

Current Meter Counter
HydroMate
OPERATION GUIDE

AMENDMENTS

Issue No.	Description	By	Date	Checked	Date
1.0	Initial Release.	SL	19-Mar-02		
1.1	Added ft/s + km/day + battery state of charge gauge.	SL	4-Jun-02		
1.2	Added +/- to Fan formula + Clean screen function.	SL	24-Jun-02		
1.3	Changed Menu structure + Added display icons	SL	25-Jul-02		
1.4	Added Discharge Menu Items	SL	31-Oct-02		
1.5	Added communications to HydroMate Interrogator	SL	18-Nov-02		
1.6	Added full Alpha-numeric keypad + various others.	SL	4-Jul-03		
1.7	Appendix C added (Firmware Upgrade Instruction)	SL	25-Sep-03		
1.8 P	Appendix D + E added (Discharge Methods)	SL	21-Apr-04		
1.8 P1	Appendix F + Change Batteries Size	FG	28-May-04		
1.9	Changed battery access and programming socket	SL	20-Oct-05		
1.10	Added photographs showing battery removal AppC+G	SL	10-Nov-05		
1.11	Revised the implementation of WE-LB and WE-RB	SL	30-Nov-05		
1.12	Updated Appendix E example	SL	23-Apr-08		
1.13	Updated description of Discharge Methods	SL	6-Feb-09		
1.14	Modified drawings on Page 24, 25 and 26 + updated programming instruction in Appendix C	SL	26-Mar-09		

This manual applies to HydroMate Firmware Version 1.04.09. Changes and additions include:

- Fixed up the “Edit Old Discharge” menu – it now allows all distances to be edited correctly.
- The “Factor” parameter, entered in the Mean Section Waters Edge vertical, is applied to the outside segment.
- Allow for single verticals where “no” velocity observations are taken, to be entered in-between verticals where observations “are” taken. These allow an accurate picture of the river bed.
- Allow the distance from a reference point to the first vertical to be zero or non-zero.
- Corrected some of the Spanish abbreviations.

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1. INTRODUCTION

The HydroMate is a state of the art microprocessor based instrument used to measure the flow of water when used in conjunction with Hydrological Services Fans. The HydroMate operates as an autonomous unit allowing fan calibration formulas to be entered so that direct reading of river flow can be accurately measured without further reference to the calibration data supplied with the fans. The discharge of a river can be measured and plotted while in the field.

1.1 Mechanical Features

- Waterproof Case Dimensions :210mm x 170mm x 90mm
- Weight :1.5kg
- Operating Temperature :-5⁰C - 55⁰C
- Humidity :0 - 100% Waterproof
- Enclosure Rating :IP65

1.2 Electronic Features

- Graphics LCD and Touchscreen.
- State of the Art Design.
- Internal rechargeable batteries.
- Mains and car charger provide rapid and trickle charge.
- Standard connection of Fan.
- RS232 serial port for PC operated configuration.
- Calibration formulas for up to 32 Fans stored in non volatile memory.
- The discharge of up to 30 Sites can be measured.
(Up to 30 verticals per site and up to 11 points per vertical)
- Measures both instantaneous and average water velocity.
- Software can be easily upgraded as new features are made available.

2. MAINTAINENCE

The HydroMate does not require much maintenance, but a few simple precautions will ensure a long life for this product.

2.1 Battery Maintenance / Life

The HydroMate contains 2 x “D” size rechargeable batteries which have been chosen because of their excellent recharging characteristics. The internal smart charger keeps the batteries at optimal state of charge and performance.

The HydroMate product comes complete with a plug in mains charger and a cigarette lighter charger suitable for any 12V vehicle. Charging the batteries from completely flat to fully charged takes approximately 4 to 5 hours.

***** WARNING *****
DO NOT CHARGE THE HYDROMATE WHILE IT IS OPERATING !!
SWITCH OFF THE HYDROMATE AND THEN PLUG IN THE CHARGER

During normal operation, the HydroMate batteries do not need to be removed. When fully charged, the batteries will operate the HydroMate continuously for 20 hours with the backlighting off, and 5 hours with the backlighting on. (The backlighting can also be configured to switch on when the screen is touched, and switch off after a programmed time, say 10 secs. If backlighting is required, then this mode is optimal.)

2.2 Touchscreen Care

The touchscreen of the HydroMate is made from a polyester film material, and may be damaged if not treated with care.

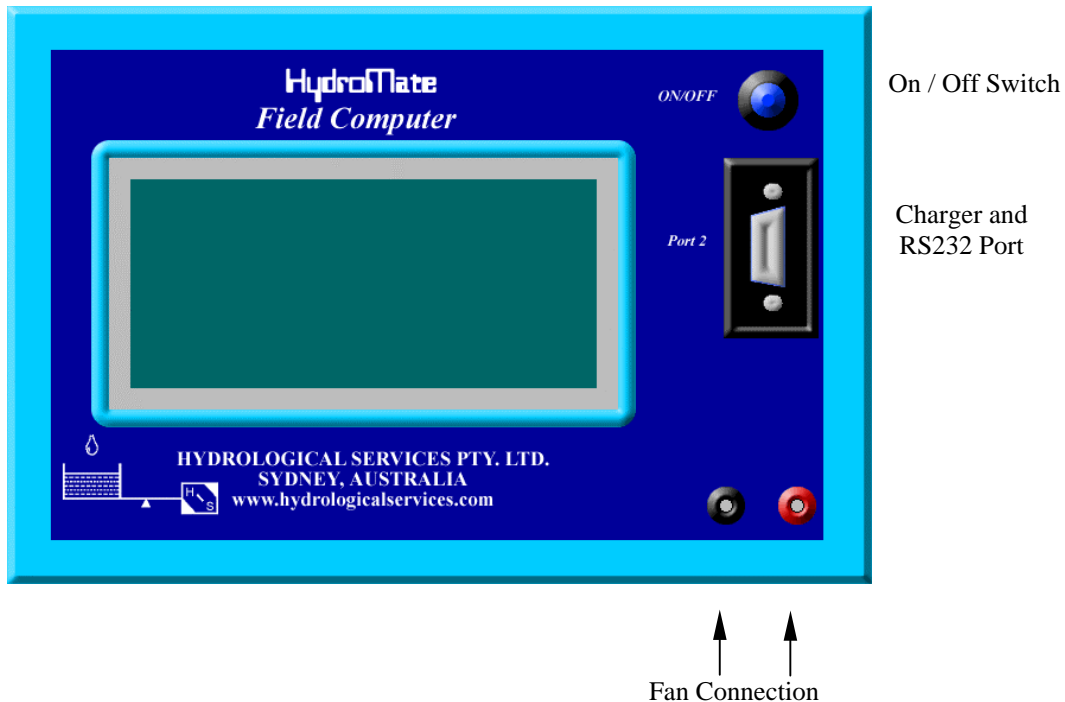
- DO NOT use a ball point pen or pencil or sharp object to touch the screen.
- DO NOT use excessive pressure when touching the screen.

A very light finger pressure is all that is required to perform a touch.

If the touchscreen becomes greasy or smudged, then either switch off the HydroMate or select the “Clean the Touch Screen” function in the “Measure...” menu, and wipe gently with a damp or dry soft cloth – DO NOT use any abrasive materials or cleaners to wipe the screen.

If the screen is extremely dirty, then ethyl alcohol may be used on a soft cloth.

3. EXTERNAL CONNECTIONS



3.1 Fan Connection

The fan connects to the HydroMate via a red and black “banana plug” style connector.

3.2 Charger Connection

Both the Mains and Car charger plug into the Port 2 socket.

3.3 RS232 Serial Port Connection

The RS232 Serial Port adapter also plugs into the Port 2 socket. This allows configuration via the HydroMate Interrogator Windows application operating on a PC as well as uploading of field data. Use a one to one DB9 Male to Female cable to connect to your PC. (These are available at your local PC store.)

3.4 Software Download Connection

The software download connection is now internal to the HydroMate. Remove the six screws on the bottom of the HydroMate, and carefully extract the electronics module. A special adapter cable, plugged into the Port 1 DB9 male connector, allows new software to be downloaded into the HydroMate from a PC, with the appropriate software and download files supplied by Hydrological Services.

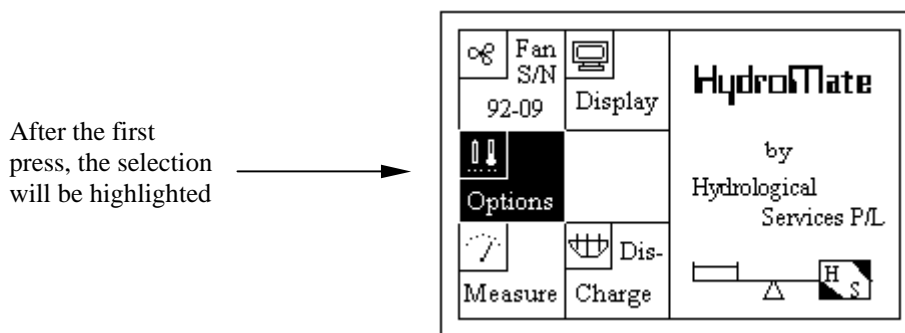
4. HYDROMATE OPERATION

4.1 Power Up/Down

The HydroMate is powered on by pushing the button located above and to the right of the LCD, and **holding it pressed until the display text starts to appear**. The HydroMate can be powered off at any time by pressing and releasing the same button again. The HydroMate has an auto power off feature that powers off the unit if the screen is not touched for 15 minutes – conserving battery power.

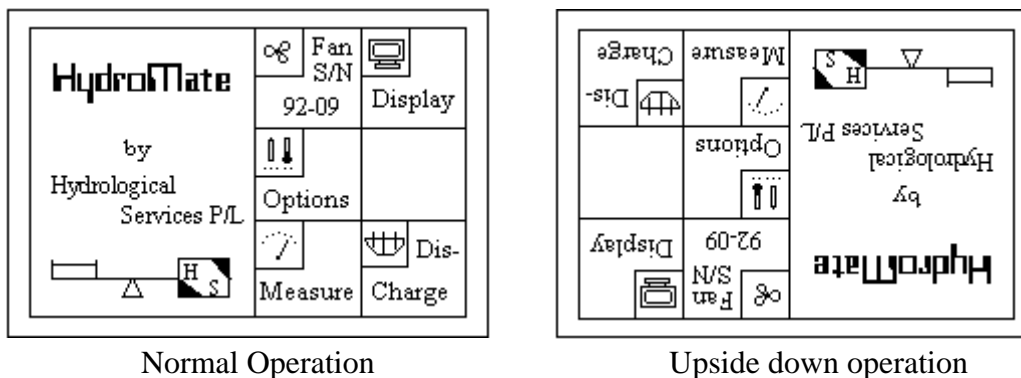
4.2 Touch buttons

The HydroMate does not have conventional buttons, but has touch buttons that are areas above buttons drawn on the LCD screen. A light touch with a finger on these areas will highlight them – a second touch will cause the function to be executed. (The “double touch” is similar to what most people are used to when using a mouse on a Personal Computer) Each touch of the screen also causes the internal sounder to beep.



4.3 Screen Orientation and Customisation

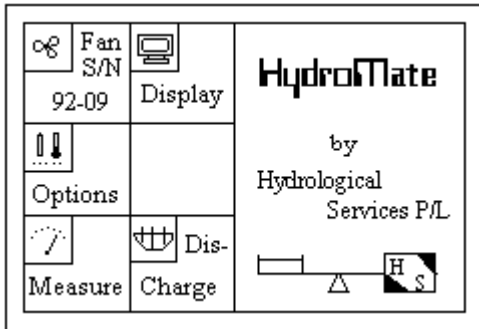
The HydroMate may be operated normally, when opened like a suitcase, or may be used with a strap around the operator’s neck, so that the operator’s hands are free to hold other equipment. Hence the information on the LCD screen may be flipped upside down to accommodate both modes of operation. (This is selected in the “Display” menu item “U/Down”.)



The LCD screen area is primarily split into 2 areas :

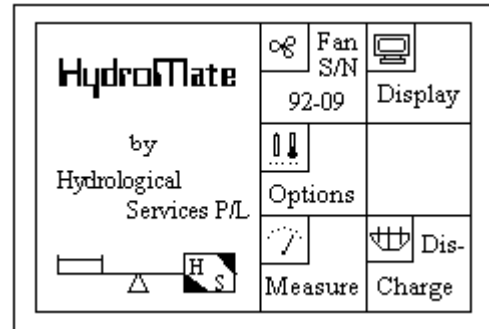
- an area for touching and
- an area for displaying information

The touch area of the screen can be changed to either the left hand side or the right hand side of the screen for left or right handed operators. (This is selected in the “Display” menu item “SwapL/R Sides”.)



Left handed operator

OR



Right handed operator

4.4 Menu Operation

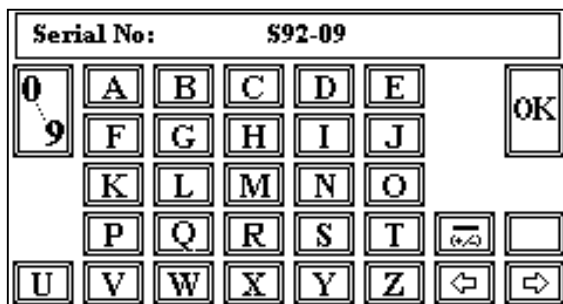
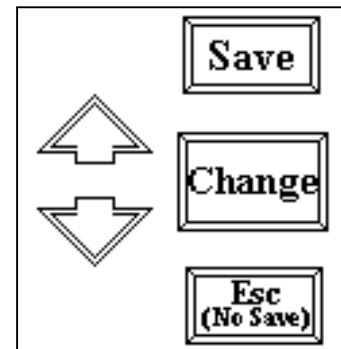
Each menu item will be described in detail as follows :

4.4.1 Data Entry

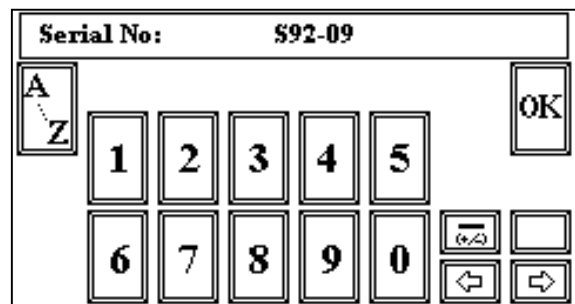
The method of entering data has been changed in this release of the HydroMate Firmware.

The “up” and “down” arrows allow an editable field to be selected – indicated by flashing inverse video. When “Change” is pressed, one of 3 options occur :

1. If the field has one of several discrete values, the value will cycle to the next available. (eg Cycle between m/s and ft/s)
2. If the field is numeric, then the numeric keypad will appear. (eg Water Gauge Height 12.745m)
3. If the field is alpha-numeric, then the alpha keypad will appear, with the option to switch to the numeric keypad with the 0-9 button. (Eg Fan Serial Number S92-09)



Full Apha Keypad



Full Numeric Keypad

Once all parameters on the screen have been changed, press the “Save” button to move on to the next screen.

Alternatively, if there are several pages of parameters, such as a Discharge, the up and down arrow buttons may be used to step off the top or bottom of the page to access the previous or next screen respectively. (This is particularly useful when performing a Discharge.)

The “Esc” (no save) button is used to Exit the operation and leave all parameters unchanged. When “Escaping” from a Discharge none of the parameters or collected data is saved.

(Note that a single press on a keypad enters a digit, rather than a double press as with menu items)

4.4.2 Fan

Selecting this menu item displays the calibration parameters for the selected fan, and makes available two more sub-menu items “New Fan” and “Edit Fan”. The calibration parameters are displayed in exactly the same format as supplied on the “Certificate of Calibration” by Hydrological Services when a Fan is purchased.

4.4.2.1 New Fan

This menu item will display a list of up to 32 Fans that the operator can select and customise with their calibration parameters. The “Up” and “Down” selection buttons allow a new Fan to be highlighted, and the pressing the “Select” button will return to the previous menu. (Note that a single press on these buttons, selects the item, rather than a double press)

4.4.2.2 Edit Fan

This menu item allows the **units** and calibration **parameters** to be customised by the operator. Flashing inverse video indicates where the cursor is, and the up/down arrow allows to cursor to be moved around the display. If the cursor is over the fan Units parameter when the “Change” button is pressed, then the allowed options will be displayed. If the cursor is over the fan Serial No when the “Change” button is pressed, then an Alpha keypad A-Z will appear allowing the Serial Number to be changed. The 0-9 button allows the operator to change to a 0-9 keypad so that full alpha-numeric data may be entered. Press the “OK” button when complete, to return to the parameter screen. If a numeric value is selected then only the 0-9 keypad will be available. When all parameters have been successfully changed, press the “Save” button. Alternatively, press the “Esc” (no save) button to return without changing any parameters.

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The calibration parameters (or formula) for a Fan has the following basic form :

(where n = Fan pulses per second and V = water velocity)

$n < 0.99$ $V = 0.1374 n + 0.0828$	$0.99 < n < 8.12$ $V = 0.1429 n + 0.0774$	$n > 8.12$ $V = 0.1510 n + 0.0116$
---------------------------------------	--	---------------------------------------

Three Step Formula

If the fan calibration has a two step formula :

$n < 4.21$ $V = 0.1374 n + 0.0828$	$n > 4.21$ $V = 0.1510 n + 0.0255$
---------------------------------------	---------------------------------------

Then enter the data as :

$n < 4.21$ $V = 0.1374 n + 0.0828$	$4.21 < n < 4.21$ $V = 0.1374 n + 0.0828$	$n > 4.21$ $V = 0.1510 n + 0.0255$
---------------------------------------	--	---------------------------------------

Two Step Formula

If the fan calibration is linear and has a one step formula :

$$\text{All } n \\ V = 0.1374 n - 0.0828$$

Then enter the data as :

$n < 5.00$ $V = 0.1374 n - 0.0828$	$5.00 < n < 5.00$ $V = 0.1374 n - 0.0828$	$n > 5.00$ $V = 0.1374 n - 0.0828$
---------------------------------------	--	---------------------------------------

One Step Formula

4.4.3 Display...

This menu makes available 4 display functions.

4.4.3.1 Contrast

This function shows an up and down arrow that allows the display to be made Lighter or Darker respectively, when the arrows are pressed repeatedly. Press the “Select” button to save the setting. (Note that this adjustment is temperature compensated – so that the display is always readable, even if the temperature reaches minus10°C)

4.4.3.2 Backlight

This menu allows the operator to set the backlight options. The backlight can be “Always On” or “Always Off” or “Auto-off after xx Secs”. The last option causes the backlight to turn on when the screen is pressed, and the backlight will stay on for 01 to 99 Secs. (The Auto-off mode is preferred as it conserves battery power, and still allows illumination of the LCD)

4.4.3.3 Display Upside Down

Allows the operator to turn the display upside down, so the unit can be worn with a neck strap for hands free operation.

4.4.3.4 Swap L/R Sides

Allows the operator to swap the menu from the left to the right side of the screen, or vice-versa. This allows easy operation for both left and right handed operators.

4.4.4 Options

Selecting this menu displays the Software Revision, the Time, the Battery Voltage and Internal Temperature and also makes available the “Display Units”, “Discharge Method” and “Set Clock” menu. Underneath the battery voltage display is a bar gauge that indicates the battery state of charge. This can be used as a rough indication of the battery condition. When at the “Low” end of the scale the operator should consider recharging the batteries. Note that the HydroMate will automatically switch off if the batteries are charging while the unit is operating.

4.4.5 DisplayUnits

This menu allows the displayed units in the Measure Menu to be changed. The resultant flow can be measured in m/s (meters per second) ft/s (feet per second) or km/day (kilometers per day). Simply double press one of the three selection buttons and the units will be changed.

Please note that the units of the fan parameters in 4.4.2.2 do not limit the displayed units. For example: The fan parameters can be entered in m/s but the water flow can be measured in ft/s. The HydroMate makes all of the appropriate conversions for you.

4.4.6 Discharge Method

This menu allows the operator to select the discharge Calculation Method. Either Mean Section or Mid Section methods may be selected. This option, once chosen, determines the method used in the Discharge menus for calculating the total discharge. See Appendix D for a detailed description of each method.

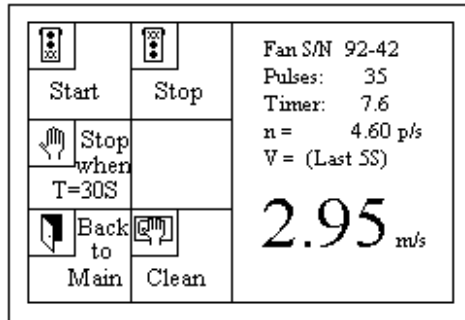
The Mean Section and Mid Section methods will yield slightly different discharge results for the same measured data. If the discharge method is changed, the Site Summary results of existing data WILL NOT automatically change! To see what difference would result in changing the “method”, you must select “Edit Old Discharge” and then step through the complete discharge to the end – the HydroMate will then recalculate the discharge based on the new “method”.

4.4.7 Set Clock

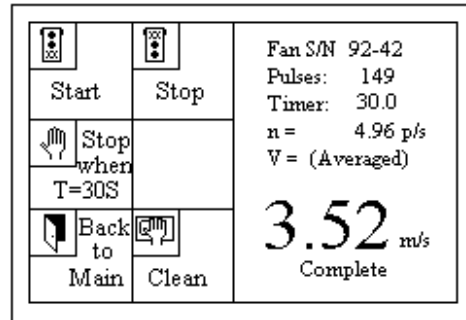
This menu allows the operator to set the time and date of the internal real time clock. Note that the RTC has separate battery backup, that continues when the HydroMate batteries go flat or are removed.

4.4.8 Measure

This menu allows a Current Meter measurement to be made. (When the next menu is entered, it is automatically ready to start a measurement.) A sounder beeps once for each revolution of the fan, the same as the other Hydrological Services CMC products.



During Measurement
(Instantaneous Speed
calculated over 5 secs)



After Measurement
(Average Speed
over test duration)

4.4.8.1 Start

When a measurement is started, the HydroMate sits waiting for the first pulse from the fan before the timer commences. During the measurement, the number of “Pulses” is displayed, along with the “Timer” and the calculated pulses per second “n”. The water Velocity displayed during the test is **not** calculated on these figures. Instead, the number of pulses over the previous 5 seconds of the test is used to estimate the instantaneous pulses per second and hence the instantaneous water speed. At the completion of the specified time (or pulses), the measured rate in pulses per second is used to calculate the average water speed over the duration of the test. (The calculation of the water speed is based on the selected Current Meter and it’s entered formula.) The units of water speed can be in m/s or ft/s or km/day. See section 4.4.5 for information on how to change the display units.

If only the instantaneous speed is required, then set the Auto Stop duration to 999 secs.

A measurement in progress can also be stopped and restarted by pressing the “Start” measurement button.

4.4.8.2 Stop

A measurement in progress is stopped immediately by pressing this button.

4.4.9 Stop when T=30S / P=30

This menu item allows the operator to decide when the pulse counting stops and the average water velocity is calculated.

4.4.9.1 Stop when >Time

The HydroMate will stop counting pulses when the time exceeds this number.

4.4.9.2 Stop when >Pulses

The HydroMate will stop counting pulses when the pulses exceed this number.

4.4.9.3 Set Limit

Allows the operator to set the time or pulse limit. Press the “Change” button and a numeric keypad will appear. Using the edit buttons, enter the number you require and press the ‘OK’ and then “Save” buttons.

4.4.10 Clean

This function disables the touch screen for 15 seconds so that it may be cleaned by wiping with a soft cloth. The display shows the 15 second timer counting down. The Measure menu is displayed when the clean screen function is completed.

4.4.11 Discharge

This menu item allows a Discharge measurement to be made. This is performed by taking water flow measurements at several “verticals” across the river section. This builds up a water flow profile from which the total Discharge is calculated.

The operator can “Select a Site”, “Edit old Discharge” (or continue adding data to an existing discharge), “Start new Discharge” (clears previous discharge data for this site and starts afresh) or “Plot” (displays vertical or discharge data for the selected site).

4.4.12 Select Site

This menu item allows the site data for a previously performed discharge to be displayed and “Plotted” if the operator so wishes.

4.4.13 Edit old Discharge

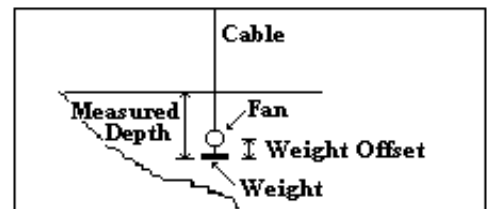
This menu item allows an existing discharge measurement to be edited, or more verticals added.

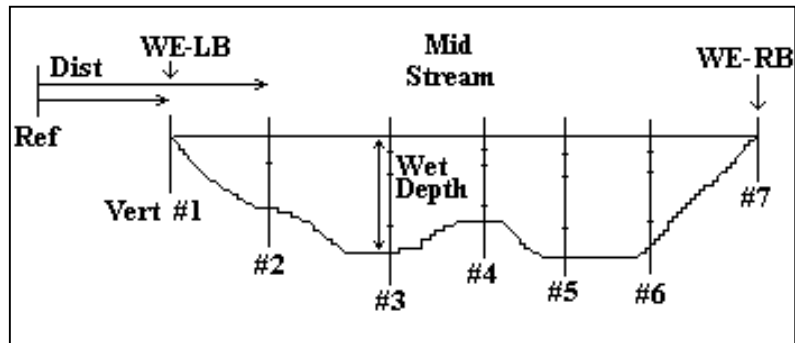
4.4.14 Start new Discharge

This menu item erases the discharge data for the selected site and allows a discharge to be commenced afresh. (Note that the “Units” and “Discharge Method” as set in the Options Menu are used in the discharge calculation. See Appendix D for a detailed description of the discharge methods.) The operator is first prompted to select one of 30 site positions, and then prompted to enter Site specific data.

Note that some data is used for reference only – and has **no** effect on the Discharge calculation (in its present form). Only the items marked with an “=” sign actually impact on the calculation.

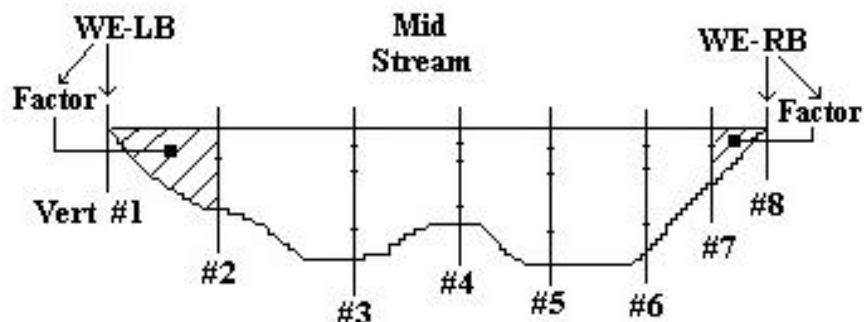
- Site name :** Enter a 20 character alpha-numeric string.
- Time & Date:** Automatically inserted when a discharge commences.
- Control:** None / Checked / See Notes
- Method :** Wading / Traveller / Cable / Boat / Bridge
- Rods:** Top Set / Cable / Bottom Set
- Measure:** Surface = 0 (Measurements are made from waters surface)
Bed = 0 (Measurements are made from the stream bed)
- Staff Gauge:** Enter gauge height when commencing measurements – optional.
- Weight Offset:** Offset from weight to center of Fan – future.
(Measurement point = measured depth – weight offset)
- Notes:** Enter a 15 character alpha-numeric string for later reference.





The operator is then prompted to enter data specific to each vertical :

- Type=** WE-LB / Mid Stream / WE-RB
 (WE-LB = Waters Edge Left Bank)
 (WE-RB = Waters Edge Right Bank)
- #Points=** Measurement points on this Vertical : 0,1,2,3,4,5,6,9,11
- Staff:** Enter Staff Gauge height – optional.
- Distance=** Distance across the river from reference point to this vertical.
- DryDepth:** Future.
- WetDepth=** Water Depth at this Vertical.
- WetAngle:** Future.
- Factor=** 100% / 90% / 66% / 50% / 33% (For this panel only)
 Based on the operators visual observation, a factor may be applied to the data in the panel calculations for this vertical. The default is 100%. The Factor is usually applied to the velocities on a vertical closest to the Waters Edge at each bank when using the Mean Section method. (It is not used in the Mid Section method)
- Notes:** Discrete notes may be selected.



(This diagram shows that the factor entered for the WE-LB and WE_RB is applied to the first panel on each side of the river.)

A menu then appears that allows the measurements for each point on the vertical to be taken. The operator is prompted with :

Vertical #	(Indication of which vertical operator is at)
Point #:	eg. 3/5 (point #3 where there are 5 points on this vertical)
0.20D:	1.25m (indicates measurement is at 0.20 of total Depth) (and operator should take a measurement at 1.25m from the bottom to the measurement point)
Last:	Indicates previous flow measurement (for reference only)
This:	Indicates this flow measurement (once taken)

The operator must press the “Start” menu item to start a measurement. The “Prev” and “Next” menu items allow the operator to step to other points on this vertical, or other verticals.

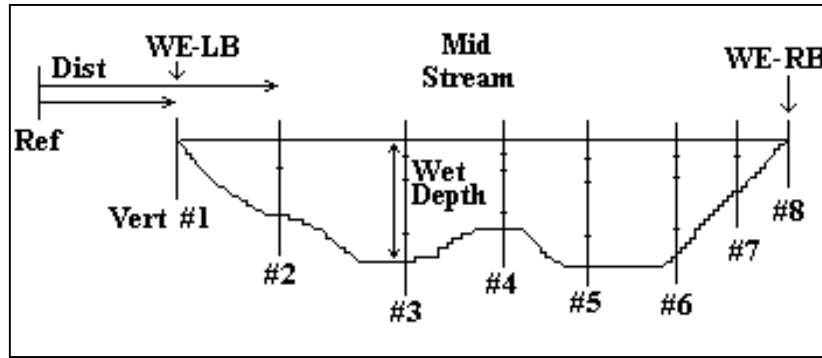
The “More” menu item allows the operator to select a new Fan, or set different stop criteria, or Plot data measured so far.

***** Note 1:** The discharge measurement should **commence** and **end** with a Type = WE-LB and / or WE-RB. When the discharge is completed with a WE-LB and/or WE_RB the discharge is calculated and the result posted on the summary page. This summary data is displayed when a site is selected.

***** Note 3:** When a site’s data is edited, the operator should step through to the end of the discharge data (that is the final WE-LB or WE-RB so that the summary data is also updated.

***** Note 4:** When a “New” Discharge is started, the Units set in the Options Menu are used with all future calculations for this discharge. If you different units are required, then select the new Units in the Options menu and start a New Discharge.

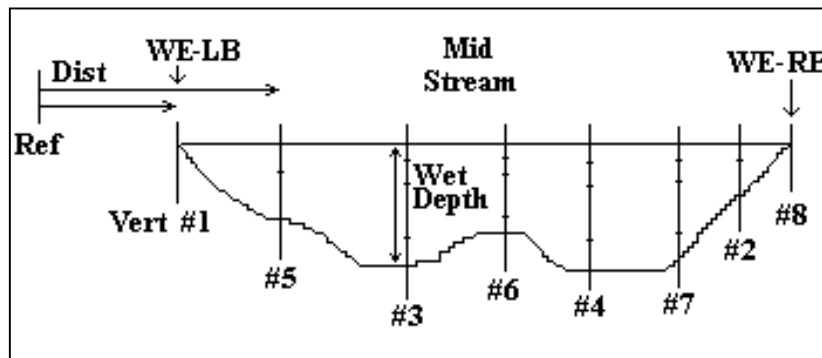
***** Note 5:** When a “New” Discharge is started, the Discharge Method (either Mid Section or Mean Section) set in the Options Menu is used to calculate the discharge.



This diagram simply shows the verticals where flow measurements are taken, and the Waters Edge Left Bank (WE-LB) and Right Bank (WE-RB). The latest version of HydroMate firmware (V1-04-09) allows the distance from the reference point to the first vertical (Waters Edge) to be zero or non-zero.

At the End of a Discharge, a button appears labeled **“Add new Vertical”**. The sketch on the previous page shows Waters-Edge Right Bank as Vert #7. When a new vertical is added, the data collected for WE_RB is moved to Vert #8 and a new Vert #7 is made available for new measurements.

NOTE : The verticals do not need to be in increasing order. The plot software sorts the verticals into order of increasing distance from the Reference point. The only requirement is that the first and last points should be the Waters Edge L/R Banks.



4.4.14 Plot

This menu enters a Plot submenu that allows the operator to “Plot a Vertical”, “Plot 2 adjacent Verticals”, “Plot next Vertical”, “Plot previous Vertical” or “Plot All” (which plots the river depth profile against the river flow and calculates the Overall Discharge.) The Plot Vertical menus also calculate the Mean Flow for the selected vertical, using the weighting factors shown in Appendix A.

Note that the “Plot” menu also appears within the “More” menu while performing a Discharge. This allows the operator to view the flow measurements progressively as a discharge is being performed.

5. HYDROMATE INTERROGATOR WINDOWS S/W

The HydroMate Interrogator software allows parameters to be set and data to be uploaded from and downloaded to the HydroMate via an RS232 connection to a PC.

The HydroMate Interrogator application requires a Pentium platform and will operate on Windows 95, 98, NT, ME, Win2000 and XP.

The CD also installs a PDF version of this HydroMate manual.

5.1 Installation

The HydroMate Interrogator software is installed by simply putting the CD into your PC. The installation software will commence automatically. Simply follow the on screen instructions.

To start the application go to Start – Programs – HydroMate – HydroMate Interrogator (Alternatively move a copy of the HS icon to your desktop for easier access.)

5.2 Selecting the Comms Port

Click on the comm port drop list to see which comm ports are available on your PC. Simply select the desired port and make sure a one to one DB9 cable is plugged from the PC comm port into the HydroMate. Click on the “Test Comms” button to check comms is OK.

(If the port you are expecting to use does not appear on this list, then maybe another application is using the comm port. Close HydroMate Interrogator, then close the application that is using the comm port. Restart HydroMate Interrogator and the comm port will appear on the drop list.)

5.3 Displaying / Setting the Time

Click on the “Get HydroMate Time” button to retrieve the time and date from the HydroMate. Click on this repeatedly and you will see the seconds incrementing. This verifies the clock is operating in the HydroMate.

If the HydroMate time / date is incorrect, select the correct time and date and click on the “Set HydroMate Time” button.

5.4 Current Meter Fan Details

Click on the “Get All Current Meter Details from HydroMate” button to retrieve the parameters for all 32 Current Meters configured in the HydroMate. This data may be viewed and / or edited on screen by selection the appropriate Current Meter using the left and right arrows.

The data can be saved to a file by clicking on the “Save All Current Meter Details to a File” button. The file is saved in an ascii format and can be viewed using Windows Notepad. (If editing the file, it is important to keep the data strictly in their columns.) The file is in csv format (Comma Separated Variables) and so if the name is changed to filename.csv then the file can be opened using Excel. (Note that HydroMate Interrogator will not be able to open the file once it is saved using Excel !!)

A saved file can also be retrieved by clicking on the “Get All current Meter Details from a File” button.

The Current Meter details can also be sent to the HydroMate “**one at a time**” by clicking on the “Set this Current meter Only to HydroMate” button.

Once your Current Meter details have been entered, it is wise to keep a file copy for easy download at a later date.

5.5 Discharge Data

The Discharge data collected while in the field can be retrieved and saved in a file on your PC. This data is uploaded one Site / Discharge at a time. Simply use the left and right arrows in the Discharge Data area of the screen to select the discharge number you wish to upload. Click on the “Get Present Discharge from HydroMate” button to upload the data.

This data can be saved to a file by clicking on the “Save this Discharge to a File” button. The file is saved in an ascii format and can be viewed using Windows Notepad. (If editing the file, it is important to keep the data strictly in their columns.) The file is in csv format (Comma Separated Variables) and so the file can be opened using Excel if the name is filename.csv. (Note that HydroMate Interrogator will not be able to open the file once it is saved using Excel !!) The data is grouped into 3 main areas with header descriptors to assist in identifying variables. The first 2 lines contain site description data. Then 30 blocks of data appear that define the data collected at each of the 30 verticals. The first 2 lines of this block contain data defining the vertical – and each of the following lines contain the measurements taken on the vertical.

Some of the parameters in the Discharge file are referenced by a number. See Appendix B for the translation table.

These files can be retrieved and sent back to the HydroMate for further editing using the “Get a Discharge from a File” button and the “Save this Discharge to HydroMate” button. Note that data may be retrieved from say “Site 0” and then saved to “Site 20” – so you can have duplicate sets of data saved on the HydroMate. The “Site Number” on the right hand side of the screen is used for both retrieving and saving Discharge data.

A conversion to translate data to “HydSys” format will be coming soon.

APPENDICIES

Appendix A Vertical Weighting Factors

The measurements taken at each point on a vertical are weighted by a factor as indicated in the following table. This weighted average is used as the flow for the vertical.

# Pts	1	2	3	4	5	6	7	8	9	10	11
1	0.6D										
1	100%										
2	0.2D	0.8D									
2	50%	50%									
3	0.2D	0.6D	0.8D								
3	25%	50%	25%								
4	0.2D	0.4D	0.6D	0.8D							
4	20%	30%	30%	20%							
5	Surfa c	0.2D	0.6D	0.8D	Bed						
5	10%	30%	30%	20%	10%						
6	Surfa c	0.2D	0.4D	0.6D	0.8D	Bed					
6	10%	20%	20%	20%	20%	10%					
9	0.1D	0.2D	0.3D	0.4D	0.5D	0.6D	0.7D	0.8D	0.9D		
9	11%	11%	11%	11%	12%	11%	11%	11%	11%		
11	Surfa c	0.1D	0.2D	0.3D	0.4D	0.4D	0.6D	0.7D	0.8D	0.9D	Bed
11	9%	9%	9%	9%	9%	9%	10%	9%	9%	9%	9%

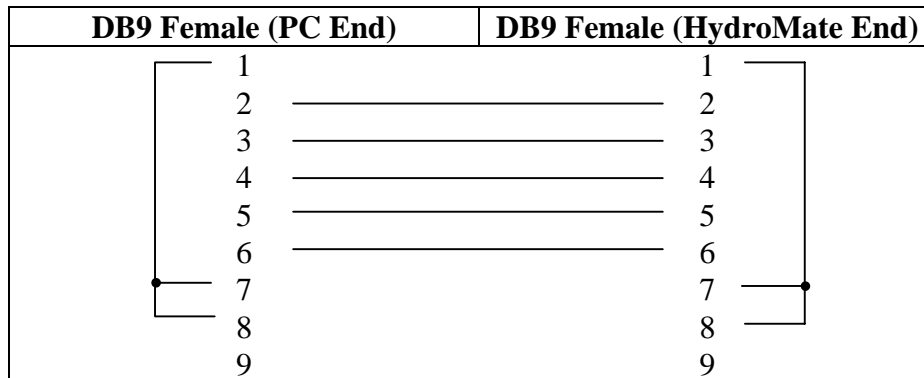
Appendix B Discharge File Translation

Some of the data in the Discharge File is referenced by a number. The following table gives the meanings :

Discharge Data Name	Number	Description
Control	14	None
	15	Checked
	16	See Notes
Method	7	Wading
	8	Traveller
	9	Cable
	10	Boat
	11	Bridge
Rods	4	Top Set
	5	Cable
	6	Bottom Set
Side	19	Up Stream
	20	Down Stream
MeasType	18	Bed = 0
	17	Surface = 0
Units	1	m/s (metres per sec)
	2	ft/s (feet per second)
	3	km/day (km per day)
DchgType	1	Mean Section
	2	Mid Section
Factor	24	100%
	53	90% (9/10)
	23	66% (2/3)
	22	50% (1/2)
	21	33% (1/3)
WE	1	WE-LB
	2	Mid Stream
	3	WE-RB
DNotes	25	All OK
	26	Pylon Close
	27	Rock Upstream
	28	Debris
	29	Change Fan

Appendix C Firmware Upgrade In The HydroMate

1. Ensure that the batteries are in a charged condition before you start. Make sure the HydroMate unit is "OFF" BEFORE YOU COMMENCE CHARGING.
2. Switch "ON" the HydroMate and press the "Options" button and note down the existing software version. Switch "OFF" the HydroMate. (This step is to verify the new software has been loaded, when you have completed all steps.)
3. The programming cable can be made as follows :



Note that the cable is symmetrical, so it doesn't matter which way around it is plugged in.



4. Turn the HydroMate upside down and remove the 6 screws. Carefully extract the electronics assembly.



5. Ensure that the HydroMate is OFF. Plug one end of the programming cable into your selected COMM PORT on your PC – and the other end of the programming cable into the HydroMate programming port located next to the batteries.

Programming port



Hydrological Services Current Meter Counter – HydroMate

*** **NOTE** *** : The third party utility “RFU.exe” has problems when operating through a USB serial port. **You must use a PC or Notebook with a traditional serial port !!**

6. Hydrological Services will supply the following files :
 - Rfu.exe - Application used to download the new firmware
 - coldload.bin - Bootstrap loader file
 - pilot.bin - Bootstrap loader file
 - HydroMateV1-04-xx.bin - Binary File to be downloaded into the HydroMate
7. Copy these file to your hard drive and double-click on "Rfu.exe".
8. Select "setup", "communications" and check that you have "serial option", "baud rate" is 115,200 and you have the wanted serial port, ie "comm 2" say. If all is correct, click on the OK button.
9. Select "setup" again and then "bootstrap loaders". Click on the “...” button next to Cold Loader and browse to find the file “coldload.bin” in the Rfu directory. Similarly click on the “...” button next to Pilot Bios and browse to find the “pilot.bin” file in the Rfu directory. Click on the OK button.
10. Select "file" and then "load flash image". Click on the “...” button on the right-hand side to browse and locate the binary file, "HydroMateV1-04-xx.bin" (xx changes with the firmware version) ***** **Don't click on OK yet !!!** *****
11. Press and **HOLD** the blue ON/OFF button on the HydroMate and now click on "OK". The upgrade process will commence. **CONTINUE** to **HOLD** the blue button **DOWN** until the progress bar shows that the upgrade is finished. It will take about a minute or so. If you make a mistake, simply release the ON/OFF button, and repeat from Step 10.
12. When the download is complete, release the blue button, and remove the cable from the Programming Port of the HydroMate. Test the HydroMate operates OK by pressing the blue button to power it up. If all is OK, power it off and carefully reinstall the electronics module making sure that the seal seats correctly around the enclosure flange. Replace the 6 screws and tighten firmly for a good watertight seal. Your HydroMate is now ready for use with the new Firmware installed.

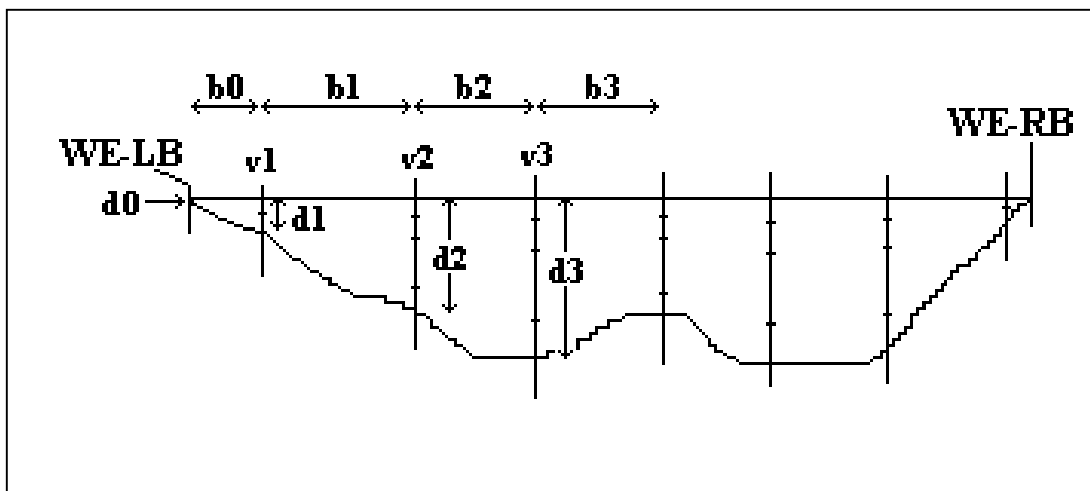
After you have used this software for the first time you will find you have a list of 1 or more files after you select "files". In this case all you do is click on the appropriate file you wish to upgrade to and the upgrade process will start.

Appendix D Discharge Calculation Methods

In both methods the mean water velocity in each vertical is calculated by using the weighting table shown in Appendix A. For example, if 3 water velocities are measured in a single vertical, they would be measured at depths of 0.2D, 0.6D and 0.8D. The mean velocity of this vertical would therefore be :

$$V_{\text{mean}} = (V_{0.2D} \times 0.25) + (V_{0.6D} \times 0.50) + (V_{0.8D} \times 0.25)$$

The following sketch shows a typical discharge with depth measurements $d_0, d_1, d_2, d_3, \dots$ taken at each vertical (note d_0 is the depth at the bank, usually zero, but may be non zero) – and the distance between the verticals $b_0, b_1, b_2, b_3, \dots$ calculated from the distance from the reference point - and the mean water velocity v_1, v_2, v_3, \dots calculated for each vertical.



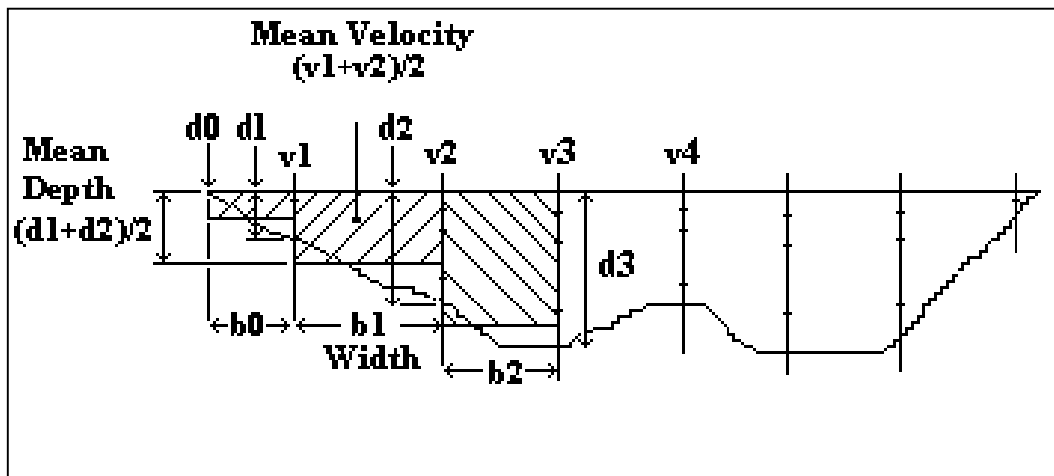
These measurements are then used to calculate the discharge using either the Mean Section method or the Mid Section method.

*** **PLEASE NOTE** ***

Each method will yield slightly different results, as described on the following pages.

Mean Section Method (From Australian Standard AS3778.3.1 ISO 748)

The cross section is regarded as being made up of a number of segments, **each bounded by two adjacent verticals** as shown in the following diagram.



The discharge of each segment is calculated as :

$$\text{Discharge of Segment} = \text{Mean velocity of Segment} \times \text{Mean depth of Segment} \times \text{Width of Segment}$$

$$q_{(0-1)} = (v_1 \times \text{Bank Factor}) \times (d_0+d_1)/2 \times b_0$$

$$q_{(1-2)} = (v_1 + v_2)/2 \times (d_1+d_2)/2 \times b_1$$

$$q_{(2-3)} = (v_2 + v_3)/2 \times (d_2+d_3)/2 \times b_2 \quad \text{etc...}$$

where

$$\text{Mean velocity of Segment} = \frac{\text{sum of mean velocity of bounding verticals}}{2}$$

$$= \frac{(v_1 + v_2)}{2}$$

$$\text{Mean depth of Segment} = \frac{\text{sum of depth of bounding verticals}}{2}$$

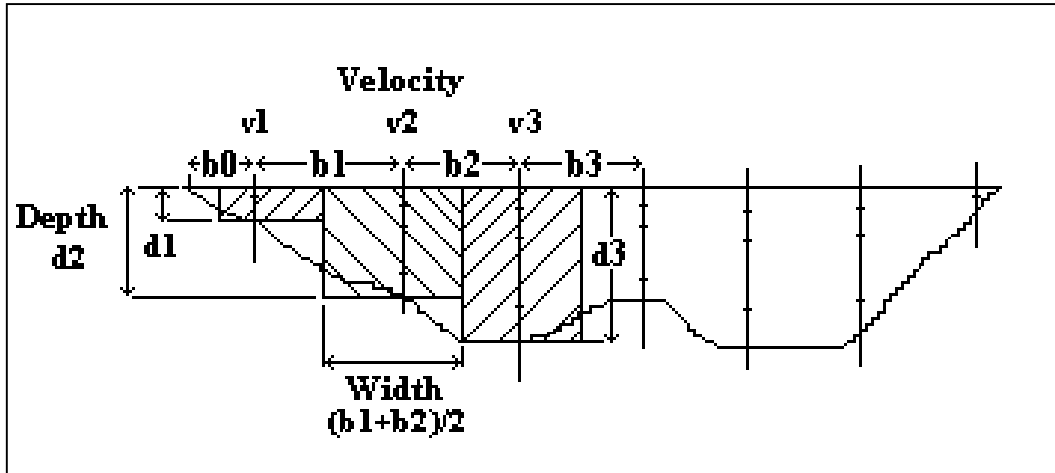
$$= \frac{(d_1 + d_2)}{2} \quad (\text{Note } d_0 = \text{Depth at Water Edge})$$

The total discharge is obtained by adding the discharge from each segment.

$$Q_{(\text{total})} = q_{(0-1)} + q_{(1-2)} + q_{(2-3)} + \dots$$

Mid Section Method (From Australian Standard AS3778.3.1 ISO 748)

The cross section is again regarded as being made up of a number of segments, however in the mid section method each segment is bounded by the midpoint of two verticals.



The discharge of each segment is calculated as :

Discharge = Mean velocity x Depth of x Mean Width
of Segment of Vertical Vertical between Verticals

$$q_1 = v_1 \times d_1 \times (b_0+b_1)/2$$

$$q_2 = v_2 \times d_2 \times (b_1+b_2)/2$$

$$q_3 = v_3 \times d_3 \times (b_2+b_3)/2 \text{ etc....}$$

where

$$\begin{aligned} \text{Mean Width} &= \text{sum of widths to} / 2 \\ \text{Between Verticals} &\text{ adjacent verticals} \\ &= (b_2 + b_3) / 2 \end{aligned}$$

The total discharge is obtained by adding the discharge from each segment.

$$Q_{(total)} = q_1 + q_2 + q_3 + \dots\dots\dots$$

Appendix E Discharge Examples

1. Discharge of a simple box section culvert (1.00m wide by 1.00m high)

Using the “Mean Section” method, enter the discharge vertical data as follows :
(Note that only the data critical to the calculations is mentioned in this example)

Type	#Points	Distance	WetDepth	Factor
WE-LB	1	0.01m	1.00m	100%
Mid-Stream	1	0.50m	1.00m	100%
WE-RB	1	1.01m	1.00m	100%

Area = 1.01 m² Width = 1.00 m Depth max = 1.00 m

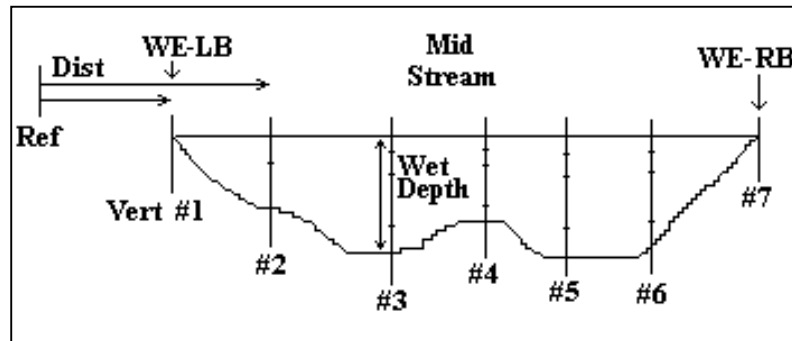
NOTE : A software bug has been discovered in the Hydromate Rev 1.04.04 and below. If the WE-LB “WetDepth” is non zero, then make sure that the “Distance” to the reference is also non-zero. This is a work around until the bug can be fixed. (A minor consequence is that the calculated area will be in error by 1%)

2. Discharge of a more complex Section – Step-by-Step

This example will be worked through step by step – indicating button presses.

When gauging, the hydrographer usually picks a reference point on a bank that doesn't change, such as a tree. The hydrographers tape measure is then secured to the reference point "Ref" and all measurements are taken from there. ("Ref" is not a vertical !!!)

***** NOTE***** : It is best to set the first WE-L/RB to have 0 samples – as in this example.



Steps :

1. Set Discharge Method to "Mean Section" in Options and Start a New Discharge.
2. Enter the Site Name eg. "HS-Tst1" Press "Save"
3. Vert#1 WE-LB #Points=0 Dist=1.00m WetDpth= 0.00m Press "Save" again
4. Vert#2 Mid-str #Points=1 Dist=1.50m WetDpth=1.00m Press "Save"
Press "Start" and take a sample
Press "Next"
5. Vert#3 Mid-str #Points=3 Dist=3.0m WetDpth=4.50m Press "Save"
Press "Start" and take sample 1
Press "Next" Press "Start" and take sample 2
Press "Next" Press "Start" and take sample 3
Press "Next"
6. Repeat step 5 for Vert#4,5,6
7. Vert#7 WE-RB #Points=0 Dist=8.0m WetDpth=0.00m Press "Save"

Summary Page is displayed : (Mean-Section)
 Area: 15.62m² (Calculated Cross sectional area)
 Wdth: 7.00m (WE-RB Dist (8.0m) minus WE-LB Dist (1.0m) = 7.0m)
 Dmax: 4.50m (Maximum water depth)
 Dchg: 21.63m³/s (Calculated Discharge)
 Vmn: 1.38m/s (Mean Flow)

8. Press "Save and Exit"

Appendix F Handling The HydroMate In The Field

Handling the HydroMate in the Field:

1. The HydroMate comes with a strap which allows the user to carry the unit by simply placing the strap around the neck. Figure 1 to 3 shows how to attach the clamp of the strap to the HydroMate lid.

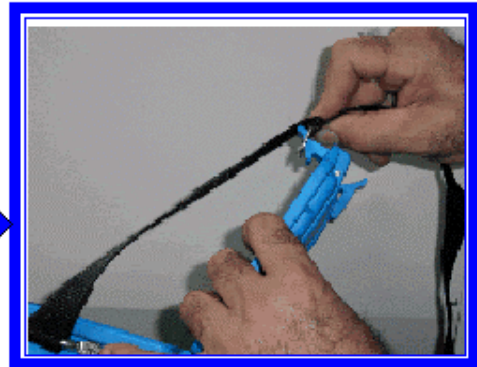


Figure 1



Figure 2



Figure 3

2. Figure 4 shows the HydroMate unit held around the user neck and ready to use in the field.

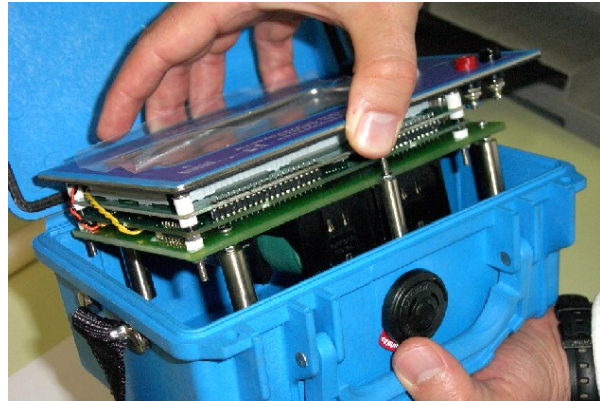


Figure 4

Appendix G Replacing the Batteries

The HydroMate is fitted with two NiMH rechargeable D cells. If by chance these batteries go flat while you are in the field, they may be temporarily replaced with standard alkaline D cells so that you can continue working without having to wait for a recharge.

Simply remove the six screws on the base of the HydroMate and carefully extract the electronics assembly.



Remove the two NiMH D cells from the battery holder, and replace them with two standard alkaline D cells. For the longest life, use good quality batteries such as Energiser or Duracell.



Carefully replace the electronics module ensuring the seal seats correctly around the enclosure flange. Replace the 6 screws and tighten firmly for a good watertight seal.

At the first opportunity replace the alkaline batteries with the original NiMH batteries and perform 3 consecutive charging cycles of 5 hours each – to ensure the batteries are at peak charge.

***** DO NOT** mix NiMH batteries and alkaline batteries in the HydroMate at the same time.

***** DO NOT** connect the battery charger while alkaline batteries are installed in the HydroMate – this will cause the batteries to leak and/or explode.