

WET Labs Archive File Processing (WAP)

User's Guide

Sea-Bird Scientific
PO Box 518
Philomath, OR 97370
(541) 929-5650
www.seabird.com

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1. Overview

The WET Labs Archive Processing program (WAP) provides primary processing of data files created by Data Handlers (DH-4s) and ac-9 Plus meters. This primary processing consists of extracting time-stamped raw data from the archive files and applying calibration coefficients to the data for all WET Labs instruments and selected instruments from other manufacturers.

WAP processes data from archive files that have a *.000 (three-digit) filename suffix. WAP creates an **Instrument Selection File** for each “channel” of data, applying user-selected device and/or calibration files. It then creates an **Extraction Setup File** with user-defined parameters about how archive file will be processed. Last, an optional **Merge Setup File** applies time and/or depth adjustments to processed data and combines/re-orders the data from one or more of the “channels” of data into single files.

Secondary data processing such as data binning, quality control checks on data, statistical analysis, etc. is not provided by WAP.

1.1 User's Guide Organization

Section 1, Overview

Section 2, Setting up WAP: Step-by-step instructions for processing data in WAP.

Section 3, Reference: Details on WAP menus and setup options.

Section 4, Summary: Single-page “quick start” setup steps, with worksheet.

2. Setting up Processing Parameters

This section provides step-by-step instructions for using WAP to process data generated by an example system consisting of an ac-s, ac-9, CTD, *ECO* BB9, and WET Labs Flow Sensor.

2.1 Create Folder Structure

Creating the folder structure listed is not required, but it will help a great deal to keep the numerous files organized.

- Create a folder and copy DH-4 or ac-9 Plus archive files you wish to process into that folder.
- Create a folder and copy all the device files and any ac meter correction files for each meter's data you wish to process into that folder.
- Create a folder to contain data files processed ("extracted") by WAP.

The main window will display the path of each file and folder. WAP generated:

- Instrumentation Selection File
- Extraction Setup File
- Merge Setup File

Instrumentation Selection File:	C:\WAPexamples\veg1.isf
Device File Folder:	C:\WAPexamples\calsdevs
Extraction Setup File:	C:\WAPexamples\veg1.ESF
Output File Folder:	C:\WAPexamples\extracted
Merge Setup File:	C:\WAPexamples\acsac9.msf

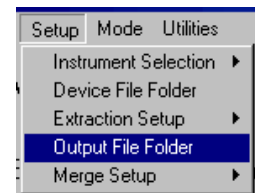
User-generated:

- Folder to store DH-4/ac-9Plus-generated archive files in for processing by WAP.
- Device File Folder
- Output File Folder

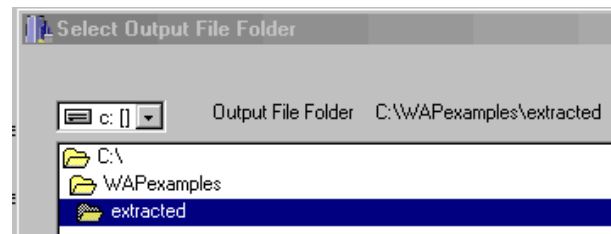
2.2 Check and Extract Raw Data

Follow the steps below to view "raw" archives as a data check. Note that for ac meters, the raw output will be binary.

1. Select the Setup pull-down menu, then Output File Folder.



2. In the resulting window, navigate to and **double-click** on the folder in which you want to store the **raw_archive** files WAP will create (example at right).

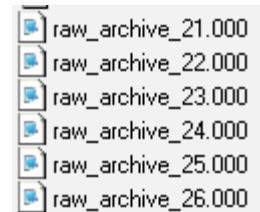


Note that this path and folder name will also be indicated on the main WAP screen as Output File Folder.

3. Select the Extract to Raw button on the main WAP screen. The Status indicator will change from Ready... to Done With Raw Extraction when WAP is finished.
4. In the resulting window, navigate to the folder in which you have saved the DH-4 or ac meter archive data files and select the desired run you wish to check.



5. WAP names the resulting files, adding “raw” and appending the meter’s WAP ID number to the filename.
6. View the raw_archive file(s) to verify the data appears reasonable.



2.3 Create WAP Setup Files

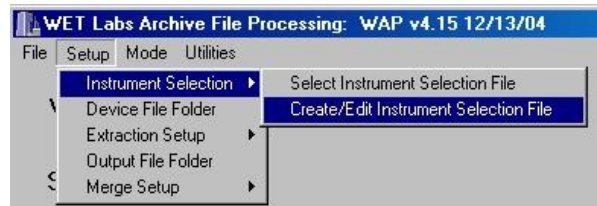
WAP will further processes archive data and apply necessary corrections, calibration and device file information. This will allow you to obtain data in engineering units, and eventually merge this data with other meter data files. from the DH-4 or ac9 Plus archive files.

2.3.1 Instrument Selection File

The *.isf files contain setup information regarding a specific meter and its associated calibration and/or device file. Once created and saved, these setup files can be re-used for processing other meter data files using WAP.

1. Start WAP if necessary.
2. Select Setup / Instrument Selection > Create/Edit Instrument Selection File.

To open an existing ISF file that needs no modifications, choose Select Instrument Selection File.



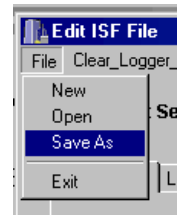
3. Select Meter Type and enter a device file name if one is required.

If you do not wish to process data from one or more channels, leave the meter selection OFF. Note that if a Meter Type is selected (not set to OFF), an output file will be created whether or not a meter is physically present.

Serial Port	WAP ID	Meter Type	Device File *.DEV *.CON *.CAL	Serial Port	WAP ID	Meter
1	21	AC-S	ACS043.DEV	1	21	ac-s
2	22	AC-9	AC90156.DEV	2	22	ac-9
3	23	Time + ASCII		3	23	CTD
4	24	Time + ASCII	BB9-274.DEV	4	24	BB9
5	25	Time + ASCII		5	25	Flow Sensor
6	26	OFF		6	26	OFF

✓ *Tip* Using the worksheet in Section 4 may help keep setup parameters organized.

4. After each of the Meter Type and Device File entries have been completed, save the settings. The saved *.isf and path will display on the main WAP window.



2.3.2 Extraction Setup File

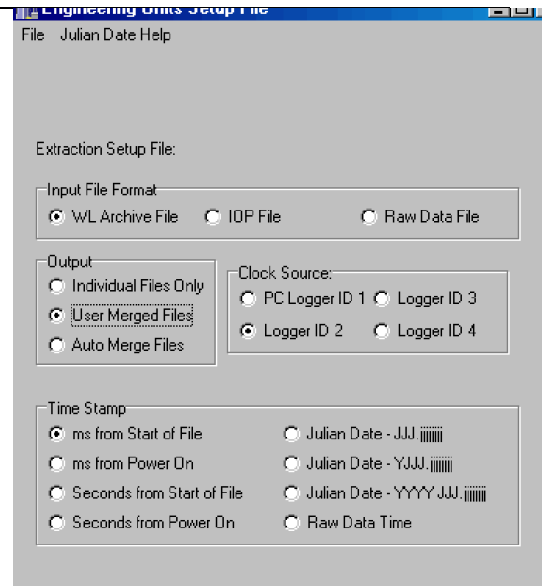
Creating an *.esf provides WAP with the parameters (file type, output, and time stamp) for processing an archive file.

1. Select Setup / Extraction Setup > Create/Edit Instrument Selection File.

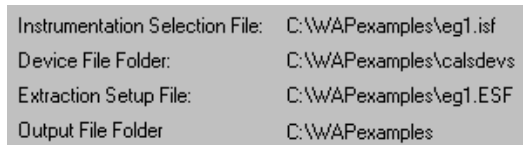
To open an existing *.esf that needs no modifications, choose Select Extraction File.



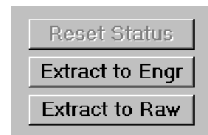
2. Select WL Archive File (default setting) in the Input File Format area of the resulting window.
3. Select User Merged Files in the Output area.
4. Select Logger ID 2 (default setting) in the Clock Source area.
5. Select ms from Start of File (default setting) in the Time Stamp area.
6. Use the File pull-down menu to save these settings.



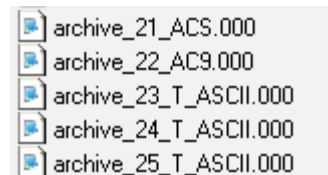
7. The saved *.esf and path will display at the main WAP window. This file can be used for subsequent file extractions.



8. At the main window, select Extract to Engr, then the archive file. In this example, it's archive.202.



WAP generates a new file for each instrument, adding the WAP ID # to the filename. These files will be saved at the location shown for the Output File Folder on the main screen (This is a user-specified folder as created in section 2.1.)



2.3.3 Merge Setup

The Merge Setup File (*.msf) controls the final portion of the WAP merging process. This data merging occurs at the end of the archive file extraction process and is used to create merged files that contain the data from multiple instruments that is time/depth-aligned.

WAP file merging is executed as series of sequential file merges performed on two files at a time. The merge routines sequentially step through pairs of files, with each step resulting in a merged file called pair.xx. Each pair of files consists of a “base” file and a “merge” file. The base is used to determine the time/depth resolution for the merged pair.

Each pair can build upon the previously created pairs. For example, if the first merged pair contains data from an ac-9 and a CTD, the next merged pair could add the data from a second ac-9, creating a merged file with data from two ac-9s and a CTD.

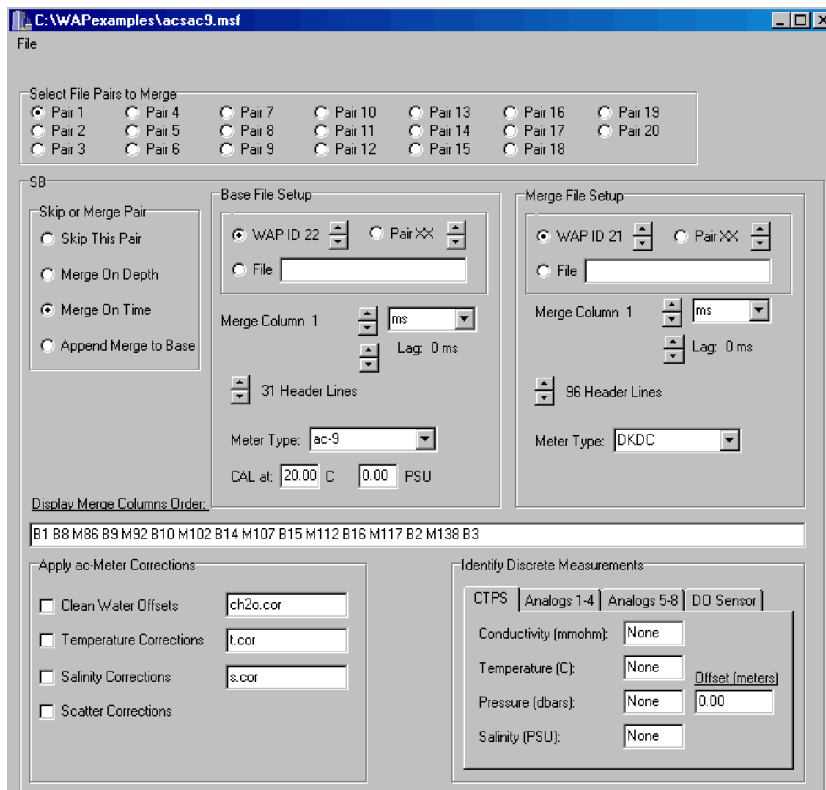
At the basic level, the user

- Selects the “base” and a “merge” pair of files to merge.
- Identifies whether the files will be merged using depth or time.
- Identifies the depth or time columns in the base and merge files.
- Sets the time or depth corrections (if any) for both the base and merge file.
- Selects the number of rows of header information in both base and merge files.
- Sets up any special ac meter data processing.
- Identifies analog channels, if any.
- Formats the output records.

In the following example, the ac-s file (WAP ID 21) will be merged with the ac-9 “base” file (WAP ID 22). This will result in Pair 01.

ID 1	Logger ID 2	Logger ID 3	...
WAP ID	Meter Type		
21	AC-5		
22	AC-9		

The figure below shows all selections for merging WAP ID 21 with WAP ID 22 to form Pair 01. Details follow.

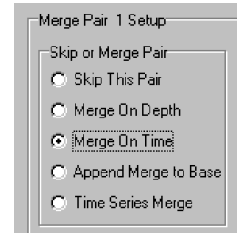


1. Select Setup / Merge Setup > Create/Edit Merge Setup File to create a new Merge Setup File.

2. Select Pair 1. These will be the first files merged.



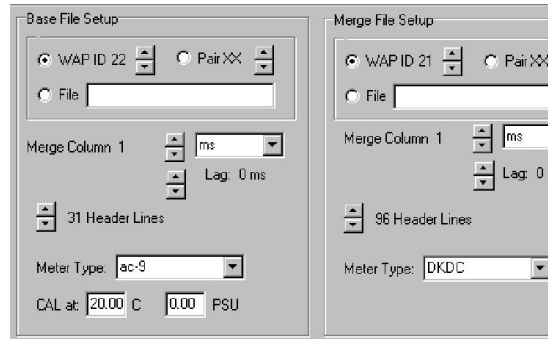
3. Select Merge On Time. The Base File Setup and the Merge File Setup boxes will appear.



4. Under Base File Setup and Merge File Setup, use up and down arrows to select the ID # associated with the Meter Type assigned in the *.isf window.



5. In the Merge Column areas under Base File Setup and Merge File Setup, use the arrows to select the first column of data you wish you to merge (typically column 1). Do this for Base File Setup and Merge File Setup.

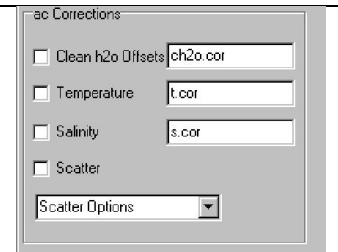


6. The time/date pulldown menu can be left at ms and the Lag at 0.
7. Scroll to select the number of header lines in the meter's output file. WAP will process data beginning on the next row.

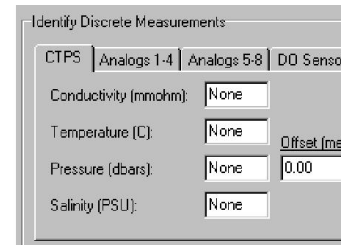
8. Select the Meter Type: If one of the meters is an ac-9 or ac-s, select ac9 as the meter type. Otherwise, leave as DKDC (Don't Know, Don't Care).

Note that it is only necessary to input the number of header lines for the first pair of merged files; WAP includes only one header row for each subsequent file/pair.

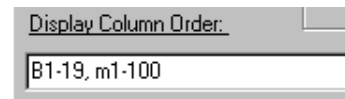
9. Selecting a meter as **ac9** will display the **ac Corrections** portion of the window, allowing you to input clean water, temperature, salinity, and scattering corrections. See the appropriate sections below for details.



10. You can still apply a depth offset to the output records (see section 3.4):
- identify a base or merge column as the depth under the CTPS/Pressure setting, OR
 - input a HAD value in the second location on the CTPS pressure setting line, OR
 - input “iPres” (insert Pressure) as an item in the Display Column Order area (see below).



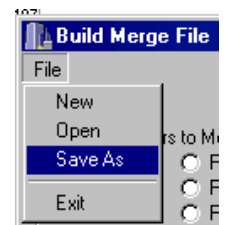
11. Input the columns to be displayed after merging.
B1–19 is a “base” file, ac-9 columns 1 through 19.
M1–100 is a “merge” file, ac-s columns 1 through 100.



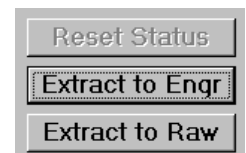
Note

In practice, setting up a complex file merge will take several iterations to get all the column selections and merge options set correctly. WET Labs recommends you attempt to set up one or two pairs of files at a time, making sure they are correct before setting up additional pairs that may be dependent on earlier merges.

12. Save the settings for the first pair of files (ac-9 and ac-s): go to **File / Save As**. Name the file in the resulting window.

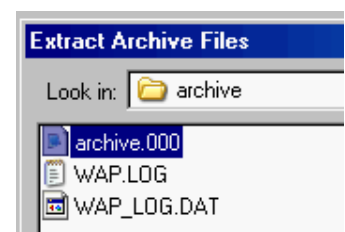


13. In the main WAP window, click the **Extract to Engr** button.



14. In the resulting window, select the archive.000 file.

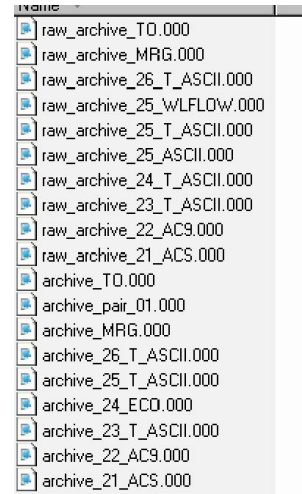
15. The status display in the main window will display **Ready . . .** while WAP processes the file, then **Done with Extraction**. The file **archive_pair_01.000** will be added to the designated output folder.



16. Locate the newly created `archive_pair_01.000` (in this example, it's in the "extracted" folder set up to contain all WAP-generated data files.) The .000 files may be opened in a text-view program such as Notebook, or in MS Excel.

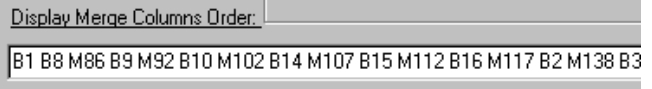
Following the steps in this section, then, will have generated

- `raw_archive_WAP ID#_Meter Type.000` files, in which ASCII data can be verified.
- `archive_WAP ID#_Meter Type.000`, which contain processed data.
- (Section 2.4: `archive_pair_01.000`, which in this example is merged ac-s and ac-9 data.)



The example archive Pair 01 is a bit more complex than merging entire files, but demonstrates the program's functionality and is the basis for creating Pair 02 discussed in Section 2.4.

B1 B8 are "base" files, ac-9 columns 1 and 8.



M86 is a "merge" file, ac-s column 86.

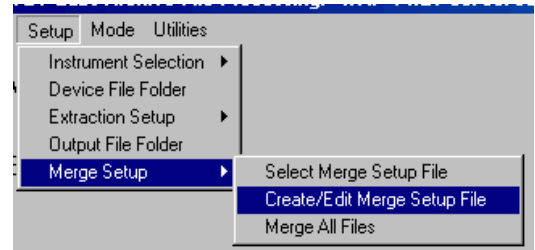
B9 is a "base" file, ac-9 column 9.

This ordering will merge ac-9 and ac-s meters into columns by wavelength, with ac-9 "c" data followed by ac-s "c" data, then ac-9 and ac-s "a" data.

2.4 Merge File Pairs

Configure the second part of the merge: In the following example, ac-9 and ac-s files have been merged to form Pair 1, and a BB9 file will be merged with Pair 1 to form Pair 2.

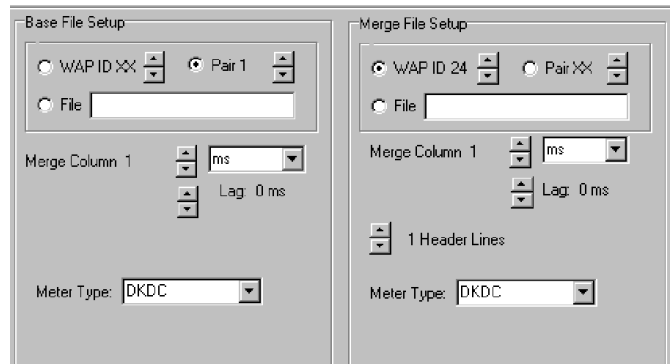
1. In WAP, go to Create/Edit Merge Setup File. Check Pair 02, and in the resulting box, check Merge on Time.



2. Select Pair 1 as the Base File. Select WAP ID 24 (BB meter) as the file to merge.

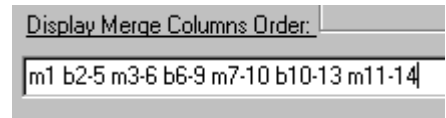


3. In the Merge Column areas under Base File Setup and Merge File Setup, use the arrows to ascend or descend to the first column of data you wish you to merge (typically column 1).

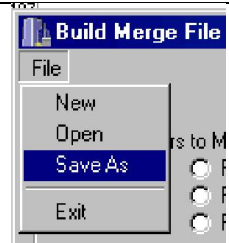


4. Leave the “time” pull-down set to milliseconds (ms). Set the Lag in milliseconds for both the Base and Merge files. (0 ms is perfectly acceptable.) A positive lag will cause a record to be merged later than file time indicates. For example, if a lag is set to 1000 ms, a record collected at 2500 ms will be processed and labeled as 3500 ms.
5. Select whether you want to keep the last header line as column headers in the merged file or whether you want to discard all header lines.

6. Input the columns to be displayed after merging:
 - m1: time column, BB9 file to be merged.
 - b2-5: “base” (pair 1) columns (ac-9 and ac-s) of “a” and “c” measurements at 412 nm.
 - M3-6: “merge” column of BB9 data at 412 nm.
 - B6-9: “base” (pair 1) columns (ac-9 and ac-s) of “a” and “c” measurements at 440 nm.



7. Save the settings: File / Save As.
8. In the main WAP window, click the **Extract to Engr** button.
9. In the resulting window, select the archive.000 file. The status display in the main window will display **Ready . . .** while WAP processes the file, then **Done with Extraction**. The file **archive_pair_02.000** will be added to the designated output folder. Merge results for 412 and 440nm are shown below (the entire file has nearly 75 columns, including data to 715nm.)



Note

In practice, setting up a complex file merge will take several iterations to get all the column selections and merge options set correctly. WET Labs recommends you attempt to set up one or two pairs of files at a time, making sure they are correct before setting up additional pairs that may be dependent on earlier merges.

ac-9, ac-s and Beta BB9, merged to form Pair 02 (412 and 440 nm columns only)

Time(ms)	c412__	c410.9	a412__	a411.7	BetaP(412)	bbP(412)	bb(412)
1870	0.25018	0.25466	22.90292	0.22446	0.000359	0.002479	0.005809
1870	0.25049	0.25142	22.84109	0.21797	0.000359	0.002479	0.005809
1870	0.25119	0.25142	22.85968	0.21797	0.000359	0.002479	0.005809
1870	0.25237	0.25142	22.94692	0.21797	0.000359	0.002479	0.005809
2890	0.2517	0.25463	22.99126	0.21807	0.000314	0.002169	0.005499
2890	0.25124	0.2584	22.94062	0.18353	0.000314	0.002169	0.005499
2890	0.25278	0.2584	22.83817	0.18353	0.000314	0.002169	0.005499
2890	0.25712	0.25786	22.78035	0.15854	0.000314	0.002169	0.005499
2890	0.24898	0.25815	22.83817	0.15543	0.000314	0.002169	0.005499
2890	0.25326	0.25815	22.87512	0.15543	0.000314	0.002169	0.005499
3910	0.25409	0.25114	22.81372	0.17101	0.000336	0.002324	0.005654

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•
•

Beta(440)	c440__	c441.2	a440__	a442.3	BetaP(440)	bbP(440)	bb(440)
0.00096	0.18258	0.17995	22.13241	0.11689	0.000606	0.004189	0.006709
0.00096	0.18213	0.18376	22.24255	0.11933	0.000606	0.004189	0.006709
0.00096	0.18351	0.18376	22.21958	0.11933	0.000606	0.004189	0.006709
0.00096	0.18478	0.18376	22.1682	0.11933	0.000606	0.004189	0.006709
0.001037	0.18456	0.18219	22.23635	0.128	0.000683	0.00472	0.00724
0.001037	0.18711	0.18128	22.31657	0.13271	0.000683	0.00472	0.00724
0.001037	0.18871	0.18128	22.20137	0.13271	0.000683	0.00472	0.00724
0.001037	0.19121	0.18604	22.18475	0.14012	0.000683	0.00472	0.00724
0.001037	0.1836	0.18897	22.25932	0.13026	0.000683	0.00472	0.00724
0.001037	0.18743	0.18897	22.13233	0.13026	0.000683	0.00472	0.00724
0.001139	0.18625	0.18467	22.2778	0.12395	0.000785	0.005428	0.007947

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•
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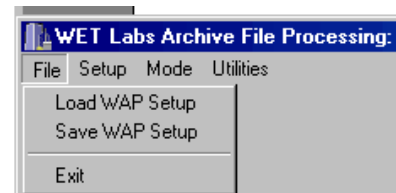
3. Reference

This section describes the options available under the pull-down menus of the WAP program and details the setup options under the Instrument Selection File, Extraction Setup File, and Merge Setup File menus.

3.1 Menu Items

3.1.1 File

Load WAP Setup, Save WAP Setup—Loads or saves the .isf, .esf, and .msf files in a user-defined Output File Folder. File path and location is shown in main WAP window.



Exit—Exits the program, saving the current settings. Note that using the X box to exit the program will not save any settings.

3.1.2 Setup

Instrument Selection > see section 3.2.

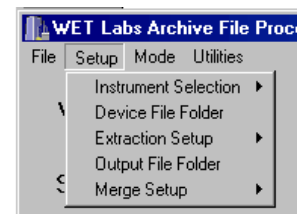
Device File Folder—Functions as a pointer to a user-created folder that contains necessary device and correction files.

Extraction Setup > see section 3.3.

Output File Folder—Functions as a pointer to a user-created folder in which files generated by WAP are stored.

Merge Setup > see section 3.4.

Note that file and folder locations from the above setups display in main WAP main window.



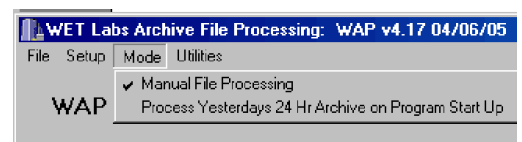
Instrumentation Selection File:	C:\WAPexamples\veg1.isf
Device File Folder:	C:\WAPexamples\scaldsdevs
Extraction Setup File:	C:\WAPexamples\veg1.ESF
Output File Folder:	C:\WAPexamples\extracted
Merge Setup File:	C:\WAPexamples\vacsa09.msf

3.1.3 Mode

Manual File Processing—Default mode for using WAP.

Process Yesterday's 24-hour Archive on Program Startup—for advanced users.

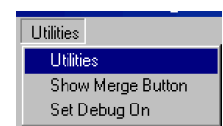
Contact WET Labs about using this option.



3.1.4 Utilities

Utilities—Troubleshooting for the advanced user.

Show Merge Button—Activates the Merge a Previously Extracted File at the main window, which allows merging of previously extracted files.



Set Debug On—WET Labs-directed diagnostics and troubleshooting for the advanced user.

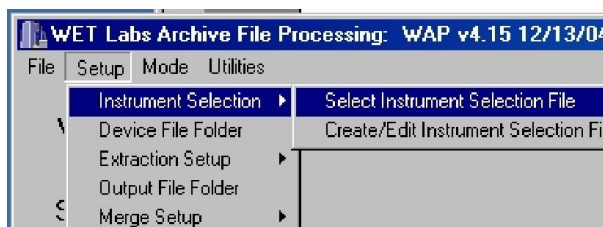
3.2 Instrument Selection

An Instrument Selection File (*.isf) is used to tell WAP how the data from every channel is going to be processed. The file includes information regarding meter type and the meter's respective calibration or device files. WAP can process an archive file with data from up to 4 independent data loggers.

Setup / Instrument Selection >

Instrument Selection File

Allows selection of a previously saved file and fills in that line on the main WAP window. This file type will be used during subsequent file extractions.



Create/Edit Instrument Selection File:
Displays the Logger ID tabs.

Logger ID # Tabs

Logger ID 1–Logger ID 4 correspond to each configured data logger. The Logger ID is embedded in each data packet of every archive file.

If multiple data loggers were used in the creation of an archive file, each data logger must have a unique Logger ID.

- Logger ID 1 is the typical ID for a host computer used as a data logger (refer to the WET Labs DH-4 User's Guide for details).
- Logger ID 2 is the default ID for DH-4 and ac-9Plus meters.
- Logger ID 3 and Logger ID 4 are IDs for systems with more than one DH-4 or ac-9Plus.



Serial Port	WAP ID	Meter Type	Device File *.DEV *.CON *.CAL
1	21	AC-S	ACS043.DEV
2	22	AC-9	AC90156.DEV
3	23	Time + ASCII	
4	24	ECD	889-274.DEV
5	25	Time + ASCII	
6	26	OFF	
7	27	OFF	
8	28	OFF	
9	29	OFF	

Note

The terms Logger ID, MUX ID, and DH-Mux ID are all equivalent and may be found on different versions of WET Labs host programs.

Serial Port

The Serial Port column consists of numbers 1–9, which correspond to a mix of serial and analog data channels from the various data loggers. Each WET Labs DH-4 may have up to 8 serial data ports and 3 analog ports. WAP identifies port 9 as the analog port if the meter has one. If there are two analog ports, the second analog port will be identified by WAP as port 8.

WAP ID

The WAP ID column displays nine ID numbers depending on which Logger ID tab is currently selected. The tens digit represents the Logger ID; the ones digit represents the Serial Port. For example:

WAP ID 23 indicates the data is from Logger ID 2, the 3rd serial port.

WAP ID 39 indicates the data is from Logger ID 3, the analog port.

As WAP processes each archive file, a single data file will be created for each instrument. The WAP ID associated with each instrument will be embedded in the extracted output file name to help identify the instrument's logic port number.

Meter Type

Each data port has a **Meter Type** selection. WAP will alter the way it processes the data (data verification, time stamps, conversion to engineering units) according to which meter type is selected. See Appendix B, WAP Meter Types, for a complete description of each meter.

Note that if a **Meter Type** is selected (not set to OFF), an output file will be created whether or not a meter is physically present.

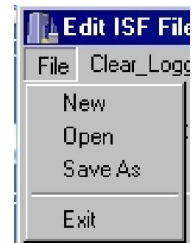
Device File

Each meter has a device file selection that is used to convert data from its "raw" state, as collected, to "processed," or engineering units. Device file selections are dependent on the Meter Type selected. See Appendix B: WAP Meter Types, for a complete description of each meter. Typical device file types:

- WET Labs— *.dev
- Sea-Bird— *.con
- Satlantic— *.cal

File

- **New:** clears all 4 Logger ID tabs, enabling the user to start with empty entry forms.
- **Open:** open and load an existing ISF. This is used to review or modify a previously saved ISF.
- **Save As:** saves all the current settings for all 4 Logger ID tabs for all Meter Types and device file entries.
- **Exit:** closes the Edit ISF File window without saving the current ISF settings.



Clear_Logger_Settings

Clear Logger ID 1–Clear Logger ID 4 can be used to erase the Meter Types and device file selections for respective Logger ID tabs. This may be useful when modifying existing *.isf files.

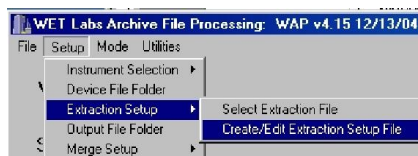


3.3 Extraction Setup File

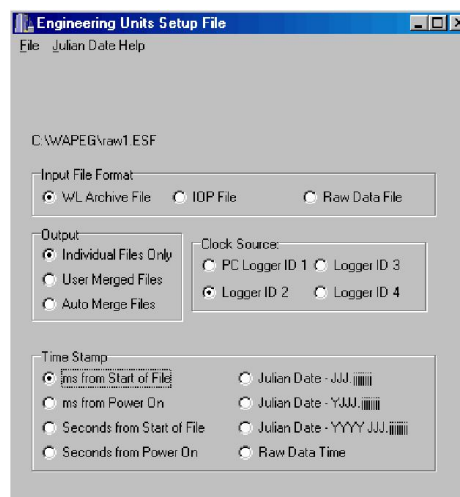
The Extraction Setup File (*.esf) menu items are used to configure how WAP is going to process each data file.

Setup / Extraction Setup >

Select Extraction File: allows selection of a previously saved file, and fills in that line on the main WAP window.

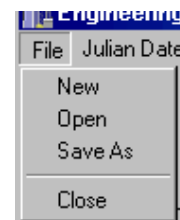


Create/Edit Extraction Setup File: Displays the Extraction Setup File window.



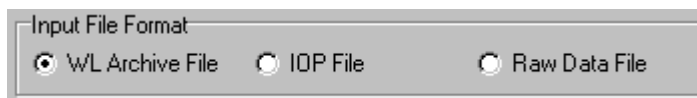
File

- **New:** clears any existing extraction settings; replaces them with program defaults.
- **Open:** opens and loads a previously saved ESF.
- **Save As:** saves all the current settings in an ESF.
- **Exit:** closes the ESF Setup File window without saving the current settings.



Input File Format

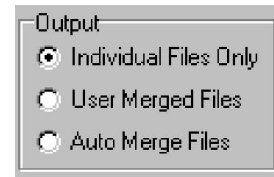
Indicates the file format WAP will process.



- **WL Archive File**—the usual and default standard archive file for ac-9Plus and DH-4.
- **IOP File**—non-standard file, not commonly used.
- **Raw Data File**—if WAP is set to output raw data, no data conversion will be performed on the extracted data, and the resulting files will be archived raw. Where possible, WAP will perform minimal data checking for selected instruments to validate the raw data packets before saving the data. To get byte-for-byte, “pure” raw data without any data checking, use the Binary option under **Meter Type** in the ISF options.

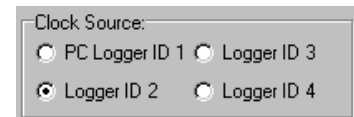
Output

- **Individual Files Only**—WAP will stop processing after extracting each channel of data.
- **User Merged Files**—Merges archive files based on user-selected options from the Merge Setup File. A *.msf must be created and saved to direct merged processing.
- **Auto Merge Files**—WAP will automatically merge all files by ascending WAP ID# and create a *.msf.



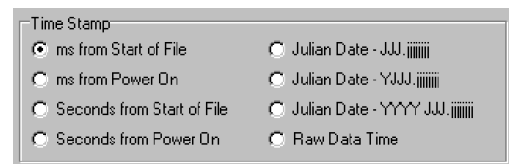
Clock Source

Identifies Logger ID records are to be used as the time source for the entire archive file. When data is recorded in a single logger configuration, this is usually set to Logger ID = 2, the factory default setting. If no records are found using ID 2, try the other IDs.



Time Stamp

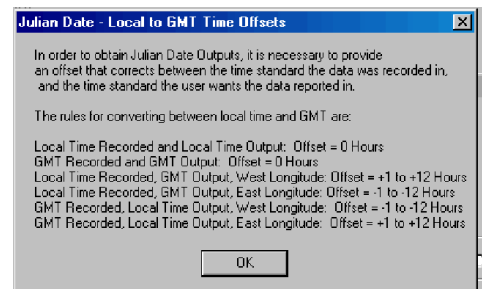
Time stamps for each processed record can be in milliseconds, seconds, Julian Date, or Raw Data Time.



Raw Data Time is associated with Raw Data File input type and when selected offers the ability to select time increments: e.g., 1000 ms = 1 Hz, 500 ms = 2 Hz, etc.

Julian Date Help

Help screen for determining time offsets.



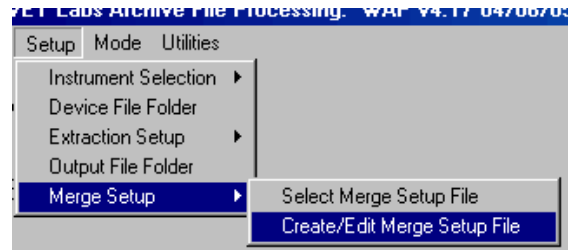
3.4 Merge Setup File

The Merge Setup File (*.msf) is used to control the WAP merging process. This data merging occurs at the end of the archive file extraction process and is used to (a) process analog data recorded in CTD records or WET Labs loggers (such as DH-4 or ac-9 Plus), and (b) create files that contain the data from multiple instruments that is time/depth-aligned. WAP file merging is executed as series of sequential file merges performed on two files at a time. The merge routines sequentially step through pairs of files, with each step resulting in a merged file called pair.xx. Each step can build upon the previously created pairs.

Setup / Merge Setup >

Select Merge Setup File

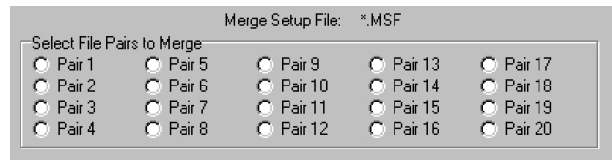
allows selection of a previously saved file, and fills in that line on the main WAP window. This file type will be used during subsequent file extractions.



Create/Edit Merge Setup File: results in the Merge Setup File: *.MSF window below.

Select File Pairs to Merge

Displays the pair of files to be merged. If the parameters for a pair are displayed, they can be changed. Starting with Pair 1, define the files you want to work with, and what processing you want to occur.



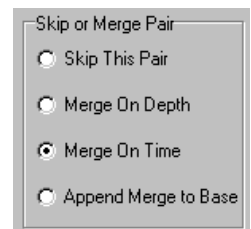
Once a pair has been selected, its merge parameters will be displayed and may be changed. Note that you cannot proceed unless a pair is selected.

As each pair is selected, the bottom portion of the program display will show the pair selected for display, and all its current parameters.

Skip or Merge Pair

Determines whether and how the two data files will be merged.

- **Skip this Pair:** All parameters within the Merge Pair XX group box are ignored, and processing begins on the next pair,
- **Merge On Depth:** Data files will be merged according to the depth columns identified under the Depth Column XX of the Base File Setup and Merge File Setup.
- **Merge On Time:** Data files will be merged according to the time columns identified under the Time Column XX of the Base File Setup and Merge File Setup.



- **Append Merge to Base:** Merges two files without performing any other merge processing. This is useful to “pre-pend” a header file to the a data file. If this option is selected, the entire “base” file will be copied to the “pair” file, followed by entire “merge” file.

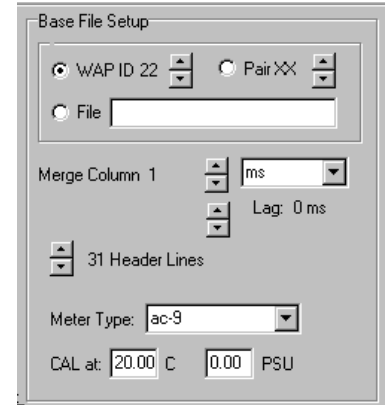
Base File Setup, Merge File Setup

Each file in the pair of files to be merged is either considered the base file or the merge file. The data rate and merge units (depth or time) are determined by the data rate or units of the base file.

WAP ID corresponds to the **Meter Type** in the ISF setup window (see 3.2). It is selectable from 11 to 49.

Pair xx is selectable from 1 through 20.

File: allows inputting the path and name of an archive file to merge.



Merge Column: the first column of the “base” and “merge” file data to be merged, typically column 1.

Merge On Time: Any lag is entered in milliseconds (ms) for both the Base and Merge files. (0 ms is perfectly acceptable.) A positive lag will cause a record to be merged later than file time indicates. For example, if a lag is set to 1000 ms, a record collected at 2500 ms will be processed and labeled as 3500 ms.

Merge on Depth: Any Height Above Datum (HAD) can be entered for both the Base and Merge Files. (0 cm is perfectly acceptable.) The datum point is usually the CTD pressure sensor location. If a measurement surface or inlet tube is located above the datum point (or pressure sensor), subtract the height from the depth measurement. For example, if a sensor is located 50 cm above the CTD pressure sensor, the HAD relative to the datum point would be 50 cm.

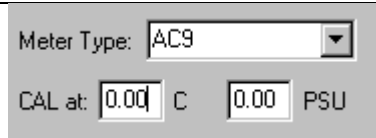
Header Lines: The number of header lines in the base and merge files. It is only necessary to input the number of header lines for the first pair of merged files; WAP includes only one header line for each subsequent files/pairs.

Note that ac-9s have 31 lines of header information. ac-s meters typically have 96. CTD files processed by WAP have 1 line of header information.

Meter Type identifies what type of meter created the data file. This is required only to correctly apply the ac corrections to the data. The options are DKDC (Don’t Know, Don’t Care), CTD-Analog-DO, and ac-9.



CAL at xx.x C and x.xx PSU define the ac meter calibration temperature and salinity. Factory calibrations are performed in clean water (0 PSU) and at a temperature listed in the ac meter's .cal file.



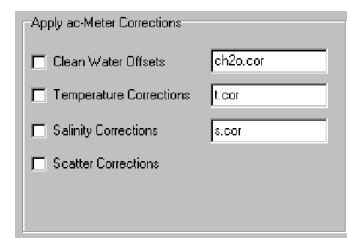
Meter Type: AC9
CAL at: 0.00 C 0.00 PSU

Apply ac-Meter Corrections

Caution!

These corrections may only be applied to the WETView-compatible data files generated by WETView or during the archive file extraction process of WAP. Once a record order has been altered by a merge, applying the ac Corrections will result in erroneous data.

If a meter type of ac-9 is selected in either the **Base File Setup** or **Merge File Setup** boxes, the **Apply ac-Meter Corrections** is used to determine what corrections will be applied to the ac meter data. the associated *.cor file must be specified to perform desired corrections.



Apply ac-Meter Corrections

Clean Water Offsets: ch2o.cor

Temperature Corrections: t.cor

Salinity Corrections: s.cor

Scatter Corrections

Clean Water Offsets applies user-calculated clean water offsets to the ac data. If the file listed in the edit box is not found or if the file format is not correct, data merging will be halted.

Temperature applies temperature corrections, as found in the file listed in the t.cor edit box, to the ac data. If the file listed in the t.cor edit box is not found or if the file format is not correct, data merging will be halted.

Salinity applies salinity corrections, as found in the s.cor edit box, to be applied to the ac data. If the file listed in the s.cor edit box is not found or if the file format is not correct, data merging will be halted.

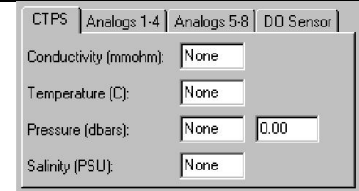
Scatter causes one of three scatter corrections to be applied to the ac data. The three scattering correction options are listed in the ac-9 user's guide:

1. **Base Wavelength Subtraction** using a715 as the absorption wavelength being subtracted.
2. **(c-a)%** where a percentage of the c-a measurement is used as the scattering correction.
3. **Zaneveld Method.**

If you select either the temperature or salinity absorption correction, you must specify the calibration temperature or salinity in the appropriate **Base File Setup** or **Merge File Setup** box.

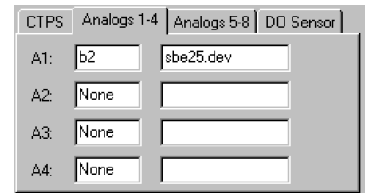
CTPS

WAP includes values for conductivity, temperature, pressure, and salinity for inclusion in the **Display Order** listed below. To select a column as conductivity, temperature, pressure, or salinity, type the column number as Bx for a Base File column or Mx for a Merge File Column in the appropriate edit field. Columns for both the Base and Merge files start with column 1.



Analogs 1–4 and 5–8

Raw voltages from analog meters may be converted to the appropriate units for non-WET Labs instruments through a simple scale and offset conversion. Again, on the **Analogs 1–4** or **Analogs 5–8** tab, input either Bx or Mx as the column, and input the analog meter's device file.



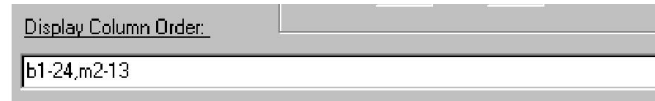
DO Sensor

To process data from either the SB23 or SBE43 oxygen sensors, type the **OX Current** value in the edit box (Bx or Mx) Type the **OX Temp** value in the associated edit box.



Enter the oxygen sensor device file in the bottom edit box.

Display Column Order defines the format of how the merged files will appear in the pair data file.



Display Column Commands

- Bxx: outputs a base data column xx in the merged record.
- Bxx-yy: outputs base data columns xx through yy in the merged record.
- Mxx: outputs a merge data column xx in the merged record.
- Mxx-yy: outputs merged data columns xx through yy in the merged record.

- ICond: inserts the current value for conductivity as specified by the CTPS tab.
- ITemp: inserts the current value for temperature as specified by the CTPS tab.
- IPres: inserts the current value for pressure as specified by the CTPS tab.
- ISal: inserts the current value for salinity as specified by the CTPS tab.
- IVx: inserts the processed value for Voltage X, where X is 1–8.

- iSBE23: calculates and inserts the current value of the SBE 23 oxygen sensor as its analog channels and device file are identified in the Oxygen Sensor group box.
- iSBE43: calculates and inserts the current value of the SBE 43 oxygen sensor as its analog channel and device file are identified in the Oxygen Sensor group box.

- IDens: calculates and inserts the value for density based on the conductivity, temperature, pressure, or salinity as identified by the CTPS tab.
- ISig: calculates and inserts the value for Sigma-T based on the conductivity, temperature, pressure, or salinity as identified by the CTPS tab.

- IZERO: inserts a column of zeros into the merged output record.
- ININES: inserts a column of 9999.0's into the merged output record.

4. WAP Data Processing Summary

1. Create a folder for archive files and move all such files to be processed into it. Create a folder for meter device files and any ac meter correction files; move associated files to it.
2. Create a folder to store extracted files in. Select **Setup/Output File Folder** in WAP, then choose the folder you created.
3. Select **Setup/Instrument Selection > Select Instrument Selection File** menu option. Edit an existing file or create a new one. Save if desired.
4. Select **Setup/Extraction Setup > Select Extraction File** menu option. Edit an existing file or create a new one. Save if desired.
5. Select **Setup/Merge Setup/Select Merge Setup File** menu option. Edit an existing file or create a new one. Save if desired.
6. Select **Extract Engr** on the main screen, then select the file to be extracted. The file will be processed according to the options selected in the .isf, .esf, and .msf files. The extracted and processed files will be saved in the user-selected **Output File Folder**.

At this point, another archive file may be selected for processing by repeating Step 6.

7. When all the archive files have been processed, select **File/Exit** on the main menu to exit the WAP program. Using this option instead of the X-box in the upper right hand corner will cause the WAP program to save the current settings to **Last.WAP** so WAP can reload them the next time the program is started.



Worksheet for Merging Data Files

Pair	Base File Setup WAP ID/Meter Type	Merge Column #	Merge File Setup WAP ID/Meter Type	Merge Column #	# Data Columns	# Header Rows	Display Column Order

Appendix A: ASCII Data Processing

WAP can process most meters with <CR LF>-terminated ASCII output files. The ASCII meters are selected in the Instrument Selection File (ISF) and are classified as:

1. **Analog**: raw voltage measurements for analog meters such as C-Stars or WETStars, but not limited to WET Labs meters.
2. **CTD_ENGR**: CT and CTD meters that have calibrated engineering unit data as their output. These include, but are not limited to, meters from FSI and Sea-Bird's SBE19Plus, SBE37, and SBE49.
3. **ECO**: All WET Labs *ECO* series meters.
4. **MISC_ASCII**: All other meters for which the output is calibrated or that can be processed using linear calibration coefficients.

Device Files

Meter device files have three sections:

1. header lines
2. meter-specific settings
3. output record definitions.

Blank lines are ignored. Lines beginning with “.” are considered comment lines and are also ignored.

1. Header Lines

The device file header contains two lines:

- Line 1 is the meter name / identification and the meter S/N.
- Line 2 is the file creation or modification date.

2. Meter-Specific Settings

Some meters require additional information to process their data. These settings are made after the header lines and before the output record definitions.

- CTD meters require the line:
ISCTD=YES
- If a file is for a moored CT meter, a fixed depth can be entered into the processed record using:
FIXED-DEPTH=XXX.X
where XXX.X will be used as the pressure column.

For *ECO* BB scatter meters, the default settings used in the scatter calculations may be altered. These settings and their defaults are:

Fixed-Salinity = <i>ss.ss</i>	Default is 32.0 PSU
Water= <i>Pure</i>	Default is SEA
Theta= <i>x.xxx</i>	Default is 2.0042035 radians = 117 degrees
XFactor= <i>x.x</i>	Chi: Default = 1.1

3. Output Record Definition

Each field or column of an ASCII output record must be described so WAP can process (or skip) it. The data definition section begins with the number of columns in the data record and ends with the end of the file.

Each column is defined by a record in the device file that (a) identifies what type of data it is, (b) which column it is found in, (c) parameters used to process the data, and (d) an optional column heading.

Each tab or space-delimited field is considered a column regardless of whether the data is numeric or alphanumeric.

Sig = Raw Signal Count
 V = Voltage
 Ref = Reference Count
 RV = Reference Voltage
 N is a column number starting with column 1
 SF = Scale Factor
 OF = Offset
 CL is a Column Label used for the output column header
 SWL = Signal Wave Length—Wavelength of LED
 DWL = Display Wave Length—Not used by WAP
 DC = Dark Count Voltage

The first line of the Output Record Definition section is:
 COLUMNS=N

Fields ignored/not processed by WAP:

Date=N	Numeric date or DD/MM/YY format
Time=N	Numeric time or HH:MM:SS format
Ref=N	A reference value
DKDC=N	Don't Know Don't Care
N/U=	Not Used
Reference=	Same as Ref=

The following measurement types use $x = (\text{Sig-OF}) * \text{SF}$ and are initialized using the form:

Signal=N SF OF CL where CL is optional	
DKFOL	Don't Know Find Out Later—Used to process meters that WAP does not recognize.
CHL	Fluorescence due to chlorophyll (ug/l)
Phycoerythrin	Fluorescence due to phycoerythrin (ug/l)
Uranine	Fluorescence due to uranine dye (PPB)
Rhodamine	Fluorescence due to rhodamine dye (PPB)
CDOM	Fluorescence due to CDOM
NTU	Turbidity Sensor

The following measurement types use $x = \text{Sig} * \text{SF} + \text{OF}$ and are initialized using the form:

Signal=N SF OF CL where CL is optional	
iTemp	Raw Internal Temperature Measurement–C
xTemp	Raw External Temperature Measurement–C
PRES	Raw Pressure Measurement

Calibrated CTD measurements are identified with:

Signal=N CL	
Temperature	Assumed to be C
Conductivity	Mmohms
Pressure	Pressure in dbar \cong meters for shallow depths
Depth	Depth in meters
Salinity	in PSU
Volts	Raw voltage measurement

ECO VSF meters use the form:

Signal=N SF OFF CL	
B100	Blue wavelength measurements for ECO VSF at 100 degrees
B125	Blue wavelength measurements for ECO VSF at 125 degrees
B150	Blue wavelength measurements for ECO VSF at 150 degrees
G100	Green wavelength measurements for ECO VSF at 100 degrees
G125	Green wavelength measurements for ECO VSF at 125 degrees
G150	Green wavelength measurements for ECO VSF at 150 degrees
R100	Red wavelength measurements for ECO VSF at 100 degrees
R125	Red wavelength measurements for ECO VSF at 125 degrees
R150	Red wavelength measurements for ECO VSF at 150 degrees

ECO BB measurements will result in four columns of data as defined in the *ECO* BB user's guides. WAP requires the BB signal to follow the form:

Lambda=N SF OF SWL DWL

Analog Meter Data

Analog ENGR0, where raw data is used as calibrated

ENGR0=N CL x = Raw—use raw output as calibrated output

Analog ENGR1, apply $x = (V-OF) * SF$

Signal=N SF OF CL

ENGR1= Generic Output

WETSTAR= WET STAR $\mu\text{g/l}$

Analog ENGR2, apply $x = (V-DC) / (RV-DC)$

Signal=N RV DC CL

ENGR2= Generic Output

CSTAR= %transmissivity

CSTAR10= m^{-1} for 10 cm CSTAR

CSTAR25= m^{-1} for 25 cm CSTAR

Analog ENGR3, apply $x = \text{Sig} * SF + OF$

ENGR3=N SF OF CL

Appendix B: WAP Meter Types

This Appendix lists all the Meter Types selectable in the Instrument Selection File window.

Off

Description	WAP will ignore all data for that channel.
--------------------	--

AC-9

Raw Data Processing	WAP will checksum validate each ac-9 data packet, saving all valid packets.
Engineering Units	WAP will checksum validate each ac-9 data packet and will apply device file offsets and internal temperature corrections, creating a WET View compatible *.DAT ASCII data file that does not contain reference values. This ac-9 option is used to create an output record with a uniform width data file suitable for additional data processing.
Device File Requirements	WET Labs ac-9 device file is required for both raw data processing and for conversion to engineering units

AC-9 w/Reference

Raw Data Processing	WAP will checksum validate each ac-9 data packet, saving all valid packets
Engineering Units	WAP will checksum validate each ac-9 data packet and will apply device file offsets and internal temperature corrections, creating a WETView- compatible *.DAT ASCII data file that does contain reference values on every 10 lines of data. This ac-9 option may be used to help the user perform 1 in 10 binning by keying on the extended length reference records.
Device File Requirements	WET Labs ac-9 device file is required for both raw data processing and for conversion to engineering units.

AC-S

Raw Data Processing	WAP will checksum validate each ac-s data packet, saving all valid packets.
Engineering Units	WAP will checksum validate each ac-a data packet and will apply device file offsets and internal temperature corrections, creating a WETView 7- compatible *.DAT File.
Device File Requirements	WET Labs ac-s device file is required for both raw data processing and for conversion to engineering units.

Analog

Raw Data Processing	WAP will identify and save <CR LF>-terminated ASCII records.
Engineering Units	WAP will identify <CR LF>-terminated ASCII records, apply calibration coefficients as defined in the Appendix A, and create a tab-delimited ASCII file with time stamps for each record.
Device File Requirements	An ASCII device file is required for both raw data processing and for conversion to engineering units.

ASCII

Raw Data Processing	WAP will identify and save <CR LF>-terminated ASCII records
Engineering Units	WAP will identify and save C<CR LF>-terminated ASCII records. (For processing ASCII data to engineering units, see the Misc_ASCII meter type.)

Time + ASCII

Raw Data Processing	WAP will identify and save <CR LF>-terminated ASCII records.
Engineering Units	WAP will identify <CR LF>-terminated ASCII records and save each record with a time stamp at the start of each record. (For processing ASCII data to engineering units, see the Misc_ASCII meter type.)

ASCII + Time

Raw Data Processing	WAP will identify and save <CR LF>-terminated ASCII records
Engineering Units	WAP will identify <CR LF>-terminated ASCII records and save each record with a time stamp at the end of each record. (For processing ASCII data to engineering units, see the Misc_ASCII meter type.)

Binary

Raw Data Processing	WAP will save every byte of data recorded in the archive file for this “channel.” Use Hex Output to view binary data as human-readable ASCII output.
Engineering Units	Same as Raw Data Processing

CTD-ENGR

Raw Data Processing	WAP will identify and save <CR LF>-terminated CT and CTD records.
Engineering Units	WAP will identify and process <CR LF>-terminated CT and CTD records, saving the data as tab delimited ASCII. Each record will start with a time stamp. If both temperature and conductivity are present in the raw data and salinity is absent, WAP will calculate the salinity and append it to the record.
Device File Requirements	An ASCII data processing device file (CTD parameters) is required for both raw data processing and for conversion to engineering units.

DMM 22-812

Raw Data Processing	WAP will identify and checksum validate DC V and DC mV records from a Radio Shack digital multimeter (DMM 22-812), convert the data to ASCII, and output the data as a time-stamped, tab-delimited ASCII record.
Engineering Units	WAP will identify and checksum validate DC V and DC mV records from a Radio Shack digital multimeter, DMM 22-812, convert the data to ASCII, and output the data as a time-stamped, tab-delimited ASCII record.

ECO

Raw Data Processing	WAP will identify and save <CR LF>-terminated ECO records.
Engineering Units	WAP will identify <CR LF>-terminated ECO records, apply calibration coefficients as defined in the Appendix A, and create a tab-delimited ASCII file with time stamps for each record.
Device File Requirements	An ASCII device file (ECO parameters) is required for both raw data processing and for conversion to engineering units.

GPS

Raw Data Processing	WAP will identify and save valid GPS records that conform to NMEA-0183 GGA, GLL, or RMC record types
Engineering Units	WAP will identify valid GPS records that conform to NMEA-0183 GGA, GLL, or RMC record types, and save the data in time-stamped, tab-delimited ASCII records

GPS-GGA	Same as GPS but only GGA records will be processed.
GPS-GLL	Same as GPS but only GLL records will be processed.
GPS-RMC	Same as GPS but only RMC records will be processed.

GPS-RMC-AO

Description	GPS-NMEA-0183 RMC records with an alternate output.
Raw Data Processing	Same as GPS, but only RMC records will be processed.
Engineering Units	WAP will identify valid GPS records that conform to NMEA-0183 RMC format and save the data in tab-delimited files as DDMMYY HHMMSS Latitude Longitude

Hex

Description	Outputs any data as Hex ASCII output.
Raw Data Processing	None
Engineering Units	For each sample interval, WAP will output a timestamp plus space delimited Hex ASCII output for all the data in the sample interval. This means that each byte of data is decoded into 2 bytes of readable text characters representing the hexadecimal equivalent of the binary data.

LISST-100, LISST-100 add TS

Description	Process data from the Sequoia LISST-100Raw Data Processing: WAP will record the LISST-100 data, starting with the “{” header.
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Misc ASCII

Raw Data Processing	WAP will identify, validate, and save <CR LF>-terminated ASCII records.
Engineering Units	WAP will identify and validate <CR LF>-terminated ECO records, apply calibration coefficients as defined in the Appendix A, and create a tab-delimited ASCII file with time stamps for each record.
Device File Requirements	An ASCII device file (Misc ASCII parameters) is required for both raw data processing and for conversion to engineering units.

SAFire

Raw Data Processing	WAP will checksum validate each SAFire data packet, saving all valid packets.
Engineering Units	WAP will checksum validate each SAFire data packet, apply device file offsets and internal temperature corrections, and create a tab-delimited ASCII data file. Each line of output will be terminated with a <CR LF>.
Device File Requirements	WET Labs SAFire device file is required for both raw data processing and for conversion to engineering units.

SAIV SD-204

Raw Data Processing	WAP will read and save valid SD-204 data records.
Engineering Units	WAP will read and validate SD-204 data records, saving the data with a time stamp, pressure, temperature, and conductivity (if present). If salinity is not present, WAP will calculate the salinity from the temperature and conductivity, appending it to the end of the record. Each line of output will be terminated with a <CR LF>.
Device File Requirements	None.

Satlantic

Raw Data Processing	WAP will read and save valid Satlantic data records.
Engineering Units	Using the Satlantic-supplied device files, WAP will process the data files for most Satlantic instruments, giving results directly comparable to Satlantic software output. Highly complex Satlantic instrumentation (such as the HyperOCR that interlaces dark count records with the sensor measurement records) can not be fully processed by WAP. For these instruments, select Satlantic Insert Time as the meter type and process the WAP output with the correct Satlantic post-processing software.
Device File Requirements	Satlantic instrument-specific device file(s).

SBE-16

Raw Data Processing	WAP will read and save all valid SBE-16 data records
Engineering Units	WAP will read and validate SBE-16 data records, converting the raw data to engineering units, saving the data with a time stamp as temperature, conductivity, and salinity. Each line of output will be terminated with a <CR LF>.
Device File Requirements	A Seabird SBE16 *.CON file is required for converting the raw data to engineering units.

SBE19

Raw Data Processing	WAP will read and save all valid SBE-19 data records.
Engineering Units	WAP will read and validate SBE-19 data records, converting the raw data to engineering units, saving the data with a time stamp as pressure, temperature, conductivity, salinity and converted analog measurements. Each line of output will be terminated with a <CR LF>.
Device File Requirements	A Seabird SBE19 *.CON file is required for converting the raw data to engineering units.

SBE19Plus-Raw

Raw Data Processing	WAP will read and save all valid SBE-19 Plus data records.
Engineering Units	WAP will read and validate the SBE-19 Plus hex ASCII data records, converting the raw data to engineering units, saving the converted data with a time stamp as pressure, temperature, conductivity, salinity and all converted analog measurements. Each line of output will be terminated with a <CR LF>.
Device File Requirements	A Seabird SBE19Plus *.CON file is required for converting the raw data to engineering units.

SBE21

Description	Raw hex ASCII data from a SBE-21 CT meter, with or without a remote temperature sensor and up to 4 voltage measurements.
Raw Data Processing	WAP will read and save all valid SBE-21 Plus data records.
Engineering Units	WAP will read and validate the SBE-21 hex ASCII data records, converting the raw data to engineering units, saving the converted data with a time stamp as temperature, conductivity, salinity, remote temperature and all converted analog measurements. Each line of output will be terminated with a <CR LF>. If one or more analog measurements are being made, the remote sensor must be turned on for WAP to process the data.
Device File Requirements	A Sea-Bird SBE21 *.CON file is required for converting the raw data to engineering units.

SBE25

Raw Data Processing	WAP will read and save all valid SBE-25 Plus data records.
Engineering Units	WAP will read and validate the SBE-25 hex ASCII data records, converting the raw data to engineering units, saving the converted data with a time stamp as temperature, conductivity, salinity, remote temperature and all converted analog measurements. Each line of output will be terminated with a <CR LF>. If one or more analog measurements are being made, the remote sensor must be turned on for WAP to process the data.
Device File Requirements	A Sea-Bird SBE25 *.CON file is required for converting the raw data to engineering units.

SBE25-Modaps

Description	Raw hex ASCII data from a SBE-25 CT meter, with or without a remote temperature sensor and up to 4 voltage measurements.
Raw Data Processing	WAP will read and save all valid SBE-25 Plus data records.
Engineering Units	WAP will read and validate the SBE-25 hex ASCII data records, converting the raw data to engineering units, saving the converted data with a time stamp as temperature, conductivity, salinity, remote temperature and all converted analog measurements. Each line of output will be terminated with a <CR LF>. If one or more analog measurements are being made, the remote sensor must be turned on for WAP to process the data.
Device File Requirements	A Sea-Bird SBE25 *.CON file is required for converting the raw data to engineering units.

SBE32 Carousel

Description	Raw hex ASCII data from a SBE-232 CT meter, with or without a remote temperature sensor and up to 4 voltage measurements.
Raw Data Processing	WAP will read and save all valid SBE-32 Plus data records.
Engineering Units	WAP will read and validate the SBE-32hex ASCII data records, converting the raw data to engineering units, saving the converted data with a time stamp as temperature, conductivity, salinity, remote temperature and all converted analog measurements. Each line of output will be terminated with a <CR LF>. If one or more analog measurements are being made, the remote sensor must be turned on for WAP to process the data.
Device File Requirements	A Sea-Bird SBE232 *.CON file is required for converting the raw data to engineering units.

Thermo-Bath D-Plus

Description	WET Labs internal use.
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WL-Flow

Raw Data Processing	WAP will add a time stamp to the WL-Flow meter output. The user can view the WL-Flow meter data and adjust instrument lag values during a second running of the WAP program
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XASCII

Description	WET Labs internal use.
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XMF

Description	WET Labs internal use.
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Revision History

Revision	Date	Revision Description	Originator
A	3/14/00	New document (DCR 39)	D. Romanko
B	7/11/00	Provide additional .TOS file handling explanation (DCR 44)	D. Romanko
C	3/20/01	Update data handling capability and add appendices (DCR 96)	D. Romanko
D	5/30/02	Revise document (DCR 134)	D. Romanko
E	6/5/02	Correct Voltage Scaling reference in Appendix E (DCR 227)	D. Romanko
E1	1/11/05	Draft—update to reflect software interface upgrades	D. Romanko
E2	4/15/05	Draft2—updates	D. Romanko, H. Van Zee
E3	6/12/06	Draft 3—update from 4.17 to 4.21—4.23 (software not complete)	D. Romanko, H. Van Zee
E4	6/19/06	Finalize update to GUI v. 4.23 (DCR 421) (approval pending)	D. Romanko, H. Van Zee