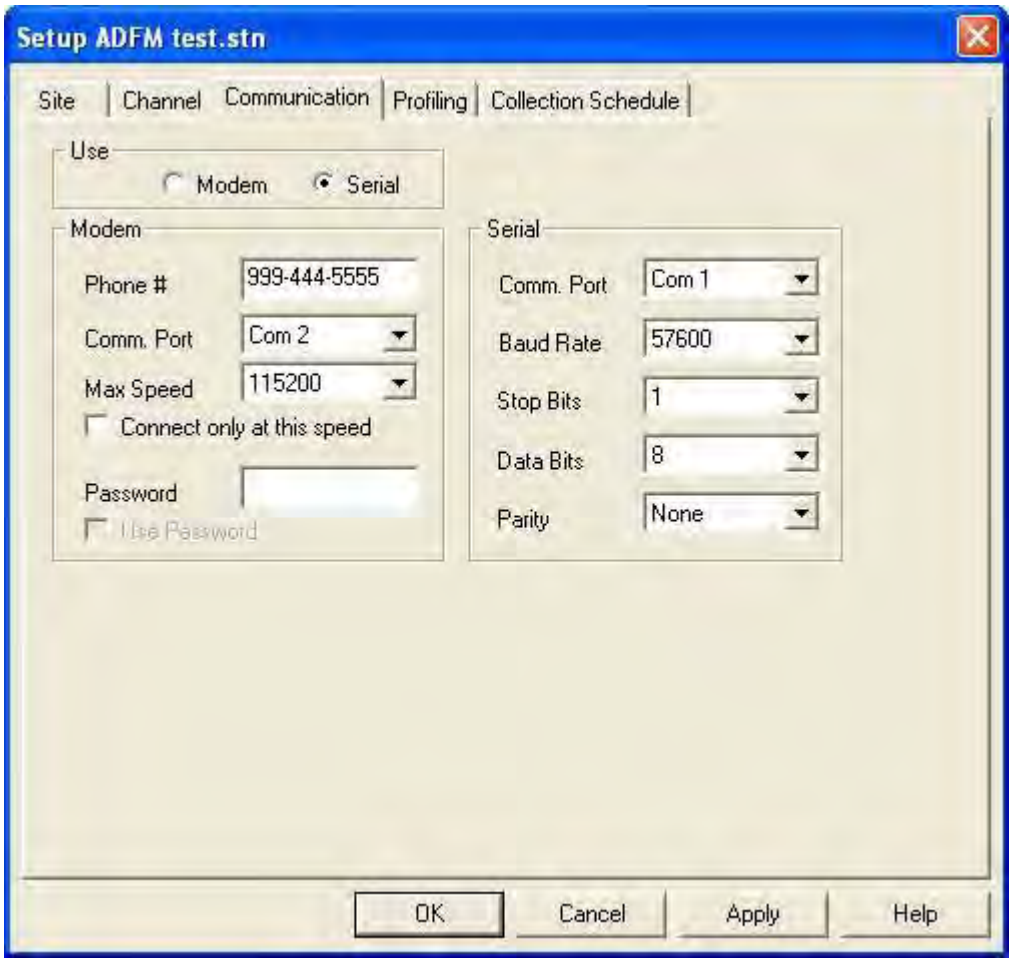



*Figure 2-6 Communication tab*

Select the type of external communications that will be used: Modem for remote connection, or Serial for direct connection.

*Modem*

Modem is selected only if an internal or external modem is connected to the ADFM and the computer is going to be calling the ADFM remotely. Enter the phone number of the site in the Phone # field, including area (or city) codes and any required prefixes. For international dialing, include the local international prefix and country code. Select the computer's communication port to be used, and the maximum speed, from the dropdown menus. To connect only at the chosen Max Speed, check this box.

**Note**

Password protection is not yet available with this version of WinADFM software.

*Serial*

Serial is selected for direct RS232 connection using the communication interface cable.

A typical computer will have the following Serial RS-232 communication settings:

| | |
|---|---|
| Comm. Port: | Select the computer's active serial/com port. Default is Com 1. Options are Com 1 – Com 8. |
| Baud Rate: | The selected baud rate is used for data downloads only. The default baud rate is 9600. Options are 1200, 2400, 4800, 9600, 19200, 38400, 57600. |
| Stop Bits: | 1 (Default) |
| Data Bits: | 8 (Default) |
| Parity: | None (Default) |

Baud rate applies to serial downloads only. When testing and initiating startup/programming with WinADFM, the default baud rate is 9600. However, any computer capable of running Windows 95 or greater should be able to successfully download data at a baud rate of 57600. This is recommended to reduce the download time.

Stop Bits, Data Bits, and Parity should be left at their default values.

### 2.2.4 Profiling Tab

The Profiling tab is for setting up flow and data collection measurement parameters.

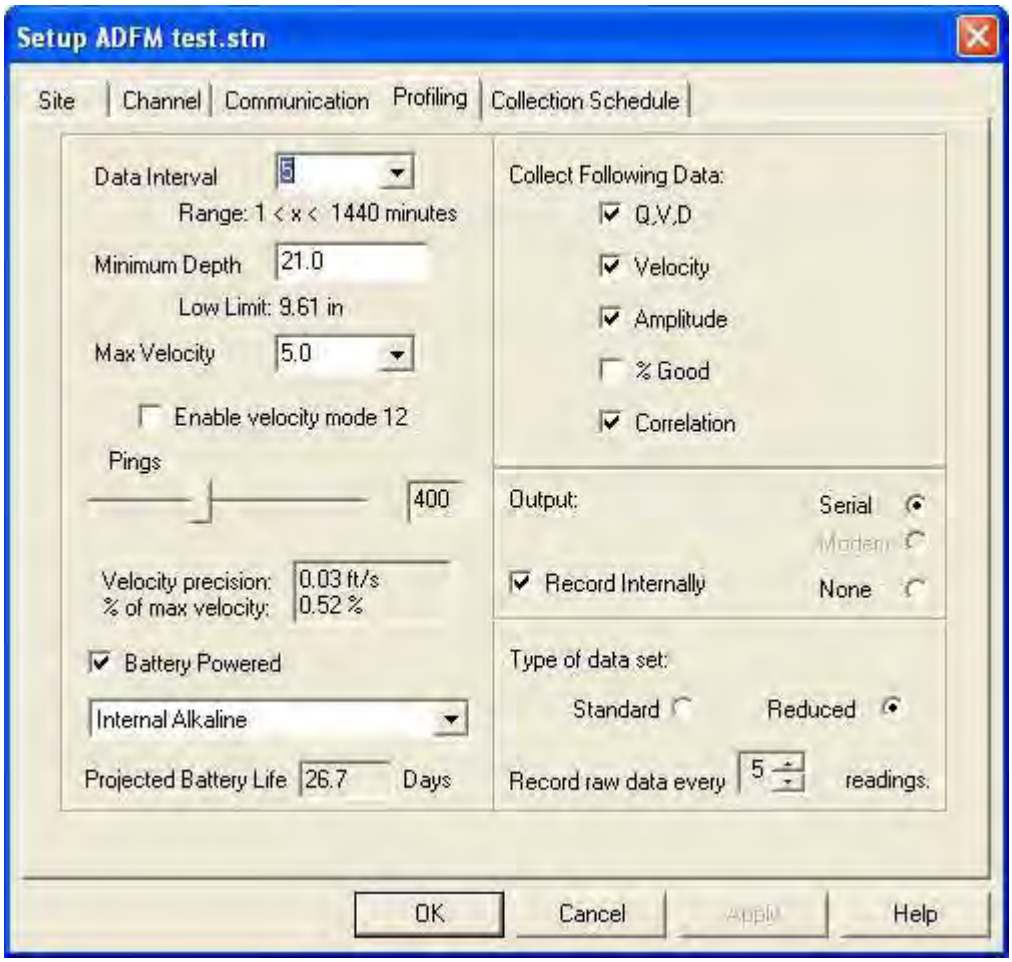



*Figure 2-7 Profiling tab*

Select the desired profiling parameters from the list on the left. Select the desired data types to collect from the list on the right, as well as data recording and transfer settings.

*Data Interval* This is the time between successive measurement readings. The intervals are 1, 2, 5, 10, 15, 20, 30, 60, or 120 minutes.

*Minimum Depth* This value is one of the factors used to determine the profiling resolution, i.e., the size of the individual bins in the velocity profile. Selecting a value higher than the actual minimum experienced on site may result in a loss of velocity data at this low flow depth. Enter the expected minimum depth of flow using the units selected on the Site Tab. Note that the minimum depth for velocity profiling is approximately 9 inches.

*Max Velocity*

This value is used to set the velocity measurement range. Enter the expected maximum velocity. The choices available from the dropdown menu are 1, 1.5, 3, 5, 7, and 10 m/s or 3, 5, 10, 15, 20, and 30 ft/s. The program will also accept any legitimate numerical entry (i.e., using alpha-numeric characters).

It is important to make a solid estimate for this value. Selecting a higher velocity decreases the precision of the velocity measurement. However, selecting a value too low can lead to velocity measurement errors. A good rule of thumb is to select a maximum velocity that is approximately 50% higher than what you actually expect. After you have collected some data, and have actual velocity values from the site, you can modify this entry.

*Pings*

The ADFM makes multiple velocity measurements not only at different points in the water column, but successively in time. An individual measurement, called a ping, consists of a complete velocity profile in the water column. However, the precision of the discharge estimate is improved by averaging many pings together into an ensemble. An individual ping is very quick; an ensemble of 400 pings will take no more than about three minutes.

Under Pings, drag the slide bar left or right to adjust the number of pings. With the slide bar selected, you can also increment the number of pings using the left and right arrow keys. When adjusting pings, the value you choose may be affected by the following two factors:

**Velocity precision / % of max velocity –** This shows the estimated velocity precision as a percentage of maximum expected velocity.

**Projected Battery Life –** This estimates the number of days of battery power you will have for the selected setup.

Increased precision also means increased energy consumption. Note that there is a check box for whether the system is battery powered or not. Also note that the number of pings you can select is time-dependent. You could not select 1000 pings with a one minute reading interval because 1000 pings would take a longer amount of time. But you could select 1000 pings with a 10 or 15 minute interval, giving you a very precise measurement.

*Enable Velocity Mode 12*

To improve the ping rate, check the box next to Enable Velocity Mode 12. The increased ping rate provides reduced power consumption while maintaining the same precision.

Improved precision may be obtained by increasing the selected number of pings. Please contact Teledyne Isco if you are using a short data interval and wish to program the meter for a greater number of pings than the program will allow.

**☑ *Note***

Enabling Velocity Mode 12 will not change the displayed values for Velocity Precision and Projected Battery Life, and will not change the maximum number of pings allowed for a given data interval. Velocity Mode 12 will enhance battery life by approximately 50%.

*Collect Following Data*

The internal recorder collects flow, velocity, and depth data, along with additional data that can be used for ADFM performance evaluation and diagnostics. The following raw data types may be recorded and collected by checking their respective boxes.:

**Q, V, D –** Discharge values (flow), Average velocity, and depth. Q, V, D must be checked in all applications to obtain these parameters.

**Velocity, Amplitude, % Good, Correlation –** These data types are optional. The information collected with these data types is typically used to analyze the performance of the sensor for diagnostic purposes. We recommend that all boxes be checked except for %Good.

**Velocity –** Raw beam velocities measured by the ADFM. There is a velocity value for each bin in each of the four velocity measuring beams. These raw radial Doppler velocities are used to compute discharge via the system's discharge algorithm. They can also be used to generate plots of the velocity distribution throughout the wetted cross-section. For diagnostic purposes, this should be checked.

**Amplitude –** Raw beam intensity amplitudes measured by the ADFM. There is an amplitude value for each bin in each of the four velocity measuring beams. Amplitude can be used as a relative measure of the return echo's signal strength. For diagnostic purposes, this should be checked.

**% Good –** This represents the percentage of pings within an ensemble that contained valid velocity data. There is a % Good for each bin in each of the four velocity measuring beams.

The "% Good" option is typically not used.

**Correlation –** Raw beam correlation values measured by the ADFM. There is a correlation value for each bin in each of the four velocity measuring beams.

The correlation value is a useful measure of data quality. In almost all applications, a correlation value in the region of 128 counts (± 10 counts) signifies valid data. For diagnostic purposes, this should be checked.

**Output –** Select Serial.

**Record Internally –** Check this box to record flow data internally.

**Type of Data Set –** To manage the data file size, select Reduced.

> ☑ ***Note***
>
> Quick Data files are always created using the reduced data set with raw data recorded every reading.

**Record Raw Data Every xx Readings –** When using the internal recorder, every flow reading is recorded. Each flow reading contains the date/time stamp, flow, velocity, and depth if

the Q,V,D data type box is checked. The recording interval of additional useful data such as Velocity, Amplitude, and Correlation is determined by the number entered in this step. If this is set to 1 then the additional data will be recorded with every reading. If it is set to 2, the additional data will be recorded every other reading, and so on.

While the inclusion of raw data is useful, it creates a larger file, which lengthens download time. Teledyne Isco recommends setting Record Raw Data so that raw data is recorded every 15 to 30 minutes, (e.g. if you set Record Raw Data to 15, for 1 minute sample intervals, raw data is recorded every 15 readings; for 5 minute sample intervals, raw data is recorded every 3 readings, etc.) If you are not concerned with file size and/or download time, or if you are collecting data to aid in troubleshooting data quality issues, then select 1 for the raw data reading.

### 2.2.5 Collection Schedule Tab

The Collection Schedule is only used for remote communication via modem or other means. The collection schedule may be turned on enable automatic scheduled data downloads. To use this feature, the computer must be on and running WinADFM software with the station file(s) open. To disable this feature, select None.

If using a field computer such as a laptop for downloading data on–site, select None. If Collection Schedule is on and the time for collection has passed, WinADFM will keep trying to connect to the ADFM via remote communications, and you will not be able to direct-connect to the ADFM.

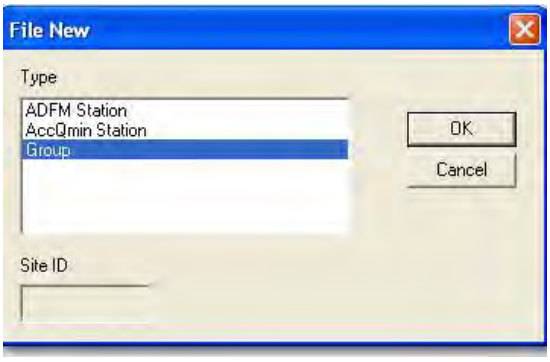
### 2.2.6 Saving the Program

When finished with the programming selections on the setup tabs, click Apply to save changes but keep the station file open, or click OK to save and close the file.

## 2.3 Group Files

A group file groups a number of station configuration files together under a single identity. group files are used to set up a group of specific stations with common operating and polling parameters. When you group station files together, the files and the information they contain are not changed.

To group station files, select File > New. Select Group > OK.



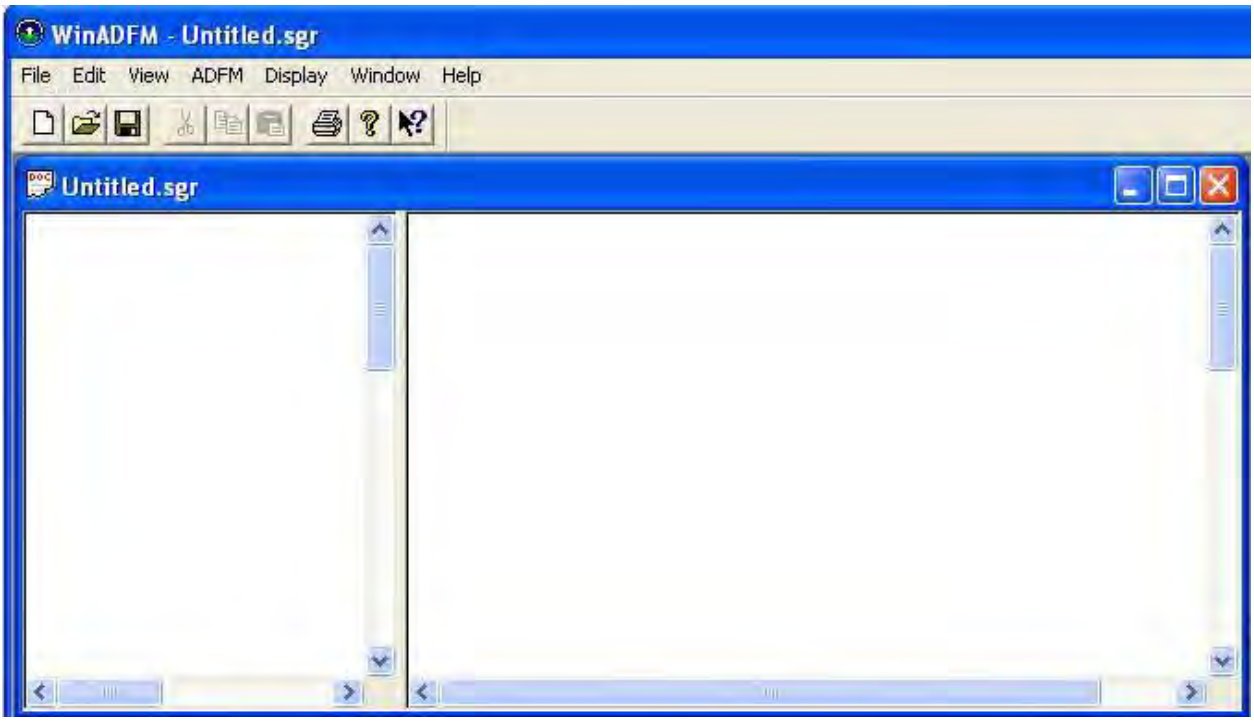
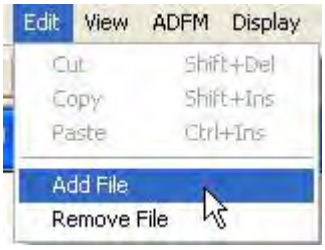



*Figure 2-8 Creating a Group file*

Creation of a group file will display the default Group File window with the default file group name of Untitled.sgr.

### 2.3.1 Adding Station files

To add station files to the new group File, select Edit > Add File.




Select the station file to be added. When all of the station files to be grouped together have been added, click File > Save As. Name the file and select Group Files for the file type.

### 2.3.2 Viewing Grouped Files

To view the contents of grouped station files, select File > Open, and select the file type Group. Select the group of station files to view (Figure 2-9).

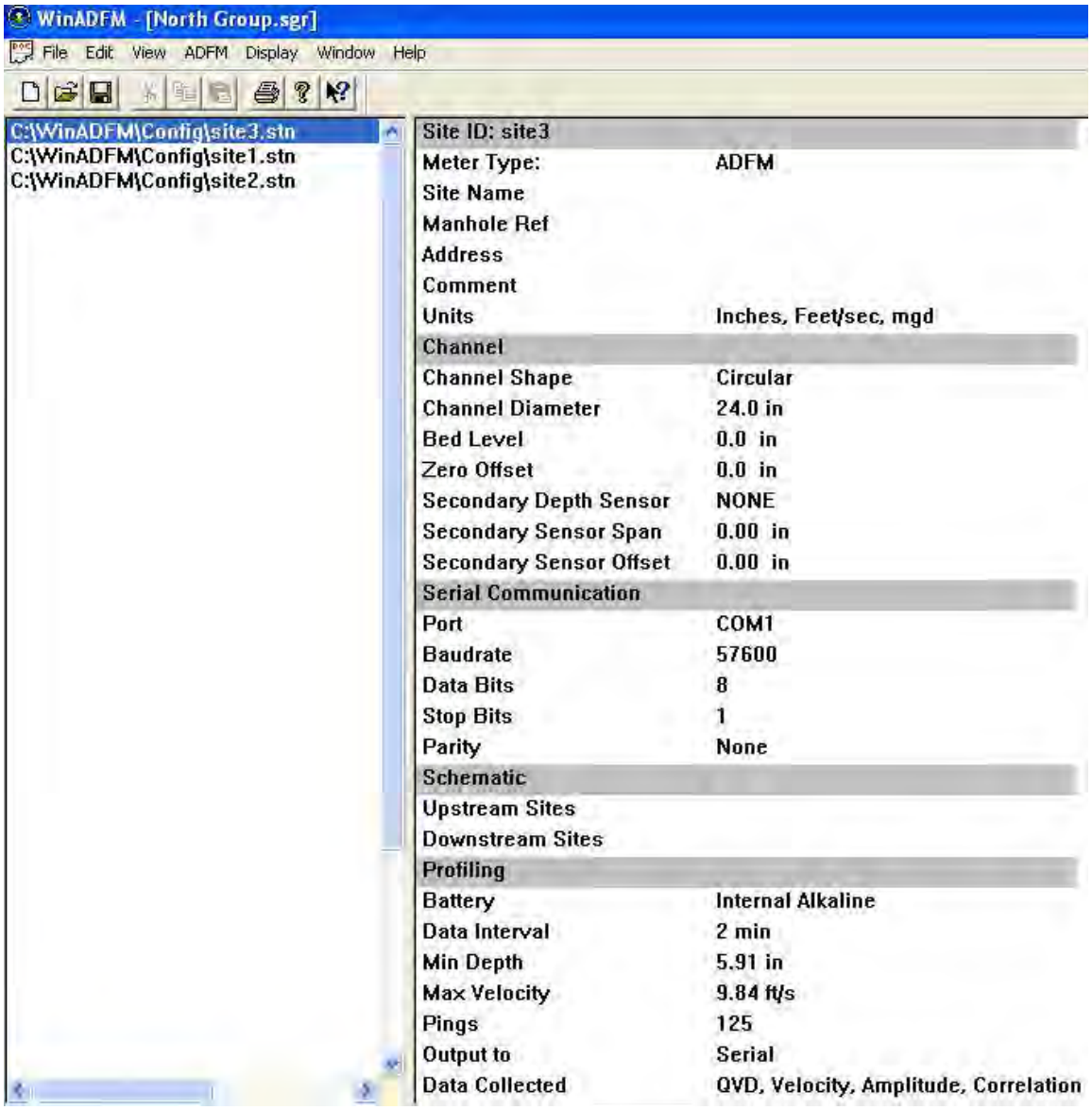


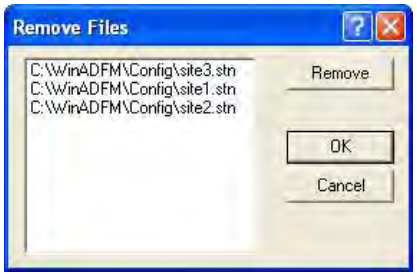

*Figure 2-9 Viewing grouped Station files*

The grouped station files appear in the left window. Select the file you want to view, and the parameters for that station file will appear in the right window. Scroll on the right to view all of the parameters in the window.

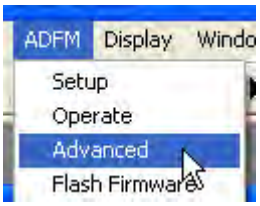
### 2.3.3 Removing Station Files

To remove a station file from the group, select Edit > Remove File.

A separate window will appear, listing the files. Select the station file and click Remove, then OK.




## 2.4 Advanced Commands




Advanced commands allow certain operating commands to be input to the meter. These special commands, entered in the Dialog window (Figure 2.5.1), are used to change or override one or more of the default parameters programmed in the meter by WinADFM software. These commands are only to be used in special circumstances as determined by Teledyne Isco. **Contact Teledyne Isco before attempting to use the Advanced Command function.**

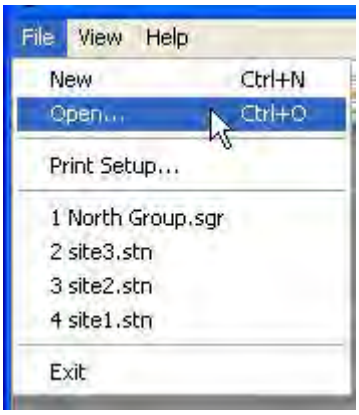

*Figure 2-10 Advanced Commands dialog window*

## 2.5 Programming and Operation

In order to connect to the ADFM, the station file for the metering site must be open.

Connect the communication cable between the computer and the ADFM.

To begin operation of the ADFM click ADFM > Operate.





This will open the Connect Window. All of the ADFM operating functions for programming, date/time set, testing, operation, and data collection are available in this window.

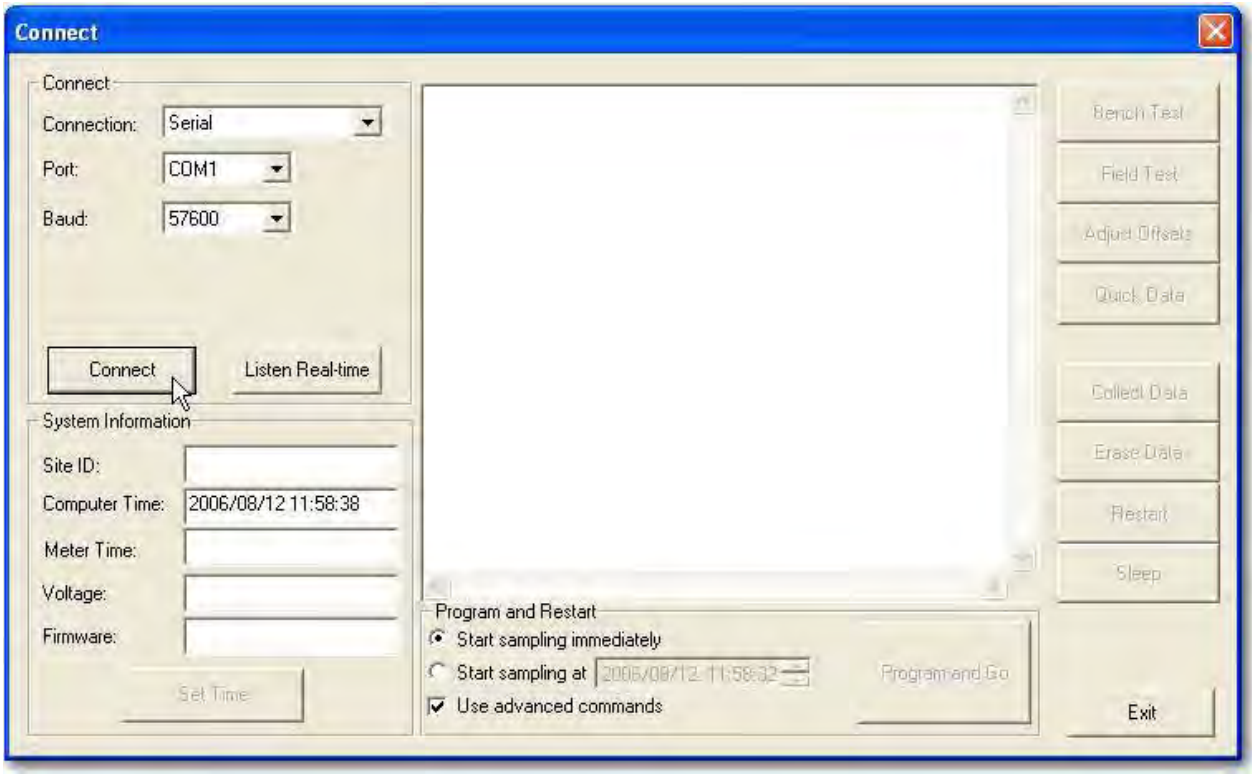



*Figure 2-11 Connection window*

Select the correct Com Port in the upper left area of the Operate screen. Click the Connect button to wake up the ADFM and establish communication. A system status message will appear in the terminal screen. If the wrong Com Port on the computer is selected in the Communication Tab of the station file, the error message “Cannot open port” will appear.

If unable to communicate with the ADFM, the error message "did not receive prompt." will appear. Check the communication cable and power to the ADFM. Check to make sure that the correct Com Port is selected.

The station file (site ID) is unique to an ADFM. If the meter has not been programmed with the station file that is open, or if the station file for another ADFM is opened by mistake, a warning message will appear upon connection:

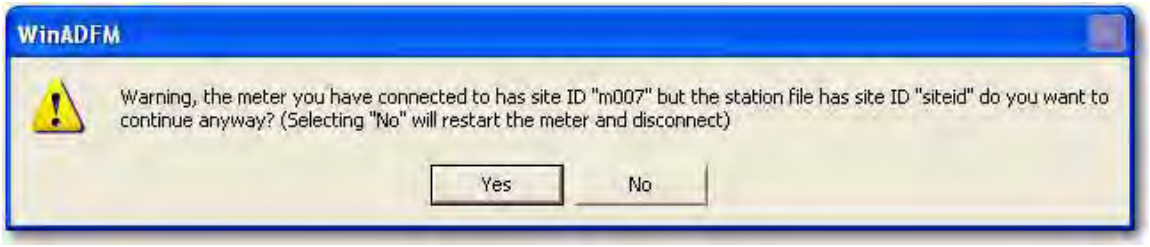



*Figure 2-12 Site ID warning*

To connect to the meter and/or program the meter with the open station file, select Yes. To cancel, select No, then open the appropriate station file and Connect.

**Note**

Clicking No will also restart the meter, to prevent accidental interruption of data collection.

### 2.5.1 Dialog Window

When a connection is established, an operational status or fault list will appear in the window (Figure 2-13). The Status list may indicate "no faults occurred" or it may list one or more "faults" that have occurred since the last time a connection was made to the ADFM. Once connection is established, the faults are reset.

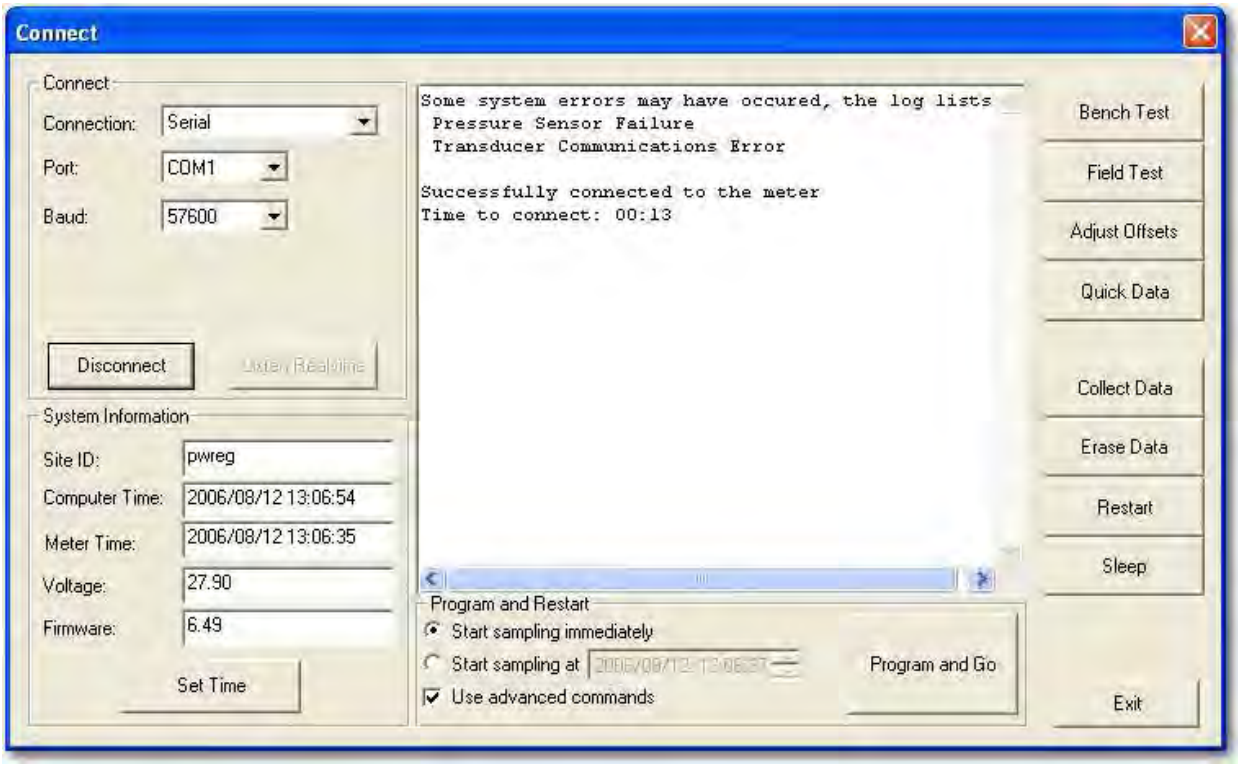



*Figure 2-13 Status window*

**Table 2-1 Possible System Faults**

| Fault | Possible Causes |
|---|---|
| Power Loss | Loss of operating voltage due to low batteries, poor battery contact, power supply problem, or batteries were replaced, interrupting power. It may also appear after flashing new firmware into the flow meter. |
| Pressure Sensor Failure | The pressure sensor is malfunctioning or the cable connection is bad. It is also possible to get this error if the station file was programmed for a secondary depth sensor and there is no secondary depth sensor connected to the ADFM. |
| Auto Restart Occurred | The ADFM was restarted by a microprocessor reset. This is not necessarily an error, but just a notice that the ADFM restarted automatically, rather than at the user's command. |
| Transducer Communications Error | The ADFM electronics lost contact with the ADFM sensor. Indicates the transducer is not connected, poor sensor connection, or possible transducer problem. |
| Recorder Full | The ADFM internal recorder has been left on and the recorder is full. Erase the internal recorder. |
| Bus Error | Usually indicates a malfunction in the main circuit board. If resetting (restarting) the ADFM does not clear the Bus Error or it returns, then it is most likely a valid circuit board problem. |

☑ ***Note***

If other errors besides those listed above occur repeatedly, contact Teledyne Isco.

### 2.5.2 System Information

The System Information box provides specific site information: the Site ID, the voltage powering the ADFM, and the firmware version, as well as the times and dates from both the computer and ADFM internal clocks. You can set the ADFM time/date to the computer's time by clicking the Set Time button.


The Set Time window will appear. The Timezone Offset sets the ADFM time to the computer time, plus or minus the offset (in hours). If the Set ADFM Time To radio button is selected, click in the date-time field on the date, hour, or minutes to change and use the up/down arrows to increment to the correct date or time.

### 2.5.3 Testing the ADFM

Diagnostic tests are selectable from the buttons to the right of the screen. The results of each test are displayed and recorded in the station's Log File.

*Field Tests*

The Field Test should be performed in the field with the sensor installed and underwater. The test performs internal ADFM system checks. Click Field Test to perform the test.

The first test is labeled PT4, and determines if the transmit path is operating properly and returns a Pass or Fail for each transducer beam in the sensor. This test will fail if the transducer is not connected to the electronics. This test can also fail if there is a problem in the main circuit board, or the sensor or sensor cable has a short.

The PT5 test determines if the receive path is operating properly, and returns a Pass or Fail. Rows 5, 8, and 12 should always be 255 255. The other rows can have 0, 7, or 11, and still be okay even though the test shows a failure. A failure can be caused by a noisy environment (external interference). If all rows show 255, a hardware failure on the main circuit board has occurred.

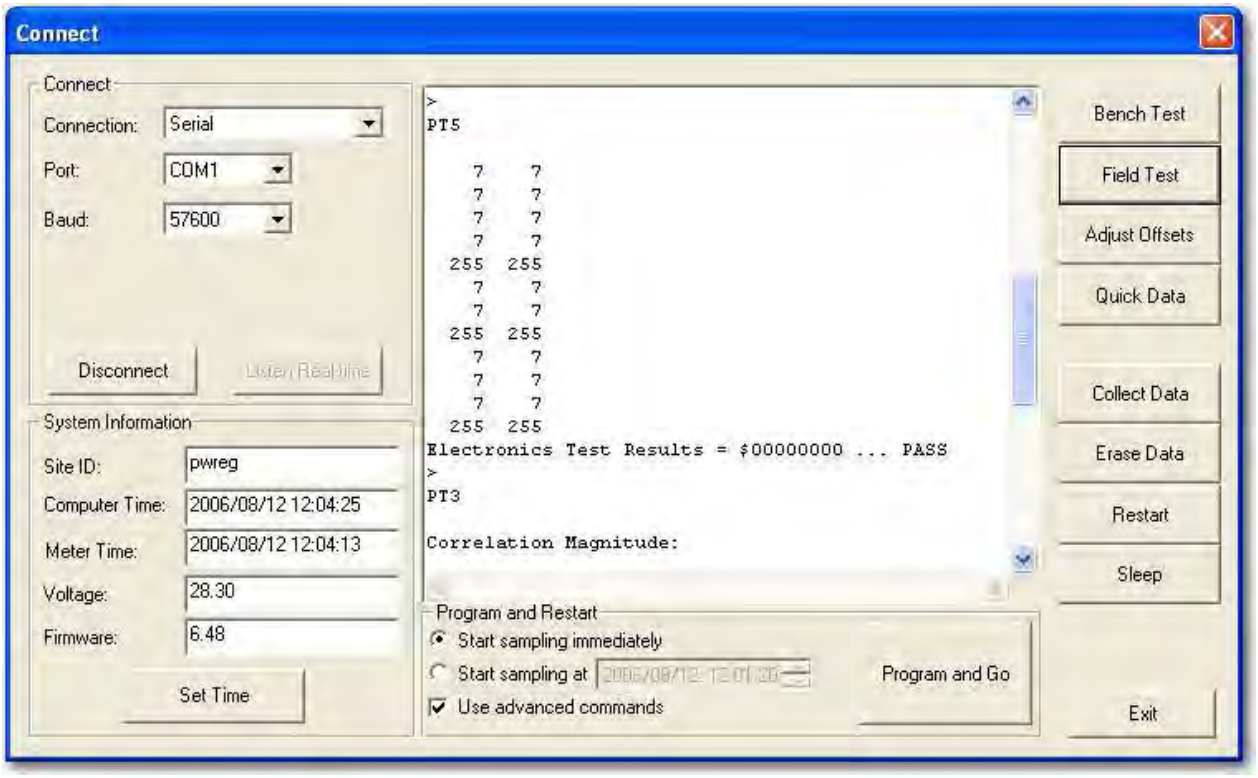



*Figure 2-14 Second Field Test (PT5)*

The PT3 Correlation Magnitude test (Figure 2-15) is an indication of the quality of the ADFM operation and the environment in which it is installed. This test can indicate a FAIL even though the ADFM is working properly. High numbers indicate external interference or noise. Values for correlation magnitude should start at 255 for lag 0, and decay steadily as the lag increases. High Gain RSSI (Relative Signal Strength Indicator) normally runs between 50 and 90. Values in the 20-30 range indicate an extremely weak signal, or disconnected sensor. Values higher than 100 indicates a high-noise environment.

Contact Teledyne Isco for more information and corrective action.

**☑ Note**

Additional diagnostic tests can be performed using the BBTalk diagnostic software. Contact Teledyne Isco for additional information regarding this software and its use.

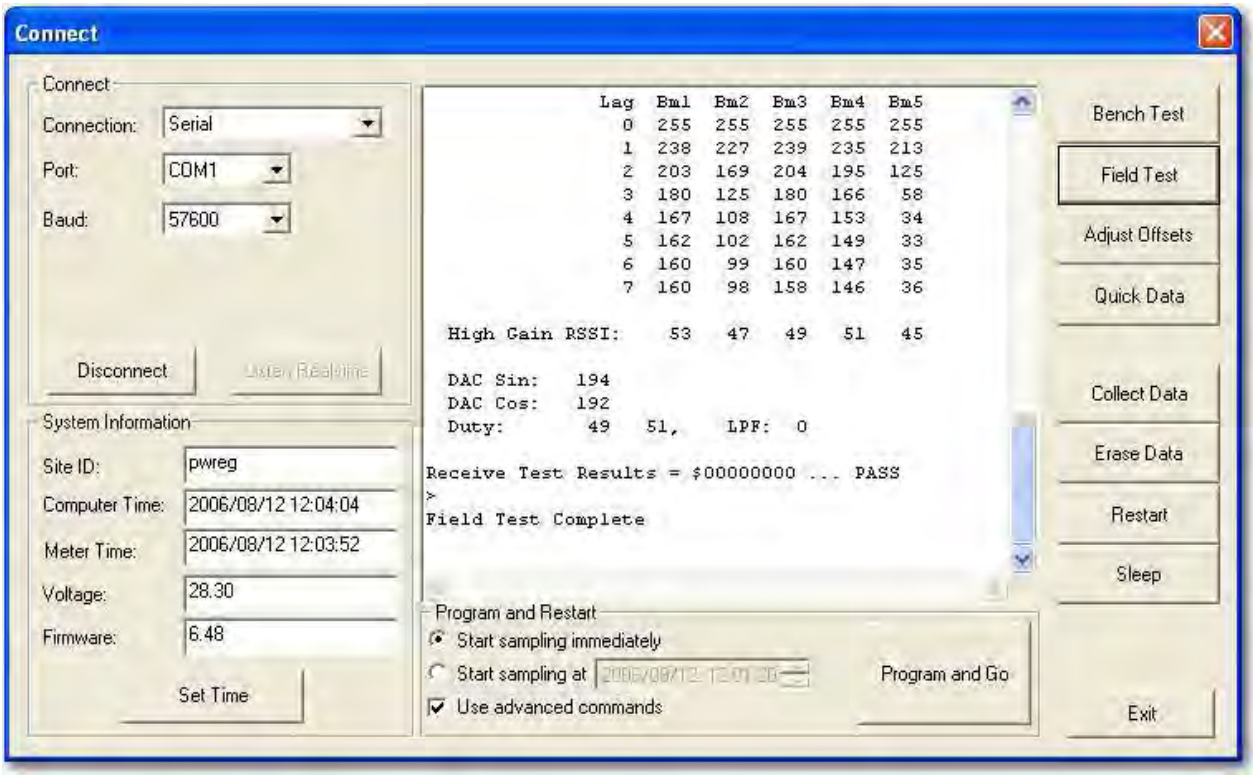



*Figure 2-15 3rd Field Test PT3 Correlation Magnitude test)*

*Bench Test*

The Bench Test function is for diagnostic purposes and is not required for routine operation. If for any reason the Bench Test *is* performed, regardless of the time interval between tests, first retrieve and save all recorded data before it is performed again. Prior to redeployment, select "Erase Recorder" and then "Restart."

## 2.6 Program and Restart

Select **Start Sampling** to begin flow monitoring immediately, or at a predetermined time in the future. Delaying the start of flow monitoring can be an advantage, if the meter is battery operated. The system can be set up in-house, programmed using the Program and Go button, and then transported to the field site at a later time. Battery power is conserved until the date and time to start sampling is met.

Check the box next to “Use advanced commands” to activate any special commands entered in the Advanced Window's dialog box (see section 2.4).

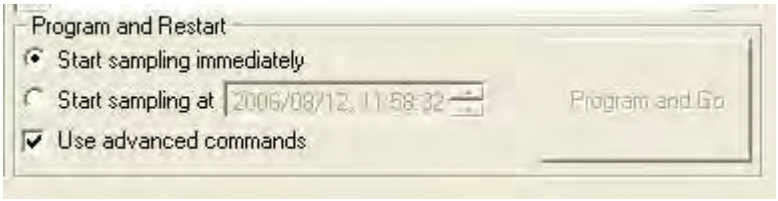



*Figure 2-16 Start Sampling options*

**⚠ CAUTION**

Advanced Commands should only be entered and used as directed by Teledyne Isco.

### 2.6.1 Program and Go


To load the application and operating parameters configured in the station file into the ADFM and start the program, click Program and Go.

After a few seconds of operation, a real-time screen appears, indicating the ADFM has been programmed and started.

To exit the program, click Exit, and the screen will return to the Operate screen. In the Operate screen, click Exit, then disconnect the communication cable. Close the station file and exit WinADFM.

As long as the real-time screen is active, each time the ADFM takes a reading based on its programmed sampling interval, the real-time screen will be updated with the latest flow reading.

In addition to the real-time screen being continually updated, a data file with the readings is sent to the computer. This file contains data recorded during the time the real-time display screen is active.

This file is automatically named **rt**, followed by the two-digit year, month, and day, with an incrementing extension. The extensions begin at .001. If Program and Go mode is used more than once in the same day, the second **rt** data file will have the extension .002, the third, .003, and so on. Data collected in Real Time mode will also be stored in the ADFM's internal recorder if the internal recorder is enabled.

The real-time display shows flow information in tabular format including Depth, Ultrasonic Depth, Secondary Depth, Qmain (actual computed flow), Qmann (computed Manning flow – if available), QmodAV computed flow, Average Velocity, and Raw Velocity. A hydrograph and the raw data velocity signal graphs are also shown (Figure 2-17).

Click Exit to return to the Connect screen.

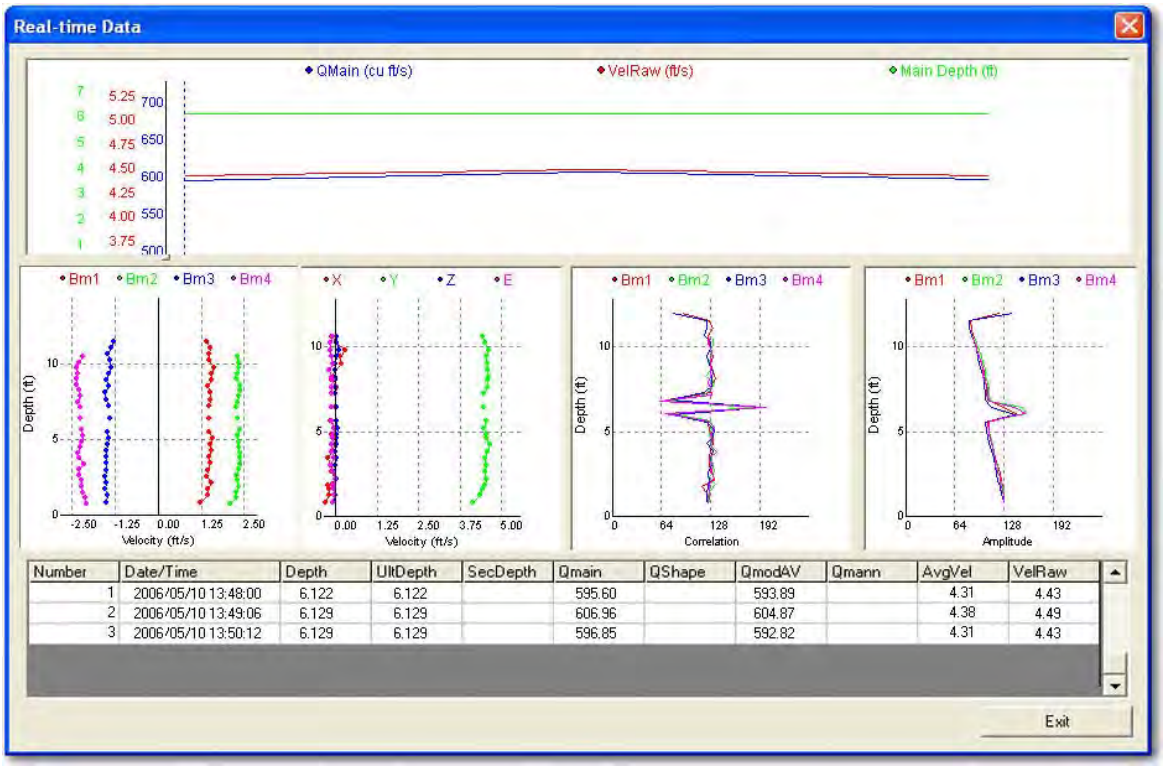



*Figure 2-17 Program and go real-time data screen*

*Graphs*
The top graph builds a hydrograph as real-time data is received.

*Velocity Beam Graphs*
The four graphs below the hydrograph show the raw velocity beam data. This data is used to assess the quality of sensor installation, the hydraulics at the sensor location, and the operation of the ADFM system. Velocity beam data is shown as beam radial velocity for each beam and bin. X, Y, Z, and E vectors at each bin location indicate correlation (a measure of signal quality), and amplitude (a measure of signal strength). Beam velocities should be symmetrical about the Y axis. X, Z, and E vectors should be near zero, and the Y vector should approximate the horizontal velocity in the pipe or channel. Ideal correlation values are around 128. Amplitude (for bins below the water surface) should be at least 30-40 counts above the High Gain RSSI values shown in the PT3 portion of the Field Test. For more information on interpreting velocity beam graphs, please contact Teledyne Isco. For specific information on the velocity beam graphs, refer to Section 2.8.3 *Expert View*.

*Depth*
Main depth used in flow calculation. Depth information from the primary ultrasonic depth sensor is compared to depth information from secondary depth sensor (if used). Best fit is determined and used for final (Ultrasonic) depth.

*Ultrasonic Depth*
This is the depth measured by the primary (ultrasonic) depth sensor.

*Secondary Depth*
Secondary depth readings appear here, if a secondary depth sensor is being used.

*Qmain* — Qmain is the final output of flow rate value after determination of the value by internal algorithms within the ADFM. Other flow rates shown in the plot, e.g., Qshape and QmodAV, are diagnostic in nature and should not be used except under the advice of Teledyne Isco. An exception is Qmann – the flow rate calculated by a Manning equation based formula, calibrated using historically measured data. When the flow depth drops below the ADFM's minimum capability for measuring velocity, the Qmann value is used for Qmain.

*Average Velocity* — Velocity divided by cross-sectional area.

*Raw Velocity* — Average of individual point velocities from the four velocity beams

**Note**

The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 2.6.5 for an explanation of these differences.

### 2.6.2 Adjust Offsets

The Adjust Offsets feature is used in the field to check or adjust the depth calibration of the ultrasonic depth transducer and/or the secondary depth sensor.


*Figure 2-18 Adjust Offsets window*

When the screen opens, it will automatically update the ultrasonic and secondary depth readings. Enter the manually measured Depth. Click Calculate, and the new sensor offset will be calculated. Click Set to change the existing sensor offset to the new offset and program it into the ADFM. The new offset is also saved in the station file.

> **Note**
>
> When clicking the Set button, watch the window box below the Set button. If the window is not able to reprogram the new offset into the ADFM because the ADFM is doing other calculations, the window will indicate a failure. Clicking on the Set button a second time usually reprograms the ADFM, and it will be indicated in the window. When finished, click Exit.

### 2.6.3 Quick Data Mode

The Quick Data feature is recommended for field evaluation and diagnostics.

Quick Data is used in the field to view real-time data. Quick Data displays a graphical and tabular screen in real time with a data update approximately every 15-20 seconds. The Quick Data real-time display is identical to the Program and Go display, except for the update time.

> **Note**
>
> If the ADFM Velocity Mode 12 is enabled, the Quick Data update may take up to 60 seconds.

> **Note**
>
> Upon exiting this screen, restart the meter using either the Program & Go or Restart button.

Quick Data creates a data file of the readings and stores it in the computer. This file will contain data recorded during the time the real-time display screen is active, and contains the velocity beam raw data used for diagnostics. This file is automatically named **qd**, followed by the year, month, and day with numerical extension. To view the Quick Data file and for analytical data, refer to the WinADFM Quick Data Evaluation Section.

> **Note**
>
> The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 2.6.5 for an explanation of these differences.

### 2.6.4 Listen Real-time Mode

Listen Real-time can be used in the field to view real-time data. The Listen Real-time display is the same as the Program and Go real-time display and Quick Data display. The Listen Real-time information is updated on the screen each time the meter takes a reading. In other words, it updates at the programmed sample interval.

During the Listen Real Time mode, the internal recorder, if activated, continues to store data. Upon exiting this mode, the current deployment continues and a new deployment is not started in the recorder.

> **Note**
>
> The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 2.6.5 for an explanation of these differences.

**2.6.5 Defining the Three Modes**

Although the three modes display the same graphical, tabular screen, their functions differ.

*Program and Go*

This function programs or reprograms the ADFM based on the configuration settings in the station file. Starts a new deployment and captures data on the computer, and also stores the data on the meter's internal recorder if the recorder is enabled.

*Listen Real-time*

Listen Real-time captures data on the computer as sent out by the meter. If the internal recorder is on, data continues to be recorded to the current deployment. Upon exiting this mode, the current deployment continues, rather than a new one starting.

*Quick Data*

Quick Data is used in the field to view real-time data. This mode updates the display screen approximately every 15-20 seconds, and is used in the field to view the operation of the ADFM on-site and verify proper operation of the system. A specially modified configuration is used to obtain more rapid updates than would normally be available, including a reduced number of pings.

**2.6.6 Restart**

This button will restart the ADFM using the programmed parameters currently stored in its memory.

**2.6.7 Sleep**

Sends an "off" command to the ADFM that puts it in Sleep mode. The ADFM will not wake up at the specified sample time and take a reading. In Sleep mode, the ADFM will only wake up and start operating when a wakeup command is sent via the Connect button.

> **Note**
>
> If the ADFM is put to sleep, immediately disconnect the serial connection to the computer to prevent and accidental wake-up of the ADFM.

## 2.7 Downloading and Viewing Data

To download data from the recorder, open the Connect window (see section 2.5). Connect to the ADFM and click Collect Data. The Collect Data window appears and shows the amounts of available and used recorder space to the nearest megabyte. The Available Deployments indicates the number of data files currently in the recorder. The Last Download indicates the number of the last deployment downloaded.

> **Note**
>
> The ADFM recorder must be cleared following data retrieval. Save all downloaded data and, prior to redeployment, erase the recorder and restart the ADFM.

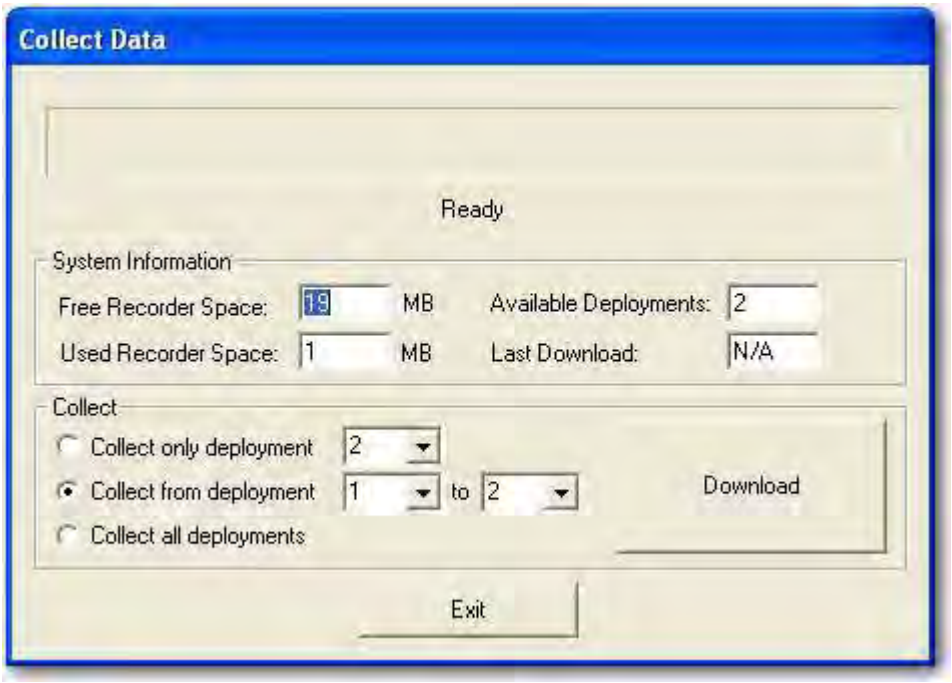



*Figure 2-19 Collect Data window*

> **Note**
>
> The Last Download information is stored in the station file, not the ADFM. Therefore, if a different computer is used to download recorder deployments each time, the Last Download information may be incorrect.

Select the desired Collect mode from the three options and click Download.

The Transferring Data Bar appears. This window shows the name of the file as well as the size of the file and the number of bytes collected in real time. When the file(s) have been transferred, the message “Transfer completed successfully” will appear. Exit to return to the Operate screen.

**Note**

If the recorder is completely full, data collection could take several hours. See instructions to erase the data, at the bottom of this page.

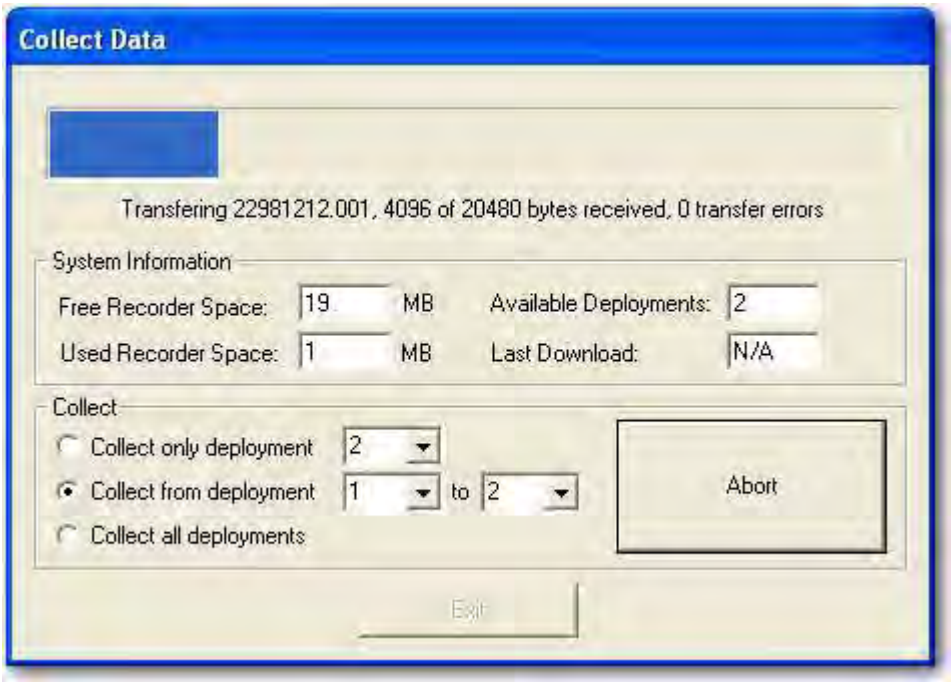



*Figure 2-20 Data transfer indicator*

When the download is finished, erase the recorder by clicking Erase Data.

When finished, restart the ADFM by doing one of the following:

- Click Restart to keep current program settings,
  or
- Click Program & Go to save new program settings.
  When the Program & Go screen appears, click Exit.

Disconnect the communication interface cable from the ADFM, exit the Operate screen, and quit the WinADFM software program.

## 2.8 Viewing Data

Data collected from the ADFM during Quick Data or Real Time mode, or data collected from the internal recorder, may be viewed using the View Data menus.


Open the station file of the site you want to view data from. From the Menu bar, select Display > Data.

The Data file selection screen will appear. This screen lists all of the Quick Data (qt), Real Time (rt), and internal recorder deployments available for the selected site.

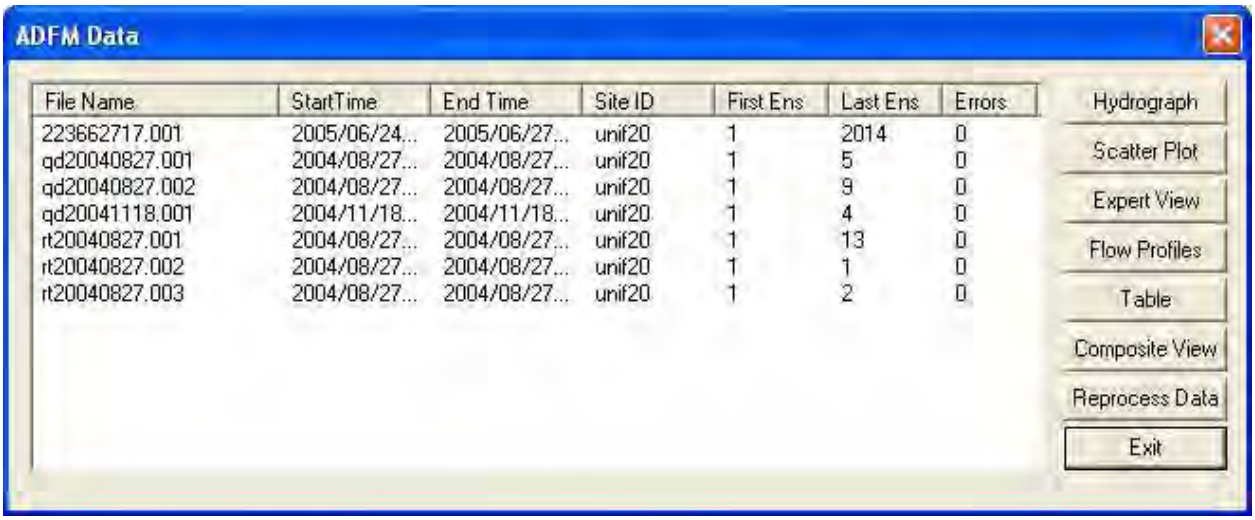



*Figure 2-21 ADFM Data window*

The ADFM Data window provides several options for viewing the data. Highlight the data file you want to view and then click the viewing option on the right side of the window.

### 2.8.1 Hydrograph

The hydrograph displays time series data, showing flow, velocity, depth, and fluid temperature.

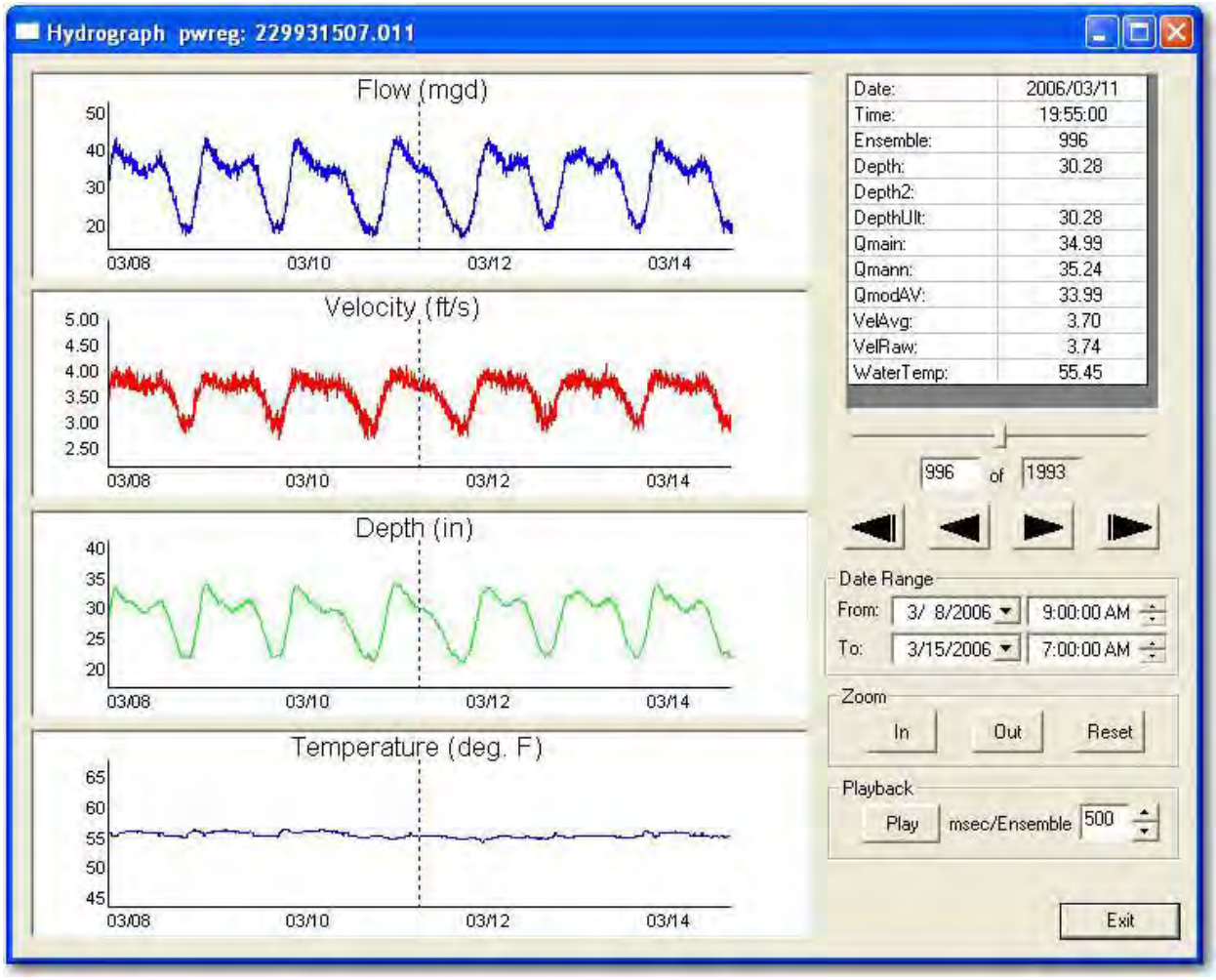



*Figure 2-22 Hydrograph*

A vertical dotted line on the graph represents a specific Ensemble (Data Point). The specific ensemble information, including the values, is shown in the table to the right of the graph. Click a point in the graph to move the dotted line and display the values for that specific ensemble.

The slide bar below the table allows you to move from one ensemble to another. The boxes beneath the slide bar show the ensemble number. The arrows are used for moving to the beginning or end of the graph, or to move to the next or previous ensemble.

The Data Range box shows the starting and ending date/time of the first and last ensemble. The start/end date/time of the graph can be changed by clicking the arrows, or by typing the value in the box.

To change the graph range, colors, and line thickness, right-click on the graph. A submenu will appear. Select Properties from the submenu.

A Playback feature is activated by clicking the Play button. This will advance the dotted line one ensemble at a time. To speed up or slow down the playback, change the msec/Ensemble time value in the box to the right of the Play button.

### 2.8.2 Scatter Plot

The scatter plot window has check boxes to view Velocity vs. Depth, Flow vs. Depth, and HC (Hydraulic Coefficient) vs. Depth. Radio Buttons are provided to select either Variable N or Fixed N for HC calculations.

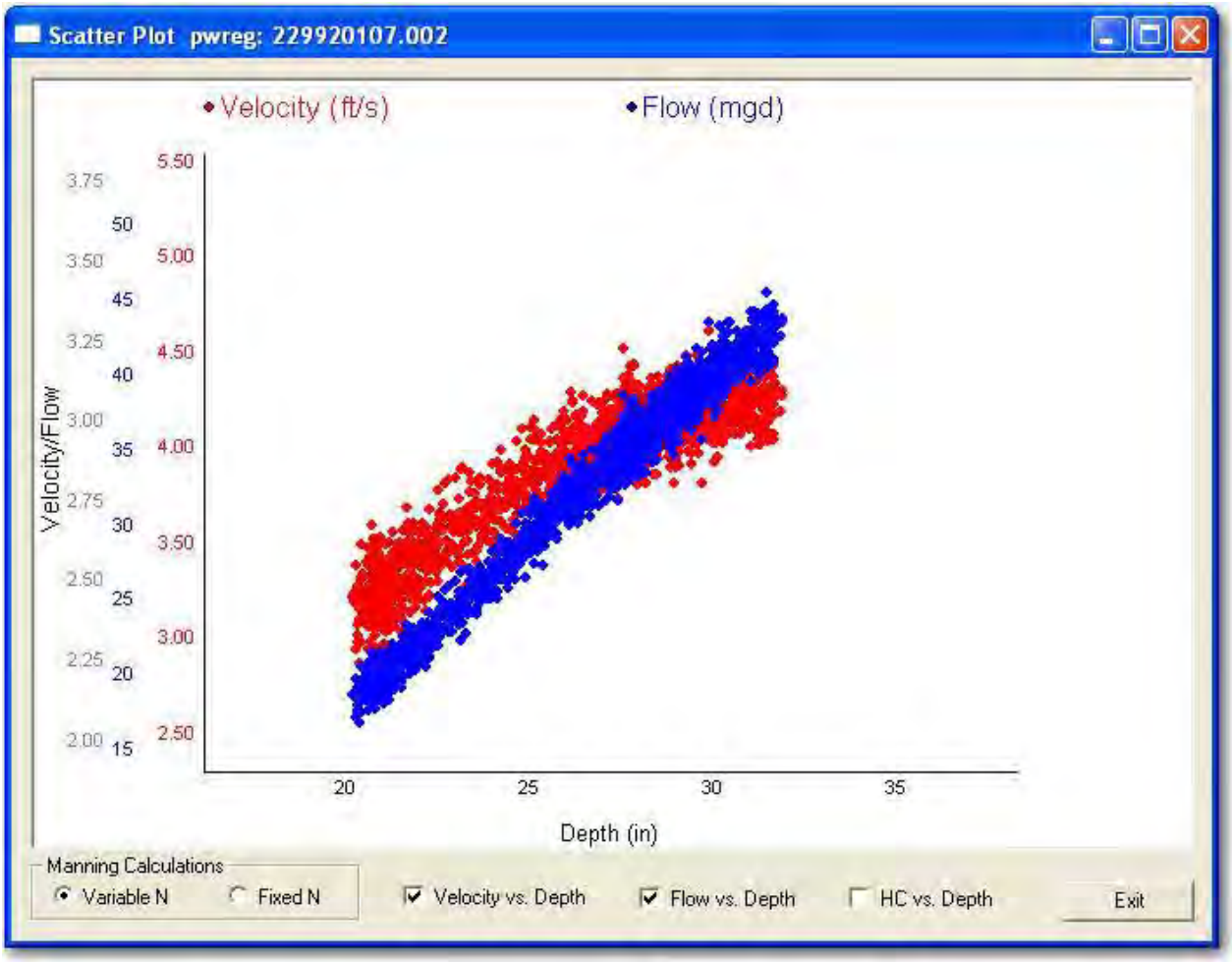



*Figure 2-23 Scatter Plot*

Hydraulic Coefficient is back-calculated from Q, depth, and channel geometry, based on the Fixed or Variable N radio button.

Variable N assumes that the coefficient of friction used in the Manning equation varies with depth of flow. Fixed N assumes that the coefficient of friction used in the Manning equation is constant and independent of depth of flow.

### 2.8.3 Expert View

Expert View includes graphical displays of the hydrograph and raw data.

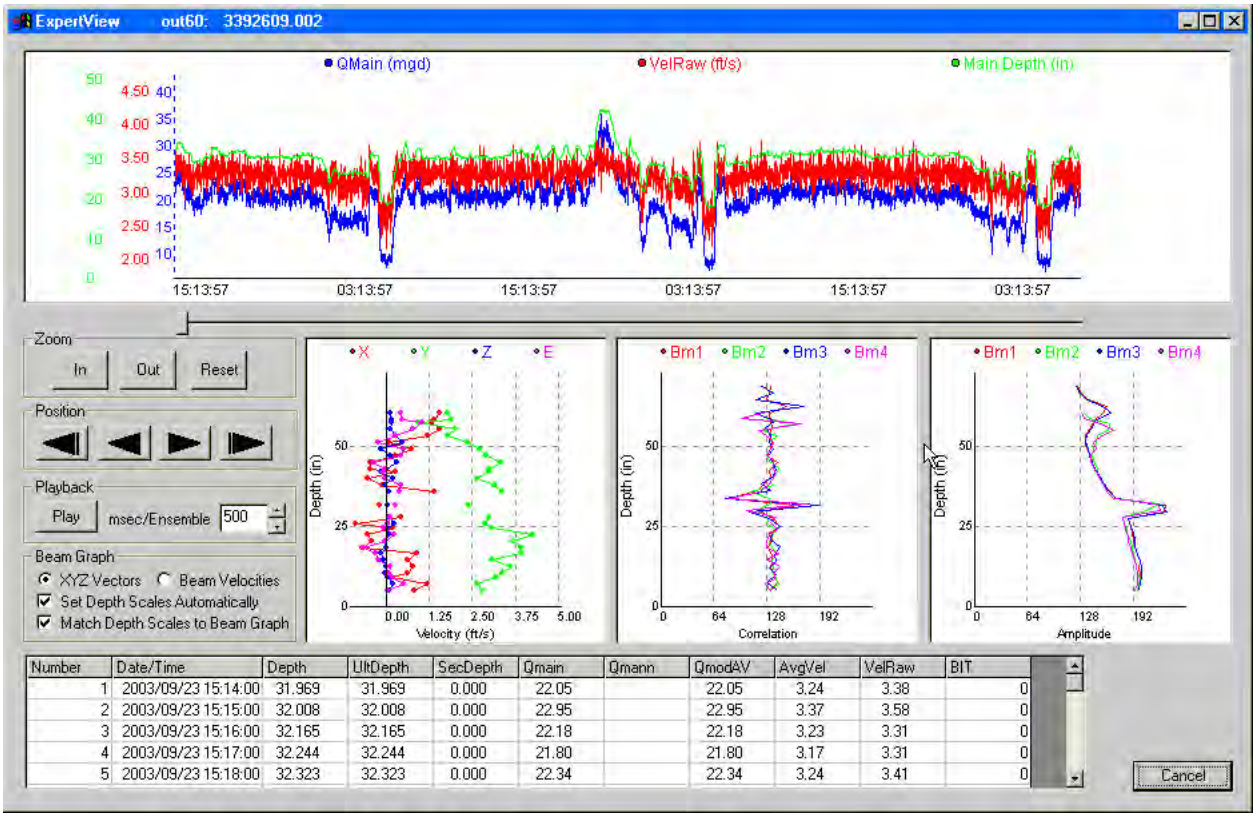



*Figure 2-24 Expert View: XYZ Vectors*

Expert View also shows tabular values for Depth, Ultrasonic Depth, Secondary Depth, Qmain, Qmann, QmodAV, Average Velocity, Raw Velocity, and BIT (Built-In Test) values.

*Graphs* — The top graph is a hydrograph of Q, V, and D.

*Velocity Beam Graphs* — The three graphs below the hydrograph show raw data information.

*Depth* — Main depth used in flow calculation. Depth information from the primary ultrasonic depth sensor is compared to depth information from secondary depth sensor (if used). Best fit is determined and used for main depth.

*Average Velocity* — Velocity divided by cross-sectional area.

*Raw Velocity* — Average of individual point velocities from the four velocity beams.

*Qmain* — Flow determined by one of four different flow calculations. The ADFM calculates four different flow values - Qpro, ModAV, AV, and (optionally) the Manning equation.

*Qpro* — Diagnostic value used by Teledyne Isco, which should be ignored by the user. Qmain is the only flow value that is used for data output.

| | |
|---|---|
| *QmodAV* | Diagnostic value used by Teledyne Isco, which should be ignored by the user. Qmain is the only flow value that is used for data output. |
| *Qav* | Diagnostic value used by Teledyne Isco, which should be ignored by the user. Qmain is the only flow value that is used for data output. |
| *Qmann* | Seven to nine inches of depth is required for velocity profiling. Below that depth, flow is calculated using a calibrated Manning equation. The calibration is based on historical velocity readings, stored and updated during velocity profiling. Velocity is not displayed when Manning-based flow value is calculated. |
| *XYZ Vectors* | XYZ vectors refer to velocity components resolved into an XYZ coordinate system. They are resolved by transforming the measured raw velocity vectors – the beam velocities (see next section) – into a normal three-dimensional coordinate system. In the ADFM's frame of reference, a positive Y velocity vector represents downstream flow. Looking downstream, an X velocity vector is a component of flow velocity to the right, and a Z velocity vector is a component of flow velocity traveling upward. The graph in Figure 2-24 shows the profiles of these three velocity components. The E component is the error of the XYZ component resolution. |
| *Bit Codes* | BIT (Built in Test) codes indicate errors that occurred during the course of an individual reading. Beginning with WinADFM version 1.47, BIT codes are displayed in hexidecimal form. See Appendix A *BIT Codes for ADFM and accQmin* for details. |

*Beam Velocities*

Under Beam Graph, if you select Beam Velocities, the velocity Beam Graph replaces the XYZ Vector Graph. The velocity beam data can be used to interpret the quality of the ADFM operation and data.

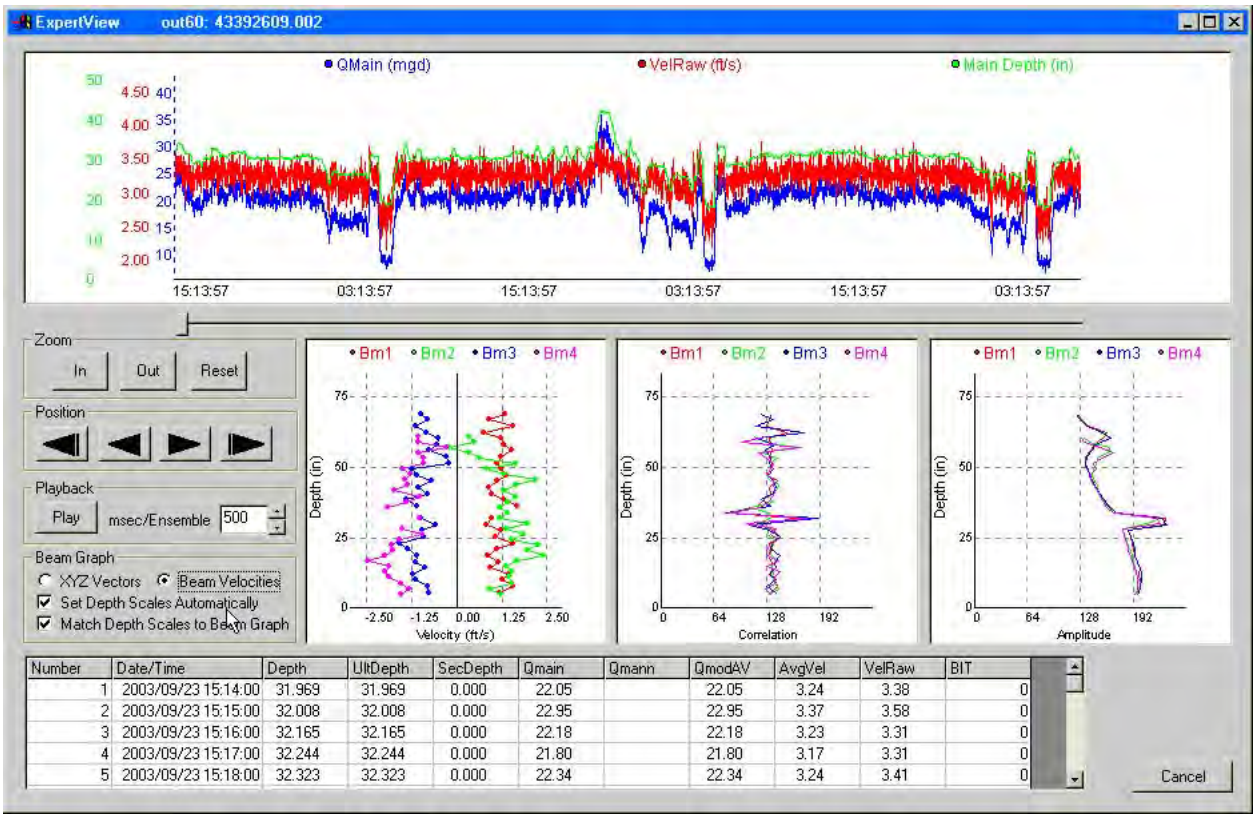
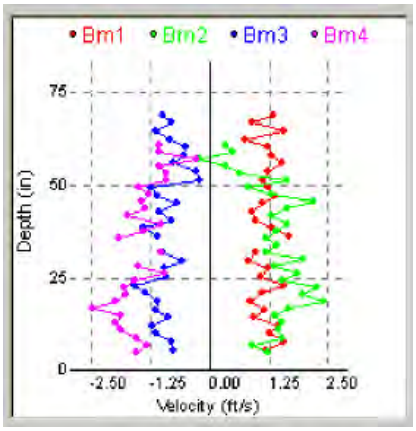



*Figure 2-25 Expert View: Beam Velocities*




*Interpreting beam and XYZ plots*

Beam Velocity profiles (shown to the left) refer to the raw Doppler-based velocity components measured by each individual beam. The Doppler effect is a directional phenomenon. The Doppler shift detected by any of the acoustic beams will be a direct representation of the velocity component along the acoustic beam's transmit and receive path. Therefore, each beam will produce its own raw velocity measurements, producing a profile of velocity components along the acoustic beam. These are the raw measurements that are transformed into the YXZ coordinate system to produce the Vector profiles shown in the XYZ graph.

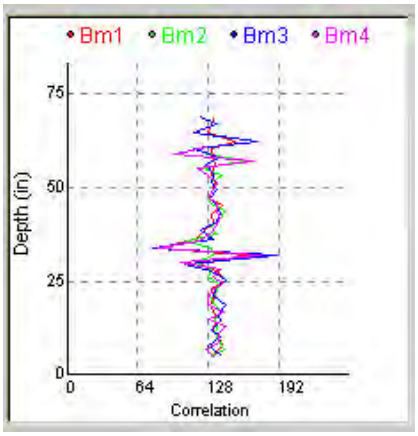
Both the Beam Velocity and XYZ Vector plots give information about the quality of the ADFM sensor installation and alignment. In a perfect installation, Beams 1 & 3 will be equal in amplitude and opposite in sign. Beams 2 & 4 will also be equal in amplitude and opposite in sign, but will have a greater amplitude than 1 & 3 by approximately 50%. This is due to the

different angles of the different beams. By observing departures from the expected ideal, the user can determine if the sensor is misaligned, and the nature of the misalignment.

Of course, asymmetrical beam profiles can be caused by hydraulic conditions, even in the case of a perfect installation. To determine the true cause of any asymmetry, the user can examine other data quality parameters that the ADFM measures and collects with each flow rate measurement.

### 2.8.4 Data Quality Parameters

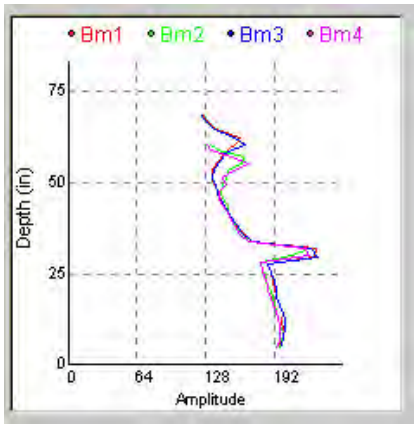
*Correlation*




Correlation is a measure of the quality of the processed velocity information. An expected Correlation value is approximately 128 counts. A *count* is an arbitrary unit unique to the ADFM. Lower Correlation values (e.g., below 100) are an indication of poor quality velocity data. Higher Correlation values (e.g., above 150) can be an indication of external interference (noise) or the presence of a "hard" acoustic barrier (e.g., the surface). If the Correlation is at a high level for part or all of the profile, this is an indication of noise. If the Correlation displays a hard spike, as it does in the example to the left, this is an indication of a hard barrier; in this case, the surface.

Note in this example that all four acoustic beams display the spike at approximately the same place. With better resolution on the graph, we would see that the spikes for Beams 1 and 3 hit the surface simultaneously, as do Beams 2 and 4. This symmetry indicates that the sensor is properly aligned with the pipe or channel. Therefore, any departure in the symmetry of the velocity measurements would be an indicator of less than ideal hydraulic conditions. If the spikes were not coincident, this would be an indication of sensor misalignment.

*Amplitude*




An ADFM operates by emitting a sound pulse and then receiving the echoes backscattered by material suspended in the flow. Amplitude data is a measure of the signal strength of these echoes. The amplitude normally decays from a high value near the sensor (bottom of graph) to a lower value at the end of the profile range (near the top of the graph). This is due to several factors, including the natural spread of sound energy as it travels farther away and loss due to absorption of sound energy by the water and suspended material. Large spikes should also be expected in the amplitude profile where the beams contact the surface.

### 2.8.5 Examples of Raw Data

The following examples provide a guide for interpreting the data in Expert View.

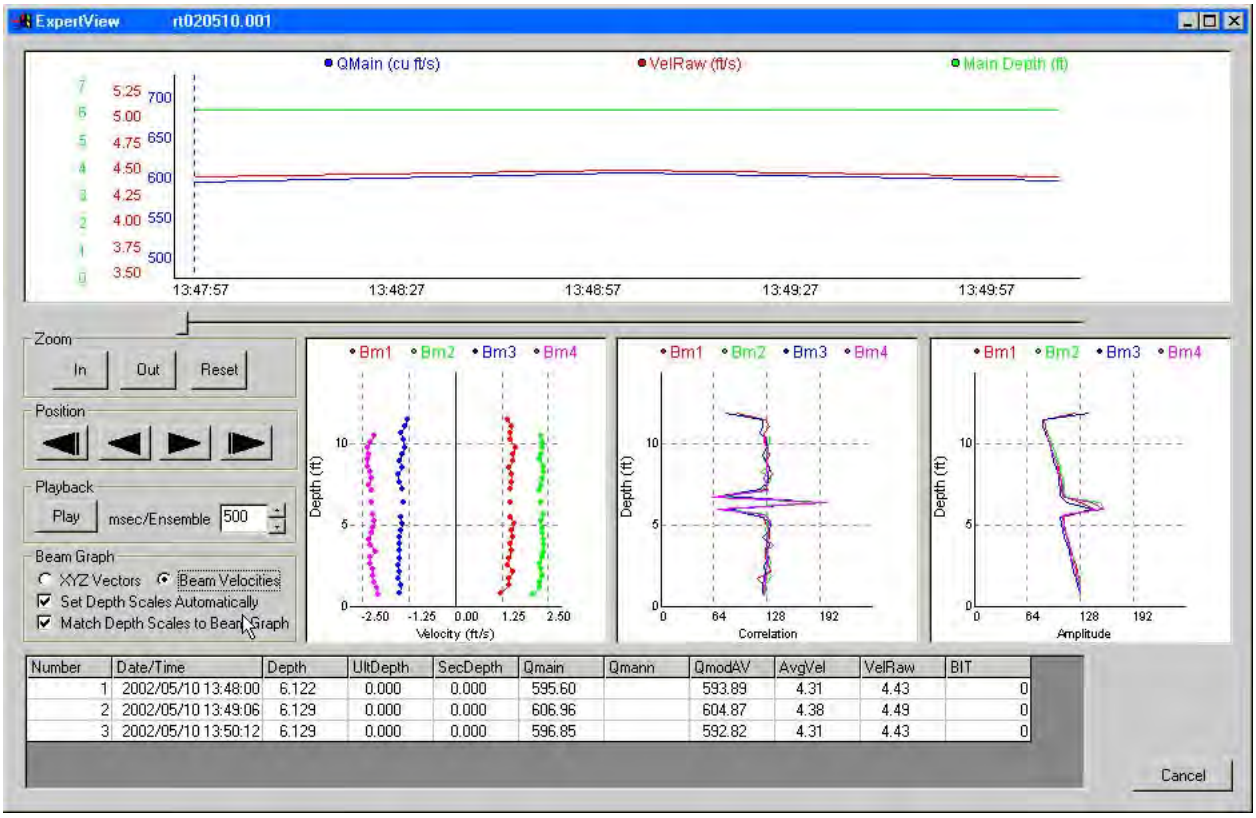



*Figure 2-26 Excellent raw data – excellent sensor alignment*

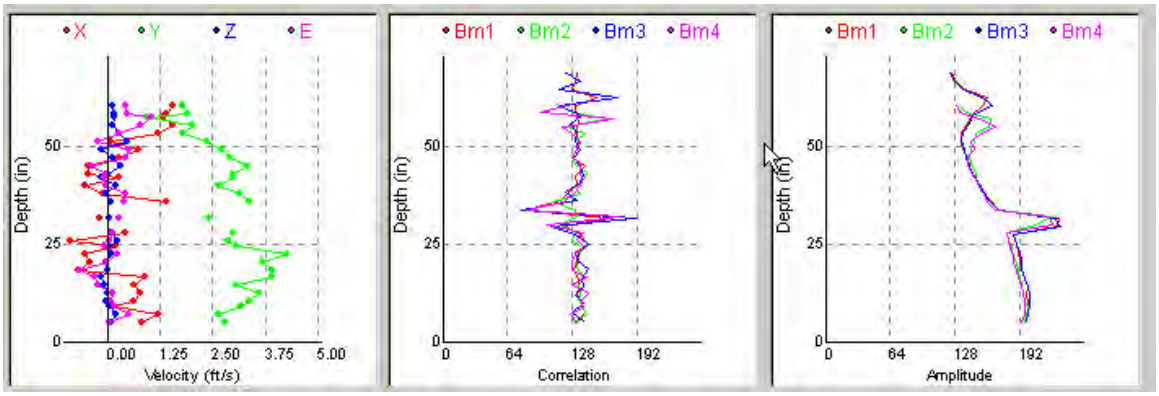



*Figure 2-27 Typical raw data waveforms*

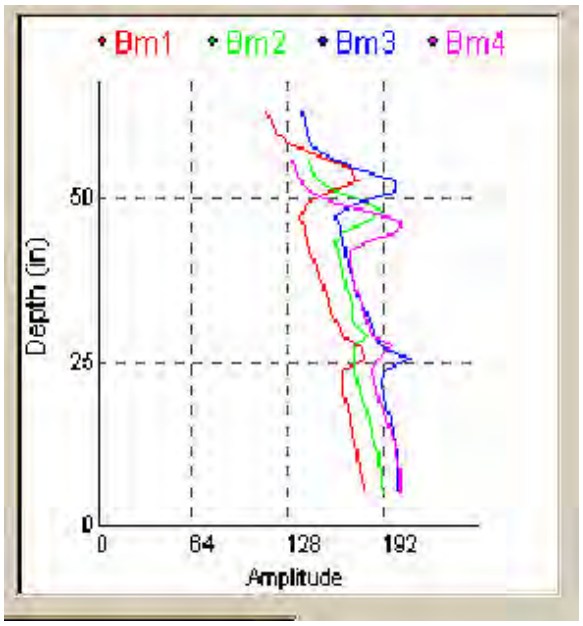



*Figure 2-28 Poor amplitude – debris influence*

In Figure 2-28, debris is starting to cover Beam 1 (front right transducer).

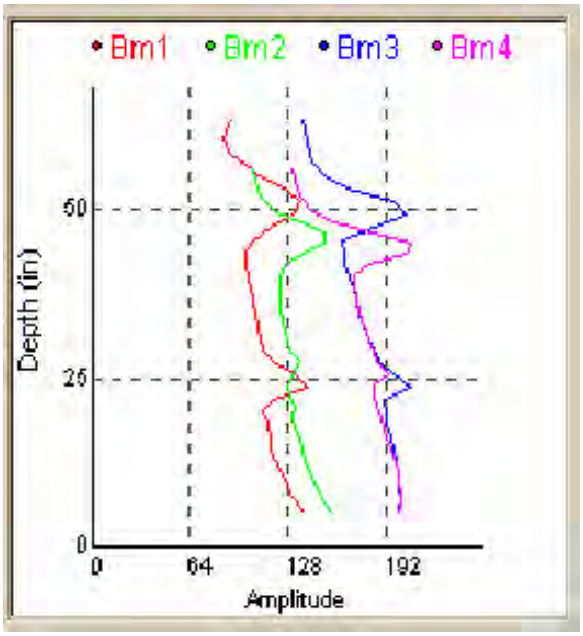



*Figure 2-29 Poor amplitude – debris blocking signal*

In Figure 2-29, Beams 1 and 2 (front) are both covered by debris.

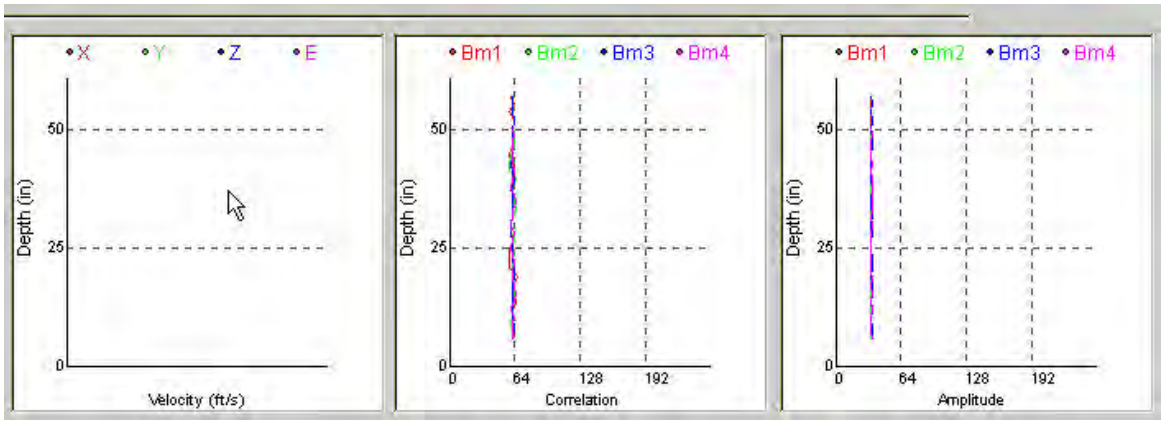



*Figure 2-30 Bad data – No signal amplitude and low correlation.*

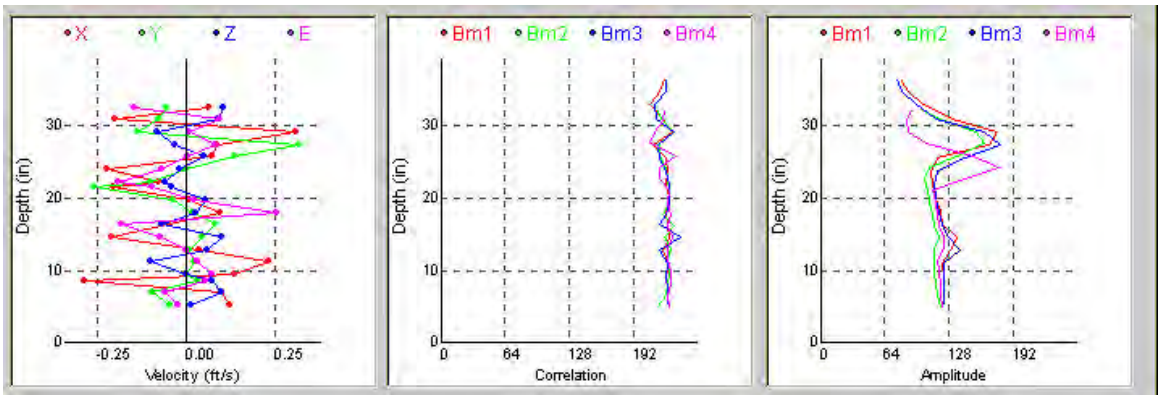



*Figure 2-31 Noise – External interference (EMI/RFI)*

Noise interference (Figure 2-31) is indicated by high correlation values – much higher than the expected 128 counts.

### 2.8.6 Flow Profile

The flow profile window shows both a hydrograph and a color contour plot of the flow profile. This flow profile is developed from the raw beam velocity profiling information. This raw velocity data is entered into an algorithm that produces a mathematical description of velocity as a function of position within the pipe or channel. The Y axis represents channel height, and the X axis represents channel width. Velocity is represented by different colors.

To view the flow profile, select the data file from the ADFM Data window (Figure 2-21) and click “Flow Profile”.

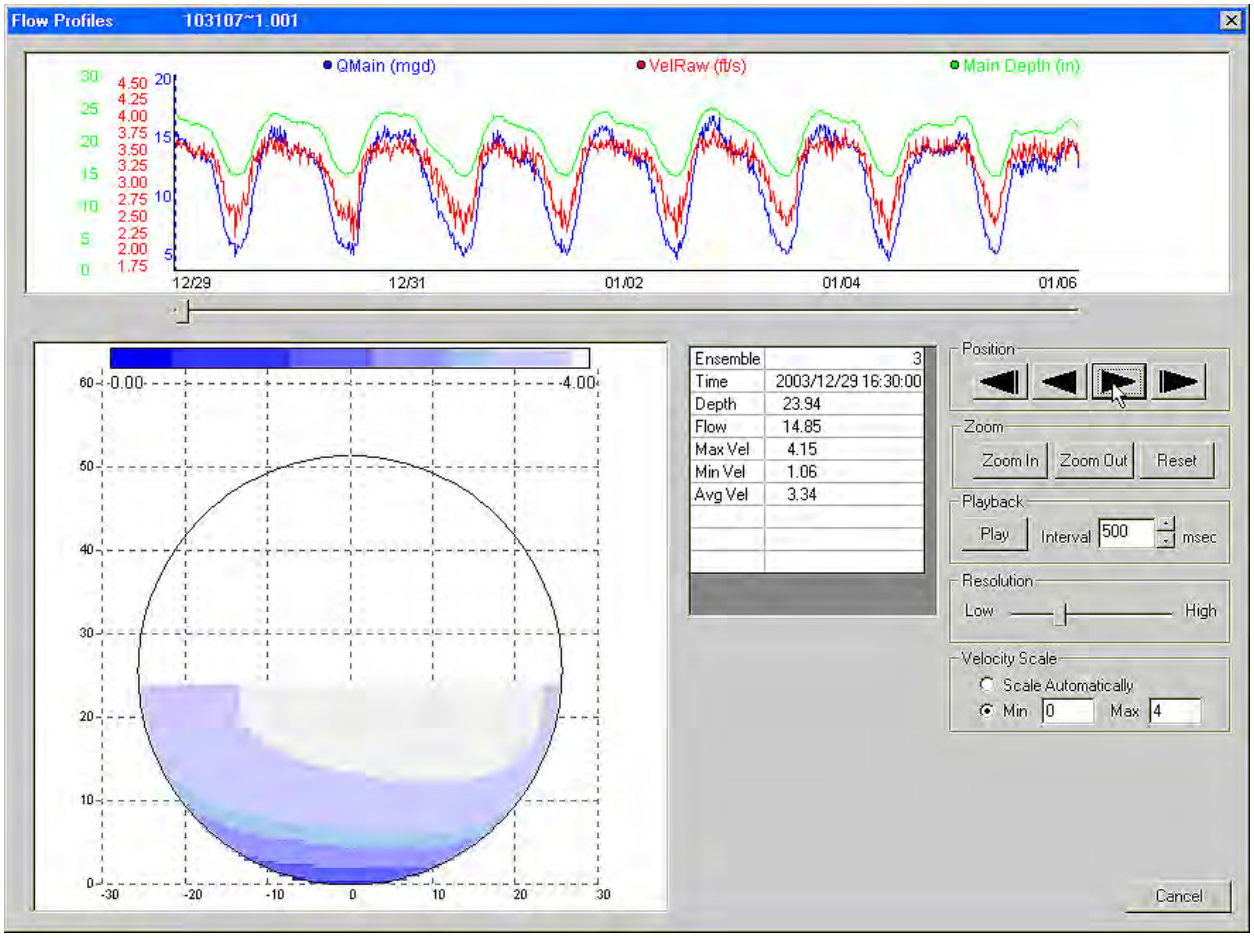



*Figure 2-32 Flow Profile window*

| | |
|---|---|
| *Resolution* | High resolution has better resolution, but takes longer to compute. |
| *Velocity Scale* | Scale automatically or set minimum and maximum velocities to use in the profiling range. All other features are similar to those described in Hydrograph, above. |

### 2.8.7 Table

To view the data in tabular form, select the desired data file from the list.

A data file can be saved in CSV or extended CSV format for use in a spreadsheet. To save in CSV, highlight the data file, checking the box for extended CSV if desired, and click Save as CSV.

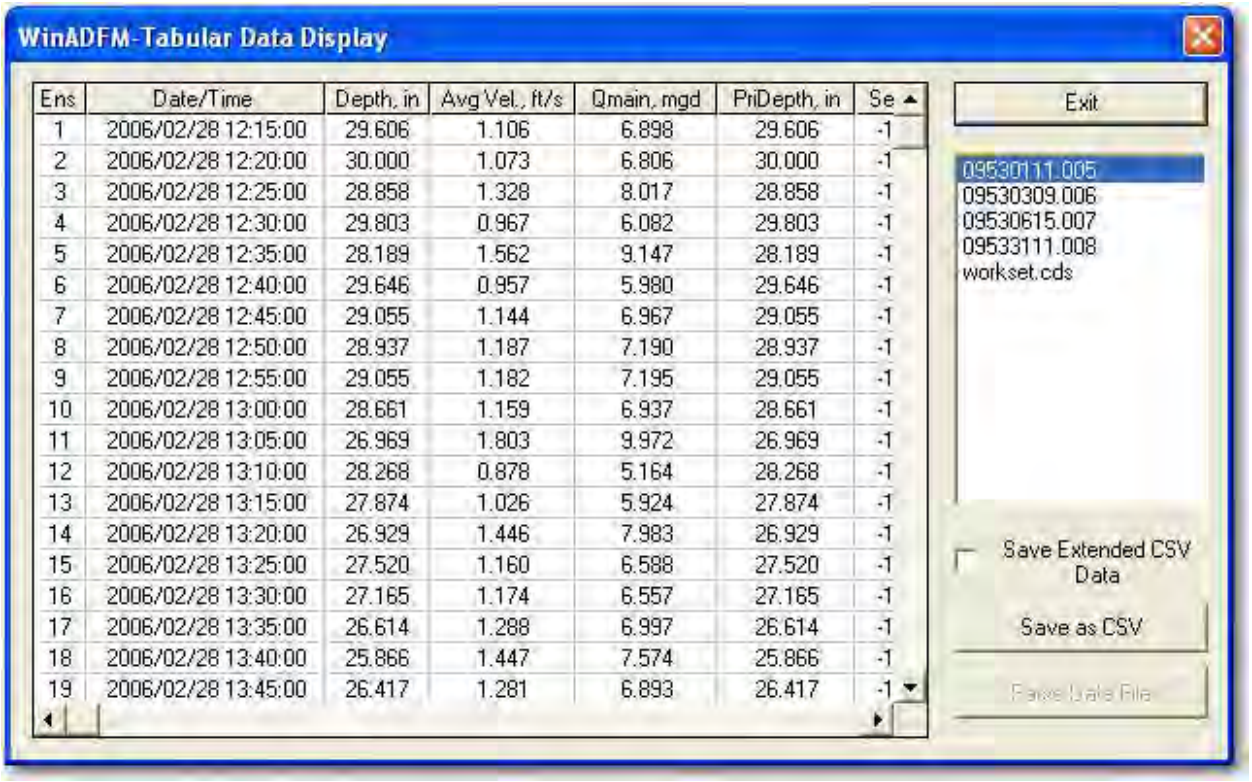
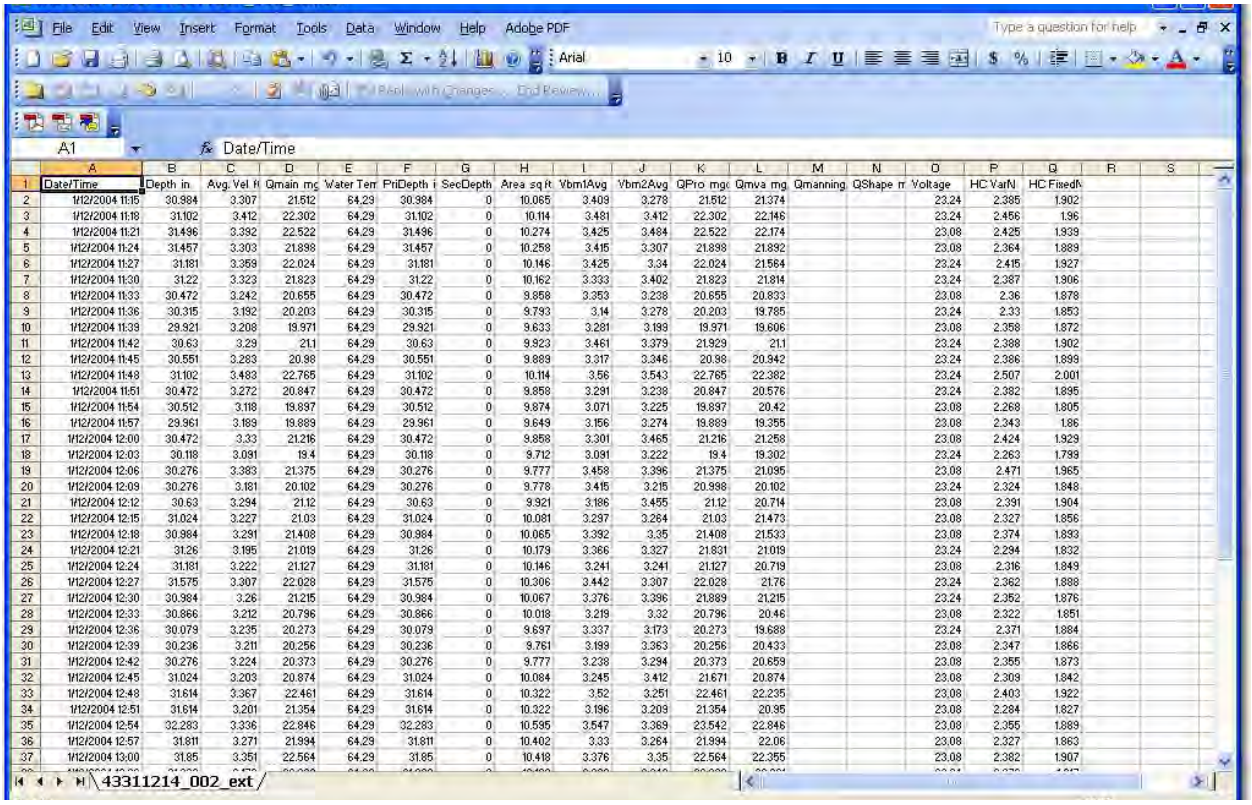



*Figure 2-33 Tabular data display*

A data file saved in CSV format and then opened with a spreadsheet program will show Date/Time, Depth, Velocity, and Flow. The same data saved as extended CSV provides more data information and is shown in Figure 2-34).

> ☑ ***Note***
>
> Only Qmain is ever output as the final flow value as computed by the ADFM. All other Q-related values are for diagnostic purposes, and should be ignored by the user.




| Date/Time | Depth in | Avg. Vel ft | Qmain mg | Water Tem | PriDepth i | SecDepth | Area sq ft | Vbm1Avg | Vbm2Avg | QPro mgd | Qmva mg | Qmanning | QShape m | Voltage | HC VarN | HC FixedN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1/12/2004 11:15 | 30.984 | 3.307 | 21.512 | 64.29 | 30.984 | 0 | 10.065 | 3.409 | 3.278 | 21.512 | 21.374 | | | 23.24 | 2.385 | 1.902 |
| 1/12/2004 11:18 | 31.102 | 3.412 | 22.302 | 64.29 | 31.102 | 0 | 10.114 | 3.481 | 3.412 | 22.302 | 22.146 | | | 23.24 | 2.456 | 1.96 |
| 1/12/2004 11:21 | 31.496 | 3.392 | 22.522 | 64.29 | 31.496 | 0 | 10.274 | 3.425 | 3.484 | 22.522 | 22.174 | | | 23.08 | 2.425 | 1.939 |
| 1/12/2004 11:24 | 31.457 | 3.303 | 21.898 | 64.29 | 31.457 | 0 | 10.258 | 3.415 | 3.307 | 21.898 | 21.892 | | | 23.08 | 2.364 | 1.889 |
| 1/12/2004 11:27 | 31.181 | 3.359 | 22.024 | 64.29 | 31.181 | 0 | 10.146 | 3.425 | 3.34 | 22.024 | 21.564 | | | 23.24 | 2.415 | 1.927 |
| 1/12/2004 11:30 | 31.22 | 3.323 | 21.823 | 64.29 | 31.22 | 0 | 10.162 | 3.333 | 3.402 | 21.823 | 21.814 | | | 23.24 | 2.387 | 1.906 |
| 1/12/2004 11:33 | 30.472 | 3.242 | 20.655 | 64.29 | 30.472 | 0 | 9.858 | 3.353 | 3.238 | 20.655 | 20.833 | | | 23.08 | 2.36 | 1.878 |
| 1/12/2004 11:36 | 30.315 | 3.192 | 20.203 | 64.29 | 30.315 | 0 | 9.793 | 3.14 | 3.278 | 20.203 | 19.785 | | | 23.24 | 2.33 | 1.853 |
| 1/12/2004 11:39 | 29.921 | 3.208 | 19.971 | 64.29 | 29.921 | 0 | 9.633 | 3.281 | 3.199 | 19.971 | 19.606 | | | 23.08 | 2.358 | 1.872 |
| 1/12/2004 11:42 | 30.63 | 3.29 | 21.1 | 64.29 | 30.63 | 0 | 9.923 | 3.461 | 3.379 | 21.929 | 21.1 | | | 23.24 | 2.388 | 1.902 |
| 1/12/2004 11:45 | 30.551 | 3.283 | 20.98 | 64.29 | 30.551 | 0 | 9.889 | 3.317 | 3.346 | 20.98 | 20.942 | | | 23.24 | 2.386 | 1.899 |
| 1/12/2004 11:48 | 31.102 | 3.483 | 22.765 | 64.29 | 31.102 | 0 | 10.114 | 3.56 | 3.543 | 22.765 | 22.382 | | | 23.24 | 2.507 | 2.001 |
| 1/12/2004 11:51 | 30.472 | 3.272 | 20.847 | 64.29 | 30.472 | 0 | 9.858 | 3.291 | 3.238 | 20.847 | 20.576 | | | 23.24 | 2.382 | 1.895 |
| 1/12/2004 11:54 | 30.512 | 3.118 | 19.897 | 64.29 | 30.512 | 0 | 9.874 | 3.071 | 3.225 | 19.897 | 20.42 | | | 23.08 | 2.268 | 1.805 |
| 1/12/2004 11:57 | 29.961 | 3.189 | 19.889 | 64.29 | 29.961 | 0 | 9.649 | 3.156 | 3.274 | 19.889 | 19.355 | | | 23.08 | 2.343 | 1.86 |
| 1/12/2004 12:00 | 30.472 | 3.33 | 21.216 | 64.29 | 30.472 | 0 | 9.858 | 3.301 | 3.465 | 21.216 | 21.258 | | | 23.08 | 2.424 | 1.929 |
| 1/12/2004 12:03 | 30.118 | 3.091 | 19.4 | 64.29 | 30.118 | 0 | 9.712 | 3.091 | 3.222 | 19.4 | 19.302 | | | 23.24 | 2.263 | 1.799 |
| 1/12/2004 12:06 | 30.276 | 3.383 | 21.375 | 64.29 | 30.276 | 0 | 9.777 | 3.458 | 3.396 | 21.375 | 21.095 | | | 23.08 | 2.471 | 1.965 |
| 1/12/2004 12:09 | 30.276 | 3.181 | 20.102 | 64.29 | 30.276 | 0 | 9.778 | 3.415 | 3.215 | 20.998 | 20.102 | | | 23.24 | 2.324 | 1.848 |
| 1/12/2004 12:12 | 30.63 | 3.294 | 21.12 | 64.29 | 30.63 | 0 | 9.921 | 3.186 | 3.455 | 21.12 | 20.714 | | | 23.08 | 2.391 | 1.904 |
| 1/12/2004 12:15 | 31.024 | 3.227 | 21.03 | 64.29 | 31.024 | 0 | 10.081 | 3.297 | 3.264 | 21.03 | 21.473 | | | 23.08 | 2.327 | 1.856 |
| 1/12/2004 12:18 | 30.984 | 3.291 | 21.408 | 64.29 | 30.984 | 0 | 10.065 | 3.392 | 3.35 | 21.408 | 21.533 | | | 23.08 | 2.374 | 1.893 |
| 1/12/2004 12:21 | 31.26 | 3.195 | 21.019 | 64.29 | 31.26 | 0 | 10.179 | 3.366 | 3.327 | 21.831 | 21.019 | | | 23.24 | 2.294 | 1.832 |
| 1/12/2004 12:24 | 31.181 | 3.222 | 21.127 | 64.29 | 31.181 | 0 | 10.146 | 3.241 | 3.241 | 21.127 | 20.719 | | | 23.08 | 2.316 | 1.849 |
| 1/12/2004 12:27 | 31.575 | 3.307 | 22.028 | 64.29 | 31.575 | 0 | 10.306 | 3.442 | 3.307 | 22.028 | 21.76 | | | 23.24 | 2.362 | 1.888 |
| 1/12/2004 12:30 | 30.984 | 3.26 | 21.215 | 64.29 | 30.984 | 0 | 10.067 | 3.376 | 3.396 | 21.889 | 21.215 | | | 23.24 | 2.352 | 1.876 |
| 1/12/2004 12:33 | 30.866 | 3.212 | 20.796 | 64.29 | 30.866 | 0 | 10.018 | 3.219 | 3.32 | 20.796 | 20.46 | | | 23.08 | 2.322 | 1.851 |
| 1/12/2004 12:36 | 30.079 | 3.235 | 20.273 | 64.29 | 30.079 | 0 | 9.697 | 3.337 | 3.173 | 20.273 | 19.688 | | | 23.24 | 2.371 | 1.884 |
| 1/12/2004 12:39 | 30.236 | 3.211 | 20.256 | 64.29 | 30.236 | 0 | 9.761 | 3.199 | 3.363 | 20.256 | 20.433 | | | 23.08 | 2.347 | 1.866 |
| 1/12/2004 12:42 | 30.276 | 3.224 | 20.373 | 64.29 | 30.276 | 0 | 9.777 | 3.238 | 3.294 | 20.373 | 20.659 | | | 23.08 | 2.355 | 1.873 |
| 1/12/2004 12:45 | 31.024 | 3.203 | 20.874 | 64.29 | 31.024 | 0 | 10.084 | 3.245 | 3.412 | 21.671 | 20.874 | | | 23.08 | 2.309 | 1.842 |
| 1/12/2004 12:48 | 31.614 | 3.367 | 22.461 | 64.29 | 31.614 | 0 | 10.322 | 3.52 | 3.251 | 22.461 | 22.235 | | | 23.08 | 2.403 | 1.922 |
| 1/12/2004 12:51 | 31.614 | 3.201 | 21.354 | 64.29 | 31.614 | 0 | 10.322 | 3.196 | 3.203 | 21.354 | 20.95 | | | 23.08 | 2.284 | 1.827 |
| 1/12/2004 12:54 | 32.283 | 3.336 | 22.846 | 64.29 | 32.283 | 0 | 10.595 | 3.547 | 3.369 | 23.542 | 22.846 | | | 23.08 | 2.355 | 1.889 |
| 1/12/2004 12:57 | 31.811 | 3.271 | 21.994 | 64.29 | 31.811 | 0 | 10.402 | 3.33 | 3.264 | 21.994 | 22.06 | | | 23.08 | 2.327 | 1.863 |
| 1/12/2004 13:00 | 31.85 | 3.351 | 22.564 | 64.29 | 31.85 | 0 | 10.418 | 3.376 | 3.35 | 22.564 | 22.355 | | | 23.08 | 2.382 | 1.907 |

*Figure 2-34 Tabular data in Extended CSV format*

### 2.8.8 Composite View

Composite view provides a composite hydrograph of multiple data files. To select more than one file to view, highlight the first file, hold down the Control key, and highlight the other file(s) to view.

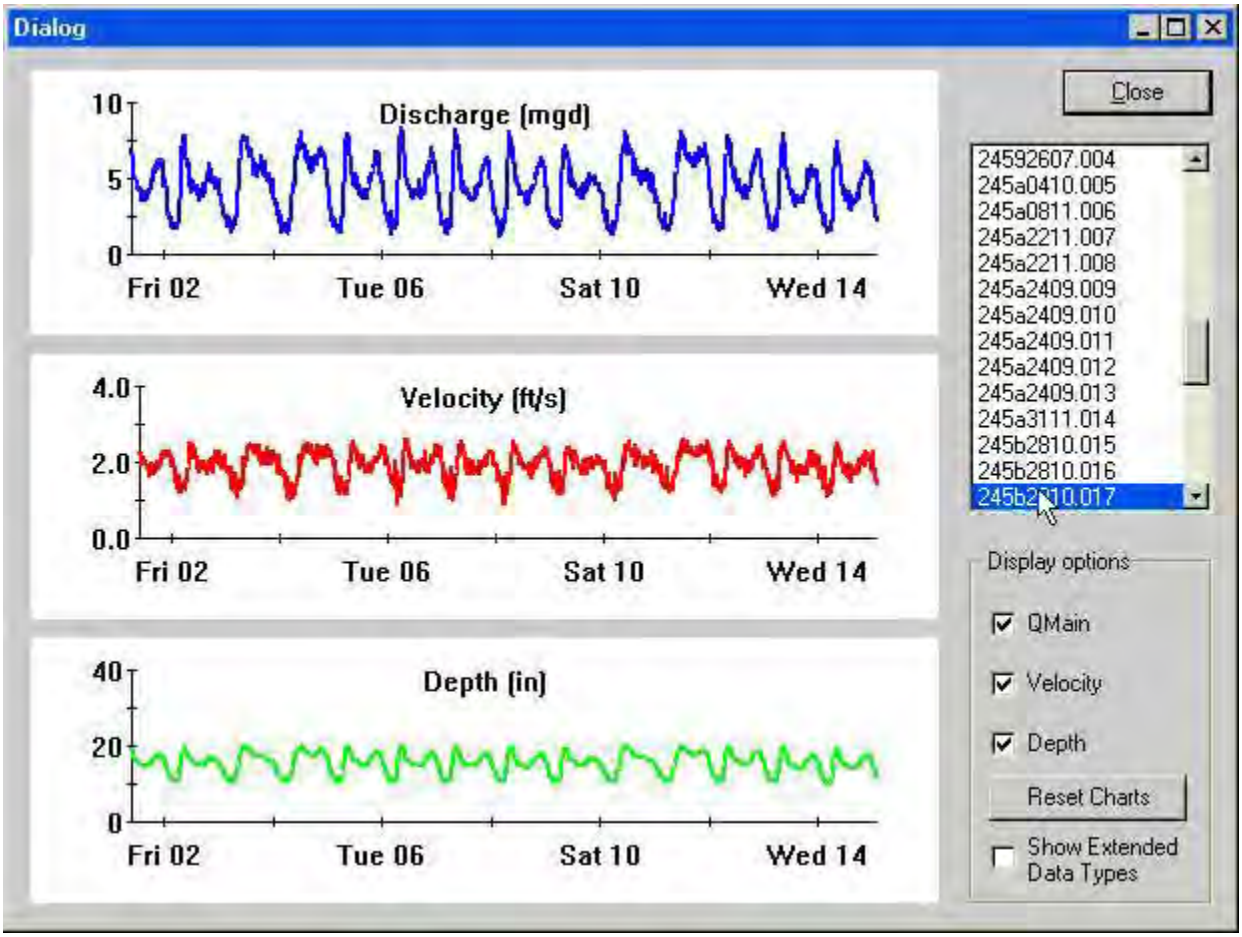



*Figure 2-35 Composite view*

### 2.8.9 Reprocessing Data

The reprocessing screen (Figure 2-36) is used to reprocess selected deployments. Reprocessing may become necessary, for example, if the channel dimensions were specified incorrectly in the station configuration file, or to remove data acquired with beams affected by debris.

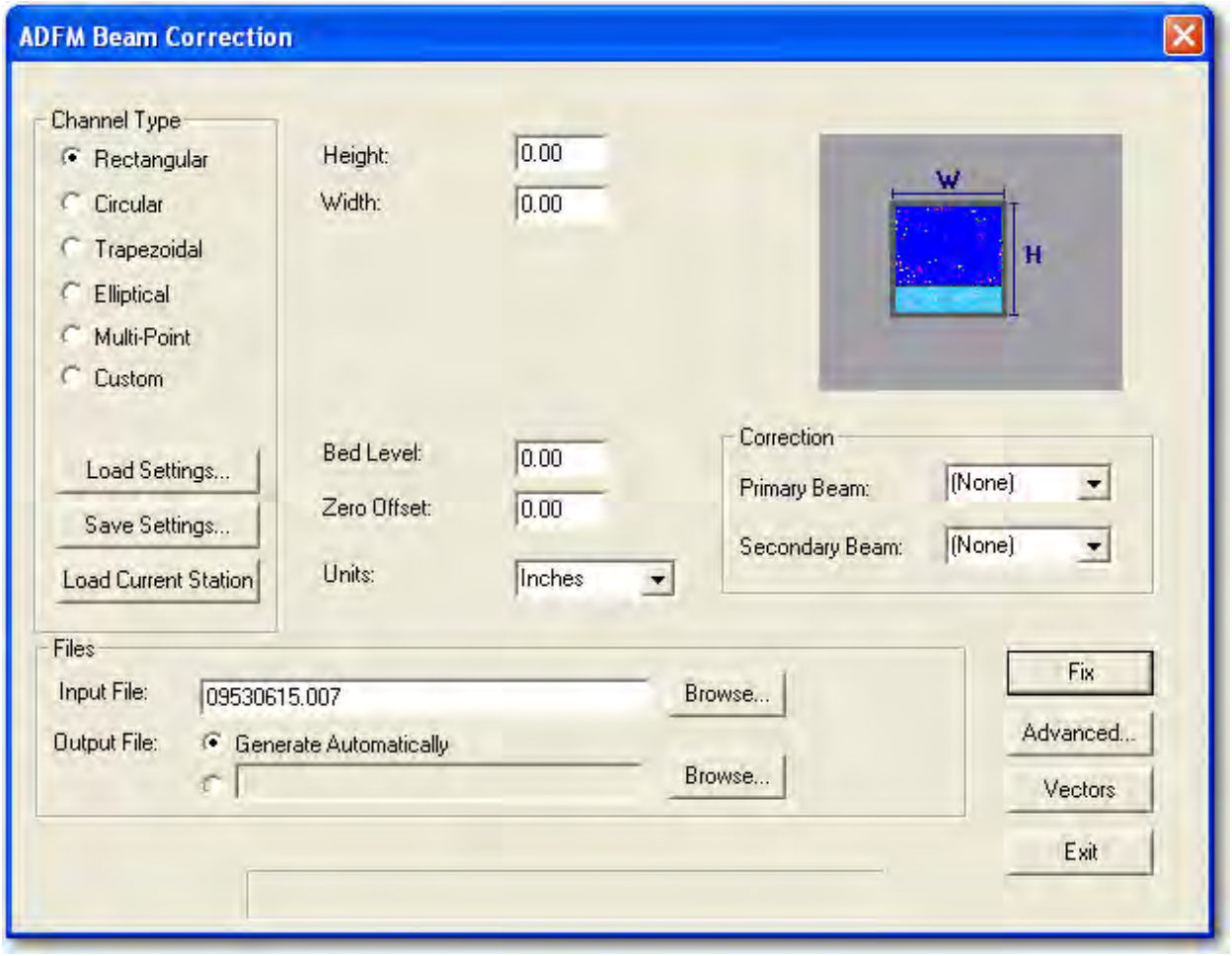



*Figure 2-36 Reprocessing data*

To load the current channel dimensions, click Load Current Station. To change the dimension, edit the current channel dimension(s) to the desired dimension(s). If the deployment to be adjusted does not appear in the Input File field, click Browse and select the deployment. Click Fix. If the Output File is set to Generate Automatically, the original file name will be used, followed by “fix”. The file will be located in the same data folder as the original file.

To add or change the Bed Level or Zero Offset, use the same procedure as above.

To remove one of the velocity beams from the data, select the Primary Beam to be removed. If two beams are to be removed, select the Secondary Beam. Click Fix, and the data will be reprocessed with the selected beam(s) removed.

**Note**

The remaining features, Advanced and Vectors, are not available in this version of WinADFM software (1.46).

# WinADFM Software

## *Section 3 accQmin (Shallow Water Meter)*

### 3.1 Creating a Station File

In order to deploy the accQmin, you must first create a station file for setup and programming.

Click File > New, or click the blank page toolbar button. The File New screen will give the options to either create a station file or group of existing station files. Click the type of file to be created – e.g., AccQmin Station. Enter the new Site ID in the Site ID box. The Site ID is limited to 8 alpha-numeric characters without spaces, or other punctuation or special characters. The Site ID must be entered before the station file (also known as a Configuration or Programming file) can be created.

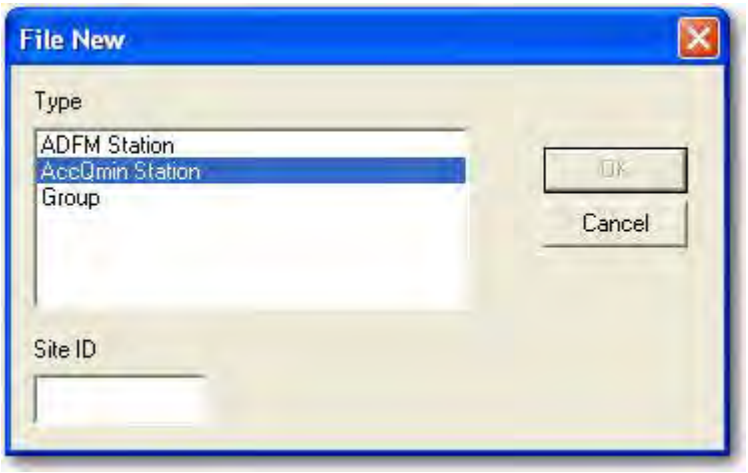




*Figure 3-1 New File*

After you enter the Site ID and select OK, a Save As dialog will appear. The Site ID will be the default file name. A longer or different name may be entered, but the first 8 or fewer alpha-numeric characters (letters or numbers only) will be used as the Site ID. If you change the first 8 characters in the file name from the default site ID name, then you have also changed the site ID name that will be programmed into the accQmin. Ensure that the file will be saved to the Config directory. When you save the file, a window with default program parameters will appear.

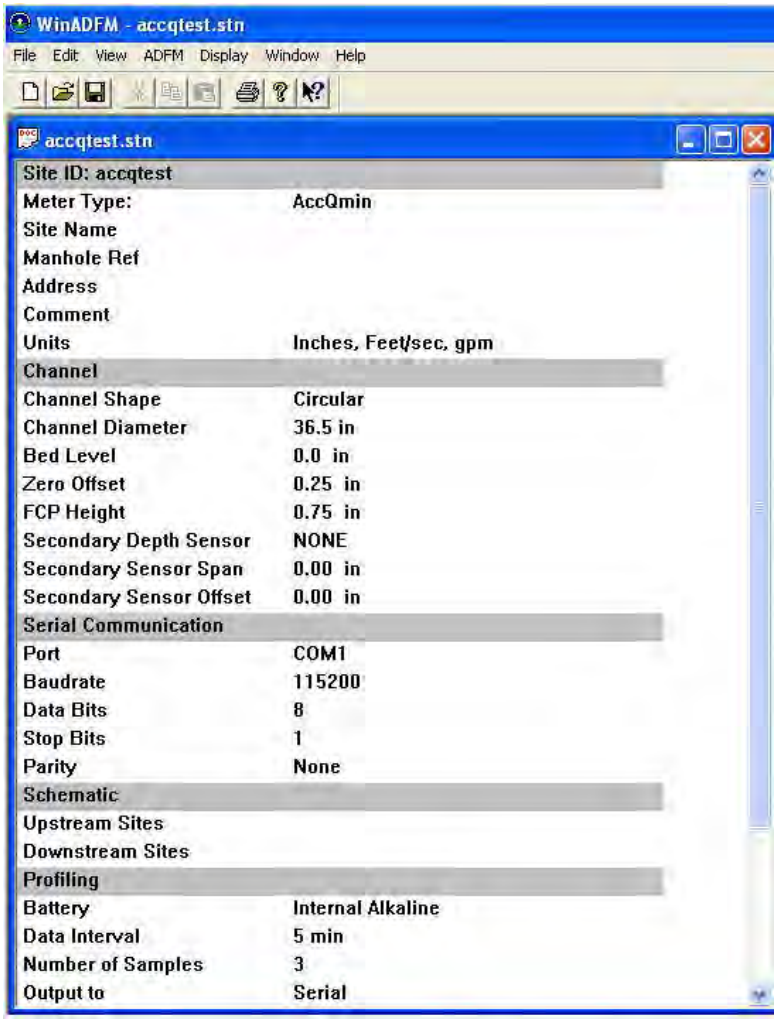



*Figure 3-2 Station File Window*

## 3.2 Setup

With the station file open, select ADFM in the menu bar and then select Setup.


This screen is for setting up or editing the accQmin operating parameters in the station file. The site-specific information in the station file will be used to program the accQmin. The Setup window has four tabs where you will enter the information: Site; Channel; Communication; Profiling.

### 3.2.1 Site tab

On the Site tab, enter site-specific information.

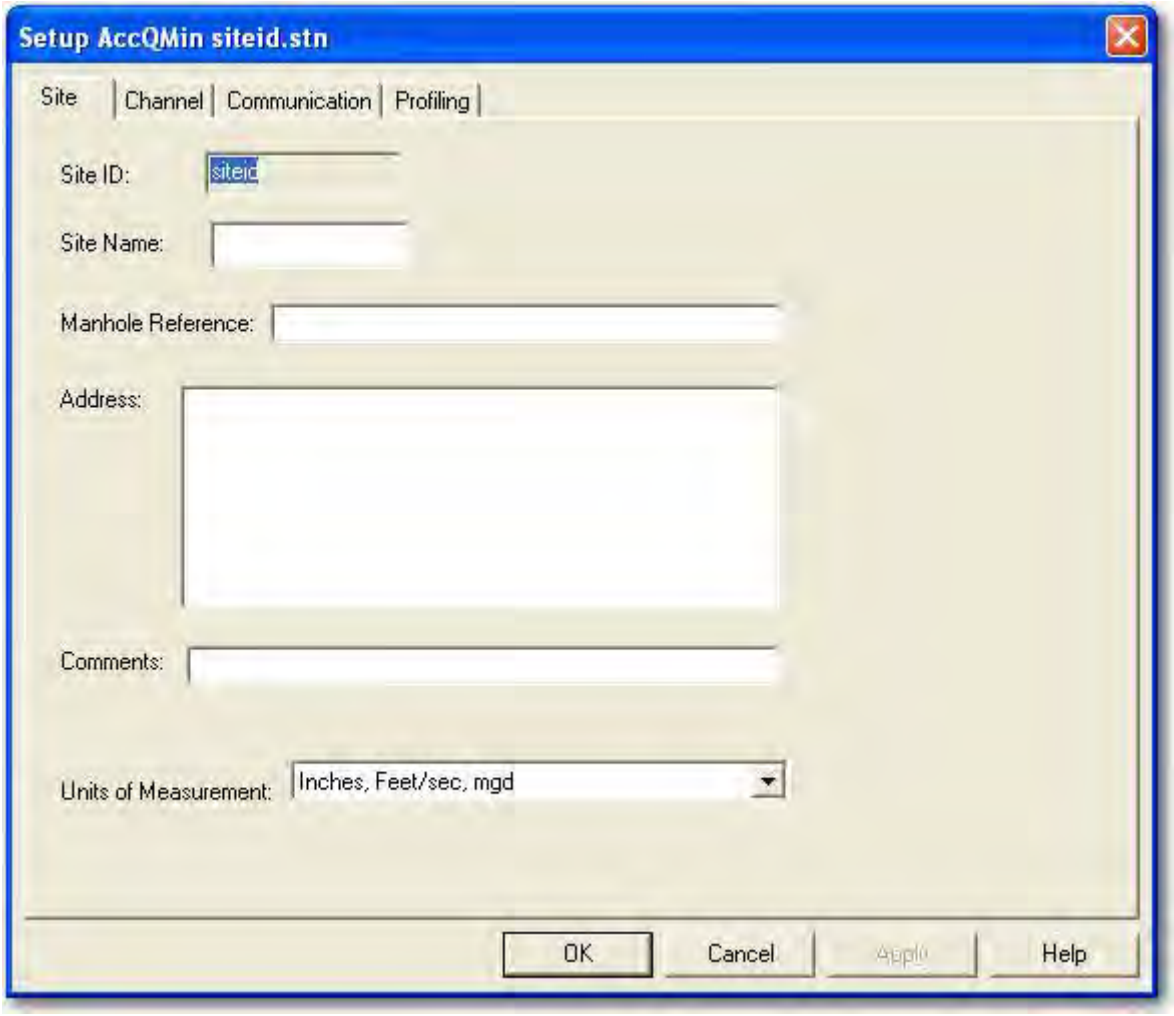



*Figure 3-3 Site tab*

*Site ID* — Site ID is used to name the station file, to create additional chart configuration files to name, and the station's data folder. This entry was made when the station file was created.

*Site Name* — This field contains the commonly used name for the site. This field can be up to 255 characters long.

*Manhole Reference* — Where applicable, this number identifies the manhole. This field can be up to 255 characters long.

*Address* — Where applicable, enter the street address for the site. This field can be up to 255 characters long. You can use multiple lines by hitting <Enter>.

*Comments* — Comments concerning the site or the installation may be documented in this field. This field may be up to 255 characters long.

*Units of Measurement* — Using the dropdown menu, select the units of measure for depth, velocity, and flow. These units will be used throughout the program. You can go back to this screen and change the units after entering pipe/channel dimensions in another screen. The dimension values are then rescaled to the new units of measure.

### 3.2.2 Channel tab

Use this tab to specify the appropriate channel geometry and dimensions.

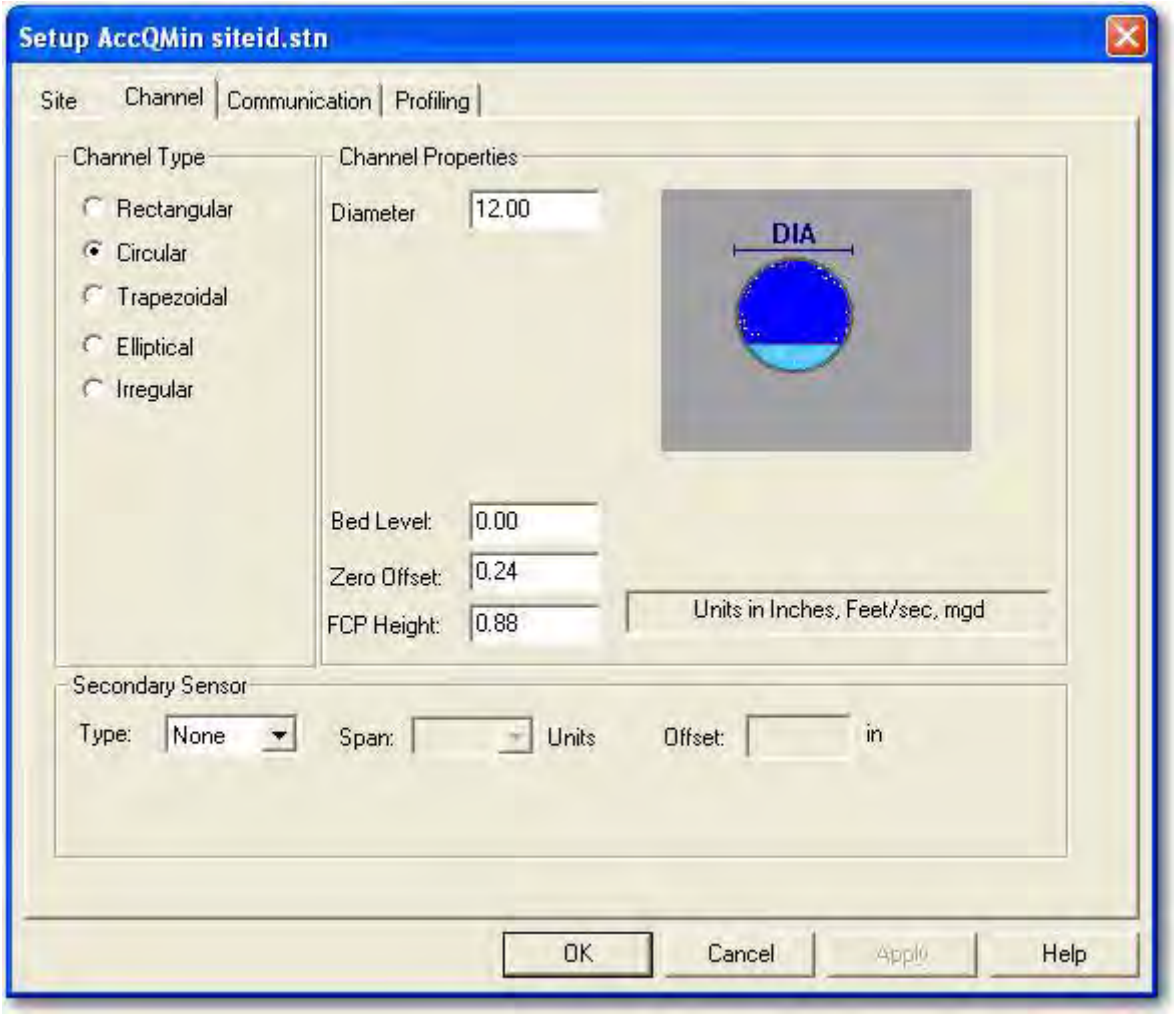



*Figure 3-4 Channel tab*

*Channel Type* — Select the appropriate channel shape from the column on the left of the screen. The right side of the screen will display a picture of the selected channel geometry under Channel Configuration, along with boxes for entering the channel dimensions.

**Rectangular –** Enter the width and height using the units of measure chosen in the Site Tab.

**Circular –** Enter the Diameter (pipe inside diameter) using the units of measure chosen in the Site Tab.

**Trapezoidal –** Enter the widths and heights (up to three) using the units of measure chosen in the Site Tab. H2 and H3 must not be zero (0), and H3 must be greater than H2.

**Elliptical –** Enter the three characteristic radii and angles of the ellipse using the units of measure chosen in the Site Tab. Teledyne Isco recommends using the multi-point channel type rather than elliptical channel type in most applications, since pipes or channels with a true elliptical shape are very rare.

**Irregular –** For irregular shapes, select Irregular and Configure Channel. The Irregular configuration assumes that the pipe/channel is symmetrical about the vertical center line. For other configurations, contact Teledyne Isco.

Enter the width ÷ 2 (half the width), and the corresponding height at that width, for ten different heights in the pipe/channel, beginning with Point 1 as the lowest point. The bottom is represented by the Origin of 0, 0. As you enter the width ÷ 2 and the height for each point starting with point 1, a drawing based on the dimensions you enter will appear on the screen. When all ten points are entered, if the drawing does not approximate the pipe/channel geometry, adjust the dimensions you have entered and click Update Display. The drawing will reflect any changes you make. When finished, click OK to return to the Channel tab (Figure 3-4).

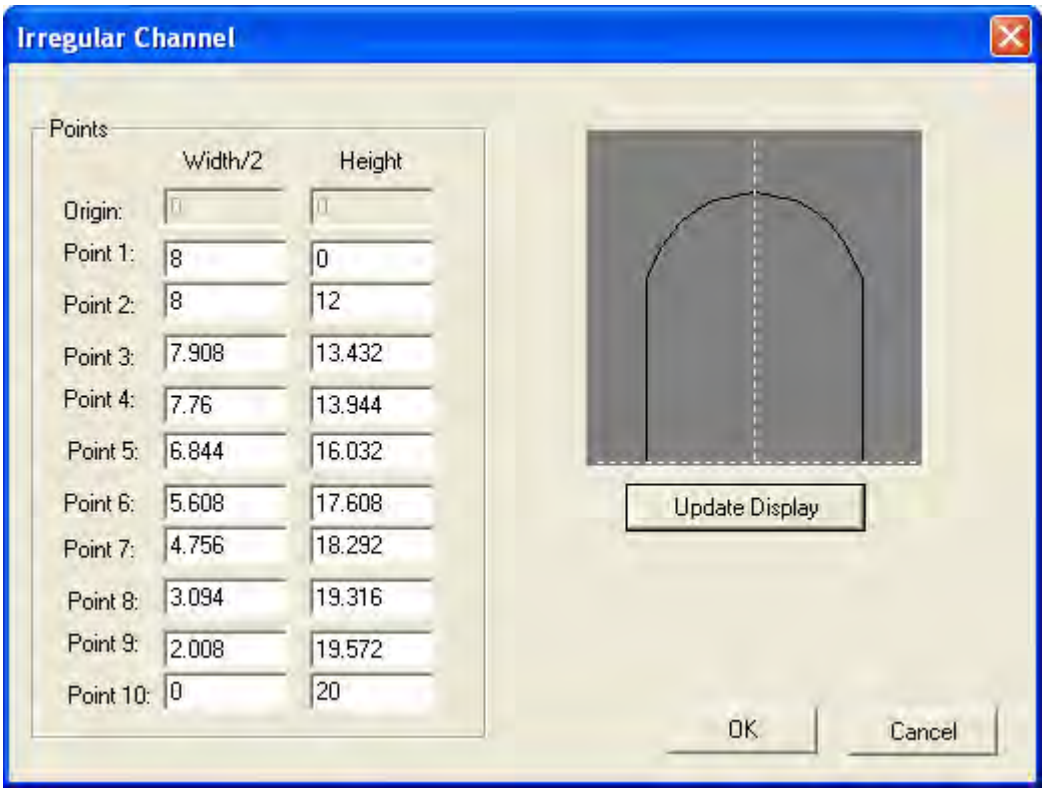



*Figure 3-5 Multiple Point Configuration for Irregular Channels*

(Continued from Figure 3-4.)

**Bed Level –** If there is a layer of permanent silt or debris in the bottom of the channel or pipe, enter its depth.

**FCP –** Enter the height of the Flow Conditioning Platform if used.

**Zero Offset –** Enter the distance from the bottom of the channel or pipe to the bottom of the sensor.

**Secondary Depth Sensor –** If a secondary depth sensor is not used, select None from the dropdown menu. Otherwise, select Pressure Sensor or Other if a depth device other than a pressure sensor is used. Enter the Sensor Span – the full scale range (in psi for a pressure sensor). Enter the sensor offset. The sensor offset is the distance from the bottom of the channel or pipe to the top of the sensor or the sensing element in the sensor.

### 3.2.3 Communication Tab

This tab is used to enter the appropriate communications protocol.

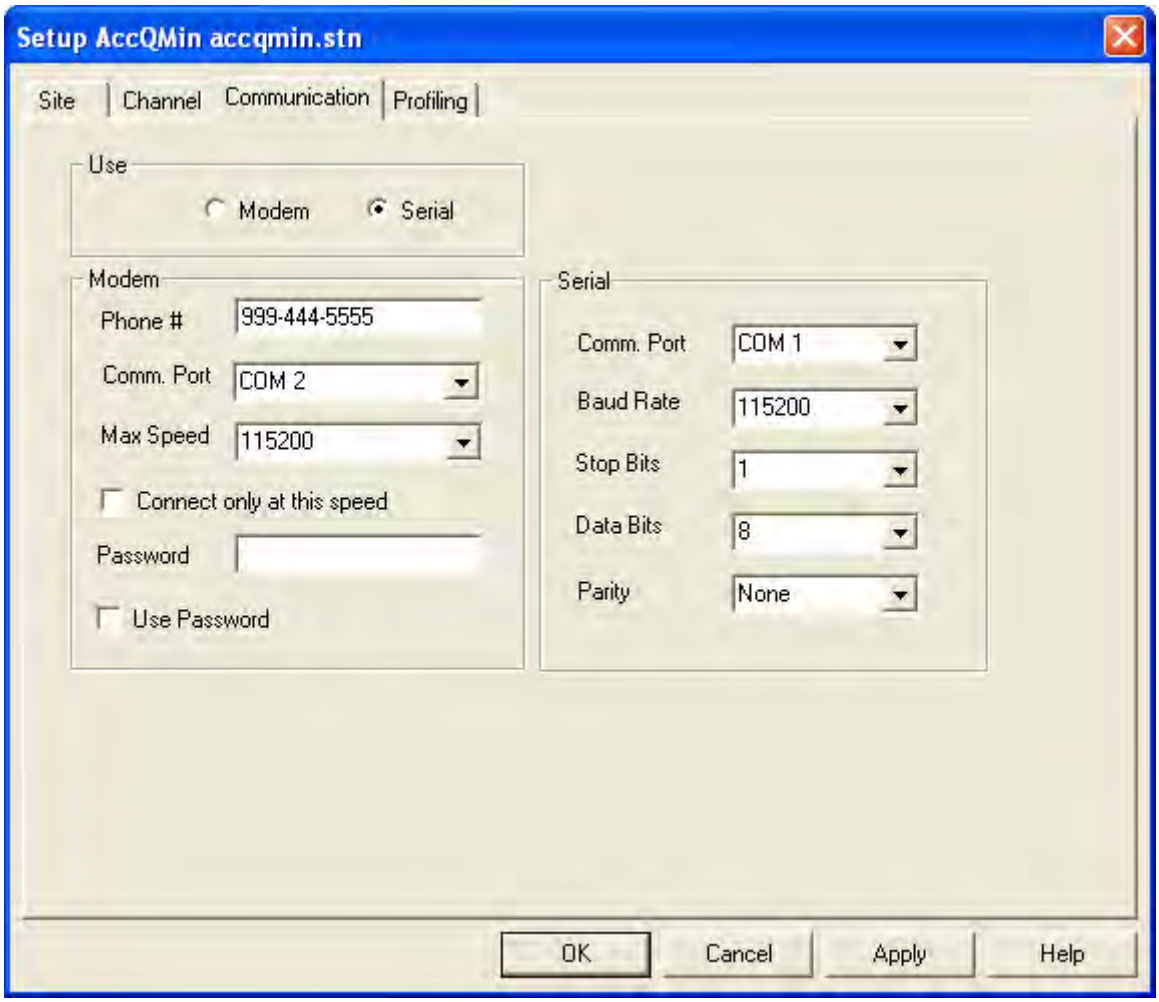



*Figure 3-6 Communication tab*

Select the type of external communications that will be used: Modem for remote connection, or Serial for direct connection.

*Modem*

Modem is selected only if an external modem is connected to the accQmin and the computer is going to be calling the accQmin remotely. Enter the phone number of the site in the Phone # field, including area (or city) codes and any required prefixes. For international dialing, include the local international prefix and country code. Select the computer's communication port to be used, and the maximum speed, from the dropdown menus. To connect only at the chosen Max Speed, check this box.

> **Note**
>
> Password protection is not yet available with this version of WinADFM software.

*Serial*

Serial is selected for direct RS232 connection using the communication interface cable.

A typical computer will have the following Serial RS-232 communication settings:

| | |
|---|---|
| Comm. Port: | Select the computer's active serial/com port. Default is Com 1. Options are Com 1 – Com 8. |
| Baud Rate: | The selected baud rate is used for data downloads only. The default baud rate is 9600. Options are 1200, 2400, 4800, 9600, 19200, 38400, 57600. |
| Stop Bits: | 1 (Default) |
| Data Bits: | 8 (Default) |
| Parity: | None (Default) |

Baud rate applies to serial downloads only. When testing and initiating startup/programming with WinADFM, the default baud rate is 9600. However, any computer capable of running Windows 95 or greater should be able to successfully download data at a baud rate of 57600. This is recommended to reduce the download time.

Stop Bits, Data Bits, and Parity should be left at their default values.

### 3.2.4 Profiling Tab

The Profiling tab is for setting up flow and data collection measurement parameters.

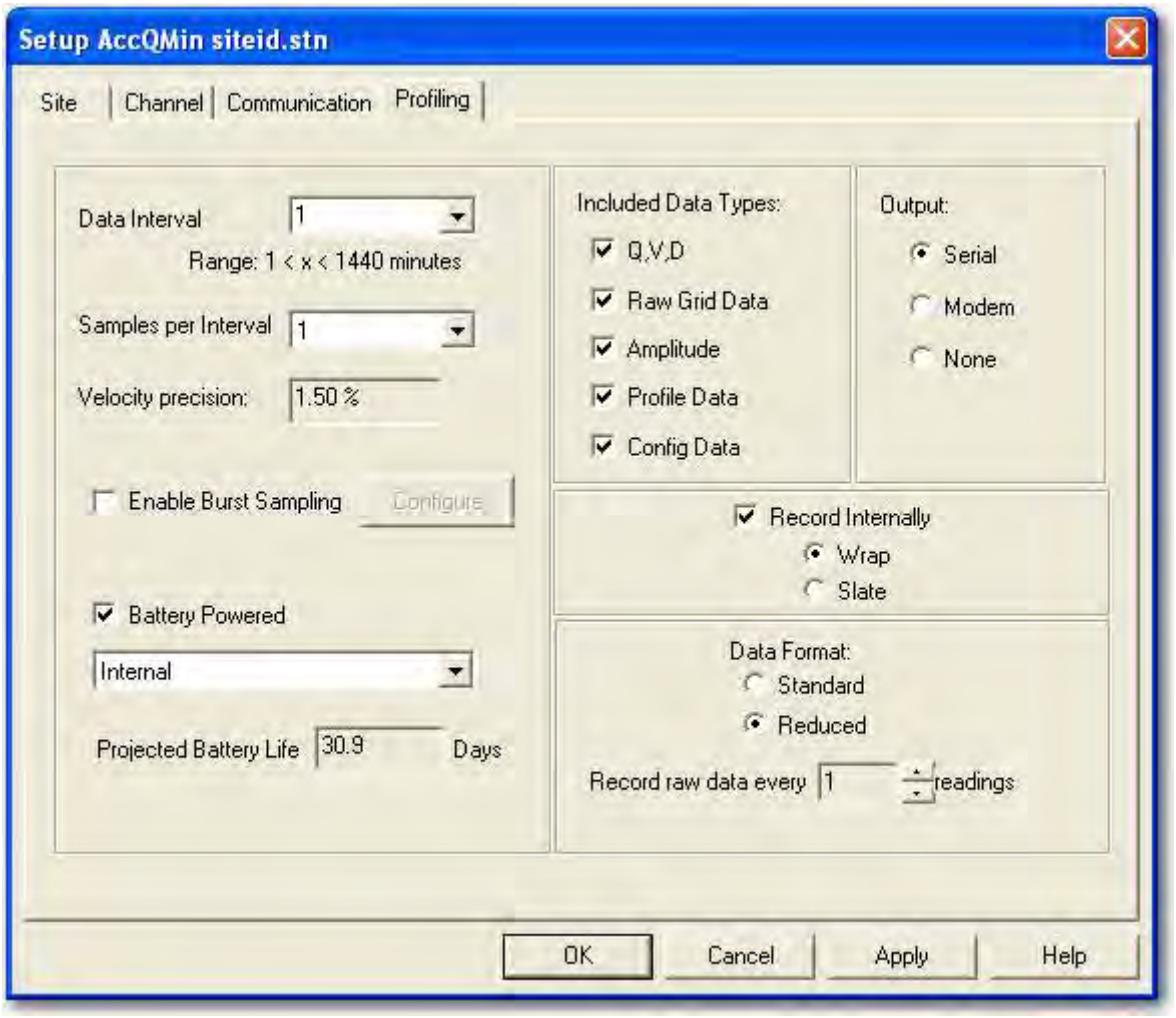



*Figure 3-7 Profiling tab*

Select the desired profiling parameters listed on the left of the screen. From the right side, select the desired data types to collect, as well as data recording and transfer settings.

*Data Interval*

This is the time between successive measurement readings. The intervals are 1, 2, 5, 10, 15, 20, 30, 60, or 120 minutes.

*Samples per Interval*

The accQmin makes multiple velocity measurements not only at different points in the water column, but successively in time. An individual measurement (sample) consists of a complete velocity profile. However, the precision of the discharge estimate is improved by averaging several measurements together. An individual sample takes approximately one minute.

Two factors can help determine the number of samples to select: Velocity precision and Projected Battery Life.

**Velocity precision –** This shows the estimated velocity precision as a percentage of maximum expected velocity.

**Projected Battery Life –** This estimates the number of days of battery power you will have for the selected setup.

Note that there is a check box for whether the system is battery powered or not. Note also that longer Data Intervals allow for more Samples per Interval, increasing the velocity precision (% of maximum velocity decreases). Increased precision, however, also means increased energy consumption, shortening battery life.

For externally powered systems, select the Samples per Interval value that results in the desired measurement precision, up to the maximum value allowed based on the selected Data Interval. Values above 5 are not normally required or desired.

*Enable Burst Sampling (Secondary Measurement Interval)*

You may want to increase the measurement interval during higher flow conditions. To program this secondary interval, check the Enable Burst Sampling box and click Configure. Select the Data Interval and Number of Samples from the dropdown menus. Enter the Enter Level (value that triggers Burst Sampling) and Exit Level (value that deactivates Burst Sampling and returns the accQmin to the normal measurement interval).

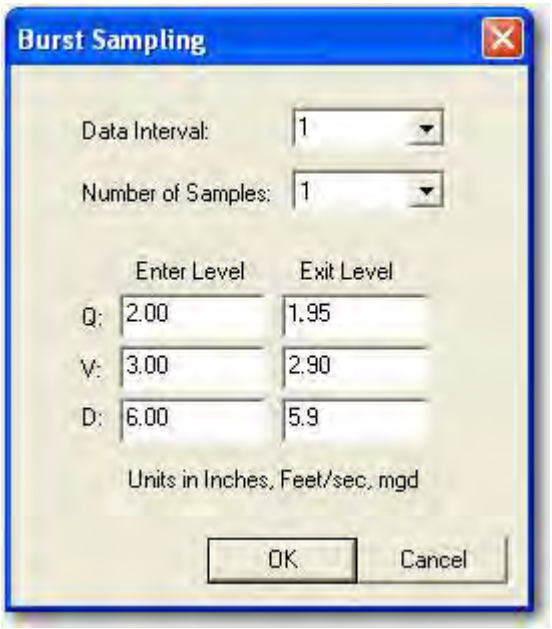



*Figure 3-8 Settings for Burst Sampling*

You may use any or all of the parameters Q (flow), V (velocity), and D (depth). For the parameter(s) you do not want to trigger Burst Sampling, enter values higher than the expected maximum.

*Included Data Types*

The internal recorder collects flow, velocity, and depth data, along with additional data that can be used for accQmin performance evaluation and diagnostics. The following raw data types may be recorded and collected by checking their respective boxes.:

**Q, V, D –** Discharge values (flow), average velocity, and depth. Q, V, D must be checked in all applications to obtain these parameters.

Raw Grid Data, Amplitude, Profile Data, and Config are optional. This information is typically used to analyze the performance of the sensor (velocity beams) in the flow stream for diagnostic purposes. However, Teledyne Isco recommends selecting all data types.

**Output –** Select Serial.

**Record Internally –** Check this box to record flow data internally. Select between Wrap and Slate data recording modes. In Wrap mode, as the recorder fills up, the oldest data is overwritten by the newest data. In Slate mode, when the recorder fills up the accQmin will continue taking and outputting readings at the specified data interval, but the new readings will not be stored.

**Type of Data Set –** To manage the data file size, select Reduced.

> ☑ ***Note***
>
> accQmin Quick Data files are always created using the standard accQmin data set.

**Record Raw Data Every xx Readings –** When the internal recorder is used, every flow reading is recorded. Each flow reading contains the date/time stamp, flow, velocity, and depth if the Q,V,D data type box is checked. The recording interval of additional useful data such as Velocity, Amplitude, and Correlation is determined by the number entered in this step. If this is set to 1, the additional data will be recorded with every reading. If it is set to 2, the additional data will be recorded every other reading, and so on.

While the inclusion of raw data is useful, it creates a larger file, which lengthens download time and fills the recorder memory faster. Teledyne Isco recommends setting Record Raw Data so that raw data is recorded every 15 to 30 minutes, (e.g. if you set Record Raw Data to 15, for 1 minute sample intervals, raw data is recorded every 15 readings; for 5 minute sample intervals, raw data is recorded every 3 readings, etc.) If you are not concerned with file size and/or download time, or if you are collecting data to aid in troubleshooting data quality issues, then select 1 for the raw data reading.

### 3.2.5 Saving the Program

When finished with the programming selections on the setup tabs, click Apply to save changes but keep the station file open, or click OK to save and close the file.

## 3.3 Group Files

A group file groups a number of station configuration files together under a single identity. group files are used to set up a group of specific stations with common operating and polling parameters. When you group station files together, the files and the information they contain are not changed.

To group station files, select File > New. Select Group > OK.

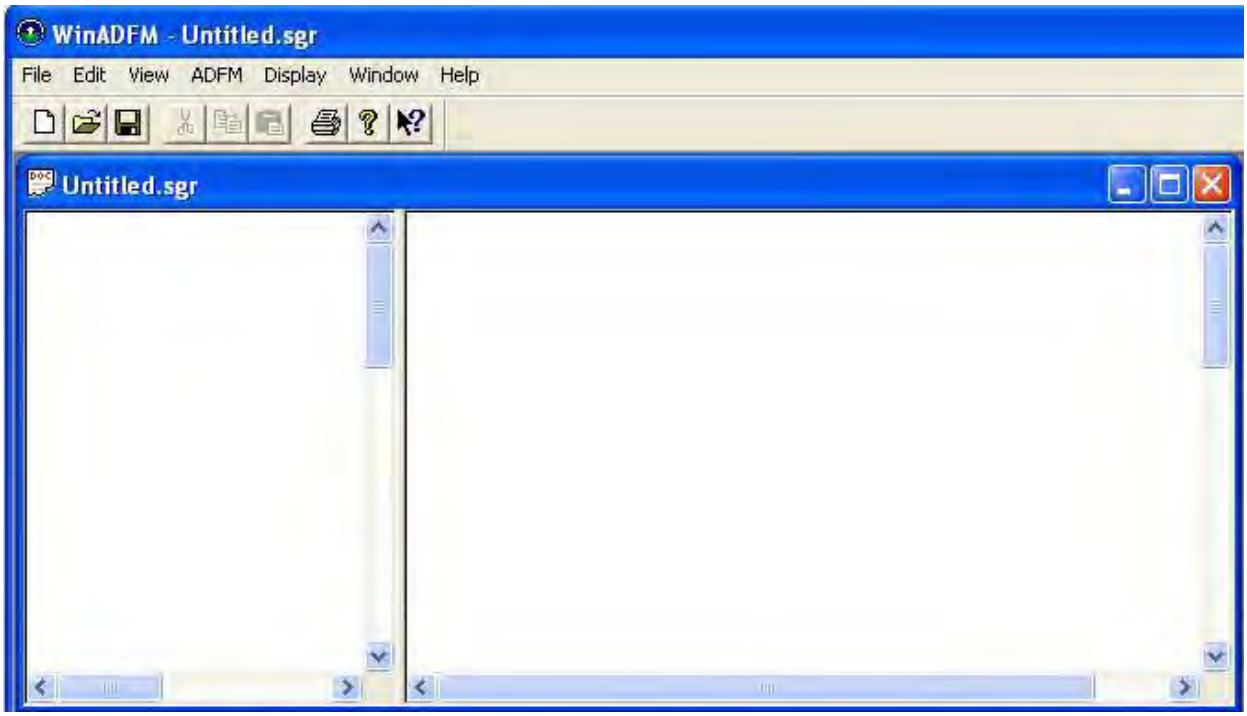
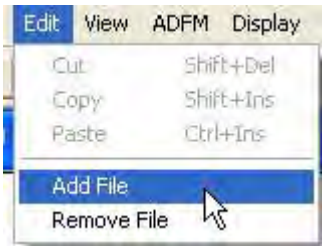



*Figure 3-9 Creating a Group file*

Creation of a group file will display the default Group File window with the default file group name of Untitled.sgr.

### 3.3.1 Adding Station files to a Group

To add station files to the new group File, select Edit > Add File.




Select the station file to be added. When all of the station files to be grouped together have been added, click File > Save As. Name the file and select Group Files for the file type.

### 3.3.2 Viewing Grouped Files

To view the contents of grouped station files, select File > Open, and select the file type Group. Select the group of station files to view (Figure 3-10). The grouped station files appear in the left window. Select the file you want to view, and the parameters for that station file will appear in the right window. Scroll on the right to view all of the parameters in the window.

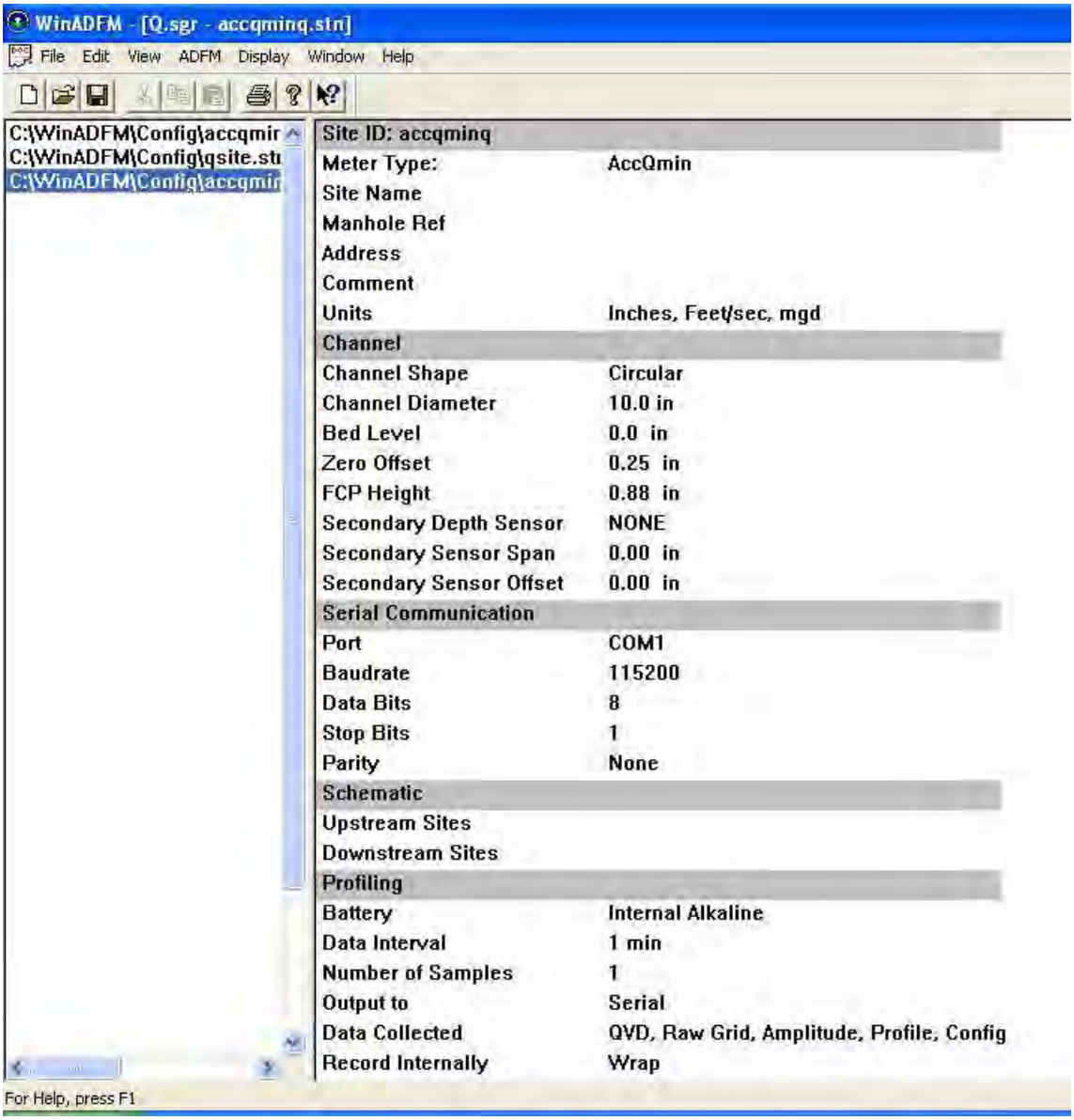
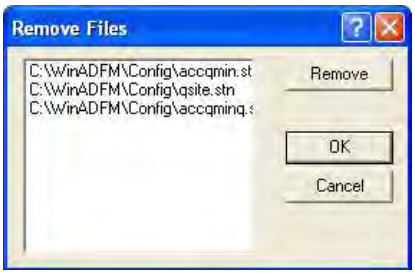



*Figure 3-10 Viewing grouped Station files*

### 3.3.3 Removing Station Files

To remove a station file from the group, select Edit > Remove File.




A separate window will appear, listing the files. Select the station file and click Remove, then OK.

## 3.4 Advanced Commands


Advanced commands allow certain operating commands to be input to the meter.

These special commands, entered in the Dialog window (Figure 3.5.1), are used to change or override one or more of the default parameters programmed in the meter by WinADFM software. These commands are only to be used in special circumstances as determined by Teledyne Isco. **Contact Teledyne Isco before attempting to use the Advanced Command function.**


*Figure 3-11 Advanced Commands dialog window*

## 3.5 Programming and Operation


In order to connect to the accQmin, the station file for the metering site must be open.

Connect the communication cable between the computer and the accQmin.

To begin operation of the accQmin, click ADFM > Operate.


This will open the Connect Window. All of the accQmin operating functions for programming, date/time set, testing, operation, and data collection are available in this window.

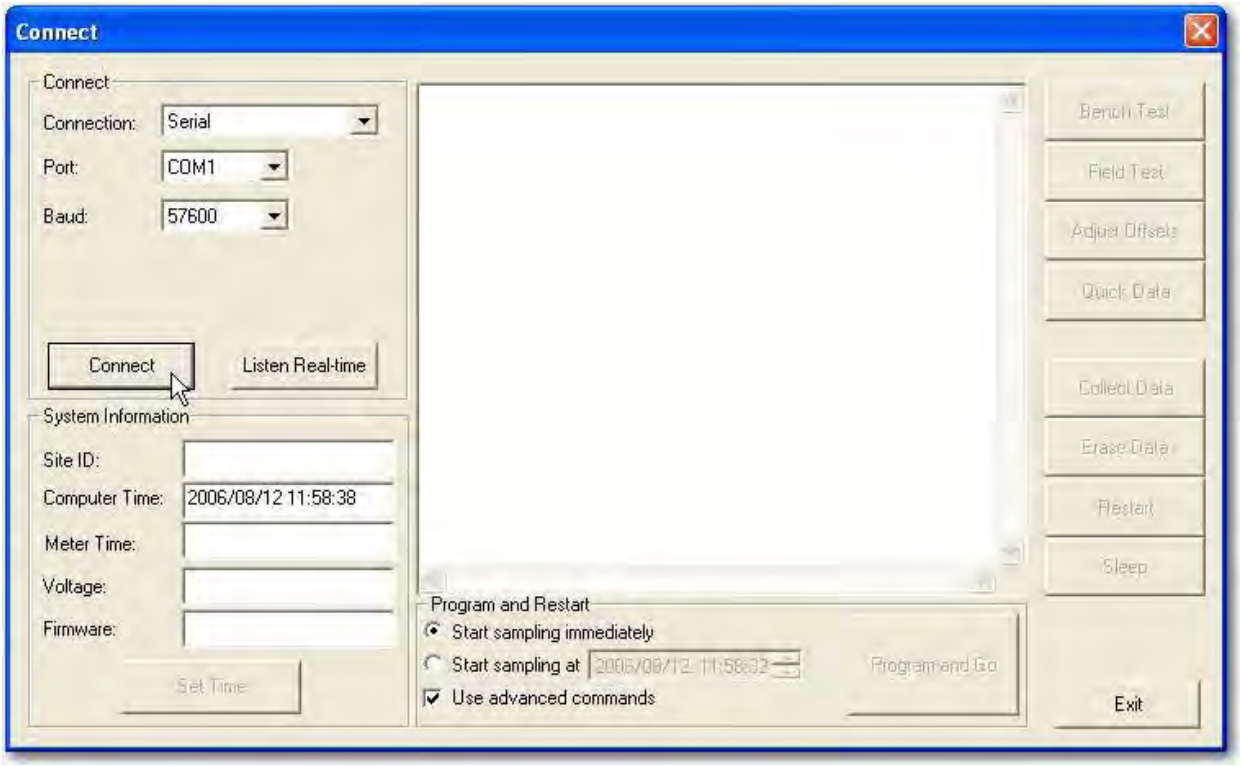



*Figure 3-12 Connection window*

Select the correct Com Port in the upper left area of the Operate screen. Click the Connect button to wake up the accQmin and establish communication. A system status message will appear in the terminal screen. If the wrong Com Port on the computer is selected in the Communication Tab of the station file, the error message “Cannot open port” will appear.

If unable to communicate with the accQmin, the error message "did not receive prompt." will appear. Check the communication cable and power to the accQmin. Check to make sure that the correct Com Port is selected.

The station file (site ID) is unique to a meter. If the meter has not been programmed with the station file that is open, or if the station file for another accQmin is opened by mistake, a warning message will appear upon connection:

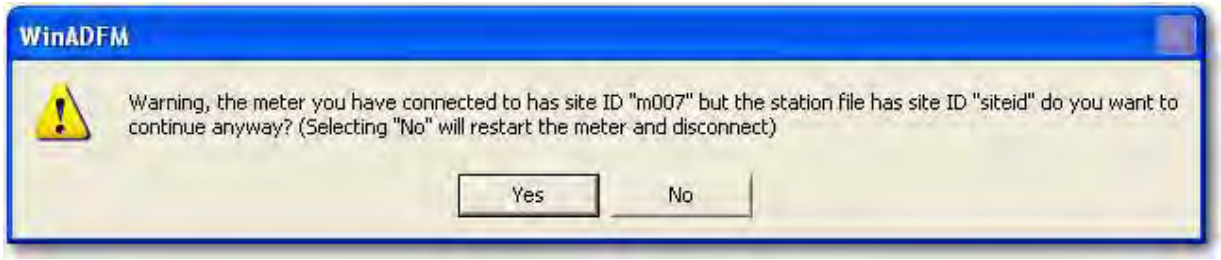



*Figure 3-13 Site ID warning*

To connect to the accQmin and/or program it with the open station file, select Yes. To cancel, select No, then open the appropriate station file and Connect.

> **Note**
> Clicking No will also restart the meter, to prevent accidental interruption of data collection.

### 3.5.1 Dialog Window

When a connection is established, a status message will appear in the window (Figure 3-14). The accQmin status message will not include any fault indications, even if fault conditions exist.

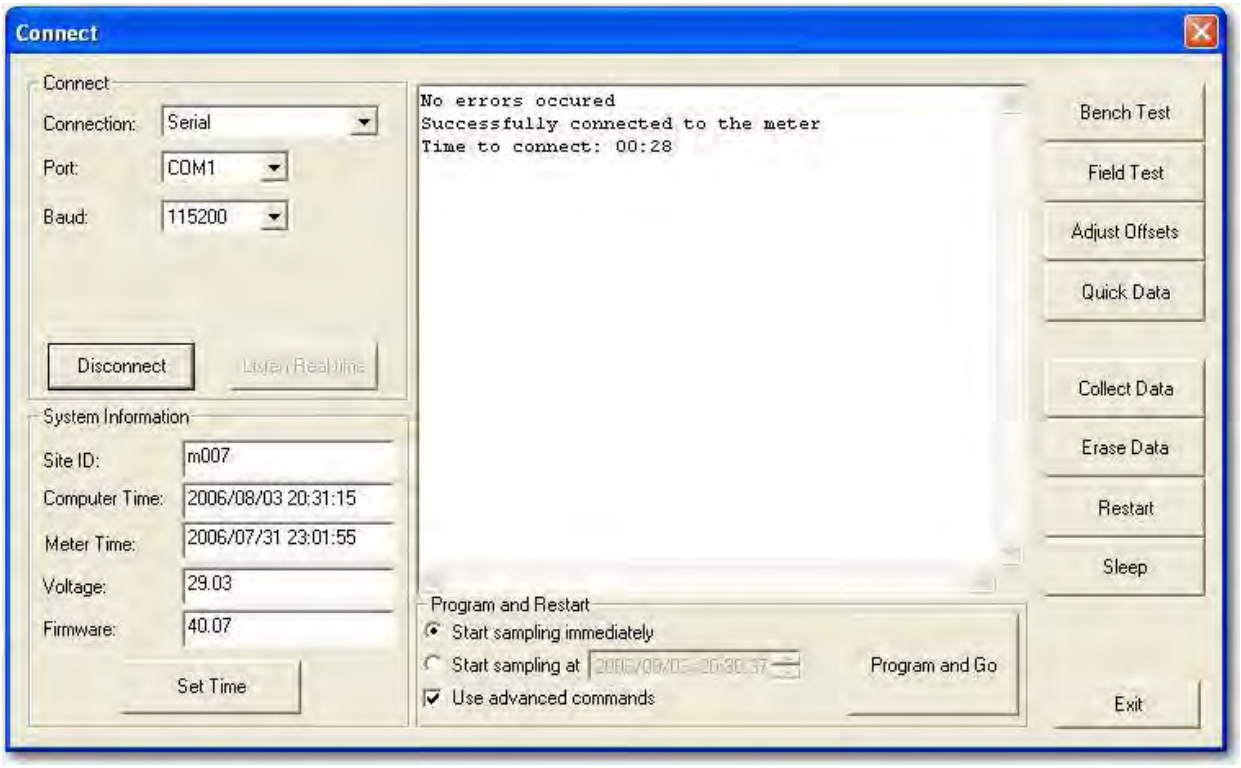



*Figure 3-14 Status window*

### 3.5.2 System Information

The System Information box provides specific site information: the Site ID, the voltage powering the accQmin, and the firmware version, as well as the times and dates from both the computer and accQmin internal clocks. You can set the accQmin time/date to the computer's time by clicking the Set Time button.


The Set Time window will appear. The Timezone Offset sets the accQmin time to the computer time, plus or minus the offset (in hours). If the Set accQmin Time To radio button is selected, click in the date-time field on the date, hour, or minutes to change and use the up/down arrows to increment to the correct date or time.

### 3.5.3 Testing the accQmin

Diagnostic tests are selectable from the buttons to the right of the screen. The results of each test are displayed and recorded in the station's Log File.

*Bench Test*

The Bench Test can be performed either in-house or on-site, but requires that the sensor be connected to the accQmin before starting the test. This test performs a series of system tests to determine if all the required accQmin systems are present and functioning. Click Bench Test to start the test.

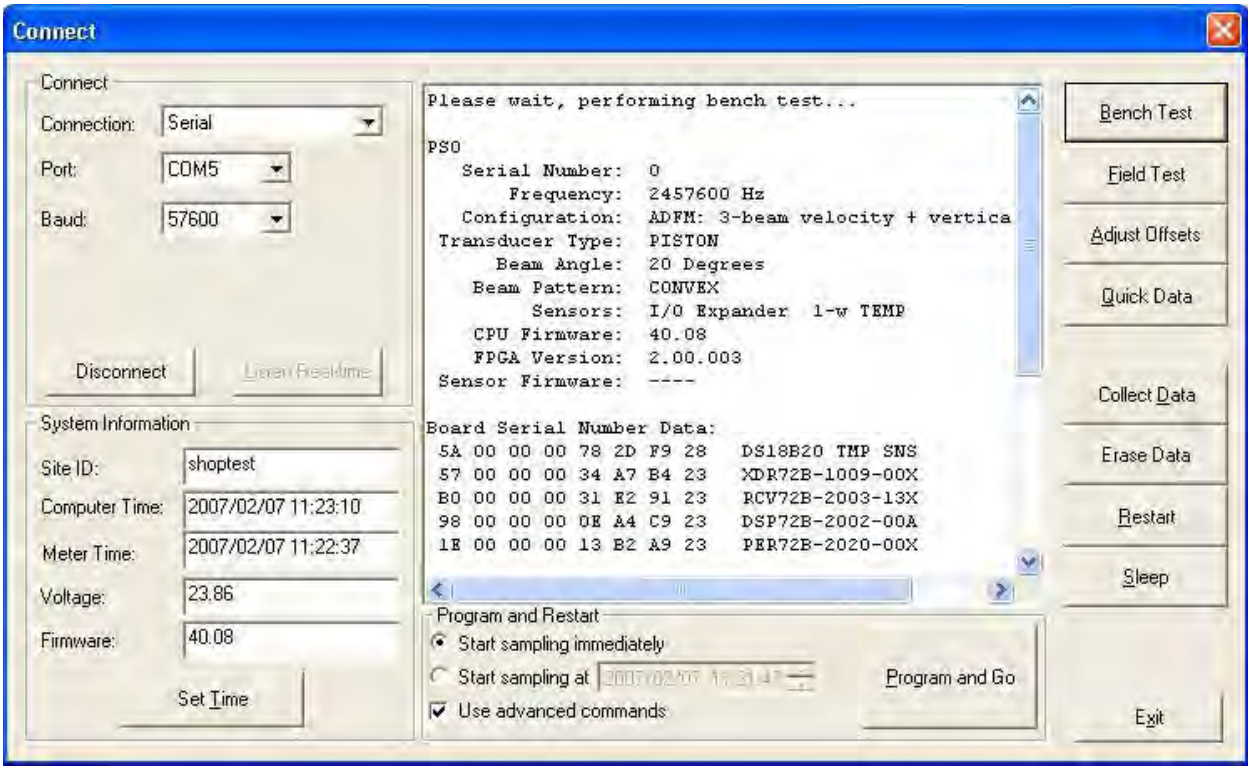



*Figure 3-15 Bench Test screen*

| Table 3-1 Bench Test Order of Results |
|---|
| accQmin electronics serial number, the electronics (cpu) firmware version, and a list of the component boards/devices with serial numbers. |
| Status of internal loop recorder. |

*Field Test*

The Field Test should be performed in the field with the sensor installed and underwater. Click Field Test to perform the test.

The PT3 Correlation Magnitude test (Figure 2-2) is an indication of the quality of the accQmin operation and the environment it is installed in. Test results are provided for four cases (High Gain/Wide Bandwidth, Low Gain/Wide Bandwidth, High Gain/Narrow Bandwidth, and Low Gain/Narrow Bandwidth). Normally, only the High Gain/Narrow Bandwidth results are important. Values for correlation magnitude should start at 100 for lag 0 and decay steadily as the lag increases. Higher values at lag 7 indicate more external interference or noise. High Gain RSSI (Relative Signal Strength Indicator) values will normally be between 60 and 70. Values greater than 80 indicates a high-noise environment.

Contact Teledyne Isco for more information and corrective action.

Additional diagnostic tests can be performed using the BBTalk diagnostic software. Contact Teledyne Isco for additional information regarding this software and its use.

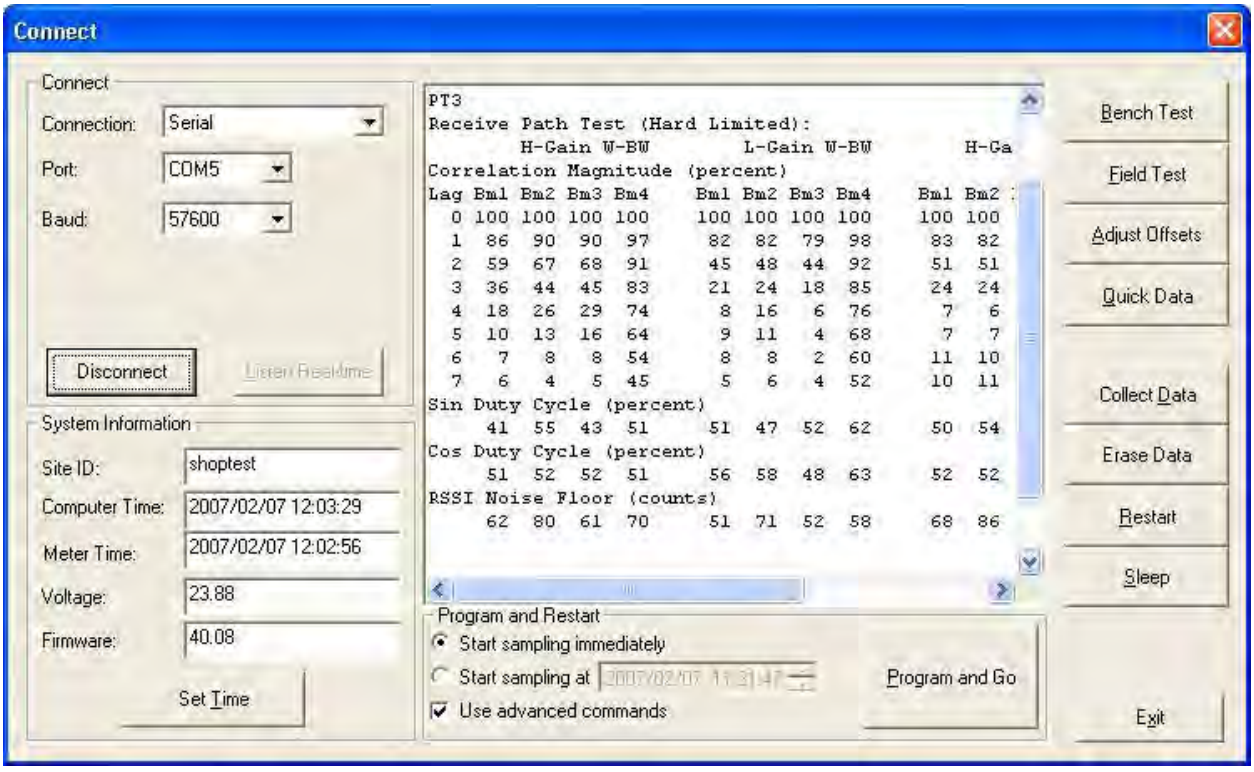



*Figure 3-16 Field Test (PT3 Correlation Magnitude test)*

## 3.6 Program and Restart

Select **Start Sampling** to begin flow monitoring immediately, or at a predetermined time in the future. Delaying the start of flow monitoring can be an advantage, if the meter is battery operated. The system can be set up in-house, programmed using the Program and Go button, and then transported to the field site at a later time. Battery power is conserved until the date and time to start sampling is met.

Check the box next to “Use advanced commands” to activate any special commands entered in the Advanced Window's dialog box (see section 3.4).

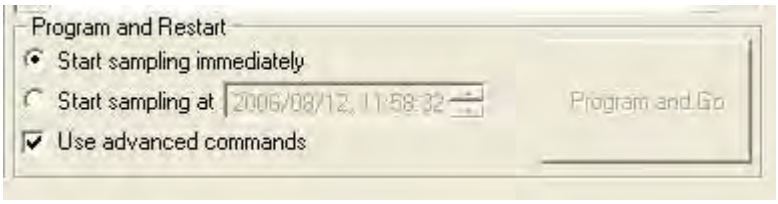



*Figure 3-17 Start Sampling options*

**⚠ CAUTION**

Advanced Commands should only be entered and used as directed by Teledyne Isco.

### 3.6.1 Program and Go


To load the application and operating parameters configured in the station file into the accQmin and start the program, click Program and Go.

After a few seconds of operation, a real-time screen appears, indicating the accQmin has been programmed and started.

To exit the program, click Exit, and the screen will return to the Operate screen. In the Operate screen, click Exit, then disconnect the communication cable. Close the station file and exit WinADFM.

As long as the real-time screen is active, each time the accQmin takes a reading based on its programmed sampling interval, the real-time screen will be updated with the latest flow reading.

In addition to the real-time screen being continually updated, a data file with the readings is sent to the computer. This file contains data recorded during the time the real-time display screen is active.

This file is automatically named **rt**, followed by the two-digit year, month, and day, with an incrementing extension. The extensions begin at .001. If Program and Go mode is used more than once in the same day, the second **rt** data file will have the extension .002, the third, .003, and so on. Data collected in Real Time mode will also be stored in the accQmin's internal recorder if the internal recorder is enabled.

The real-time display shows flow information in tabular format including Depth, Ultrasonic Depth, Secondary Depth, Qmain (actual computed flow), Qmann (computed Manning flow – if

available), QmodAV computed flow, Average Velocity, and Raw Velocity. A hydrograph and the raw data velocity signal graphs are also shown (Figure 3-18).

Click Exit to return to the Connect screen.

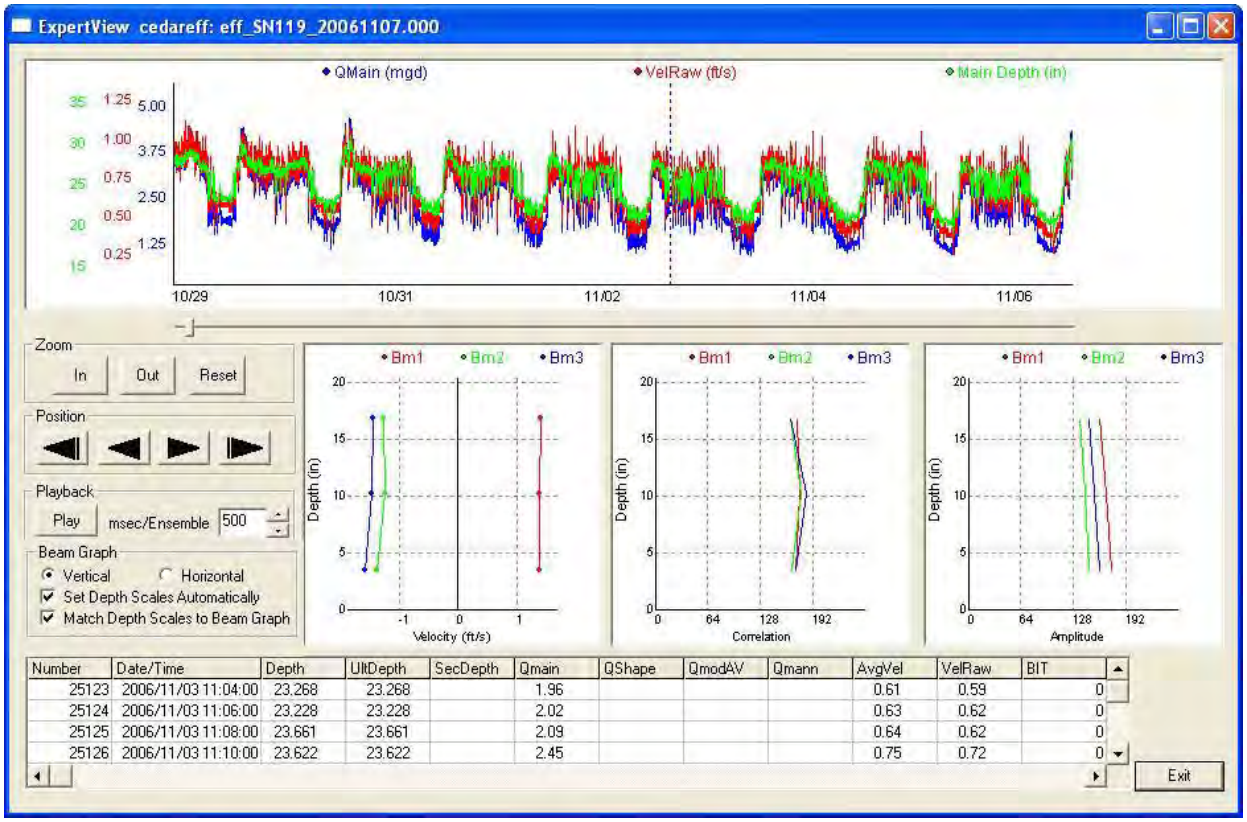



*Figure 3-18 Program and go real-time data screen*

| | |
|---|---|
| *Graphs* | The top graph builds a hydrograph as real-time data is received. |
| *Velocity Beam Graphs* | The four graphs below the hydrograph show the raw velocity data. For specific information on the velocity beam graphs, refer to Section 3.6.3, Quick Data Mode. |
| *Depth* | Main depth used in flow calculation. Depth information from the primary ultrasonic depth sensor is compared to depth information from secondary depth sensor (if used). Best fit is determined and used for main depth. |
| *Average Velocity* | Velocity divided by cross-sectional area |
| *Raw Velocity* | Average of individual point velocities from the four velocity beams |
| *Qmain* | Calculated flow |
| *Qmann* | Three inches of depth is required for velocity profiling. Below that depth, flow is calculated using a Manning equation. A hydraulic coefficient is calculated based on flow, and the last ten velocity readings stored. Velocity is not displayed. |

**QShape** and **QmodAV** are not used with the accQmin.

> **Note**
>
> The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 3.6.5 for an explanation of these differences.

### 3.6.2 Adjust Offsets

The Adjust Offsets feature is used in the field to check or adjust the depth calibration of the ultrasonic depth transducer and/or the secondary depth sensor.


*Figure 3-19 Adjust Offsets window*

When the screen opens, it will automatically update the ultrasonic and secondary depth readings. Enter the manually measured Depth. Click Calculate, and the new sensor offset will be calculated. Click Set to change the existing sensor offset to the new offset and program it into the accQmin. The new offset is also saved in the station file.

> **Note**
>
> When clicking the Set button, watch the window box below the Set button. If the window is not able to reprogram the new offset into the accQmin because the accQmin is doing other calculations, the window will indicate a failure. Clicking on the Set button a second time usually reprograms the accQmin, and it will be indicated in the window. When finished, click Exit.

### 3.6.3 Quick Data Mode

The Quick Data feature is recommended for field evaluation and diagnostics.

Quick Data is used in the field to view real-time data. Quick Data displays a graphical and tabular screen in real time with a data update approximately every 20 seconds. The Quick Data real-time display is identical to the Program and Go display, except for the update time.

> ☑ ***Note***
>
> Upon exiting this screen, restart the meter using either the Program & Go or Restart button.

Quick Data creates a data file of the readings and stores it in the computer. This file will contain data recorded during the time the real-time display screen is active, and contains the velocity beam raw data used for diagnostics. This file is automatically named **qd**, followed by the year, month, and day with numerical extension. To view the Quick Data file and for analytical data, refer to the WinADFM Quick Data Evaluation Section.

> ☑ ***Note***
>
> The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 3.6.5 for an explanation of these differences.

### 3.6.4 Listen Real-time Mode

Listen Real-time can be used in the field to view real-time data. The Listen Real-time display is the same as the Program and Go real-time display and Quick Data display. The Listen Real-time information is updated on the screen each time the meter takes a reading. In other words, it updates at the programmed sample interval.

During the Listen Real Time mode, the internal recorder, if activated, continues to store data. Upon exiting this mode, the current deployment continues and a new deployment is not started in the recorder.

> ☑ ***Note***
>
> The same display appears for the three modes: Program and Go, Quick Data, and Listen Real-Time. However, each mode performs a different function. See Section 3.6.5 for an explanation of these differences.

### 3.6.5 Defining the Three Modes

Although the three modes display the same graphical, tabular screen, their functions differ.

*Program and Go*

Programs or reprograms the accQmin based on the configuration settings in the station file. Starts a new deployment and captures data on the computer, and also stores the data on the meter's internal recorder if the recorder is enabled.

*Listen Real-time*

Captures data on the computer as sent out by the meter. If the internal recorder is on, data continues to be recorded to the current deployment. Upon exiting this mode, the current deployment continues, rather than a new one starting.

*Quick Data*

This mode updates the display screen approximately every 20 seconds, and is used in the field to view the operation of the accQmin on-site and verify proper operation of the system. A specially modified configuration is used to obtain more rapid updates than would normally be available, including a reduced number of pings.

### 3.6.6 Restart

This button will restart the accQmin using the programmed parameters currently stored in its memory.

### 3.6.7 Sleep

Sends an "off" command to the accQmin that puts it in Sleep mode. The accQmin will not wake up at the specified sample time and take a reading. In Sleep mode, the accQmin will only wake up and start operating when a wakeup command is sent via the Connect button.

> **Note**
>
> If the accQmin is put to sleep, immediately disconnect the serial connection to the computer to prevent and accidental wake-up of the accQmin.

## 3.7 Downloading and Viewing Data

To download data from the recorder, open the Connect window (see section 3.5). Connect to the accQmin and click Collect Data. All available data on the loop recorder will automatically be downloaded. A dialog box will appear showing the status of the download (figure 3-20). After completing the download, you will be prompted to erase the recorder (figure 3-21). Teledyne Isco suggests that the recorder in an accQmin be erased after each download to avoid creating download data files with overlapping data.

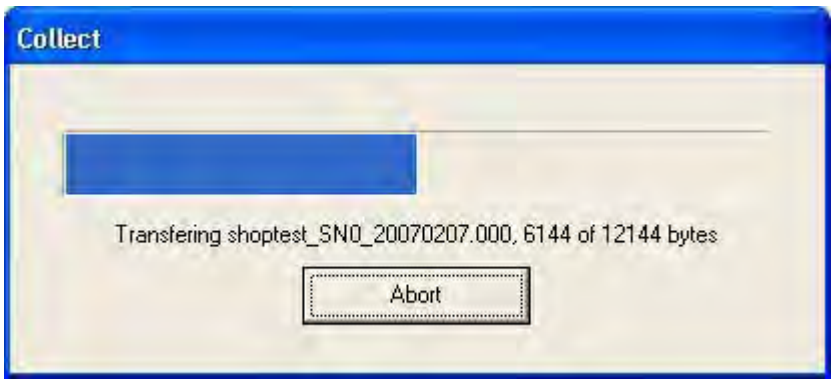



*Figure 3-20 Collect Data window*

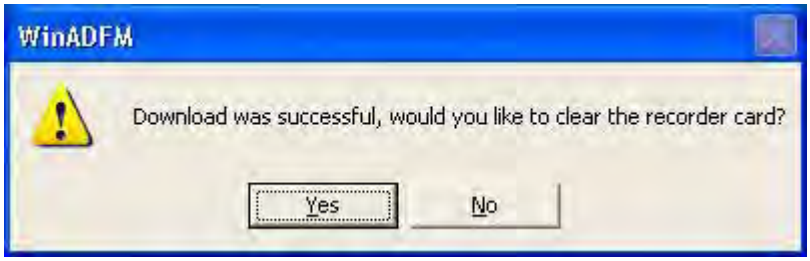



*Figure 3-21 Prompt to erase recorder*

### 3.7.1 Erasing Data

To clear the recorder, click Erase Data in the Connect screen.

## 3.8 Viewing Data


Data collected from the accQmin during Quick Data or Real Time mode, or data collected from the internal recorder, may be viewed using the View Data menus.

Open the station file of the site you want to view data from. From the Menu bar, select Display > Data.

The Data file selection screen will appear. This screen lists all of the Quick Data (qt), Real Time (rt), and internal recorder deployments available for the selected site.

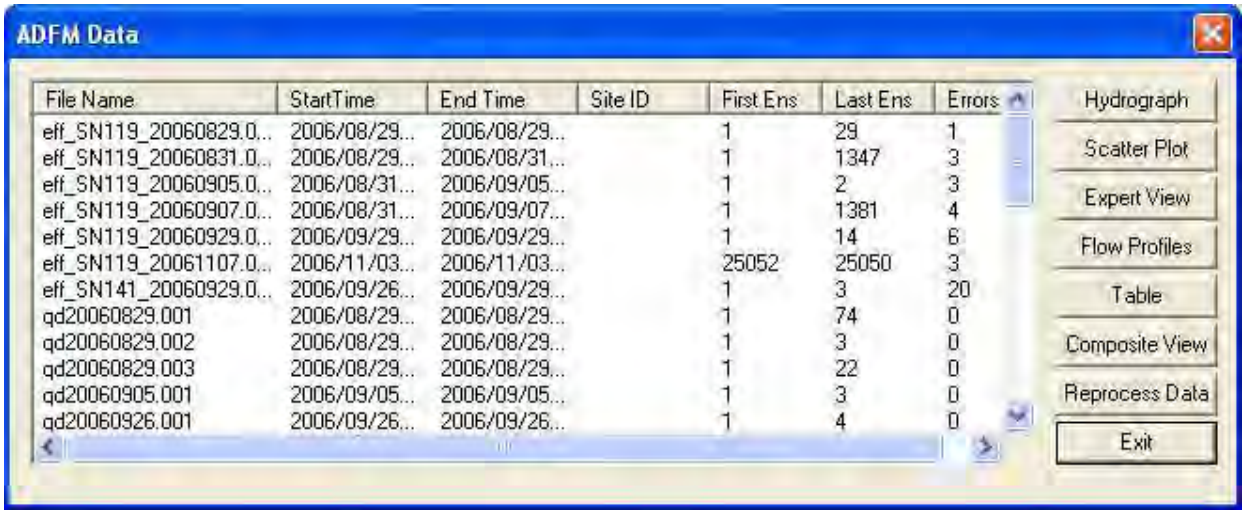



*Figure 3-22 ADFM Data window*

The ADFM Data window provides several options for viewing the data. Highlight the data file you want to view and then click the viewing option on the right side of the window.

### 3.8.1 Hydrograph

The hydrograph displays time series data, showing flow, velocity, depth, and fluid temperature.

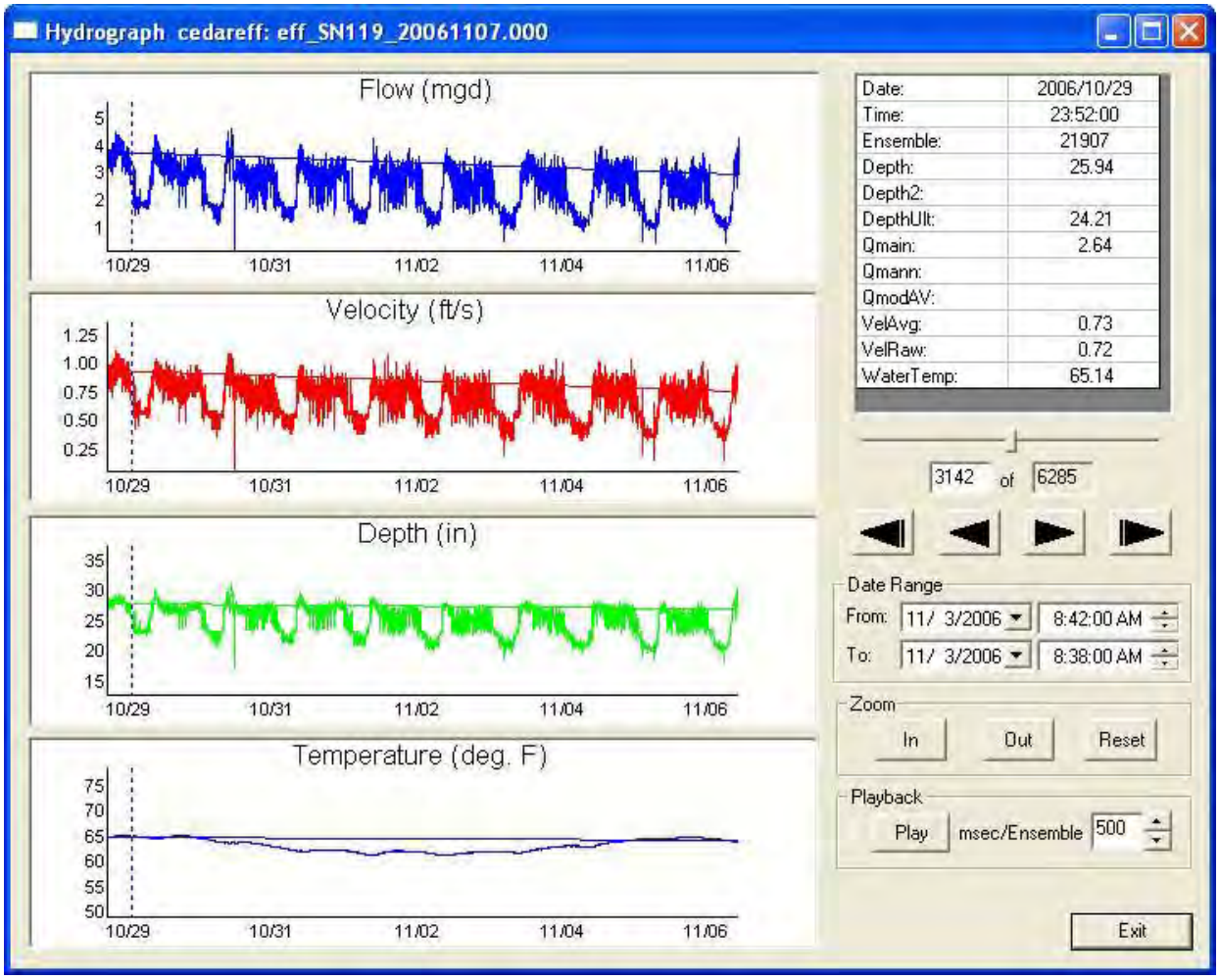



*Figure 3-23 Hydrograph*

A vertical dotted line on the graph represents a specific Ensemble (Data Point). The specific ensemble information, including the values, is shown in the table to the right of the graph. Click a point in the graph to move the dotted line and display the values for that specific ensemble.

The slide bar below the table allows you to move from one ensemble to another. The boxes beneath the slide bar show the ensemble number. The arrows are used for moving to the beginning or end of the graph, or to move to the next or previous ensemble.

The Data Range box shows the starting and ending date/time of the first and last ensemble. The start/end date/time of the graph can be changed by clicking the arrows, or by typing the value in the box.

To change the graph range, colors, and line thickness, right-click on the graph. A submenu will appear. Select Properties from the submenu.

A Playback feature is activated by clicking the Play button. This will advance the dotted line one ensemble at a time. To speed up or slow down the playback, change the msec/Ensemble time value in the box to the right of the Play button.

### 3.8.2 Scatter Plot

The scatter plot window has check boxes to view Velocity vs. Depth, Flow vs. Depth, and HC (Hydraulic Coefficient) vs. Depth. Radio Buttons are provided to select either Variable N or Fixed N for HC calculations.

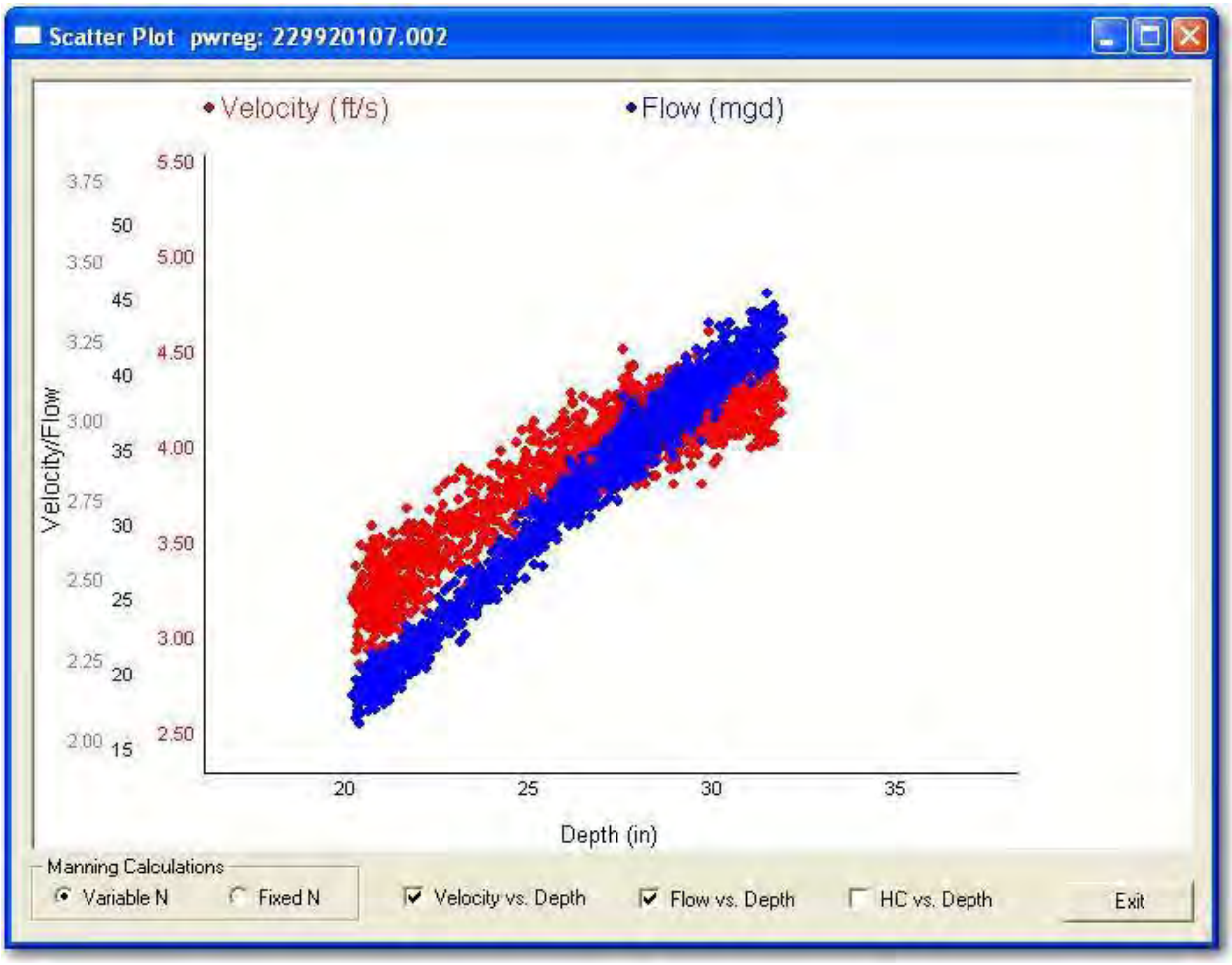



*Figure 3-24 Scatter Plot*

Hydraulic Coefficient is back-calculated from Q, depth, and channel geometry, based on the Fixed or Variable N radio button.

Variable N assumes that the coefficient of friction used in the Manning equation varies with depth of flow. Fixed N assumes that the coefficient of friction used in the Manning equation is constant and independent of depth of flow.

### 3.8.3 Expert View

Expert View includes graphical displays of the hydrograph and raw data.

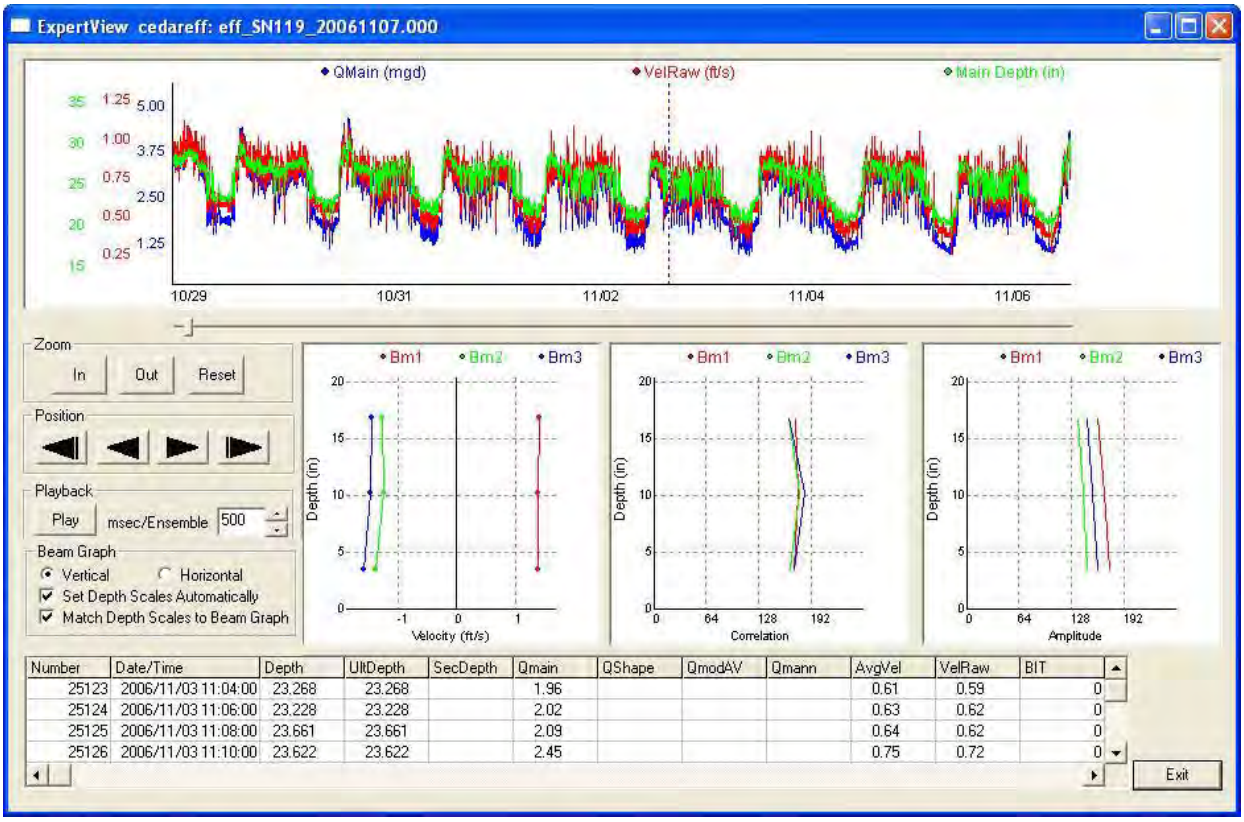



*Figure 3-25 Expert View*

Expert View also shows tabular values for Depth, Ultrasonic Depth, Secondary Depth, Qmain, Qmann, QmodAV, Average Velocity, Raw Velocity, as well as hydrograph and the velocity signals.

*Graphs* — The top graph is a hydrograph of Q, V, and D.

*Velocity Beam Graphs* — The three graphs below the hydrograph show raw data information.

*Depth* — Main depth used in flow calculation. Depth information from the primary ultrasonic depth sensor is compared to depth information from secondary depth sensor (if used). Best fit is determined and used for main depth.

*Average Velocity* — Velocity divided by cross-sectional area

*Raw Velocity* — Average of individual point velocities from the three velocity beams.

*Qmain* — Calculated flow

*Qmann* — Three inches of depth is required for velocity profiling. Below that depth, flow is calculated using a Manning equation. A hydraulic coefficient is calculated, stored, and updated during

velocity profiling. This hydraulic coefficient is used with the Manning equation to calculate flow. Raw Velocity may not be displayed.

*Bit Codes*

BIT (Built in Test) codes indicate errors that occurred during the course of an individual reading. Beginning with WinADFM version 1.47, BIT codes are displayed in hexidecimal form. See Appendix A *BIT Codes for ADFM and accQmin* for details.

### 3.8.4 Data Quality Parameters

Data in the Expert View screen is a good indicator of the quality of the data. The Raw Data velocity beams in Expert View refer to the raw Doppler-based velocity components measured by each individual beam.

*Amplitude*

The accQmin operates by emitting a sound pulse and then receiving the echoes backscattered by material suspended in the flow. Amplitude data is a measure of the signal strength of these echoes. The amplitude normally decays from a high value near the sensor (bottom of graph) to a lower value at the end of the profile range (near the top of the graph). This is due to several factors, including the natural spread of sound energy as it travels farther away and loss due to absorption of sound energy by the water and suspended material. A signal of 128 to 192 is considered normal.

*Correlation*

Correlation is a measure of the quality of the processed velocity information. An expected Correlation value is approximately 128 to 192 counts.

*Vertical and Horizontal Velocities*

Each of the three velocity beams is divided up into the three velocity measuring “bins”.

Beam 1 (red) should be positive, as it faces upstream. Beams 2 (green) and 3 (blue) should be negative, as they face downstream. If any velocity bins are missing from an ensemble, it indicates that there was no velocity information available in that bin for that ensemble.

The horizontal velocities should be relatively flat, with the second bin, or middle point, slightly higher than the first and third velocity bins.

### 3.8.5 Examples of Raw Data

The following examples provide a guide for interpreting the data in Expert View.

> **☑ Note**
>
> The Flow Profiles screen and Data Reprocessing are not available in the accQmin.

### 3.8.6 Table

To view the data in tabular form, select Table, then select the desired data file from the list.

A data file can be saved in CSV or extended CSV format for use in a spreadsheet. To save in CSV, highlight the data file, checking the box for extended CSV if desired, and click Save as CSV.

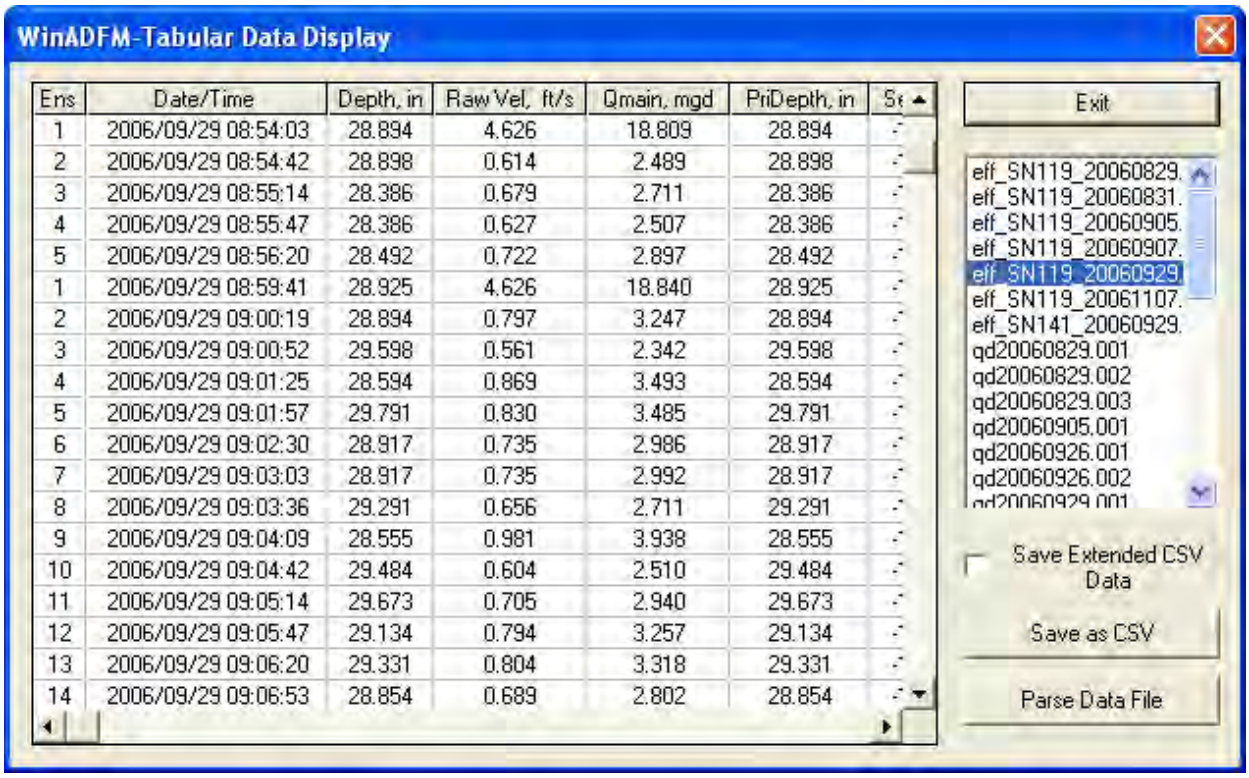
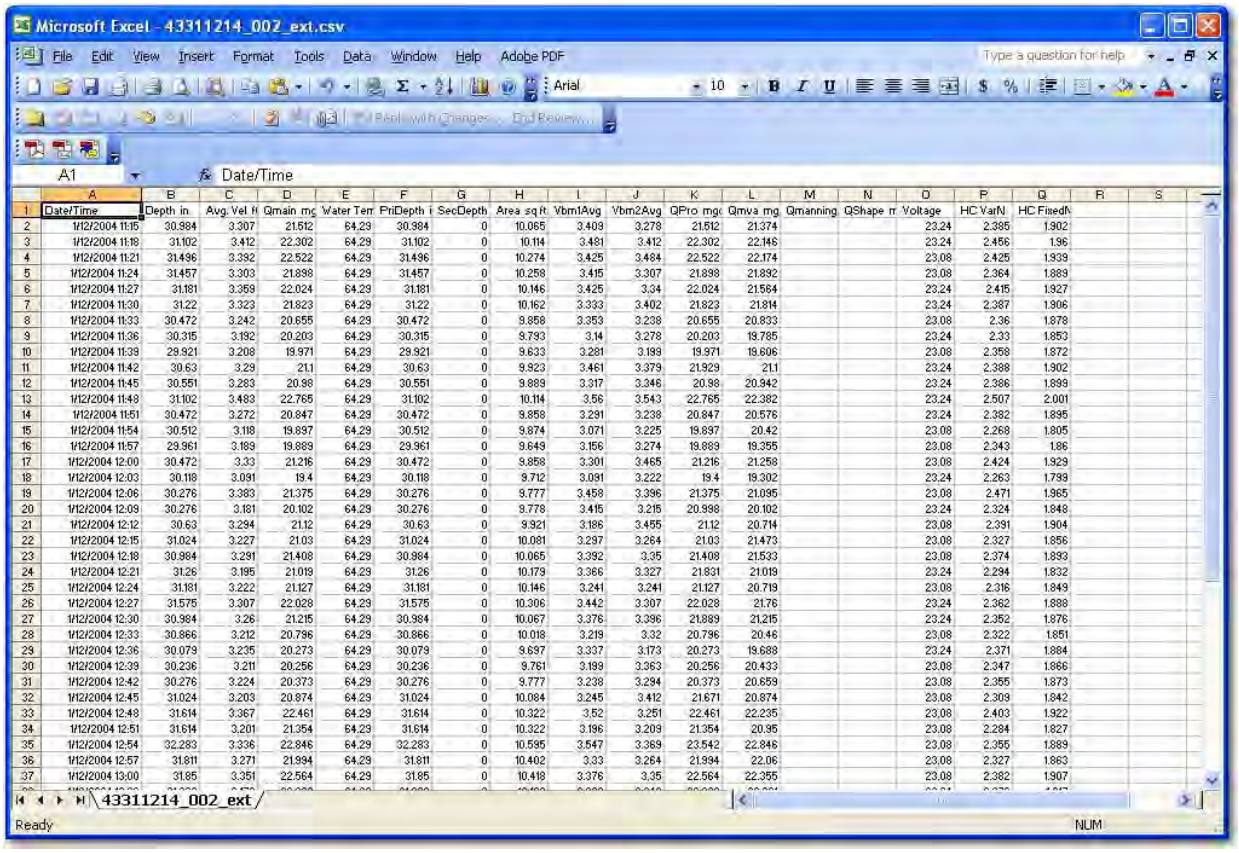



*Figure 3-26 Tabular data display*

A data file saved in CSV format and then opened with a spreadsheet program will show Date/Time, Depth, Velocity, and Flow. If additional flow information is desired, such as water temperature, click in the Save Extended CSV Data box before clicking Save as CSV. The same data saved as extended CSV provides more data information and is shown in Figure 3-27).

> **Note**
>
> Only Qmain is ever output as the final flow value as computed by the accQmin. All other Q-related values are for diagnostic purposes, and should be ignored by the user.




| | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Date/Time | Depth in | Avg. Vel ft | Qmain mg | Water Tem | PriDepth i | SecDepth | Area sq ft | Vbm1Avg | Vbm2Avg | QPro mg | Qmva mg | Qmanning | QShape m | Voltage | HC VarN | HC FixedN | | |
| 2 | 1/12/2004 11:15 | 30.984 | 3.307 | 21.512 | 64.29 | 30.984 | 0 | 10.065 | 3.409 | 3.278 | 21.512 | 21.374 | | | 23.24 | 2.385 | 1.902 | | |
| 3 | 1/12/2004 11:18 | 31.102 | 3.412 | 22.302 | 64.29 | 31.102 | 0 | 10.114 | 3.481 | 3.412 | 22.302 | 22.146 | | | 23.24 | 2.456 | 1.96 | | |
| 4 | 1/12/2004 11:21 | 31.496 | 3.392 | 22.522 | 64.29 | 31.496 | 0 | 10.274 | 3.425 | 3.484 | 22.522 | 22.174 | | | 23.08 | 2.425 | 1.939 | | |
| 5 | 1/12/2004 11:24 | 31.457 | 3.303 | 21.898 | 64.29 | 31.457 | 0 | 10.258 | 3.415 | 3.307 | 21.898 | 21.892 | | | 23.08 | 2.364 | 1.889 | | |
| 6 | 1/12/2004 11:27 | 31.181 | 3.359 | 22.024 | 64.29 | 31.181 | 0 | 10.146 | 3.425 | 3.34 | 22.024 | 21.564 | | | 23.24 | 2.415 | 1.927 | | |
| 7 | 1/12/2004 11:30 | 31.22 | 3.323 | 21.823 | 64.29 | 31.22 | 0 | 10.162 | 3.333 | 3.402 | 21.823 | 21.814 | | | 23.24 | 2.387 | 1.906 | | |
| 8 | 1/12/2004 11:33 | 30.472 | 3.242 | 20.655 | 64.29 | 30.472 | 0 | 9.858 | 3.353 | 3.238 | 20.655 | 20.833 | | | 23.08 | 2.36 | 1.878 | | |
| 9 | 1/12/2004 11:36 | 30.315 | 3.192 | 20.203 | 64.29 | 30.315 | 0 | 9.793 | 3.14 | 3.278 | 20.203 | 19.785 | | | 23.24 | 2.33 | 1.853 | | |
| 10 | 1/12/2004 11:39 | 29.921 | 3.208 | 19.971 | 64.29 | 29.921 | 0 | 9.633 | 3.281 | 3.199 | 19.971 | 19.606 | | | 23.08 | 2.358 | 1.872 | | |
| 11 | 1/12/2004 11:42 | 30.63 | 3.29 | 21.1 | 64.29 | 30.63 | 0 | 9.923 | 3.461 | 3.379 | 21.929 | 21.1 | | | 23.24 | 2.388 | 1.902 | | |
| 12 | 1/12/2004 11:45 | 30.551 | 3.283 | 20.98 | 64.29 | 30.551 | 0 | 9.889 | 3.317 | 3.346 | 20.98 | 20.942 | | | 23.24 | 2.386 | 1.899 | | |
| 13 | 1/12/2004 11:48 | 31.102 | 3.483 | 22.765 | 64.29 | 31.102 | 0 | 10.114 | 3.56 | 3.543 | 22.765 | 22.382 | | | 23.24 | 2.507 | 2.001 | | |
| 14 | 1/12/2004 11:51 | 30.472 | 3.272 | 20.847 | 64.29 | 30.472 | 0 | 9.858 | 3.291 | 3.238 | 20.847 | 20.576 | | | 23.24 | 2.382 | 1.895 | | |
| 15 | 1/12/2004 11:54 | 30.512 | 3.118 | 19.897 | 64.29 | 30.512 | 0 | 9.874 | 3.071 | 3.225 | 19.897 | 20.42 | | | 23.08 | 2.268 | 1.805 | | |
| 16 | 1/12/2004 11:57 | 29.961 | 3.189 | 19.889 | 64.29 | 29.961 | 0 | 9.649 | 3.156 | 3.274 | 19.889 | 19.355 | | | 23.08 | 2.343 | 1.86 | | |
| 17 | 1/12/2004 12:00 | 30.472 | 3.33 | 21.216 | 64.29 | 30.472 | 0 | 9.858 | 3.301 | 3.465 | 21.216 | 21.258 | | | 23.08 | 2.424 | 1.929 | | |
| 18 | 1/12/2004 12:03 | 30.118 | 3.091 | 19.4 | 64.29 | 30.118 | 0 | 9.712 | 3.091 | 3.222 | 19.4 | 19.302 | | | 23.24 | 2.263 | 1.799 | | |
| 19 | 1/12/2004 12:06 | 30.276 | 3.383 | 21.375 | 64.29 | 30.276 | 0 | 9.777 | 3.458 | 3.396 | 21.375 | 21.095 | | | 23.08 | 2.471 | 1.965 | | |
| 20 | 1/12/2004 12:09 | 30.276 | 3.181 | 20.102 | 64.29 | 30.276 | 0 | 9.778 | 3.415 | 3.215 | 20.998 | 20.102 | | | 23.24 | 2.324 | 1.848 | | |
| 21 | 1/12/2004 12:12 | 30.63 | 3.294 | 21.12 | 64.29 | 30.63 | 0 | 9.921 | 3.186 | 3.455 | 21.12 | 20.714 | | | 23.08 | 2.391 | 1.904 | | |
| 22 | 1/12/2004 12:15 | 31.024 | 3.227 | 21.03 | 64.29 | 31.024 | 0 | 10.081 | 3.297 | 3.264 | 21.03 | 21.473 | | | 23.08 | 2.327 | 1.856 | | |
| 23 | 1/12/2004 12:18 | 30.984 | 3.291 | 21.408 | 64.29 | 30.984 | 0 | 10.065 | 3.392 | 3.35 | 21.408 | 21.533 | | | 23.08 | 2.374 | 1.893 | | |
| 24 | 1/12/2004 12:21 | 31.26 | 3.195 | 21.019 | 64.29 | 31.26 | 0 | 10.179 | 3.366 | 3.327 | 21.831 | 21.019 | | | 23.24 | 2.294 | 1.832 | | |
| 25 | 1/12/2004 12:24 | 31.181 | 3.222 | 21.127 | 64.29 | 31.181 | 0 | 10.146 | 3.241 | 3.241 | 21.127 | 20.719 | | | 23.08 | 2.316 | 1.849 | | |
| 26 | 1/12/2004 12:27 | 31.575 | 3.307 | 22.028 | 64.29 | 31.575 | 0 | 10.306 | 3.442 | 3.307 | 22.028 | 21.76 | | | 23.24 | 2.362 | 1.888 | | |
| 27 | 1/12/2004 12:30 | 30.984 | 3.26 | 21.215 | 64.29 | 30.984 | 0 | 10.067 | 3.376 | 3.396 | 21.889 | 21.215 | | | 23.24 | 2.352 | 1.876 | | |
| 28 | 1/12/2004 12:33 | 30.866 | 3.212 | 20.796 | 64.29 | 30.866 | 0 | 10.018 | 3.219 | 3.32 | 20.796 | 20.46 | | | 23.08 | 2.322 | 1.851 | | |
| 29 | 1/12/2004 12:36 | 30.079 | 3.235 | 20.273 | 64.29 | 30.079 | 0 | 9.697 | 3.337 | 3.173 | 20.273 | 19.688 | | | 23.24 | 2.371 | 1.884 | | |
| 30 | 1/12/2004 12:39 | 30.236 | 3.211 | 20.256 | 64.29 | 30.236 | 0 | 9.761 | 3.199 | 3.363 | 20.256 | 20.433 | | | 23.08 | 2.347 | 1.866 | | |
| 31 | 1/12/2004 12:42 | 30.276 | 3.224 | 20.373 | 64.29 | 30.276 | 0 | 9.777 | 3.238 | 3.294 | 20.373 | 20.659 | | | 23.08 | 2.355 | 1.873 | | |
| 32 | 1/12/2004 12:45 | 31.024 | 3.203 | 20.874 | 64.29 | 31.024 | 0 | 10.084 | 3.245 | 3.412 | 21.671 | 20.874 | | | 23.08 | 2.309 | 1.842 | | |
| 33 | 1/12/2004 12:48 | 31.614 | 3.367 | 22.461 | 64.29 | 31.614 | 0 | 10.322 | 3.52 | 3.251 | 22.461 | 22.235 | | | 23.08 | 2.403 | 1.922 | | |
| 34 | 1/12/2004 12:51 | 31.614 | 3.201 | 21.354 | 64.29 | 31.614 | 0 | 10.322 | 3.196 | 3.209 | 21.354 | 20.95 | | | 23.08 | 2.284 | 1.827 | | |
| 35 | 1/12/2004 12:54 | 32.283 | 3.336 | 22.846 | 64.29 | 32.283 | 0 | 10.595 | 3.547 | 3.369 | 23.542 | 22.846 | | | 23.08 | 2.355 | 1.889 | | |
| 36 | 1/12/2004 12:57 | 31.811 | 3.271 | 21.994 | 64.29 | 31.811 | 0 | 10.402 | 3.33 | 3.264 | 21.994 | 22.06 | | | 23.08 | 2.327 | 1.863 | | |
| 37 | 1/12/2004 13:00 | 31.85 | 3.351 | 22.564 | 64.29 | 31.85 | 0 | 10.418 | 3.376 | 3.35 | 22.564 | 22.355 | | | 23.08 | 2.382 | 1.907 | | |

*Figure 3-27 Tabular data in Extended CSV format*

### 3.8.7 Composite View

Composite view provides a composite hydrograph of multiple data files. To select more than one file to view, highlight the first file, hold down the Control key, and highlight the other file(s) to view.

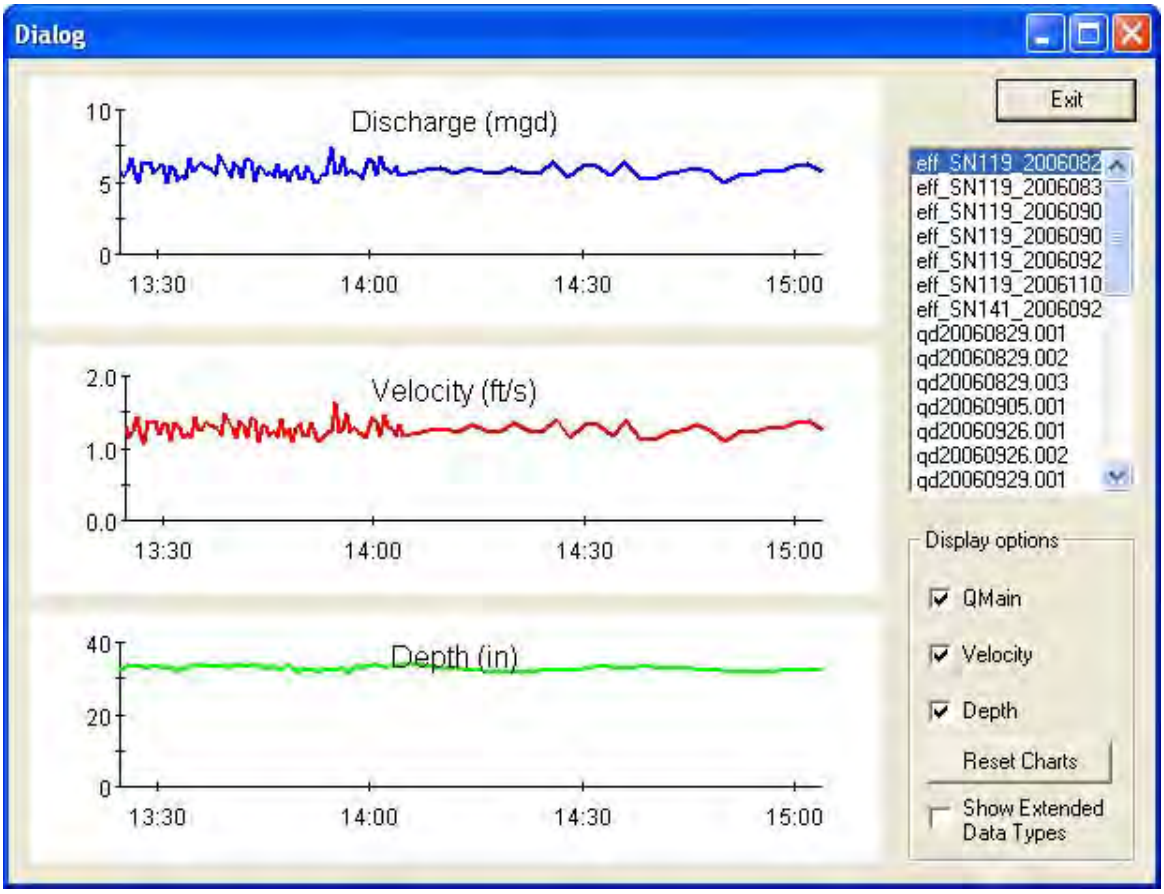



*Figure 3-28 Composite View*

# WinADFM Software

## *Appendix A BIT Codes for ADFM and accQmin*

### A.1 ADFM BIT Codes

The ADFM uses a bit-mapped value for the BIT (Built In Test) code. Each of the 16 bits (4 hex digits) signifies a different error. The ADFM outputs a BIT code with each ensemble that reflects all of the errors that occurred during that ensemble. Common ADFM errors and their corresponding BIT codes are shown below in table A-1:

**Table A-1 Common ADFM Errors and BIT Codes**

| Bit | Error | Decimal | Hex |
|---|---|---|---|
| 6 | Secondary Level Sensor Failure | 32 | 0020 |
| 7 | Demod Timeout | 64 | 0040 |
| 8 | Demod LCA failure | 128 | 0080 |
| 9 | Auto Restart Occurred | 256 | 0100 |
| 10 | Demod FIFO failure | 512 | 0200 |
| 11 | Power/Timing failure | 1024 | 0400 |
| 12 | Transducer (Sensor) Communications Failure | 2048 | 0800 |
| 13 | Recorder Full | 4096 | 1000 |
| 14 | Recorder Failure | 8192 | 2000 |

If multiple errors occur, the resulting BIT code will be the algebraic sum of the individual codes. For instance, a BIT code of 0820 hex corresponds to a transducer communications failure and a secondary level sensor failure.

### A.2 accQmin BIT Codes

The accQmin outputs error codes in a manner substantially different from the ADFM. The accQmin uses an 8-bit hex value for each error, and maintains a queue of recent errors. The output for each ensemble consists of the number errors in the queue, and the hex value for the first error code in the queue. As new errors occur, the queue is first searched to determine if that error code is already in the queue. If it is, the new occurrence of that error is ignored. If it is not already in the queue, the error code is added to the end of the queue and the error code counter is incremented. As error codes from the queue are output, they are removed from the queue and the counter is decremented. For example, if the accQmin error code is 0291, there are two error codes in the queue, with the first (oldest) error code in the queue being 91 – Interlock Open.

Only one error code is output per ensemble, and it will be the oldest one in the queue. Therefore, although the error reported for a particular ensemble may have occurred during that ensemble, but not necessarily. Also, multiple errors may have occurred during that ensemble. If you are getting bad data, you will need to look through several ensembles to see the full list of error codes being generated. When the errors begin to repeat, you can be fairly certain you've seen a comprehensive list.

Table A-2 contains a list of accQmin error codes.

**Table A-2 accQmin Error Codes**

| Code (hex) | Error | Description |
|---|---|---|
| 22 | Temperature Sensor Fail | Indicates that the temperature sensor is not available or is not configured properly. The transducer must be connected to the electronics when the BREAK is sent, or the temperature sensor will be flagged as unavailable for the duration of the deployment. |
| 23 | Pressure Sensor Fail | Indicates that the primary depth sensor, if it is the pressure sensor, is not available. If the Expander board returns a pressure sensor failure message, this code is set. |
| 30 | UART Stuck | Ensemble data is ready for output and the UART interrupt can't be cleared. |
| 31 | UART Tx timeout | A new ensemble is ready to be output and the previous ensemble is still in queue after an excessive length of time. |
| 32 | UART IRQ Stuck | Data has been in the interrupt handler loop for more than 30000 consecutive loops. |
| 33 | UART Buffer Stuck | The output buffer is full, and a character has waited more than 100 msec to be added to that buffer. |
| 35 | UART No Clear | The system is waiting to go to sleep, and the UART interrupt doesn't clear after 20 msec. |
| 37 | UART Sleep Timeout | The system does not have enough time to sleep due to data output. |
| 40 | VB No Detect | The Vertical Beam is unable to detect the surface in the DWADFM or VADCP modes. |
| 50 | RTC Battery Low | The Real Time Clock reports a low battery condition. |
| 51 | RTC Time Not Set | The time was reset due to power interruption and the user has not set the time with the TS command. |
| 60 | Recorder Pointers Lost | RAM based pointers to the next recorder write location are lost due to power interruption or a firmware download. |
| 61 | Recorder Erase Error | The system is unable to erase the Loop/Slate recorder Flash memory. |
| 62 | Recorder Data Read Time-Out | While attempting to read a page of data from the Flash memory, a time-out occurred. |
| 63 | Recorder Data Write Time-Out | While attempting to write a page of data to the Flash memory, a timeout occurred. |
| 64 | Recorder Page Erase Time-Out | While attempting to erase a page of Flash memory, a timeout occurred. |
| 65 | Recorder Erase Status Error | The Flash memory control register returned an error indication after an erase took place. |
| 66 | Recorder Slate Full | The recorder is in the Slate mode and the recorder is full. |

**Table A-2 accQmin Error Codes (Continued)**

| Code (hex) | Error | Description |
|---|---|---|
| 71 | Beam 1 Bad | While processing Beam 1 velocities, one or more bins were flagged as bad. |
| 72 | Beam 2 Bad | While processing Beam 2 velocities, one or more bins were flagged as bad. |
| 73 | Beam 3 Bad | While processing Beam 3, velocities one or more bins were flagged bad. |
| 76 | Vertical Beam Failure | In SW mode, the vertical beam percent good was less than 50%. |
| 77 | Vertical Beam Marginal | In the SW mode the vertical beam percent good was less than 70%. |
| 78 | Flow Shape Failure | A comparison between the actual measured velocities and the HRW model had a value greater than 0.1 (0 = perfect fit). |
| 79 | Flow Shape Marginal | A comparison between the actual measured velocities and the HRW model had a value greater than 0.01 (0.0 = perfect fit) |
| 7A | Unable to Calculate Discharge (Q) | The system could not calculate Q due to too few velocity bins (need at least 6 good ones) or a depth estimate was unavailable. |
| 7B | Temperature Sensor Failure | Over at least the last four sample periods, the temperature sensor did not return a valid temperature. |
| 90 | I/O Expander Board Failure | The system was unable to establish communication with I/O Expander board via the SPI bus. |
| 91 | Interlock Open | The I/O Expander board detected a failure in the external connector interlock pins. |