

# ***Probe for Windows***

***Irrigation Scheduling and Crop Management***

User Guide



**Research Services New England**  
8/16 Nicholson Street  
Balmain, NSW 2041, Australia  
T +61 (2) 9810 3563 F +61 (2) 9810 3323  
[www.rsne.com.au](http://www.rsne.com.au)  
[support@rsne.com.au](mailto:support@rsne.com.au)

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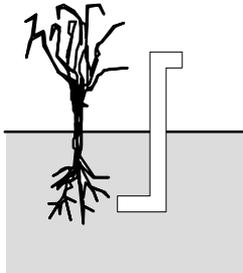
### **Disclaimer**

Research Services New England and its agents accept no responsibility for any irrigation, crop or soil management decisions made by the user as a result of using this software.

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## Introduction



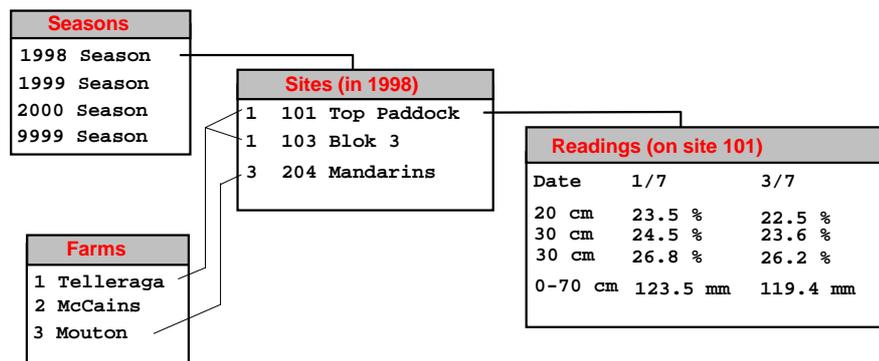
**Probe for Windows** is a *periscope*, a *virtual test pit*, that allows users to examine that most important resource - the soil. It is a tool which shows the processes that are occurring within the soil profile. Irrigators know their fields on the surface, but the sub-surface is often a mystery. Yet this area, the root zone, is the 'factory' for crop production. The more you can learn about conditions in this soil zone the more you can improve your whole operation.

**Probe for Windows** allows more accurate and informed decision making, scheduling irrigations to ensure that the soil water content is at the optimum level for plant health, maximum yield and quality. The aim is to use water more efficiently and identify problems such as through-drainage, soil compaction and waterlogging. Fields can be ranked from driest to wettest, allowing users to coordinate water delivery both to the farm and within the farm.

**Probe for Windows** provides farmers, growers and researchers with the means to easily combine soil moisture, weather, and any other soil and crop data, and to plot any of these items on the same graph. The data can be from data loggers; downloaded from main-frame computers; or it can be as simple as fruit size manually entered by the user. Relationships between plant, weather and soil can be examined in detail to improve the quantity and quality of the crop, and the efficient use of water.

## Seasons

The data is organised in Seasons, within each season are Sites, and at each site there are Readings taken on different dates.



# Introduction

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## Farms

Sites can be allocated to Farms, so that results can be printed with farm details.

## Sites

Neutron probe access tubes are normally installed in groups of three, and each group is referred to as a **site**. Each site is given a **site name**, such as 'Field 11', and a unique **site number** that is entered into the neutron probe when readings are recorded in the field.

## Neutron probe

The neutron probe is the 503DR from CPN Corporation, Martinez, CA, USA. The probe is taken from site to site, and the soil moisture measured and recorded in the data logger in the probe. When all readings have been taken, the data is transferred (see Uploading) to a computer with an RS232 cable, and posted (see Post Readings) to the corresponding site.

## Gains

Irrigation and rainfall amounts that have been applied to each site need to be posted (see Post Gains) so that the water balance and daily water use of the crop can be calculated.

## Entering user data

The software is shipped with a 'season' of sample data. When you are ready to enter your own data, use **SeasonMenu/New** to create a new season, and then **SiteMenu/New** to create all the sites for the new season.

## Installation

Insert the CD or disk 1, and run **SETUP.EXE**.

A new directory (default= **C:\PRWIN**) will be created for the programme and the data files. No changes will be made to the computer configuration. For **W3.1** a programme group with three icons and an **UnInstall** facility will be created; for **W95+** three menu items and an icon will be created.

An RS232 port is required to upload from the neutron probe.

A security key, or dongle, needs to be plugged into the printer port, and the printer cable then plugged into the back of the key. The software will run normally without the key (uploading, viewing and printing graphs and data) but new readings will not be saved. The key can be configured to use other printer ports, and an electronic key is also available - see Security

**Prwin** can display in various units - cm, inches or feet for example - see Display Units.

## Support

Free telephone support for the software is provided for one year.

A free email listserv is available – send questions to...

`<rsne-1@rsne.com.au>`

To subscribe, send an email to...

`<majordomo@rsne.com.au>`

With the message...

`SUBSCRIBE rsne-1`

The archives of the listserv are available at...

`http://www.rsne.com.au`

Software updates and other files for downloading are at...

`http://www.rsne.com.au/prwin/upgrades.htm`

### **Research Services New England**

email: `support@rsne.com.au`

tel: +61 (2) 9810 3563 fax: +61 (2) 9810 3323

Australia: **Irricrop Technologies (a Division of Selby Biolab)**

email: `support@irricrop.com.au`

tel: 13 29 91 fax: 1800 067 639,

Africa: **Cape Irrigation Consultants**

email: `cicgpsa@iafrica.com.au`

tel: +27 (21) 855 3833 fax: +27 (21) 855 3671

Europe: **Agritech**

email: `agritech@compuserve.com`

tel/fax: +44 (1767) 62 7334

Americas: **CPN**

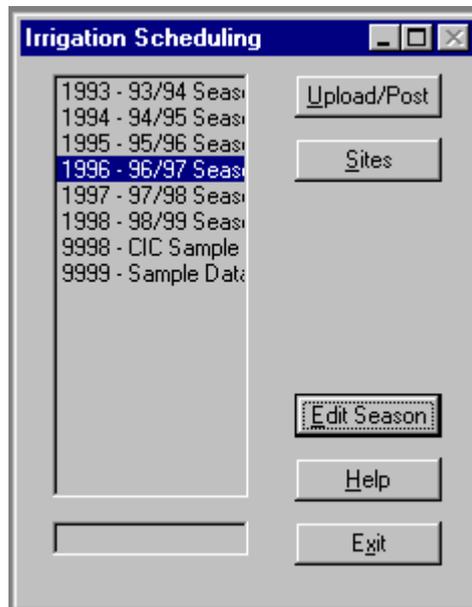
email: `cpn@cpn-intl.com`

tel: +1 (925) 228 9770 fax: +1 (925) 228 3183

# Seasons

## Seasons

Each 'season' is all the readings taken in any one growing season. A 'season' of sample data is included so that you can explore the programme.



Each year a new season can be created with **SeasonMenu/New**.

The data for each season is stored in a single file (eg 2000DATA.MDB). This entire file should be copied to tape or disk for backing up. (see Backup)

### Edit Season

Use **SeasonMenu/Edit** to edit existing seasons, and **SeasonMenu/New** to create new seasons.

The season number has to be unique (and is normally the actual year), but there is no reason why it couldn't be any number. For example, some consultants who work in different countries call the seasons for one country '1997', '1998', etc, but for another country '1898', '1899' etc. The season name can be any text you like – it appears in the list of seasons so that you can choose a season. Any season data item can be changed at any time, but if the name of the data file is changed you will need to ensure that the new file exists and is a valid season MDB file (use <CheckMDB>).

### Delete Season

When a season is deleted, the data file for that season is *not* deleted. If the data is not required, **FileManager** or **Explorer** should be used to delete the data file.

### New Season

Use **SeasonMenu/New** to create a new season.

When a season is created, **Prwin** makes a new season in the list of seasons, and also creates a data file (in Microsoft MDB format) ready for the season's data. You can either...

1. Create a new, empty, season data file.
2. Create a season data file, and then copy into it all the sites from an existing season, together with the full and refill points.

3. Do not create a file.

First time users would normally be choosing 1, and in the following years will be choosing 2. (3 can be used to incorporate somebody else's data into your system.)

The season number has to be unique (and is normally the actual year), but there is no reason why it couldn't be any number.

The suggested name of the data file is **YYYYDATA.MDB** (where **YYYY** is the season number), but it can be any valid file name.

The season **Name** and **Comments** can be used in reports.

Choose the **Sites Screen Configuration** you want for the season. The sites screen can be customised, and a new screen configuration can be chosen at any time. Configurations can be edited and created with **ProbeMenu/SystemOptions**.

**Connect** allows for other database formats, such as **dBase** or **Paradox** - contact RSNE for details.

## Incorporating other data

To incorporate data from another copy of **Prwin** into your system...

1. Copy their season **YYYYDATA.MDB** file to your computer - the file name may need to be changed so it does not conflict with any of your season files.
2. Create a new season, but choose '**Do not create file**'. Give the season a number that does not conflict with your seasons, and enter the name of the MDB file
3. After you have entered the file name, use **<CheckMDB>**. to check the file is valid.

## Advanced

Season data files can be created and copied independently of creating a new season.

Each season data file also needs to access data (calibrations, farms, groups, etc) from other MDB files used by **Prwin**. The links for all the season files are automatically checked every time **Prwin** starts, but they may need to be refreshed manually using **<CheckMDBFile>**.

If the software is upgraded it may also be necessary to use **<CheckMDBFile>**, as various additional checks are made on the data file, adding any new required data fields to the tables.

# Farms

## Farms

Farms can be created and edited using *FarmMenu/Edit*. Each site can be allocated to a farm, using *SiteMenu/Edit*.

The screenshot shows a database form titled "ALLSEAS.MDB:FARMS". The form contains the following fields and controls:

- Number: 900
- Name: Farm 900
- Owner: Anne Walden
- Comments: (empty text area)
- Address: (empty text field)
- Address 2: (empty text field)
- Town: Tomahawk
- State: (empty text field)
- Code: (empty text field)
- Country: Australia
- Telephone: (03) 6355 1234
- Telephone2: (empty text field)
- Fax: (empty text field)
- Mobile: (empty text field)
- Email: anne@rsne.com.au

On the right side of the form, there is a list box containing the following items:

- 900 - Farm 900 (selected)
- 901 - Turf Grass Examp
- 902 - Onion Example
- 903 - Telleraga Examp
- 904 - Telleraga Examp
- 905 - Grapes Example
- 906 - Tomato Example
- 907 - Wemen Grapes
- 908 - Myall Vale Weath
- 950 - Motorgate
- 951 - A B C Blocks
- 952 - Oak Valley Estate
- 953 - Twaalfontein
- 954 - Morning Start Tru
- 955 - Valley Green Trus

Below the list box are several buttons: Refresh, New, Delete, Save, Cancel, Help, and Close.

Each farm has a **number** (which must be unique), and other details such as name, address and telephone numbers, can be entered. The farm name is displayed on the sites screen, and other farm details can be printed on reports.

The sites that are displayed on the sites screen can be filtered to only show sites on one farm.

Farm numbers and other details can be changed at any time.

## Sites

A **site** is a physical location that has data recorded about it. There could be one site in a field, or many sites. Data from a single site can be used to control more than one irrigation unit (see Export).

Each site has its own table of readings data, stored in an MDB data file. There is normally one MDB file for each season; containing the **SITES** table of summary data about each site, and also separate tables for the readings for each of the sites.

Data recorded on other data loggers can be imported and the data posted to sites (see Import).

## Sites Window

Use **SiteMenu/Show** to display the sites screen. All the sites in the current season are displayed, together with the latest data from each site.

Sites															
	Farm Name	Site Num	Site Name	Full mm	Refill mm	SMD mm	FAW mm	Balance mm	Last-Date	-Probe mm	Probe mm/day	Predict Date	Amount mm	Estimate mm/day	Predict Date
<input checked="" type="checkbox"/>	Turf Grass Exam	94101	Buff Grass	218.1		218.1	218.1	-152.0				7/4	66.1		10/4
<input type="checkbox"/>	Telleraga Exam	94316	FIELD 16	315.3	236.8	146.1	78.4	-67.7	20/11	169.1	2.1	22/4	10617.7		
<input type="checkbox"/>	Telleraga Exam	94416	FIELD 16	315.8	222.8	45.9	92.9	47.0	25/1	269.8	3.1	9/2	92.9	7.0	1/2
<input checked="" type="checkbox"/>	Wemen Grapes	94701	BE101	189.5	139.9	22.7	49.6	26.9	12/3	166.8	1.9	26/3	49.6	3.4	18/3
<input type="checkbox"/>	Wemen Grapes	94702	BE102			0.0	0.0	-183.4				27/4	27.9		28/4
<input type="checkbox"/>	Myall Vale Wea	94187	Myall Vale 96/87			0.0	0.0	-347.8	27/10		0.0	12/11	141.8		12/11

Using the drop-down at the top of the screen the list can be filtered to only show the sites for a single farm.

Additional filtering can be done with **SiteMenu/Where**, to display, for example, only those sites that are close to their refill point. ((CRNTAMT-REFILL)<50)

The order of display can be set with **SiteMenu/Sort**. The order can be by farm; by site number; by predicted irrigation date; or by any other data item. The major sort could be by farm, and then the sites in each farm ranked by predicted irrigation date.

The season can be changed using the drop-down at the top of the screen.

Different screen configurations can be chosen at **screen configuration** on **SeasonMenu/Edit**. Configurations can be customised by editing the file **SCRITEMS.TXT** with **ProbeMenu/SystemOptions**. (see System Options)

Use **SiteMenu/New** to create a new site, and **SiteMenu/Edit** to edit existing sites.

## Sort Sites

Sites can be sorted by farm and site number, by predicted irrigation date, or by any other field on the sites screen. The current sort is saved and will be used next time you use **Prwin**.

## Delete Site

Users will be prompted if they also want to delete the table containing the actual readings.

# Sites

## Edit Site

The data for each site is described below - any of the items can be changed at any time, although users will be asked to confirm changes to the site number or table name.

## New Sites

Each site has a **number** that must be unique, and a **name** (which can be anything...).

The screenshot shows the 'Edit Site' dialog box. The 'Farm' dropdown is set to '901 - Turf Grass Example'. The 'Site number' is '94101'. The 'Site name' is 'Buff Grass'. The 'Crop' is 'Turf'. The 'Planting date' is '5/1/81'. The list on the right shows various site names and numbers, with '94101 - Buff Grass' selected. The 'Total: 63 sites' label is visible. The 'NewSite' tab is selected at the bottom.

The site number is the **same number** that is entered into the neutron probe in the field. To easily identify sites users could consider a site numbering system such as FarmNumber + SiteNumber. For example, farm 4, site 5 would have a site number of 405.

When a new site is created all the data about the site (except the site number, which has to be different for each site) is initially filled in for you, which makes it very easy to create many new sites that are similar. The initial data for each new site can come from either...

- A **template** site.

or...

- The **last site** created or edited.

Choose which method you prefer on the tab **NewSite**. As shipped, the 'template' is set to be site 999 in **SAMPLE.MDB**, but it can be changed to any other site.

The site should be allocated to a **farm**, which must have already been created (see Farms).

If the **planting date** is entered it can be used to set the scale of time graphs (see Graph Scales).

## Depths

The depth (20cm, 30cm etc) that each reading is taken with the neutron probe should be entered, and also the soil horizon (calibration equation) number to be used at each depth (see Calibrations)

## Root Zones

The volumetric soil water contents (VSW) measured at the various depths are summed (integrated) to calculate the total water content in three depth ranges, or root zones. The **top** and **bottom** of each of these zones need entering.

	Root Zone 1	Root Zone 2	Root Zone 3
Top	0 cm	25 cm	70 cm
Bottom	70 cm	70 cm	110 cm

Top 0 cm

Bottom 200 cm

The integration uses the actual depths each reading was taken, with linear interpolation of VSW between depths - see Update Readings.

Above the top reading (typically at 20cm) *Prwin* assumes the VSW is constant and equal to the top reading. Below the bottom reading *Prwin* assumes the VSW is constant and equal to the bottom reading.

The rate of change of water in **Root Zone 1** is calculated and displayed as **probe daily water use** (PDWU) – see Update Readings.

## Irrigations

In order to calculate required irrigation amounts *Prwin* needs to know the area of each site, and the irrigation water delivery rate - see Scheduling for details.

## Files and Table Name

The name of the table where the readings for this site will be saved defaults to **SITEEnnnn**, where **nnnn** is the site number.

The name of the MDB file where the table will be located is normally *blank*, and *Prwin* will save the readings in the season's MDB file (with the **SITES** table). This will give a single MDB file for a season, which means that just one file needs copying for archiving and backup (see Backup). However, if an MDB file *is* entered *Prwin* will save the readings tables in their own individual MDB files.

# Sites

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When the site is created by *Prwin*, an empty table is created ready to receive the new data. The table structure is copied from a template table called **ReadingsTemplate**, stored in **PRWIN.MDB**. If the structure of this template file is changed, all sites created in the future will be based on the new readings template.

## Readings

The readings screen is displayed with *ReadingMenu/Show*.

TYPE	Full	Refill	Irrigation	Probe	Probe	Probe	Estimate	Irrigation	Probe
DATE			21/Feb/92 21:00	23/Feb/92 11:00	29/Feb/92 11:00	7/Mar/92 11:30	10/Mar/92 7:55	10/Mar/92 8:00	12/Mar/92 14:00
20 cm	20.8	12.5	34.0	20.9	16.1	13.8	12.8	25.1	16.5
30 cm	25.6	16.6	-14.0	26.1	20.5	18.0	17.0	18.4	21.6
40 cm	31.5	23.1	60.0	32.3	27.0	24.7	23.8	20.0	27.8
50 cm	32.7	27.0		34.0	30.1	28.5	27.9		30.2
60 cm	31.8	28.0		33.8	31.6	30.6	30.2		30.6
80 cm	30.6	29.1		32.5	31.3	30.6	30.3		30.4
100 cm	30.1	28.9		31.8	31.4	30.8	30.6		30.6
120 cm	27.8	27.5		30.7	30.6	29.9	29.7		29.8
<b>0-70 cm</b>	<b>189.5</b>	<b>139.9</b>	<b>203.5</b>	<b>195.3</b>	<b>165.1</b>	<b>151.6</b>	<b>146.1</b>	<b>171.1</b>	<b>166.8</b>
25-70 cm	137.5	108.7		143.1	124.9	117.1	114.0		125.6
90-130 cm	115.8	112.8		125.2	124.0	121.5	120.5		120.8
Deficit	0.0	49.5	-14.0	-5.8	24.4	37.9	43.4	18.4	22.7
ProbeDwU			3.2	5.2	5.0	1.9	1.9	1.9	1.9
EstimatedDwU			5.6	4.5	4.3	3.6	2.0	2.0	3.4
SHOOT									
BERRY				3908					
AVERAGE				300					
SHOOT AVERAGE									

The readings are displayed with time running from left-to-right, each column corresponding to a **date**. Navigate using the scroll bars, or with the normal keyboard navigation keys. <Ctrl+Home>, <Home>, <End>, <PgUp> and <PgDn> can also be used.

Data can be viewed with the readings screen, and can also be changed. Click on any cell, and type in the new value.

A right mouse click will give a pop-up menu.

### Sort Readings

Readings are normally sorted by date, but can be sorted by any other row of the readings screen with *ReadingMenu/Sort*. After doing an update with *ProbeMenu/Update*, the readings will always be sorted by date.

### Delete Columns

Reading column(s) can be deleted by clicking on a column and using *ReadingMenu/Delete*, or use a right mouse click.

Either a single column; or all readings after or before a specified date; or all columns of a certain type can be deleted.

### Average Columns

Readings that have been posted 'separately' will appear in the readings screen as 'Tube1', 'Tube2', etc. The average of the tubes can be calculated and a new 'Probe' column inserted, giving the same result as if the readings had been posted 'Averaged' (see Post Readings). The original 'Tube' columns can be optionally deleted.

# Readings

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## Counts

Use *ReadingsMenu/Counts* to display the actual count from the neutron probe, and also the serial number of the probe used to take the measurements - see Calibrations for more details.

## Make Full and Refill

A reading on a particular date may be identified as the full point - the maximum water holding capacity (see Full and refill points). Click on that column, and then use *ReadingMenu/Make Full* (or use a right click) to copy the data to the full column. The readings screen will be automatically updated.

Similarly for the refill point.

## Effective Irrigation

Use *ReadingsMenu/CalculateEffective* (or a right mouse click) to calculate the effective gain (see Update Readings for details).

## Readings Options

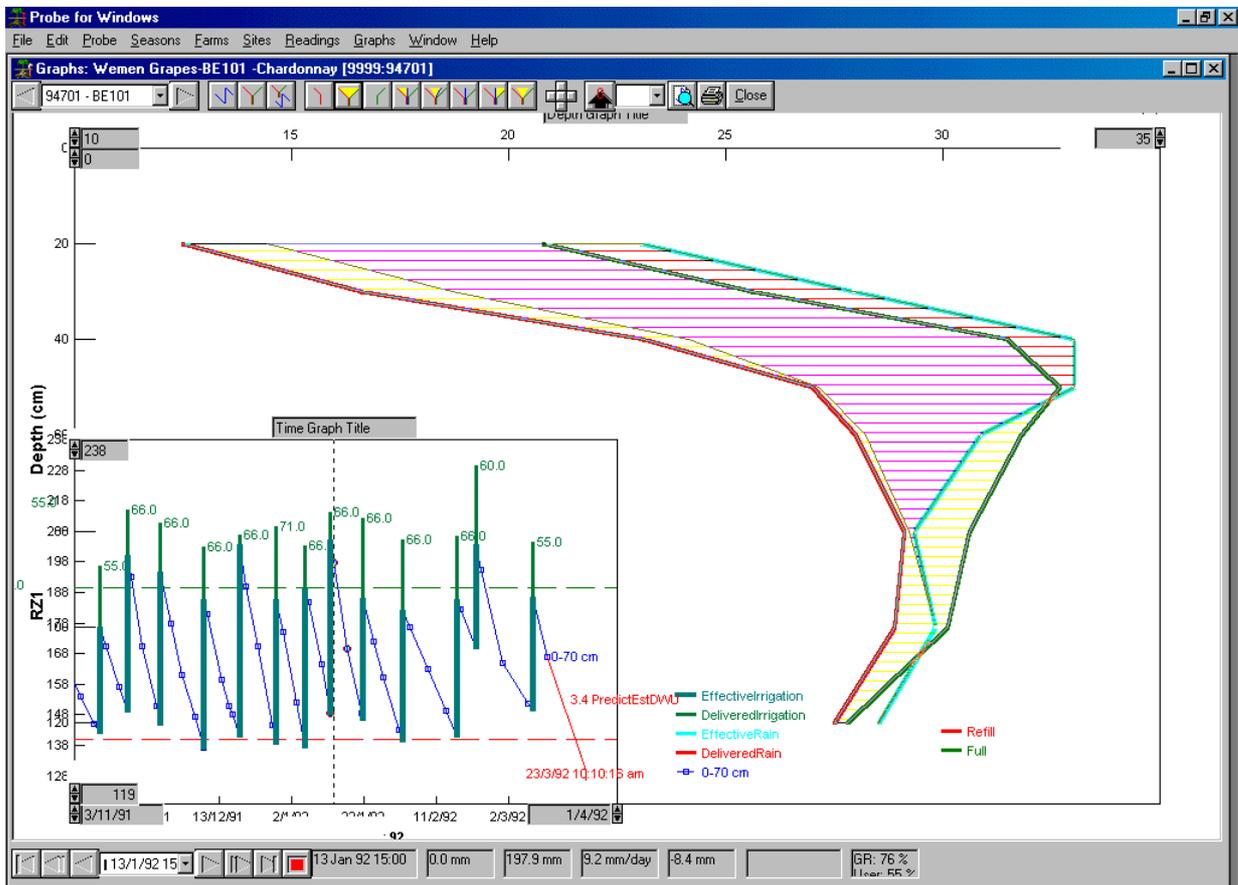
The colours of columns and rows on the readings screen can be changed, and the format for the date.

## Graphs

*Prwin* can display either a **depth** graph, a **time** graph, or **both**. Graphs are displayed on the screen, and they can also be printed.

Use Graph Options to customise the graphs as a whole - graph position, scales, and what is plotted.

Use Set Graph Styles to customise individual lines on the graphs.



## Time Graphs

Use **GraphMenu/TimeGraphs** (or the button on the top tool bar) to plot any number of data items against time. You can plot...



- All data items
- Selected items
- Items on a list

If you choose a **list** all the items on the list are plotted. Lists supplied are...

RootZone1	just root zone 1
RootZone1AndPDWU	root zone 1 and the probe dwu
VSW's	all vsw's from 20 cm to 120 cm

Items can be added to lists, and new lists created, using **GraphMenu/FieldLists** (see Field Lists)

Various options can be set using Graph Options, including plotting arrows showing predictions of the next irrigation.

# Graphs

## Depth graphs

Use **GraphMenu/DepthGraph** (or the button on the top tool bar) to plot...



- All profiles
- Selected profiles
- The latest profiles
- No profiles at all.

Various options can be set using **GraphMenu/Options**, including plotting the refill and full profiles.

The area between profiles can be **shaded**.

- Refill to full
- Refill to current
- Current to full
- Latest to previous
- Current to previous

If chosen using **GraphMenu/Options** the shading will *always* be plotted to the screen or printer. However, when graphs are being displayed on the screen the buttons on the tool bar will 'flash' the shading on and off.



Top tool bar

The **current profile** is the profile that the user has chosen in interactive mode - see User interaction with graphs.

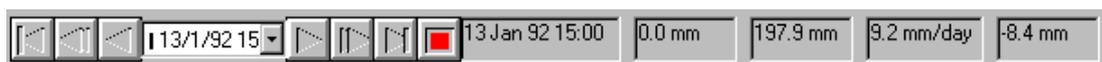
The number of profiles plotted for **latest** can be set with **GraphMenu/Options**.

## User interaction with graphs

When a graph has been plotted to the screen, users can step through the season using...

- the VCR controls.
- the keyboard.
- by clicking on a point on the time graph.
- with the 'date' drop down.

The VCR single arrows allow single stepping though the whole season, and the double arrows give fast-forward. The date drop-down will go directly to a chosen date. The keyboard <left>, <right>, <home>, <end> and <ctrl+left/right> keys can also be used to navigate.



VCR control and soil moisture status

Once a user is in 'interactive mode', **Prwin** will also plot the **current profile** when a graph is refreshed.

As each profile is plotted the previous profile can be erased, and the area between successive profiles can be shaded to show total water loss or gain - use **GraphMenu/DepthGraphMode** to change the plotting mode.

At the bottom of the screen *Prwin* will display the **status** of the current profile - root zone water content, depletion rate, soil moisture deficit.

If any of the shading buttons on the top tool bar are used (e.g. shade full-to-refill) the status will show the corresponding value (**FULL-REFILL** in this case).

When plotting profiles to the screen in **user interactive mode**, only the profiles are plotted (not symbols, labels or legend) and a vertical marker will show the current date on the time graph.

Profiles can be **selected** for plotting by displaying a time graph, clicking on a data point on the time graph, and then **selected** with **GraphMenu/Select** (**Cr1+M**), or using the right mouse popup menu. **Shift+Arrow** will extend the selection.

## Graph Scales

The scale of the depth and time graphs can be saved with each site (local), or a constant (global) scale can be used. This means that graphs can be plotted all to the same scale (global), so that sites can be compared; or each site can have its own scale (local). Use **GraphMenu/Scale** or **GraphOptions** to set using local or global scales.

The scale can be changed by...

- Directly entering numbers in the text boxes on the graph axes.
- Using the spin controls on the axes.
- Using the left/right/up/down buttons on the tool bar.
- Using the mouse plus left button to drag over the graph.



Scales can be **reset** to 'standard' values using the button on the top toolbar (the values are set on **GraphMenu/GraphOptions**). The drop-down on the toolbar allows the time graph to display the **last 30, 60, 90 days** etc of data, or to plot from the planting date (see Sites).

Scales can be entered as a **number** or a **formula**. For example...

Vertical maximum: **320**

Vertical minimum: **0**

will set the vertical scales to be 0 to 320, but...

Vertical minimum: **REFILL - 20**

Horizontal minimum: **PDATE - 10**

Horizontal maximum: **CRNTDATE + 10**

will draw a time graph with a vertical scale from 20 mm below the refill point (whatever that is for this site) to 20 mm below the refill point, and from 10 days prior to planting date to 10 days after the latest date. This will be a time graph of the whole season, with the time axis 'stretching' as the season progresses.

By default, data items are graphed against the **left hand axis** on the graph. However, an **individual scale** can be allocated to each data item with the **graph style**. For example, a style called **ProbeDWU** is shipped with the software. Crop daily water use (for countries using metric units) typically runs from 0 - 10 mm/day. If the scale for the style **ProbeDWU** is set to **Max:15 Min: 0**, then all probe dwu data will be graphed to this scale, and the axis will be plotted on the **right hand side** of the graph.

# Graphs

It is possible to locally override the scale set by the graph style. Use **GraphMenu/SetStyles** to set the scale maximum and scale minimum for individual items, overriding the scale from the graph style.

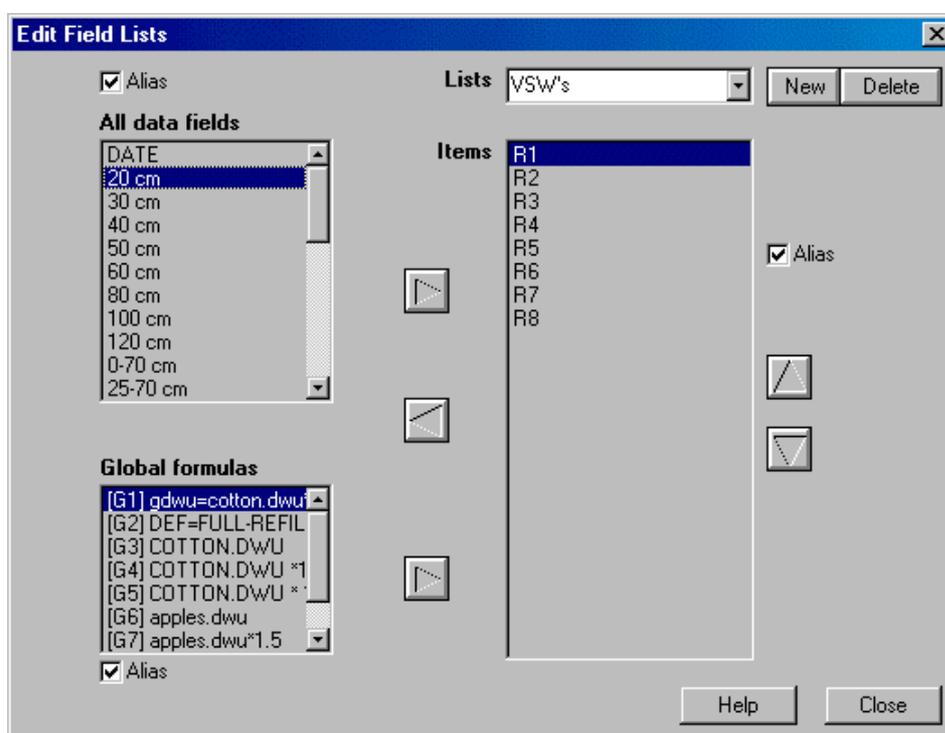
## Graph Scales

The scale of the graphs can be either

- **local** the scale settings will be different for each site.
- or
- **global** constant for all graphs. If 'global' is set the scale values will be saved and used when plotting graph reports using **FileMenu/GraphReports** and choosing **global** or **overlaid**.

## Field Lists

Field lists are edited and created using **GraphMenu/FieldLists**.



Lists of data items (or fields) can be created, and all the items in the list will be plotted. This saves having to select items at each site. For example, a list supplied with the software is called **RootZone1andPDWU** and consists of **RZ1** and **PDWU**.

Choose a list with either **GraphMenu/TimeGraph/List** or **GraphOptions/TimeGraphs**.

The top volumetric soil moisture reading is typically taken at 20 cm, and 20 cm is what users normally 'see'. However, field lists actually save 20 cm as **R1** (the first depth reading), so that the lists will work even if the actual reading depth is changed. Similarly the root zone water contents are saved as **RZ1**, **RZ2** etc, and keydata items as **K1**, **K2** etc.

## Set Graph Styles

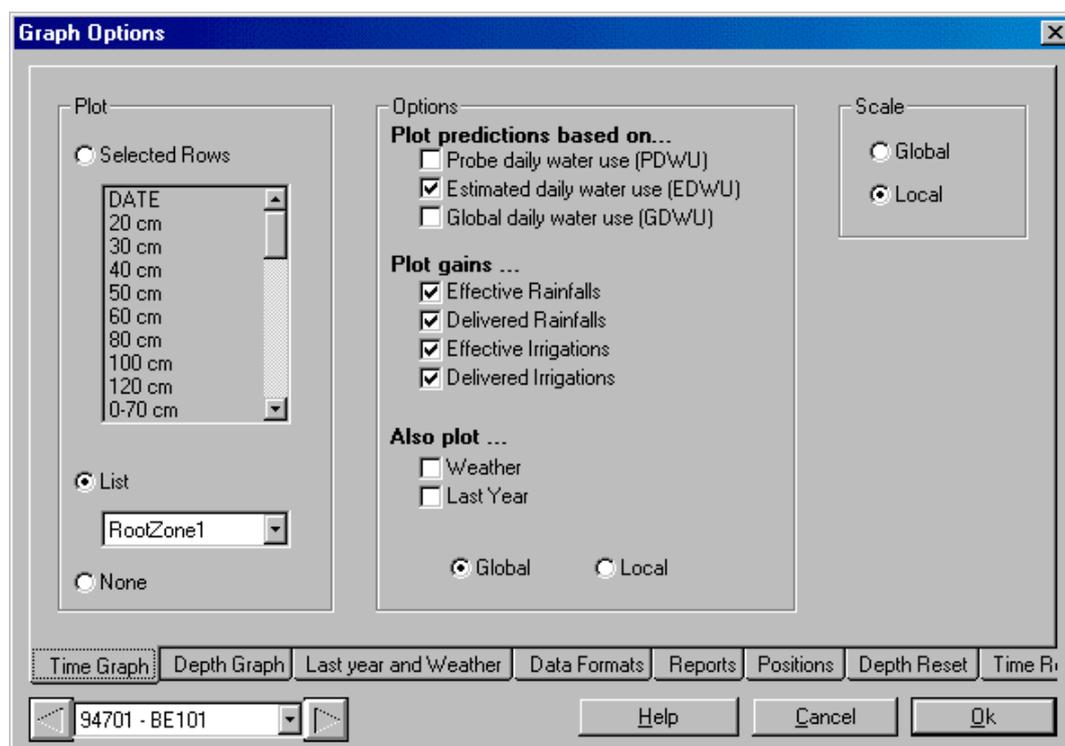
Each row of the readings screen is a data item which can be graphed, and a **graph style** needs allocating to each row. Users will not normally need to

allocate styles as defaults are allocated as each site is created. The default graph styles can be re-allocated with **SitesMenu/Edit (Files tab)**.

Some options of the style of a line can be set 'locally' for each line, and these settings will override the style. However most options (such as colour), can only be set with a graph style.

## Graph Options

Graph options affect the graphs as a whole - use Set Graph Styles to set individual line colours, thickness, etc.



Graph options can be **global**, affecting all sites; or they can be **local**, saved with individual sites. If **local** is chosen for a site, any changes made will only affect that site - all sites with **global** chosen will be controlled by the global options.

## Time graph options

Delivered and effective irrigations and rainfalls can be plotted as vertical bars, and can be styled using Graph Styles.

Lines showing the predicted irrigation dates can be plotted. The options for the prediction calculations are described at Scheduling.

## Depth graph options

The full and refill profiles can be plotted, and the area between various profiles can be shaded - Full-Refill - for example.

If an option is set on this screen the profiles or shading will *always* occur, both on the screen and the printer. However, when viewing graphs on the screen the profiles and shading can also be **flashed** with tool bar buttons.

## Graph Reports

Choose the graph report that will be used for output to the screen and printer, and for the summary - see Graph Reports for details of configuring reports. Normally 'none' is chosen for graph reports to the screen (which

# Graphs

means you will just see the depth or time graph), but if a report is chosen it will also plot on the screen.

## Last year and weather

Use **GraphMenu/Lastyear** to plot data from the same site last year; or plot data from an associated weather station can also be plotted. Use **GraphMenu/Options/AssociatedSite** to select last years site and the associated weather site. The data items that will be plotted from the associated site can be chosen, together with other options.

The graph scale can also have an **offset**. For example, an offset = 365 on the horizontal axes will be needed to plot last years data on a time graph. Depth graphs could be offset so that last years profiles are separated from this years profiles.

## Positions

The position of each graph on the screen (in % screen units, top left = 0,0), the legend position, and the size of tick marks (in % graph units) can be set. When printing, positions are set in the graph report definition file.

## Scales Reset

The scale reset values are used to 'reset' the graph scales back to a known value. The reset value can be a fixed amount (eg 120), or a formula (eg **FULL+20**) - see Graph Scales for examples. The 'reset' is done with a button on the top toolbar.

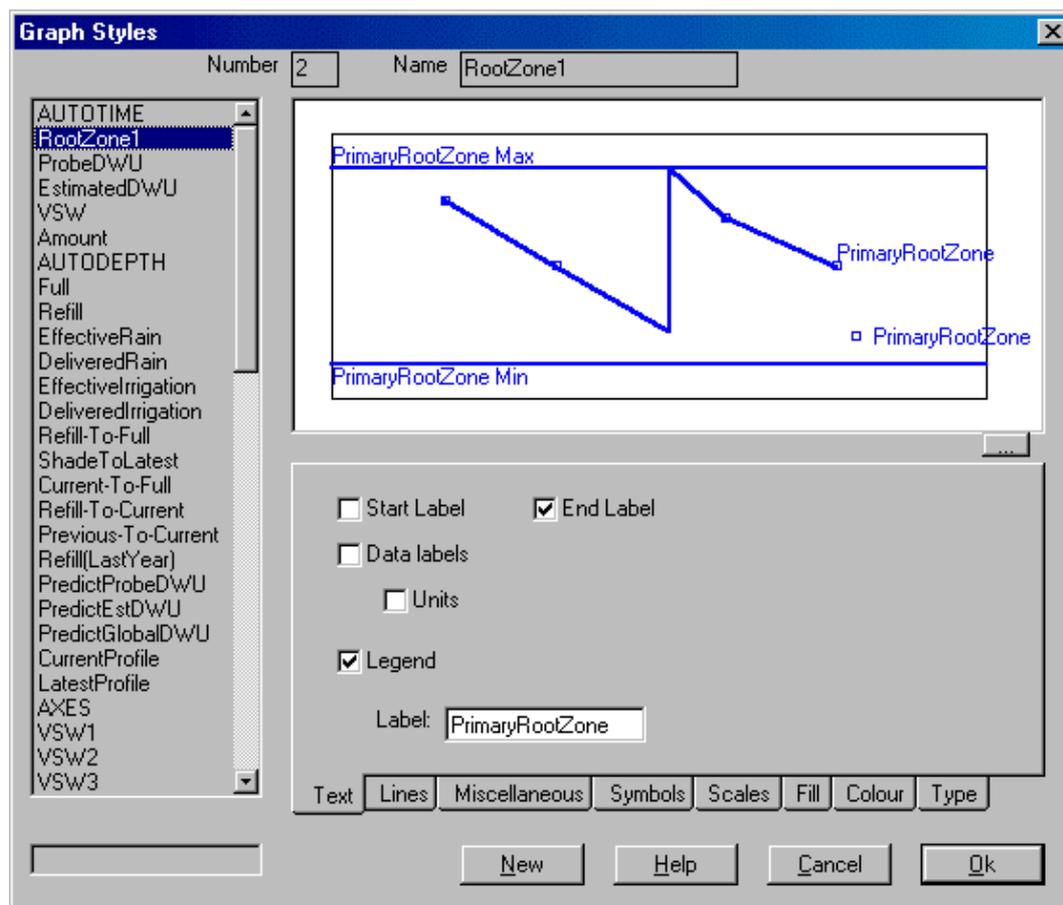


If a reset value is left **blank** the corresponding scale value on the graph is *not* reset. This enables you to, for example, reset the depth graph vertical axis to be 0 to 120, but to not change the horizontal axis scales.

## Graph Styles

Each line in a graph is given a **style**, which controls its colour, thickness, symbols, scale etc. If the style is ever changed, then all lines with that style will also change.

For example, there is a style called **RootZone1**. As shipped, this style is set to dark blue, 1 pt wide lines. If the colour of this style is changed to red, then all root zone 1 lines will change to red. When a site is created, graph styles are allocated to each data item so users do not normally need to allocate styles - however styles can be allocated with **GraphMenu/Setstyles**.



Styles can be edited and created with **GraphMenu/Styles**. There are 20 built-in styles - full and refill profiles, irrigations and rainfalls, irrigation predictions, for example - and in addition users can create their own styles. If temperature was being recorded at many sites, a style called **Temperature** could be created, and this style could be allocated to each keydata item that recorded temperature.

Some aspects of the style of a line on an individual site can be set **locally** (with **GraphMenu/SetStyles**), and these settings will override the style setting.

A style called **AUTOTIME** will automatically change its colour and symbol shape each time a new line is plotted.

A style called **AUTODEPTH** will always be used for depth graph profiles - typically it will also be set to automatically change the colour and symbol shape.

The style option **Colour/Automatic** will automatically use a different colour for each line.

The style option **Symbols/Automatic** will automatically use a different symbol for each line.

Lines can be plotted using either

**Left hand axis** allows the user to change the scale in interactive mode

or

**Right hand axis** Additional lines using their own axis will use the same axis if the maximum and minimum values are the same.

The **gain** styles, as well as allowing setting of axis maximum and minimum, also allow the gain bars to be moved up so that they 'sit' on the root zone 1 line, giving a visual indication of irrigation efficiency.

## Summary

Use **GraphMenu/Summary** to display a floating window with a summary of the current state of a site. Use a right click to hide the window, or keep it on top of all other windows.

As shipped, the summary has the site name, full point, refill point and predicted irrigation dates. However, it is displaying a graph report which can be changed using **GraphMenu/Options/Reports** (default = **SUMMARY**). The report can be customised - see Graph Reports for details.

## Comments

Comments about the site, such as irrigation recommendations, that can be printed with the graphs or exported can be entered using **GraphMenu/Comment**.

## Make Full and Refill

Click on a probe data point on a time graph, and use **GraphMenu/MakeFull** (or **MakeRefill**), or use a right mouse click, to make a reading the full or refill point.

## Graph Reports

What is plotted on the screen is not necessarily the same as what will be printed. Graphs on the screen will typically fill the entire screen, with no headings or summary data; whereas the printed version will have wider margins around the graphs, headings at the top of the page, and summaries of the data. What is printed, and where, is customised with **graph reports**.

The current graph on the screen can be previewed and printed with the <Preview> and <Print> buttons on the graph top tool bar; or use **FileMenu/GraphReports** to print graphs for many sites.

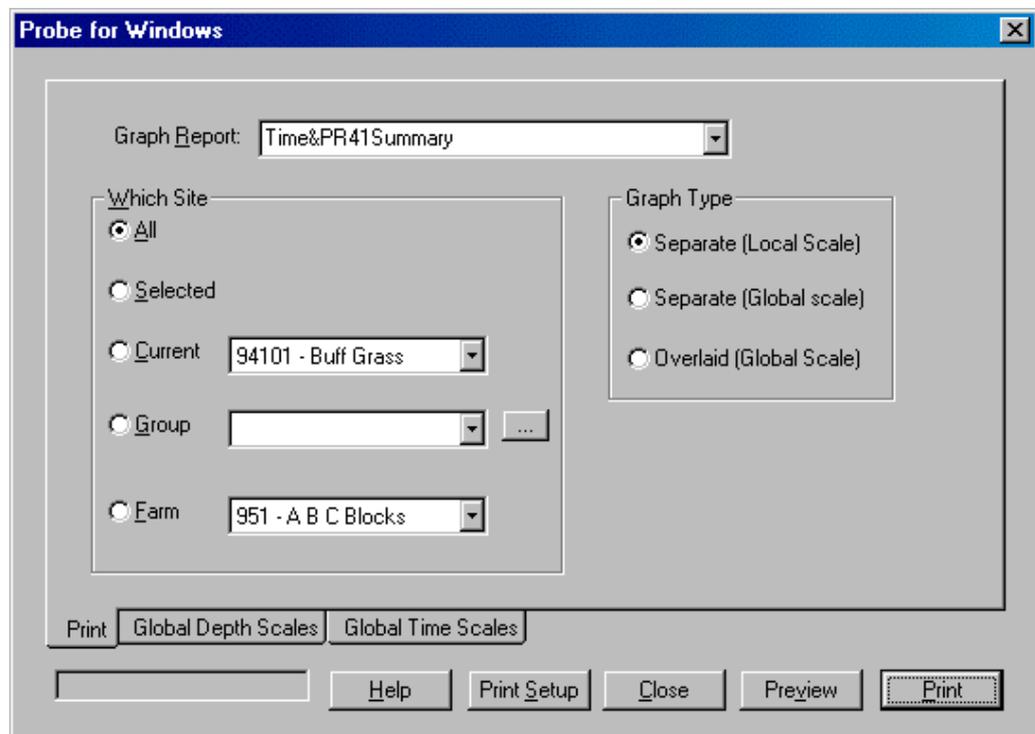
When printing from the graph screen the report that will be printed is set with **GraphMenu/Options**. Typically output to a screen will have the report **None** selected (giving just a graph on the screen), whereas for the printed version **Depth+PR41summary** report could be chosen. Separate reports can be chosen for **depth**, **time** and **both graphs**, to the **screen** and to the **printer**.

As shipped the report **Depth&PR41summary** will give a depth graph plus the same summary table as for **PR41** graphs. **Depth&Time&CIC** is a report prepared for Cape Irrigation Consultants, and will give a depth graph top left, a time graph along the bottom, and a summary of the data top right - it is designed for landscape printing.

To customise the reports the file GITEMS.TXT needs to be edited

## Printing graphs for many sites

Use **FileMenu/GraphReports** to print graphs for more than one site. Output can be for all sites; selected sites; sites on a farm; or sites in a group (see Groups).



## Graph Scales

The scale of the graphs can be either...

# Graph Reports

- **Local**      different for each site, as set on the graphs screen.
- or
- **Global**      constant for all graphs. The global scales can be set on the tab, but they are also set if you use 'global scale' on the graphs screen.

## Overlaid graphs

So that different sites can be compared, graph reports can be **overlaid** – they will all be plotted on the same sheet of paper. The scale will be the current global scale which can be changed.

Note that each site can also have an 'associated' site, typically the same site last season, or a weather site, and the data from the associated site can be **overlaid** using *GraphMenu/Weather* and *GraphMenu/LastYear* – see Last year and weather.

## Graph report definitions

To customise graph reports use *ProbeMenu/SystemOptions*, and edit the file *GITEMS.TXT*. Report numbers and names are in the file *GNAMES.TXT*.

Each line in the file *GITEMS.TXT* has the format...

Number, Order, Command, Source, Alias, Format, Align, Units, Orientation, FontSize, Bold, Left, Top, Right, Bottom

<b>Number</b>	Report number from <i>GNAMES.TXT</i>
<b>Order</b>	Printing order
<b>Command</b>	Command type - see <i>Command Codes</i>
<b>Source</b>	Text, data field or formula
<b>Alias</b>	not used
<b>Format</b>	d/m/y; 0.00; DWU see <i>Display Units</i> .
<b>Align</b>	Left; Centre; Right LB; CB; RB with word wrap
<b>Units</b>	1=display units (eg mm/day)
<b>AlignRelative</b>	Position relative to point see <i>Position of Text Boxes and Labels</i>
<b>FontSize</b>	Relative size of font (100% = standard)
<b>Bold</b>	1=bold; 0=normal
<b>Left</b>	Left horizontal coordinate position
<b>Top</b>	Top vertical coordinate position
<b>Right</b>	Right horizontal coordinate position
<b>Bottom</b>	Bottom vertical coordinate position

## Command Codes

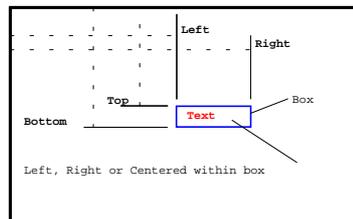
Commands that can be performed by graph reports.

<b>Command</b>	<b>Purpose</b>	<b>Units</b>
<b>GraphType</b>	Sets the graph type 0 = Depth; 1 = Time	
<b>GraphPosition</b>	Set graph position	paper
<b>GraphTickSize</b>	Set tick size	graph
<b>GraphLegendPosition</b>	Set legend position	paper
<b>GraphSymbolSize</b>	Set symbol size	graph
<b>GraphScale</b>	Set graph scale	data
<b>GraphOption</b>	Set graph options	



# Graph Reports

The text will be positioned within the box with the **align** code (Left, Centre or Right), and a line will be plotted around the box. The align codes **LB**, **CB** and **RB** will wrap the text to multi-line.

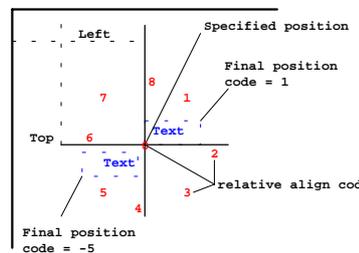


e.g. prints 'Full:' in a box from 88-92 % horizontal, 1-12 % vertical...

```
3, 3, LABEL, Full: , , , 1, 0, -6, , 0, 88, 10, 92, 12
```

## Type 2

The text is positioned **relative** to the point, with a **relative align code**.



If the relative code is **negative** (eg -5), the text is moved a small distance away from the point.

e.g. the **value of RZ1** printed just above the last probe reading..

```
3, 3, LABEL, CRNTAMT, , AMT, 1, 0, -8, , 0, CRNTDATE, CRNTAMT, ,
```

## Examples of graph report definitions

All examples are for graph report number 3

A label with 'Full:', positioned to the left of X=88%,Y=10%

```
3, 3, LABEL, Full: , , , 1, 0, -6, , 0, 88, 10, ,
```

Value of full point in amount (e.g. mm or ins) units, positioned to the right of X=88%,Y=10%

```
3, 4, FORMULA, Full, , AMT, 0, 1, -2, , 0, 88, 10, ,
```

A vertical arrow pointing to the last probe reading..

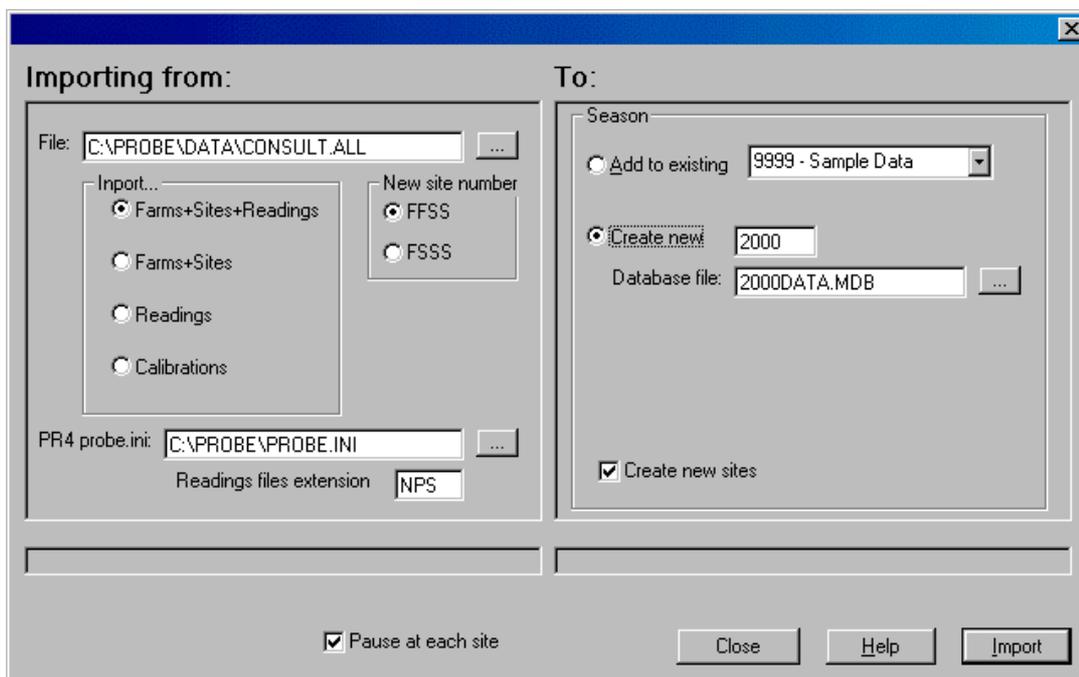
```
3, 3, ARROW, , , , , 1, , CRNTDATE, CRNTAMT-20, CRNTDATE, CRNTAMT
```

A vertical line at date = BUDBURST (set as global formula)

```
3, 3, LINE, , , , , , BUDBURST, TYMAX, BUDBURST, TYMIN
```

## Import from PR41

Data from *PR41* (the DOS version) can be imported into *Prwin* using *FileMenu/Import/PR41*.



*PR41* users typically stored all the data files for a season in a separate sub-directory, with the list of all the farms used in the season in a file called **CONSULT.ALL**. To import all the data for a season select 'farms+sites+readings' and locate the relevant **CONSULT.ALL** file - it will be something like...

C:\PROBE\1998DATA\CONSULT.ALL.

*PR41* used a site numbering system that combined the farm number and the site number to produce the number that was entered into the neutron probe in the field, whereas *Prwin* uses a **single site number**. So that *Prwin* can assemble the correct site number, choose whether the *PR41* numbering system was **FFSS** or **FSSS** (**F** = *PR41* farm number, **s** = site number)

All the data for this season can be imported into either...

- A **new** season, or...
- Appended to an **existing** season

*Prwin* stores the data for a season in a single MDB data file which can contain many tables in the same file. The list of sites, with a site number, is saved in a table called **SITES**, and each set of readings will be in their own table, each with its own name.

If the import is to a **new season**, enter a **new season number** (the default suggested by *Prwin* will be the current year **yyyy**), and the name of the **new MDB file** (**yyyyDATA.MDB** will be suggested). If the import is appending to an existing season select a season from the list of seasons.

Press <**Import**>, and you will be prompted to confirm the new site number and the name of the table where the data will be saved. The site number suggested will be the *PR41* farm number plus site number (either **FSSS** or

# Import from PR4

---

**FFSS**); and the table name will be **FSHORTSSSS** (**FSHORT** = **PR41** farm short name). You can pause at each site, or let the import and site number conversion work automatically. The import will pause if conflicting site numbers are found.

The new season will be created (if the option was chosen), a site in the list of sites will be created, and the actual readings data for each site will be in a separate table in the MDB file. A new farm will be created only if a farm with the **same farm number** does not already exist. (If a farm already exists a message will be left in the log file) After the import go to each site (**SiteMenu/Edit**), and confirm the data - you might need to re-allocate sites to different farms.

You will also need to import the **calibration equations**. Choose **Calibrations**, and locate the calibration file (typically it will be **C:\PROBE\CALIBRAT.CAL**). The calibrations will always be appended to table **CALIBRATIONS** in file **PRLOCAL.MDB**, so you do not need to choose a destination. If the calibrations are already in the table, appropriate messages will be entered in the log file, and you will be notified.

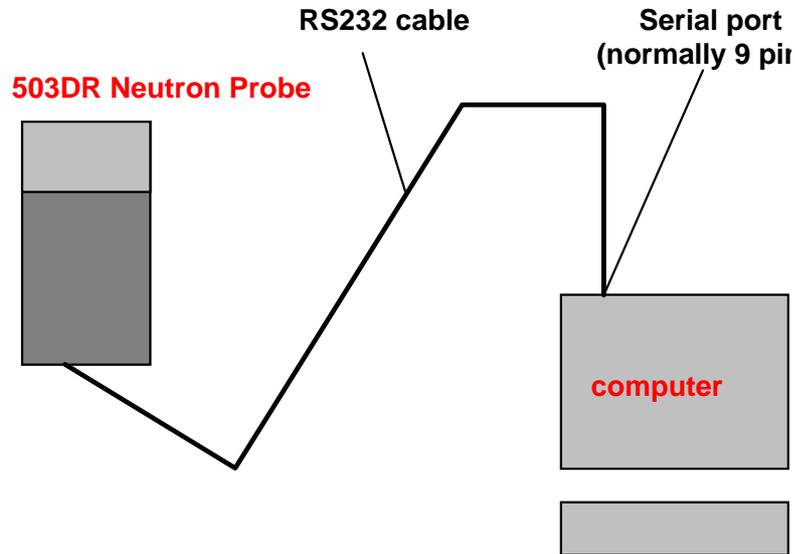
## Re-importing data from PR41

If the same data is re-imported, just the readings can be imported to the existing season, without overriding the site in the list of sites. Choose '**add to existing season**', and turn *off* '**create new sites**'.

Individual NPS files can also be imported to a table, but they can only be added to an existing season. You can choose with '**create new sites**' whether the site itself (in the list of sites) should also be created.

## Uploading

Soil moisture measurements are taken in the field and recorded in the neutron probe. The data then needs to be transferred, or uploaded, to the computer.



After uploading the data is first put in a '**post file**', and the post file is *then* posted to the corresponding site. This allows any errors with the data to be edited before posting.

Connect the neutron probe to the serial port of the computer using the RS232 serial cable, and press <Upload> to start the data transfer. If there are any errors in the data, use <Edit> to edit the post file before posting.

The Seasons screen has an <Upload/Post> button that will upload and post in one operation.

## Settings

The name of the post file can be...

- a **fixed name**, but changeable by the user. An existing file will be overwritten each time you upload.
- a **new file name** can be generated (based on today's date) each time you upload.

The baud rate needs to be the same as set in the neutron probe.

There are various models of neutron probe that upload in different ways. The 503TDR can upload at 4800 baud, but earlier models need to be at 1200 baud. Earlier models also need an interline delay of about 500 milliseconds.

# Post Readings

## Post Readings

Data is recorded in a data logger in the neutron probe, uploaded to a post file (see Uploading), and then posted.

Also post...	Date	Amount
Rain: <input type="checkbox"/>	16/8/99 6:00:00 am	10.0 mm
Irrigation: <input type="checkbox"/>	16/8/99 6:00:00 am	10.0 mm

Readings can only be posted to a single season at a time - choose the season with the drop down.

The name of the post file is generated when the readings are uploaded, and the file name is normally set to be today's date.

After pressing <Post>, the header line of the post file will be displayed, together with any warnings ('File already posted', for example)

Older model neutron probes did not record the date of the readings, so **Prwin** will always pause at the first site to allow the date and time of readings to be entered. By default the date will be today's date, and the time as set on the **Options** tab.

The **estimated daily water use** will be posted with the readings. The initial, default, value of daily water use will be from the global formula - see System Options.

Any irrigations and rainfalls that have occurred can also be posted at the same time as posting probe readings. (The default irrigation and rainfall dates can be set on the **PostGainOptions** tab).

**Prwin** can pause at each site before posting the readings, to allow the user to change the date, estimated daily water use, and rainfalls or irrigations. In addition, **Prwin** will always pause if **ID=0** is encountered in the post file.

## Averaging

The site number of each tube is entered into the neutron probe in the field. Typically, access tubes are installed in the field in groups of three, with all

three tubes having the **same site number**. The readings from the three (or more) tubes are averaged as the data is posted to the single site.

The number of tubes that were averaged can be posted to a keydata row of the readings screen.

If 'averaging' is taking place, keydata values that have been entered in the field at each tube can be either **averaged** or **totalled**.

Alternatively, readings can be posted to **separate columns** in the same readings screen, even if the site number is the same.

Normally probe readings are posted to the readings screen as **Probe** columns, but they can also be posted as **Tube1**, **Tube2**, etc. The tube number needs to be keyed into the neutron probe in the field as keydata item 1.

## Standard Count

*Prwin* normally uses the neutron probe serial number to find the correct calibration equation. However, some users prefer to use normalised equations based on the standard water drum count, in which case the **Standard Count** should be posted instead of the serial number (see Uploading). The standard count in the neutron probe cannot be directly entered by the operator, so *Prwin* allows the standard count to be changed when the header line information is displayed.

## Bottom-to-Top

Readings are normally taken starting at the bottom of the tube.

## Strip line numbers

As a post file is uploaded the line number at the start of each line is stripped off (to keep the format consistent with the original 503DR). However, if the file is uploaded using another communications programme (such as *Terminal* or *HyperTerminal*) the line numbers need to be stripped when posting.)

## Reformat Dates

The TDR model neutron probe records date and time, and the post file format is different from earlier models. During uploading, the post file is normally re-formatted so that it is in the original 'standard' format. If this has not been done (for any reason), the file can be re-formatted when posting.

## Audit

To enable consultants can keep a record of all readings, an 'audit file' can be generated with a record of the farm and site number, and the date. This file can then be exported to an accounting system, or used in a *Prwin* report.

## Errors

If errors occur (site number not recognised, for example), messages are put in the log file, and rejected readings sent to the reject file for editing and re-posting.

## Alter Site Numbers

Site numbers can be altered as the data is posted, allowing data to be first posted to separate sites, and then posted 'averaged'. The 'old' and 'new' site numbers need to be entered in to a 'lookup' file. The lookup file is a text file with format...

# Post Readings

---

```
OldSite,NewSite
101,104  `comment about site 101
102,104
103,104
```

In this example, data logged in the field with ID =101, 102, 103 will actually be posted to site 104.

Site numbers can be altered either just before posting; or the post file itself can be 'altered' so that the file can be checked before posting.

## Sort

Tubes are sometimes read out of order, so the post file needs to be sorted before posting so that the tubes are together in the post file and can be averaged. The sort can be done just before posting; or the post file itself can be sorted so that file can be checked before posting. An ID=0 will 'break' the sort into groups.

## Post Gain Options

When rainfalls and irrigations are posted the effective gain can be automatically calculated (see Calculations during irrigations or rainfalls for details).

Estimate columns should be posted so that *Prwin* can calculate and graph the state of the site just prior to the gain event.

# Post Irrigation and Rainfall

## Post Gains

The amount of rainfall and irrigation that has been applied to each site should be posted so the water balance can be calculated. Estimates of the crop water use and effective irrigation amounts can only be calculated if *Prwin* knows how much water has been applied or delivered to each site.

The screenshot shows the 'Enter Irrigations' dialog box. The 'Season' is set to '9999 - Sample Data'. The 'Post to which sites' section has 'All' selected. The 'Current' dropdown is set to '94101 - Buff Grass'. The 'User entry' section is active, showing a date of '19/08/1999 08:00', an amount of '234 KI', and an estimated D'WU of '2.0 mm/day'. The site is 'Turf Grass Example-Buff'. A 'Pause at each site' checkbox is checked. The 'Post' button is highlighted. The status bar at the bottom indicates 'Posting to: Turf Grass Example-Buff Grass [9999:94101]'.

Rainfall and irrigations can be posted either...

- By **User entry** of the amount and date, to a single site or many sites.
- From an **irrigation file** containing site numbers, amounts and dates.

A **flood irrigation** does not need a delivered amount posted as the soil profile will be brought back to the full point.

## User Entry

Users enter an **amount**, a **date**, and an estimate of the crop **daily water use**. Gains can be posted to all sites; to the sites in a group; or to the sites on a farm. The post can pause at each site so the amount, date and daily water use can be changed; and sites can be skipped.

## Irrigation File

An irrigation file of site numbers, dates and amounts can be posted. The file can be...

- 1 Prepared by the user using 'From file' tab.
- 2 Prepared using *Notepad* or some other text editor.
- 3 The file could come from an automatic irrigation controller.

# Post Irrigation and Rainfall

## Options

Amounts can be entered in **depths** (mm or ins); or **volume** (kl, gallons); or **time** (hh:mm) - the actual units are set on Display Units. Rainfalls are always in depth units (mm or ins).

*Prwin* will convert the entered amounts to the depth equivalent using the site area and delivery rate set using Scheduling.

*Prwin* can calculate the effective gain amount - see Calculations during irrigations or rainfalls for details.

## Using Post Gains to prepare an irrigation file

An irrigation file can be prepared using this screen. Enter the site number, the amount and the date of the irrigation or rainfall. For user convenience, an irrigation file can be quickly filled with all the sites in a **Group**, and then filled with the same date and amount. Before posting, the file must be saved (as a file with extension **.IRR**) - it is the file itself that is posted, not what the user sees on this screen when editing.

*Prwin* has its own irrigation file format of **Season, Site, Date+Time, Amount**; and also recognises **Gulf** and **Motorola**.

## Lookup files

When posting from a file that has come from an irrigation controller the valve or block numbers might not coincide with *Prwin* site numbers, so there is an option to find the corresponding site using data in a **lookup file**.

In addition, a *single* probe monitoring site might be scheduling *several* valves or blocks. In this case the amounts from the irrigation controller can be divided by a valve **factor**, also in the lookup file. (This is the converse of 'Export to Irrigation Controller', where the amount requested from each valve is *multiplied* by a factor - the same lookup file can be used)

The lookup file has 1 line for each irrigation controller valve. The format is...

```
ValveNumber, PrwinSiteNumber, Factor
12, 502, 1.0 `comment about site 502
13, 503, 1.0
```

although some controllers (such as **Gulf**) have...

```
Block, Valve, PrwinSiteNumber, Factor
```

in which case a **double join** should be used.

If the **divide by factor** option is selected, *Prwin* will actually post...

```
AmountPosted = Amount / Factor
```

## Totalling amounts to same site

If more than one irrigation amount is being posted to the same site the amounts can be totalled before posting. For this option, the amounts to be posted to the same site must be on successive lines in the irrigation file.

## Gulf Irrigation Controller

The **Gulf** controller from **Agriplas** outputs in volume units (MI) in the format...

```
Block, Valve, Year, Month, Day, Hour, Minute, Amount
```

# Post Irrigation and Rainfall

It therefore needs a 'double lookup', **Block** in column 1 and **Valve** in column 2.

The irrigation file can be previewed and edited using the irrigation file editor, or with **Notepad** - see Text Editor.

## Motorola Irrigation Controller

The Motorola MIR5000 system does not directly output the amounts of water that it has applied, but it does have an option to output 'billing' files to a **'Billing\'** sub-directory. Each of these files are a 'snapshot' of the water meter reading for each valve, with the file name giving the date and time. For example, the file...

**BL980615.120**

has the state of the meters on 15 June 1998 at 12:00 noon.

**Prwin** can read these files and generate an irrigation file of the valve number; date; and amount of water that was applied since the previous file was generated. The last date (or file) that was used is 'remembered', and the next time it is run only new billing files will be used to generate the output. This is to avoid posting and then re-posting the same irrigations.

The name of the irrigation file will be...

**BLlastdate.IRR**

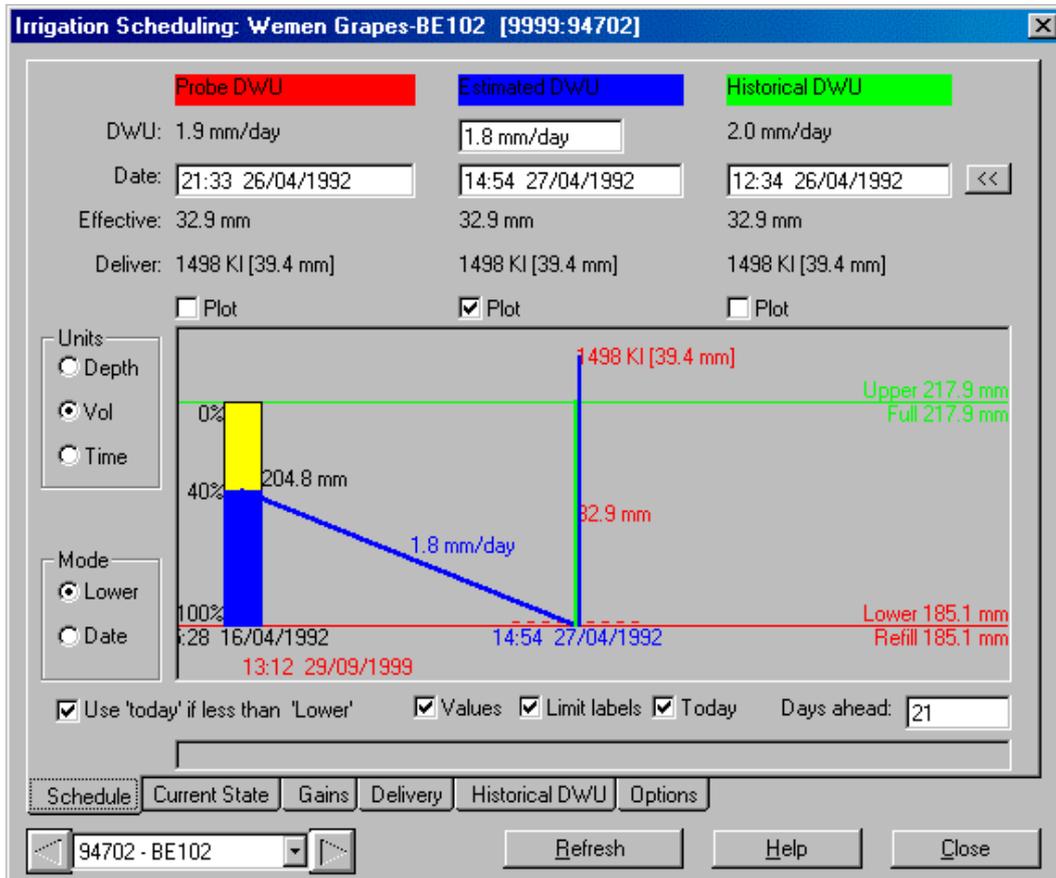
where **BLLastDate** is the name of the last file generated by the MIR5000 system.

After the irrigation file has been generated it needs to be posted.

# Scheduling

## Scheduling

Use *ReadingMenu/Scheduling* to display the predicted irrigation dates and amounts, and a summary of the latest state of the site.



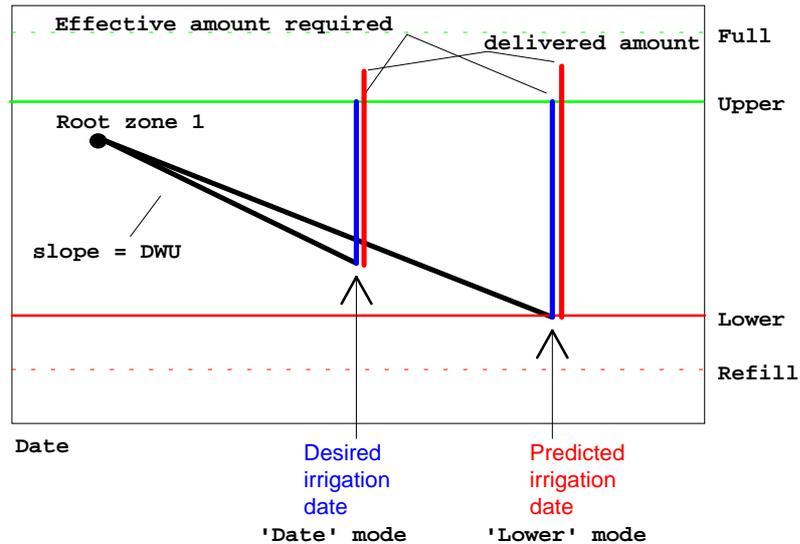
Irrigation predictions are calculated using the latest water content of the soil profile and a soil water depletion rate.

**Three predictions** are made using **three different rates**...

1. Rate from soil moisture measurements (Probe Dwu).
2. User entered rate (Estimated Dwu).
3. Historical rate from a formula (Historical Dwu).

The calculations can work in one of 2 'modes'...

1. **'Date' mode.**  
Given a desired Lower value, **calculate the date** when the soil moisture will fall to that value.
2. **'Lower' mode.**  
Given a desired irrigation date, **calculate the value** that the soil moisture will have fallen to by that date.



If the water content is already *below the lower point*, the irrigation amount required can be calculated assuming you were to irrigate **today**. If you are looking at old data this option can give very large irrigation requirements !

## Amounts required

*Prwin* will calculate the **amount** of water that should be applied, and display it in either...

- Amount units (mm or ins)
- Volume units (Ml or gallons )
- Time units (hh:mm).

In 'lower' mode the **effective amount required** (the amount that will be retained in the soil profile) is calculated from...

$$\text{Effective} = \text{Upper} - \text{Lower}$$

In 'date' mode, *Prwin* calculates the lower amount that the profile would have reached by the desired date, and uses this to calculate the amount required.

The **delivered amount required** (the amount that should be delivered) is calculated from...

$$\text{Delivered} = \text{Effective} * \text{DeliveryFactor}$$

If **DeliveryFactor** = 1.2, then 20 % extra water needs to be delivered to this site to allow for wastage. See *Delivery* to enter the irrigation delivery factor.

## Latest State

The **date** and **amount** at the last probe reading; the previous probe reading; the last irrigation; and the latest state of the site (which could be an irrigation, a rainfall or a probe reading).

## Upper and lower limits

The aim is to keep the soil moisture *above* the **lower** limit and *below* the **upper** limit. These are the desired limits that you would like the soil moisture to track between. The actual **value** of these limits are calculated from **formulas**. The values of the limits over the season can also be graphed - see Graph Styles.

# Scheduling

The **lower** formula is by default...

Lower: **Refill**

But can be raised or lowered by entering formulas such as...

Lower: **Refill+10** 'keep 10 mm above the refill

Lower: **Refill+(Full-Refill)\*0.5** 'keep above 50% depletion

The **upper** formula is by default...

Upper: **Full**

But can be raised or lowered by entering formulas like...

Upper: **Full-20** 'apply enough to bring to 20 mm *below* the full point

The formulas are separate for each site, so in order to raise the refill on *all* sites a 'global' factor needs be used. On **ProbeMenu/GlobalFormulas** (see Formulas) enter the formula...

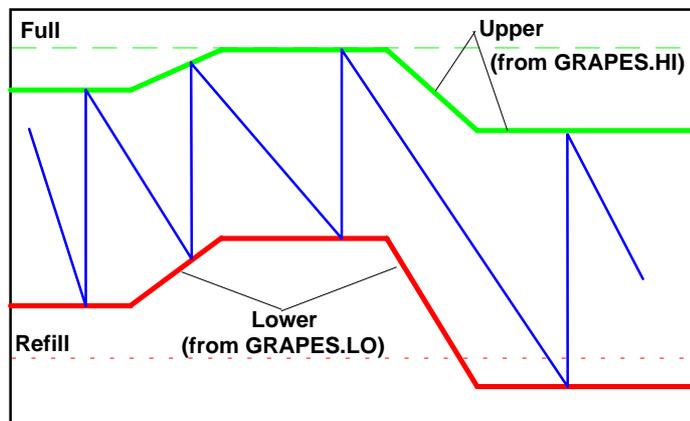
**GFac = 20**

Then, on *each* site enter...

**Lower = Refill + GFac** 'raise Lower by the value of 'GFac'

All sites using this formula would have the **lower** value raised to Refill + 20. Change the global formula to `GlobalFactor = 0` and all **lower** values would return to refill

It is also possible to have a factor changing depending on the date in the growing season (reduced deficit irrigation).



The formulas...

**UPPER = FULL - GRAPES.HI \* (FULL - REFILL)**

**LOWER = REFILL + GRAPES.LO \* (FULL - REFILL)**

would raise the **UPPER** and **LOWER** limits by factors that are in the files **GRAPES.HI** and **GRAPES.LO**. The factors would change depending on the date in the growing season (see Season Files to edit and create a season file)

## Gains

The total water delivered and the total water retained (effective) in the soil profile for both irrigations and rainfalls are totalled for the season. These values can be printed for all sites using the GAINS report..

## Delivery

All calculations by *Prwin* are done in mm of water applied uniformly over the entire area. However, if a grower works in deliveries by volume of water, or by time of application, then *Prwin* needs to know *application rates*. The rate can be calculated knowing the *area of the site*, the *volume delivered*, and the *delivery time*.

Consider for example a system delivering 5 MI/hour, and typically running for 3:00 hours, giving 15 MI delivered in total. Entering Area= 20 Ha, Volume: 15 and Time: 3:00, *Prwin* will display an application rate of **5 MI/hour**.

In practice you might know that the application rate is 5 mm/hour, and is run for 3:00 hours. Enter Time = 3:00, and then adjust the Volume: until the application rate is 5 mm/hour.

The spacing and delivery rate of emitters or drippers can also be entered, and *Prwin* will calculate the equivalent delivery rate for the entire area.

## Historical daily water use

The historical daily water use is used to predict a third irrigation. Typically this dwu is from long term historical data, stored in a dwu file. Each site can either use the current value of global dwu (applying to all sites), or each site can have its own individual formula. If the site formula is left *blank*, then the global formula is used.

Examples of formulas...

5.6	fixed value of 5.6 mm/day
COTTON.DWU	look up value in the file COTTON.DWU for today's date
COTTON.DWU*1.2	as above, but multiplied by 1.2
COTTON.DWU*CAPE.FAC	as above, but corrected by a varying crop factor in file CAPE.FAC
GDWU * 1.2	current value of global dwu multiplied by 1.2 (only use in a site formula)

## Update Readings

Some of the data on the readings screen is *calculated* - for example the root zone water contents are calculated from the individual soil water readings. The calculations are done automatically whenever new data is posted, but **ProbeMenu/Update** (shortcut = <Ctrl+U>) will do an update after new data has been entered manually.

Normally only the data in columns that that have been changed will be updated, but if root zones or keydata formulas are altered then **whole season** will force an update of the whole of the readings screen.

## Calculation of volumetric soil water content

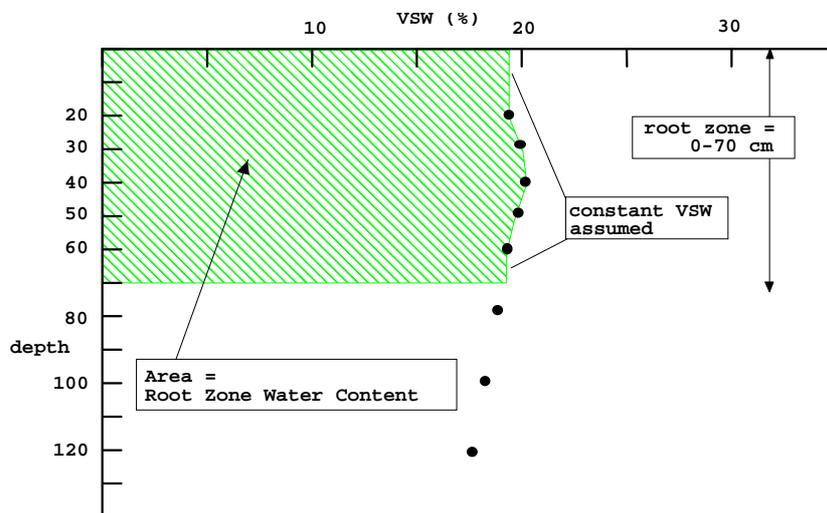
The volumetric soil water content (VSW) is calculated and displayed using the raw neutron probe counts and multiplying by the corresponding calibration equation. The equation is selected using the probe serial number (stored with every column of readings), and the soil horizon number for each depth (set using **SiteMenu/Edit**).

$$\text{VSW} = \text{Count} * \text{Slope} + \text{Intercept}$$

See **ProbeMenu/Calibrations** for details, and for the count ratio option.

## Calculation of Root Zone Water Content

Three root zones are specified using **SiteMenu/Edit** (root zone 1 is typically 0-70 cm). The total water content of each root zone is calculated using the values of VSW; the reading depths (20 cm, 30 cm etc); and the top and bottom limits of the root zone (0 cm and 70 cm). The **water content** is the area of the soil moisture profile. The soil moisture is assumed to vary linearly between depths, and to be constant from the top limit to the first depth reading, and constant from the last depth reading to the bottom limit.

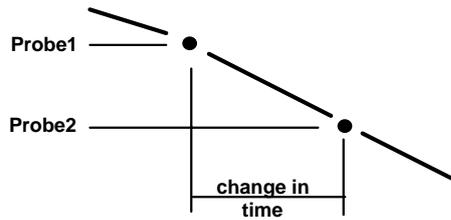


## Calculation of probe daily water use

Probe daily water use (PDWU) is the *rate of change* of the water content of root zone 1, expressed in mm/day (or units as set with Display Units). If there is no surface evaporation or through-drainage, PDWU will be the *crop daily water use*.

The PDWU is calculated from two sets of probe readings taken on different dates...

$$\text{PDWU} = \frac{\text{Probe1} - \text{Probe2}}{\text{change in time}}$$



PDWU is the differential of the root zone 1 water content with respect to time, but with a negative sign.

See Calculations during irrigations or rainfalls for a discussion of PDWU calculations before and after an irrigation or rainfall event.

## Estimated daily water use

The **estimated daily water use (EDWU)** is entered *by the user*, and the value of **EDWU** in the latest column is used to predict the estimated predicted irrigation date and the amount of water required (**EPIDATE** and **EPIAMT**). Users can also use the **EDWU** row to record a 'better' estimate of the actual crop water use taking into account their knowledge of the weather, crop behaviour, and other factors. The **EDWU** could then be used to calculate cumulative water use and predict yield (using **@CUM(EDWU)**), rather than using the 'raw' **PDWU** values.

## Full and refill points

The **full point** is the maximum water holding capacity of the soil profile; and the **refill point** the water content at which the crop becomes stressed. The full and refill points are the total water content of root zone 1, calculated in the same way as for a probe column, but with the VSW (%) at each depth entered by either copying a probe reading using **ReadingMenu/MakeFull**, (or by a right click on a graph), or by manual entry of VSW values by the user.

## Deficit

The **deficit** is the difference between the full point and the root zone 1 water content. It is the amount of water required to restore the soil profile to the full point.

## Estimate columns

An estimate column can be automatically inserted just before a posted irrigation or rainfall. **Prwin** ...

1. Assumes the **ProbeDWU** does not change.
2. Calculates the root zone 1 water content using **ProbeDWU**.
3. If there are *two previous adjacent* probe readings, then the VSW at each depth and the water content of root zones 2 & 3 will also be calculated, by linear extrapolation.

## Calculations during irrigations or rainfalls

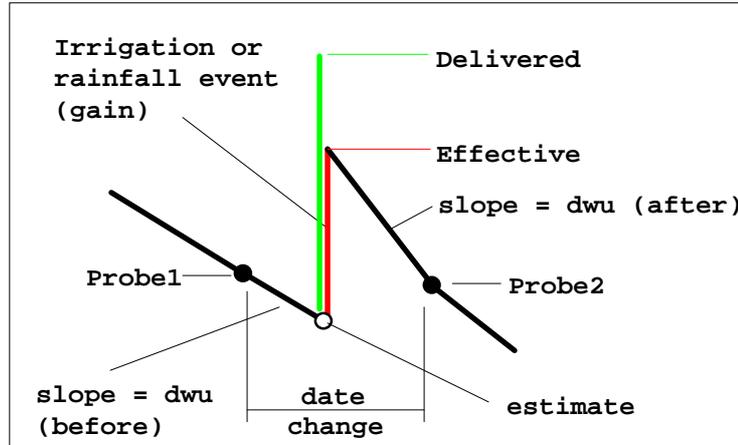
In the period before and after an irrigation or rainfall (a **gain** event) the actual daily water use (**dwu**) of the crop may change. **Prwin** can use the values **Probe1**, **Probe2** and the **date change** to calculate *either*...

**Method 1** The **dwu**, assuming the effective gain is correct.

# Update Readings

or

**Method 2** The effective gain, assuming the dwu is correct.



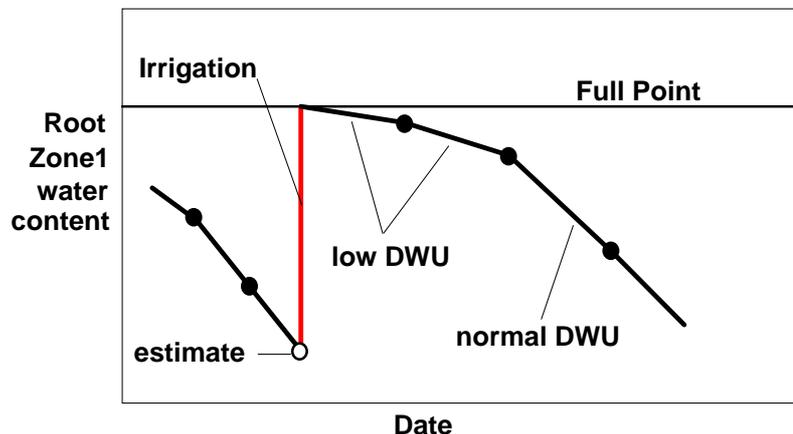
Various assumptions have to be made, because any changes in soil water content could be due to any or all of...

- Through-drainage
- Surface evaporation
- Water use by the crop

Even if readings were taken every 10 minutes during an irrigation it may still not be possible to deduce whether changes in soil water content are due to through-drainage or actual crop water use; with the added complication of **waterlogging** affecting crop water use.

## Waterlogging

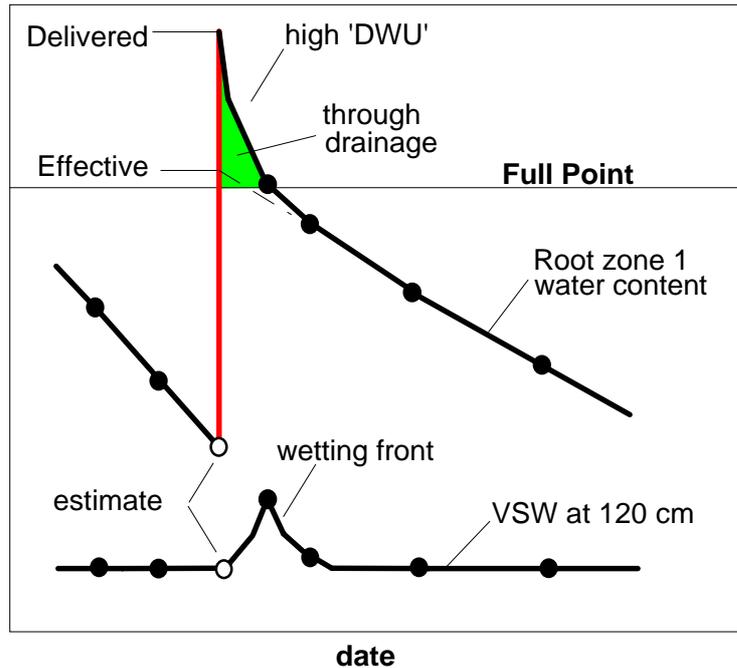
The water use of the crop may become very low because of waterlogging as a result of the irrigation.



## Through-drainage

Through drainage in free-draining soils will show up as **high values of PDWU**. This is not *actual* crop water use, but includes 'water use' by the soil profile - some water is going to the crop and some to drainage.

Through-drainage is indicated by changes in volumetric soil moisture (vsw) at depth, first an increase as the wetting front approaches, followed by a return to normal value as the profile drains. Through-drainage will have ceased when the PDWU and the vsw at depth return to their expected values.



However, because water-logging may affect the actual crop water use it is not possible to separate through-drainage from water use by the plant.

## Steady state through drainage

It also possible to have *constant soil water content* ( $PDWU=0$ ) but still have through-drainage occurring - the amount of water being delivered is the same as the amount flowing out of the bottom of the profile, with no net change in the soil water content. The solution (if a water table is not present) is to try and measure soil moisture at a sufficient depth where *no changes are measured*.

## Method 1 Calculate Dwu

The dwu is calculated *assuming the effective gain is correct* (The setting can be changed on **ProbeMenu/Update GainOptions** tab). To calculate the dwu **Prwin** can assume either...

- **Flood** The dwu remains constant up to the gain, but then changes after the gain.
- **Spray** The dwu is constant throughout the gain period (dwu before gain = dwu after gain)

The **Flood** method assumes the gain event *does affect* the crop dwu - the dwu is assumed to remain constant up to the event and is simply **copied forward** from the previous column, and a *new* value of **PDWU** calculated *after* the event.

The **spray** method assumes that the crop dwu *is not affected* by the event, and the **PDWU** calculated will be dependant on the actual effective amount of gain.

The **spray** **PDWU** is calculated from...

$$PDWU = \frac{\text{Probe1} + \text{EffectiveGain} - \text{Probe2}}{\text{change in time}}$$

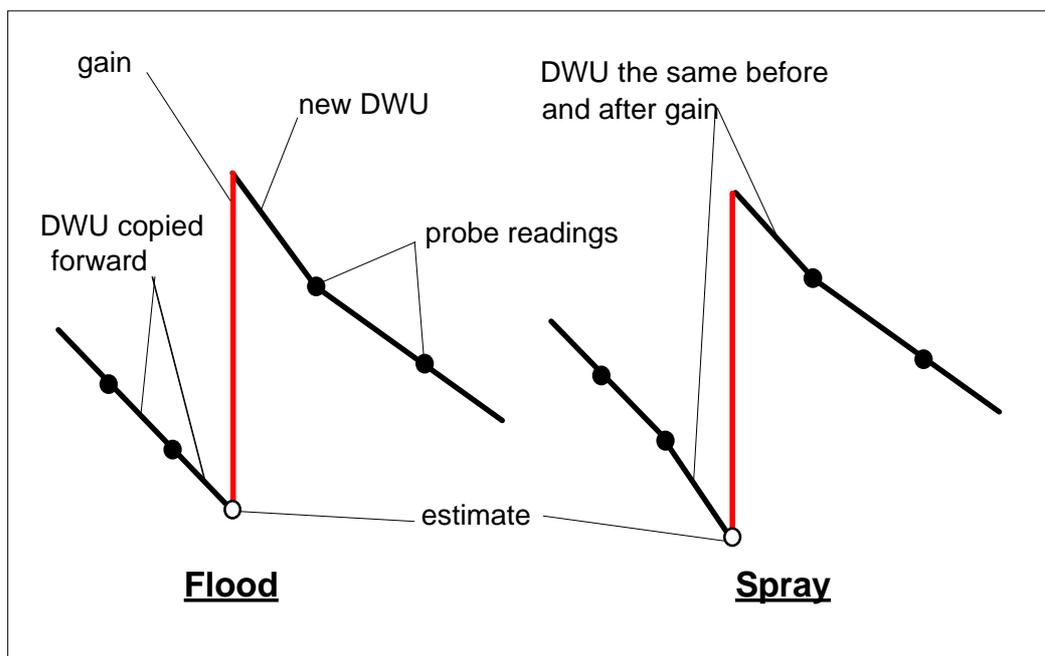
where...

**Probe1** = previous soil water content

# Update Readings

**Probe2** = soil water content after gain

**EffectiveGain** = effective amount applied



If in doubt, it is recommended that the setting be left on **Flood**, because crops do typically change their daily water use after a rainfall or irrigation event.

## Method 2 Calculate Effective Gains

The effective gain is calculated *assuming the dwu is correct*.

$$\text{EffectiveGain} = \text{Probe2} - \text{Probe1} + \text{DWU} * \text{ChangeInTime}$$

The **dwu** can be *either* the **probe dwu** or the **estimated dwu**.

If there is more than one gain event between probe readings, the total effective amount will be distributed to each gain event in proportion to the delivered amounts.

Once an effective gain has been calculated it is inserted into the readings screen as though it had been entered by the user, and can then be changed. **Prwin** will not re-calculate the effective gain and overwrite the user entered value unless **ReadingMenu/EffectiveGain** (or right-mouse click) is used.

**Prwin** 'knows' to calculate the effective amount if the delivered amount is *negative* (eg -20 mm). After the effective gain has been calculated the delivered amount will be made positive.

The effective gain can only be calculated if there are probe readings before and after the gain.

If gains are posted after the last probe reading you will see the negative delivered amounts on the readings screen - as soon as a later probe reading is posted **Prwin** will do another update, calculates the effective amount, and the delivered amounts will then be positive.

## Beginning of Season

At the beginning of the season *Prwin* needs a probe reading to calculate the root zone 1 water content (0-70 cm). If the first column is a rainfall or an irrigation, the root zone 1 water content **cannot be calculated**. In this case, users could manually enter a set of probe readings, estimating the water profile at the start of the season. Essentially, *Prwin* needs to know the state of the soil profile at the beginning of the season.

The **PDWU** is normally calculated by the software, but in order to predict the first irrigation of the season users are allowed to enter a **PDWU** in the **first column**.

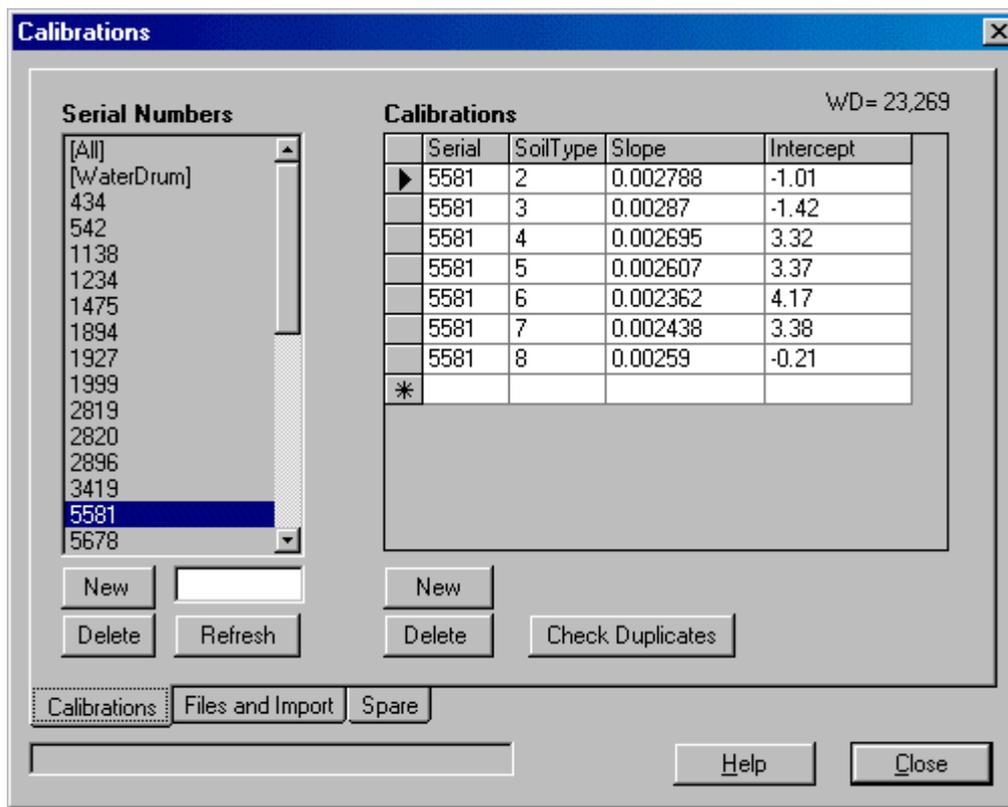
## Formulas and Functions

Formulas can be entered as keydata items using *SitesMenu/Edit* – *Prwin* will calculate a value from the formula and display the result on the readings screen and on graphs – see Formulas for examples.

# Calibrations

## Calibrations

Use *ProbeMenu/Calibrations* to enter calibration equations.



The data is uploaded from the neutron probe and saved as **counts**, but is displayed to the user as **volumetric soil water content (VSW)** using a calibration equation. If at any time the calibration equations are changed the displayed VSW will change.

The equation is linear, of the form...

$$\text{VSW} = \text{Count} * \text{Slope} + \text{Intercept}$$

vsw is in % units (0 - 100%), and typical values are...

$$\text{VSW} = 15,000 * 0.002 + 1.23 = 31.23 \%$$

(Slope = 0.002, Intercept=1.23 )

Each neutron probe needs its own calibration equations (the '0.002' number is different for each probe), and many users use a separate equation for different soil types or depths.

The neutron probe serial number is used to uniquely identify individual probes, and a **soil type** or **depth** number is used to identify each equation. Using *ProbeMenu/Calibrations* the slope and intercept can be entered for each probe serial number, and for each soil number. There is no limit to the number of equations.

The soil number must also be entered on the *EditSite* screen to tell *Prwin* which equation to use at each depth. The serial number of the neutron probe is saved with each set of readings, so *Prwin* is able to find the correct equation. Even if a neutron probe with a different serial number is used on the same site, the correct equation will be used.

## Water drum count

Neutron probes should be routinely checked by taking a measurement in a 200 litre drum of water (a very stable source of hydrogen) to give the **water drum count**. If this count ever changes it invariably means that the neutron probe has a fault, and users should be wary of compensating for the change by simply changing the equations. However, if a neutron probe is repaired and it is found that the calibrations have changed significantly then new equations must be entered. So that *Prwin* can still display data taken before the repair it is standard practice to increase the serial number by 1 (SN 1234 is changed to SN 1235), and to enter the **new equations using this new serial number**. The new serial number must also be entered into the neutron probe.

## Count Ratio

The water drum count allows for equations developed using one probe to be used with other probes - the equations are 'normalised' to the water drum count. The calibration equation can be expressed in the form...

$$\text{VSW} = (\text{Count}/\text{WaterDrumCount}) * \text{Slope} + \text{Intercept}$$

A typical equation will be

$$\begin{aligned}\text{VSW} &= (15,000/32,500) * 65 + 1.23 \\ &= 0.461 * 65 + 1.23 = 31.23 \%\end{aligned}$$

(Slope = 65 Intercept=1.23)

Many users have found that, by normalising to the water drum count, the '65' and '1.23' may vary with soil type or depth, but are the same for all neutron probes. This will only be true for neutron probes with similar geometry, in the same type of access tube. If this is assumed to be true, and if the water drum count instead of the serial number is saved with each probe reading, just a single equation for each soil type is needed (and we do not need a separate equation for each neutron probe). Choose 'Water Drum' (SN = 1) for the equations that are normalised to a water drum count.

The **count ratio** option can be selected on *Options*, but in addition, when data is uploaded from the neutron probe, the option **save standard count instead of serial number** must be selected.

The standard count is stored in the neutron probe, and (on older models) can only be changed by doing a standard count test. After the test there should normally be no significant change in its value, and the new count should *not* be saved in the neutron probe. However, if it *is* updated it is still possible to change the standard count just before posting when the user is asked to confirm the header line of the post file. The new '503TDR' (1998) model allows the user to enter any value for the standard count into the neutron probe.

The neutron probe from CPN Corporation also stores calibration equations in the head unit - these equations are not used by *Prwin*, and they are ignored when data is posted.

## Count Interval

Returning neutrons are counted by the neutron probe for a certain time interval, and greater precision is achieved by counting for longer time periods. Typically an 8 second interval is used when 3 tubes are being averaged, but a single tube needs a 32 second interval to give an acceptable accuracy of about 0.5% VSW. The 503DR internally 'normalises' the data

# Calibrations

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such that the recorded count is the same whatever the counting period (not accounting for the random nature of the neutron emissions, of course).

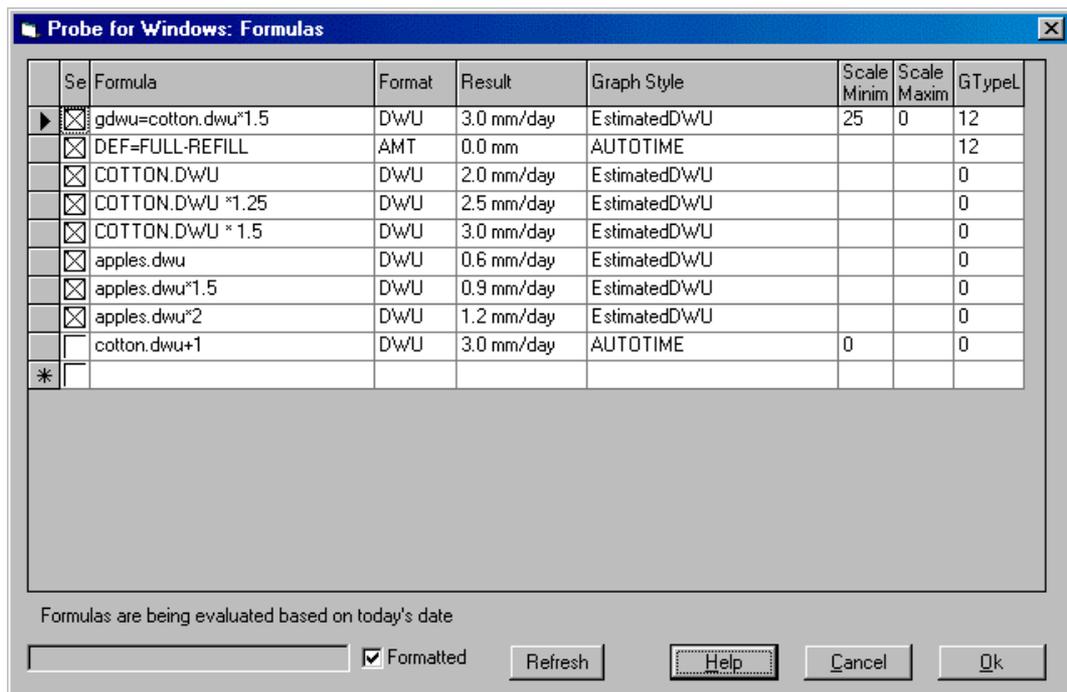
## Formulas

*Prwin* can use formulas and functions can be used in various places...

- Global formulas (*ProbeMenu/Global* formulas)
- Readings screen (*SitesMenu/Edit* as a Keydata item)
- Export (export/report definition file *FileMenu/Export*)
- Import (import definition file *FileMenu/Import*)
- Lower and Upper limits (*ReadingsMenu/Scheduling*)
- Site historical daily water use (*ReadingsMenu/Scheduling*)
- Global daily water use amounts (*ReadingsMenu/Scheduling*)
- Graph reports (graph report definitions - see *ProbeMenu/SystemOptions*)
- Graph scales (graph report definitions or directly in the scale text box on graphs screen)

## Global formulas

Global formulas and functions calculate results and variables that can be used anywhere else in *Prwin* - the values are **global** and available to all sites.



See Variables for a list of all the variable names that can be used in formulas, and see Functions for details of functions that can be used in formulas.

Formulas that are to be graphed need a **graph style** allocated (see Graph Styles).

Global formulas are saved in the file **FORMULA.TXT**.

## Examples of formulas...

`COTTON.DWU*1.2`

1.2\* current value of dwu in the file  
`COTTON.DWU`

# Global Formulas

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**GFAC=20**

a variable called **GFAC** has been set to 20.

This value can now be used in a '**LOWER**' formula to raise the refill value...

**LOWER=REFILL+GFAC**

**BUDBURST=#1/11/1999#**

Sets variable '**BUDBURST**' to the value 1 November 1991 - can be used in graph reports.

In order to format the display on the readings screen the formula entered on **EditSite** at keydata should have a ":" and a format code after the formula.

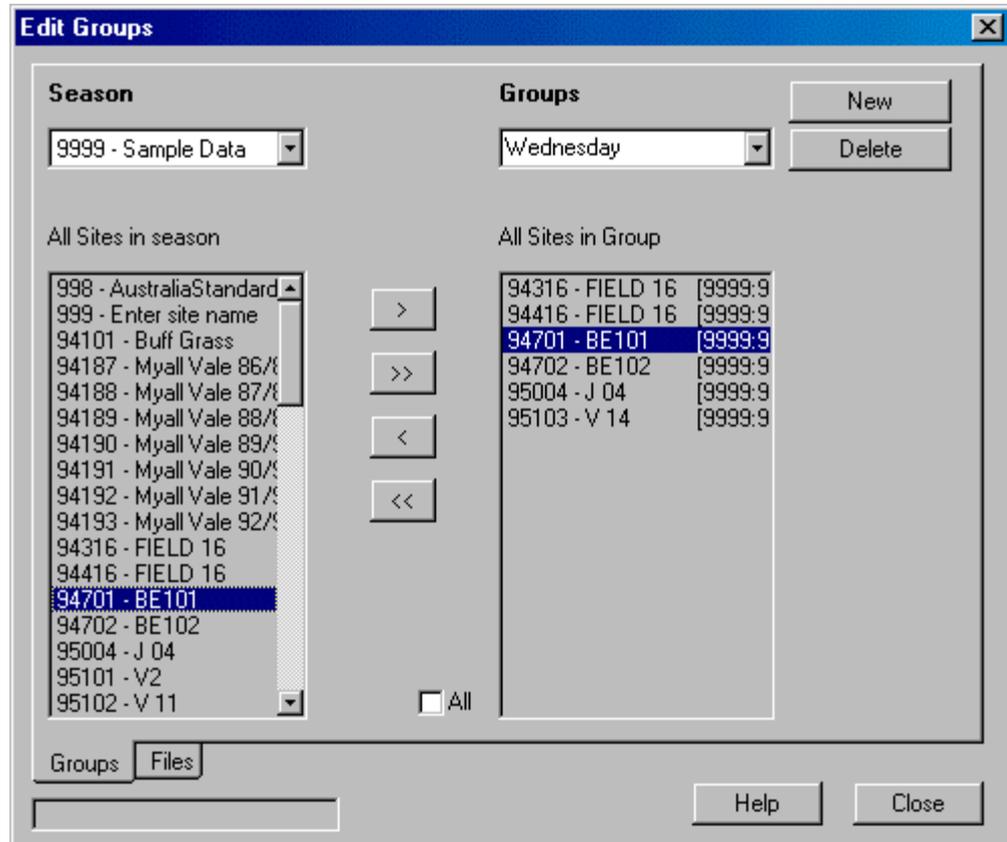
**@IF (TYPE=21 ,RZ1 ,NULL) :AMT**

copy RootZone 1 for Tube1 columns, display as an amount (mm or ins as set on DisplayPreferences)

## Groups

A Group is an **arbitrary list** of sites.

Groups can be edited and created using *ProbeMenu/Groups*. For example, a group called **wednesday** could be created that consists of all the sites monitored every Wednesday; or a group created for all sites that have a common rainfall.



A special group called **Latest** is automatically updated each time new data is posted. **Latest** can be edited by the user, but it will be updated next time data is posted.

Some uses of Groups...

- Post rainfalls to all sites in a group using *ProbeMenu/PostGains*
- Generate reports using *FileMenu/Reports*
- Generate irrigation files using *ProbeMenu/PostGains*

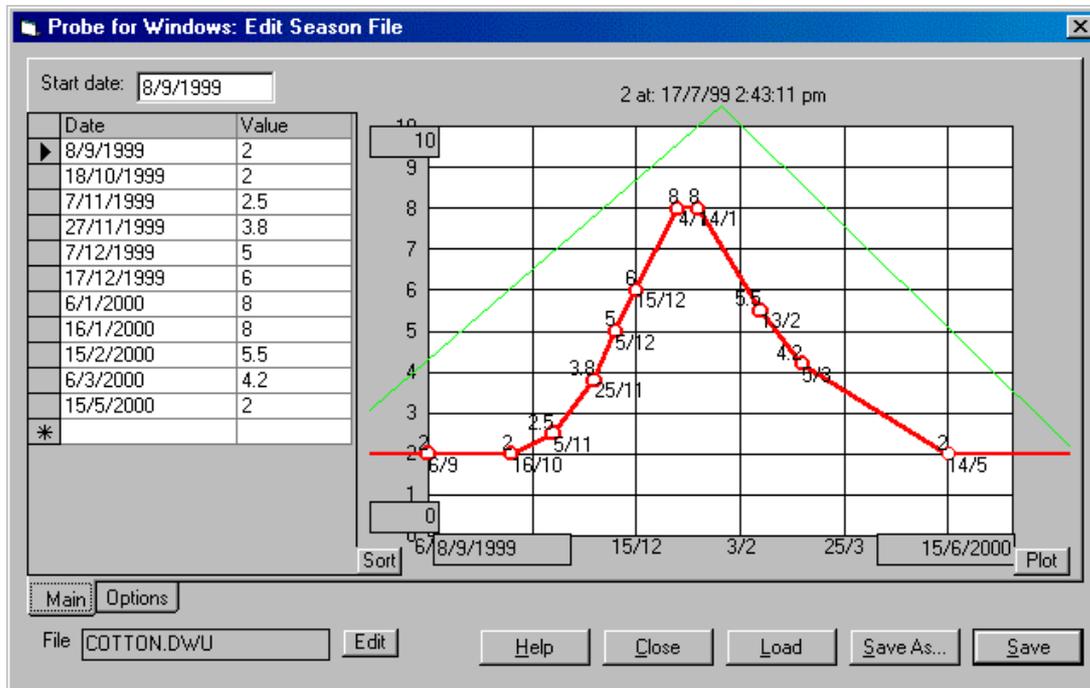
A report for **Latest** will give output only for newly posted sites.

Groups are saved as both the site number and season number, so they will need to be re-created in subsequent seasons.

# Season Files

## Season Files

Season files contain data that describes how a value, such as crop daily water use, **varies during a season**. They are text files that can be edited using *Notepad* (see Text Editor) or by using *ProbeMenu/SeasonFiles*.



As well as daily water use data, the files can also record other information...

- The pattern that the soil moisture deficit should follow for reduced deficit irrigation (RDI)
- The size that the crop should be at different stages in the season
- Historical pan evaporation values

In the file the date information is in 'days-since-January 1st', so that it can be used in different seasons.

In addition, the first line in the file contains a **day offset** that is added to all the other day numbers (Start Date). If this number is 0 then it has no effect, but if it is, for example, 180, all days will have 180 added to them. In this way the same data file can be used in different hemispheres, with just the day offset number changed.

If *ProbeMenu/SeasonFiles* is used to edit the file, a graph is drawn to show the changes during the season, and the display can be formatted such that the user 'sees' actual dates, and not 'days-since-January 1'.

As well as plotting the values being edited, another season file (or formula) can be graphed so that the two can be compared.

The data in a season file is 'read' by using the name of the file in a formula. For example the global dwu could be...

```
COTTON.DWU * 1.2
```

The value at will be calculated by **linearly interpolating** between the data points.

## Display Units

Data can be displayed in metric or imperial units, or in any other unit entered by the user.

The screenshot shows the 'Probe for Windows' dialog box with the following settings:

- Daily Water Use:**  User, Decimal places: 1, Units: mm/day, Factor (to mm): 1
- Water Amounts:**  User, Decimal places: 1, Units: mm, Factor (to mm): 1
- Area:**  User, Decimal places: 1, Units: Ha, Factor (to Ha): 1
- Volume:**  User, Decimal places: 0, Units: Kl, Factor (to Kl): 1
- Volumetric Soil Water:**  User, Decimal places: 1, Units: %, Factor (to 100%): 1
- Depth of measurements:**  User, Decimal places: 0, Units: cm, Factor (to cm): 1

Buttons: Help, Close

## Format codes used in reports

When configuring a report or screen definition, users can enter a **format code**. The formats recognised are the standard used by **Microsoft** (eg 0.00 will display to 2 decimal places, 0 will round to the nearest number), but in addition there are five special codes.

**Prwin** saves data in metric units, and to display daily water use as 'ins/day' it divides by 2.54 before display. Special format codes are used to indicate that the data item needs to be divided. For example the format code **DWU** displays the data as a daily water use in whatever units the user has chosen on **ProbeMenu/DisplayUnits**.

The five special format codes are...

<b>DWU</b>	daily water use (default= mm/day)
<b>AMT</b>	amounts of water (default= mm)
<b>AREA</b>	area (default= Ha)
<b>VOL</b>	volume of water (default= Kl)
<b>DEPTH</b>	depth of measurement (default= cm)

Each of these can be set to display in other units, and the decimal precision and text of the units can be set by the user.

Date and time formats on the graphs screen can be set with **GraphMenu/Options/Formats**, and the date format set for individual reports and screen configurations.

# System Options

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## System Options

### Message Log

All messages are added to a text file, so that there is a record of problems and errors that have occurred.

Use *ProbeMenu/SystemOptions* to view the contents of the file.

The file can be printed, or emailed as an attachment if you need support.

The file should be deleted if it gets too large.

### Backup

Use *FileMenu/Backup* to configure options. A data file nominated by the user can be backed up either...

- **Automatically** at intervals (default = 7 days)
- **Manually** using *FileMenu/Backup*.
- **Every time** you use *FileMenu/Exit*.

The data file should be the current season data file. The destination could be a local floppy disk, a **ZIP** drive, or a network drive.

The file can be compacted before being compressed (zipped) to the destination disk.

A compressed file can also be restored (unzipped).

### Table Templates

When new seasons, sites and readings are created, the data table is made by copying a **template** table. If the structure of the template table is ever changed, all new tables created will be based on the new structure. Tables can be edited using *AccessJr*, or other programmes such as *Microsoft Access*. The current version of *Prwin* uses Jet v2.5 MDB files (**Access 2.0**).

### Text Editor

Post files and report definition files can be edited with *Notepad*, *Wordpad* or DOS *Edit* - select which programme you want to run when you choose <edit> (default = *Notepad*).

A problem with both *Notepad* and *Wordpad* is if the user chooses **SaveAs**. Both these programmes seem to insist on adding **.TXT** to the end of the user entered name, so an irrigation file saved as **MONDAY.IRR** ends up as **MONDAY.IRR.TXT**. A solution is to use DOS *Edit*, which has the additional benefit of displaying line and character positions in the status bar.

Long file names can be a problem in **W95**. *Prwin* also runs under **W3.1**, which uses the old **8.3** file name system. **W95** internally also uses this system - it maintains a hidden table of **8.3** names and corresponding user long names. To avoid problems we recommend you use file and subdirectory names of less than 8 characters.

### Agronomy Help

The help file opened when the user chooses *HelpMenu/Agronomy* can be changed. This help file is designed to give users access to general information about irrigation monitoring and scheduling, together with case studies.

## Global Daily Water Use

The global daily water use is the initial value presented to the user as a suggestion when posting readings and irrigations. It is calculated from a formula using today's date. Examples of formulas are...

Formula	Result (mm/day)
4.5	4.5
COTTON.DWU	3.0 (depending on actual date)
COTTON.DWU*1.2	3.6 (on the same date)

## Options

When a user 'double-clicks' on a site on the **sites screen**, *Prwin* can...

- Show the readings screen.
- Show the graphs screen.

Changes to data in the readings screens can be optionally not saved - allowing 'what-if' tests without saving the results.

## Report Definitions

Graphs, export, and site screen definitions are all stored in text files, which can be edited by the user.

## Post Season

All readings are posted to a single season, which is normally changed by the user as readings are posted.

## Security

*Prwin* will not save data if security is not present. Security can be either

- a **Sentinal** key (dongle) plugged into a printer port, with the printer plugged in to the back of the key.

or

- A **CopyControl** electronic key.

*Prwin* first checks for a key (dongle) on the nominated printer port, and then checks for an electronic key.

The key is a **Sentinal SuperPro** from **Rainbow Technologies**. Key's can be piggy-backed only if they are of a *different* type. If there are problems, contact **Rainbow** at...

[www.rainbow.com](http://www.rainbow.com)

for their suggestions and latest 'drivers'.

The **CopyControl** electronic key is available from **Research Services New England**. It is useful for notebook computers being used in the field, and it also allows the software to have multiple users on a network. **CopyControl** is at

[www.microcosm.co.uk](http://www.microcosm.co.uk)

## Data Files

The data is stored in **Microsoft** MDB files. The current version of *Prwin* uses Jet v 2.5, used by **Access 2.0**, but also readable by **Access 7**. **AccessJr** is a programme supplied with *Prwin* that will open and edit MDB files.

# System Options

---

## Seasons

The list of seasons is in table **YEARS**, in the file **ALLSEAS.MDB**. This is the file that is opened when the user chooses **FileMenu/Open**

## Sites

The list of sites is saved in table **SITES**, in the file entered at **SeasonMenu/Edit Season** (default = **yyyyDATA.MDB**, where **yyyy** is the season)

## Readings

All the readings for each site are saved in table **SITEssss** (where **ssss** is the site number), which is normally in the same MDB file as the **SITES** table.

## Farms

All farms are saved in table **FARMS** in the file **ALLSEAS.MDB**. The **FARMS** table can be moved to its own MDB file, using **AccessJr**, and the name of this file entered here.

## Calibrations

All calibrations are saved in table **CALIBRATIONS** in the file **PRLOCAL.MDB**. The **CALIBRATIONS** table can be moved to its own MDB file, using **AccessJr**, and the name of this file entered here.

## Groups

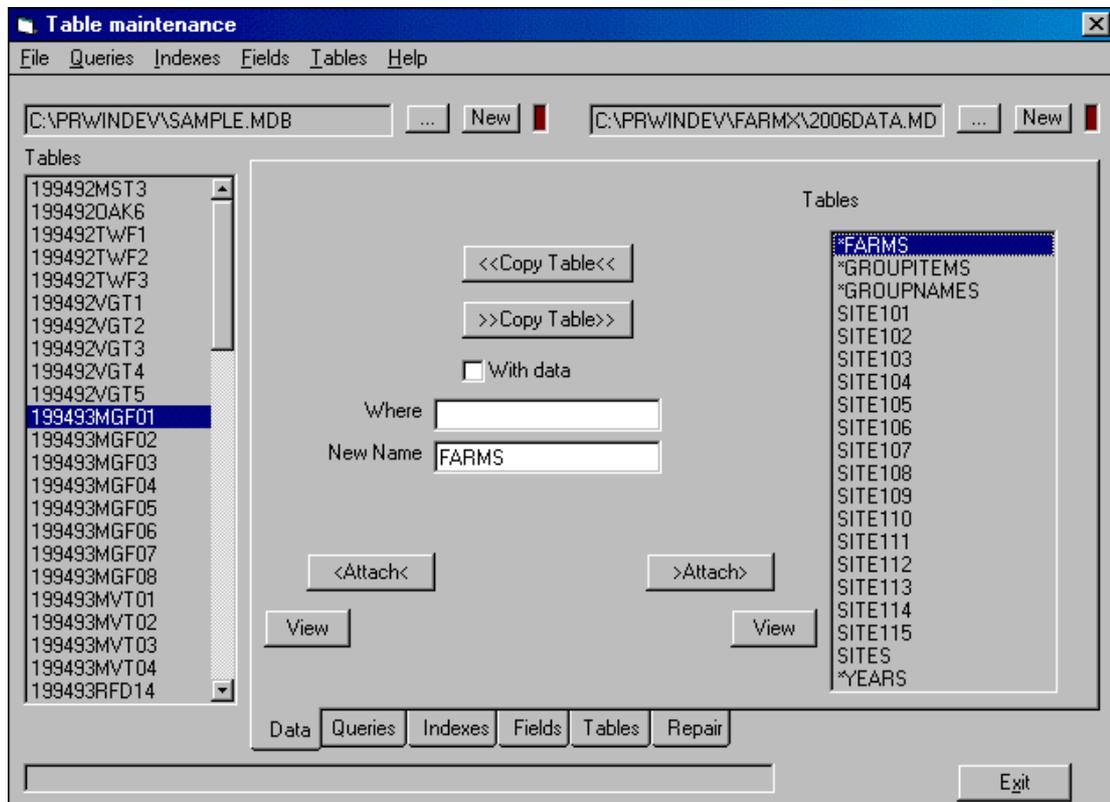
Group information is saved in tables **GROUPITEMS** and **GROUPNAMES** in the file **PRLOCAL.MDB**.

## Templates

Templates for creating new seasons, sites and farms are in the file **PRWIN.MDB**

## Database Maintenance

All data is saved in MDB files, and a separate programme called *AccessJr* is supplied to allow maintenance of these files if required.



### AccessJr ...

- Can create new MDB files..
- Tables and data can be moved from one file to another.
- Data can be viewed and edited.
- The internal structure of tables can be checked.
- Fields can be deleted and added.
- Indexes can be checked and created.

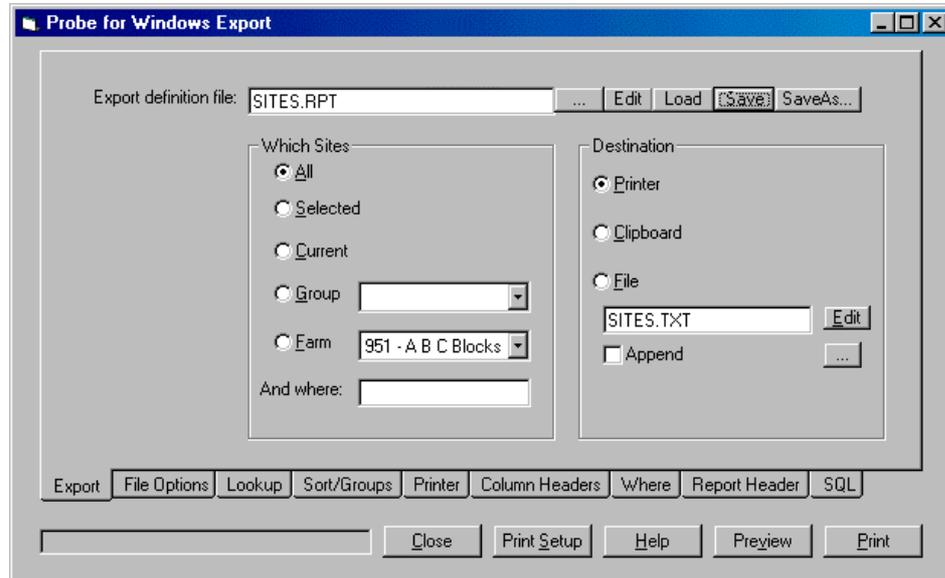
Use the **repair** tab to be **compact** files - compaction actually deletes any data that has been deleted by the user, and can make the files smaller. The season data file can be automatically compacted when using Backup.

MDB files can sometimes become **corrupted**, especially if the computer is turned off without a proper **Exit** by the software. The files can (usually) be **repaired**.

# Export and Reports

## Export

Use *FileMenu/Export* to output data to the printer or to a file.



*Prwin* has both a general purpose reporting system, with various supplied report definitions, and also some special reports. Output can be for all sites; selected sites; sites on a farm; or sites in a group (see Groups).

### Special reports

- The **Readings** report is a printed version of the readings screen (see Readings Reports)
- The **Irrigations Schedule** report is a diagram of the irrigation requirements over the next 14 days (see Irrigation Scheduling)
- The **Irrigations History** report is a diagram of the delivered and effective amounts over the season (see Irrigation History).

### Supplied general purpose reports

- The **Sites** report is a printed version of the sites screen.
- The **Irrigation Amounts** report lists each site with the predicted irrigation date and the amount of water required in a form suitable for a valve operator or automatic irrigation controller.
- The **Irrigation Summary** report is a listing of all sites, together with the amount and number of irrigation and rainfall events to date.
- The **Gains** report is a summary of the total water delivered to each site.

Users can customise these report definitions, and also create new definitions.

### Readings Reports

The data from the readings screen can be printed, or exported to a file or the clipboard.

The data is printed in columns, with dates running left to right. All columns can be printed, or just the last few columns. Each site can optionally start on a new page.

When saving to a file the file name can default to be the same as the site number. If output is to the clipboard the data can be used by opening a spreadsheet or word processor and using **Edit/Paste**.

Export of the data to a file or clipboard is in a format that spreadsheets or database programmes expect. Each row is a column of the readings screen, with the type of reading (full, refill, probe, irrigation, etc), followed by the soil moisture and keydata values. The file can be delimited with comma, tab, or any other character.

The first line can optionally be the data field names.

## Irrigation Scheduling

This is a special report that outputs a diagram of the water requirements for the next time period, say 14 days. The amounts and dates of the irrigations are shown, with symbols indicating the current status of the soil moisture. The total deliveries required across all sites are also totalled, and the required delivery rate is plotted as a bar chart.

The units can be either in **amounts** (mm or ins); **volume** (kl or gallons) (see Display Units); or **time** (days:hours:minutes); and the delivery rate can be per day; per hour; or per minute. To convert from mm of water in the profile (used internally) the following formulas and values are used...

<b>DeliverAmount</b>	used to calculate delivery rate
<b>DeliverTime</b>	used to calculate delivery rate
<b>Area</b>	used to convert depths to volumes
<b>DeliverFactor</b>	the factor the effective amount required needs to be increased by. E.g. 1.5 means deliver 50% extra to compensate for losses

All the above are entered at **ReadingsMenu/Scheduling**

$\text{DeliverRate} = \text{DeliverAmount} / \text{DeliverTime}$

$\text{EffectiveRequired} = \text{UPPER} - \text{LOWER}$  (typically **FULL - REFILL**,  
but could be different if **UPPER** or  
**LOWER** formulas have been set)

$\text{Deliver} = \text{EffectiveRequired} * \text{DeliverFactor}$

$\text{Volume} = \text{Deliver} * \text{Area} * 10$  (10 converts area \* depth to volume)

$\text{DeliverTime} = \text{Volume} / \text{DeliverRate}$

The data can be exported to a file or to the clipboard.

## Irrigation History

This is a special report that analyses all irrigations and rainfalls that have been applied to each site during the season, and prints a diagram showing effective and total amounts for each site, and in total. Symbols can be plotted showing the efficiency (effective / delivered) of each gain event, and the total delivery rate. See Irrigation Scheduling report above for various options. The data can also be exported to a file.

# Export and Reports

## Report Definitions

General purpose reports use **Report definition files** (\*.RPT) to specify the data to be exported, in which Sort and Grouping **order**, and with which **criteria**.

For example, the report definition **SITES.RPT** is similar to the sites report in **PR41**, but in addition it can be in sorted on any column (ascending or descending), and the output could be restricted to show, for example, only fields that are within 50 mm of the refill point.

A definition file can be copied using **SaveAs**.

Output can be to the **printer**, **preview**, to a **file**, or to the **clipboard**. Output to a file or clipboard will be 'stripped' (no page headers, group headers, etc - see below for options.)

As well as choosing to output from all sites, from a group of sites or sites on a farm, a **criteria** can be specified.

For example...

```
(CRNTAMT-REFILL) < 50
```

will only output data for sites that are within 50 mm of the refill value.

A report is broken up into **sections**.

- **Report header and footer** at the start and end of the report.
- **Page headers** and **page footers** at the top and bottom of each page
- **Group headers** and **group footers** before and after a group break (see Sort and Grouping )
- The **detail** section, which prints the actual data for each site.
- A **column header** section, made up of the titles from each column.

Each of these sections can print any number of items. Each item can be...

- A **label** with fixed text e.g. **Sites Report**.
- A **text box** with data from the site or farm. e.g. **Top Paddock**
- A horizontal or vertical **line**.

## Sort and Grouping

The output can be **sorted** by any item, ascending (a-Z, 0-9) or descending (Z-a, 9-0)

In addition, the report can be **grouped**. Every time the value of a nominated field changes, the report can **break** to print cross headings. For example, the output could be sorted by **Farm Name**; and every time the farm name changes there could be a group break to print the actual farm name.

A **new page** can be started before or after a group break.

## Lookup File

A lookup file can be joined to the main output so that, for example, the valve numbers of an irrigation controller could be output instead of the **Prwin** site number. Lookup files are text files, and in the example below contains **Prwin** site numbers and the corresponding valve numbers.

Example of a lookup file...

```
Block, Valve, PrwinSite, Factor4  
02, 26, 226, 0.6
```

02, 27, 226, 0.4  
02, 46, 246, 1.0

If there is more than one line in the lookup file with the same *Prwin* site number, a separate output line will be printed for each line in the lookup file. This enables a single *Prwin* site (226 in this example) to request an irrigation amount for several valves (Block 02, Valves 26 and 27 in the example).

In addition, the lookup file could also contain a **factor** to compensate for different irrigated areas (0.6 and 0.4 in the example).

You need to nominate which data item in the lookup file corresponds to (or **joins**) the *Prwin* site number. If the lookup file has **field headers** in the first line (as in this example) they can be used - if not use \L1, etc to refer to the data in lookup column 1.

Lookup file field names *must not be the same* as a *Prwin* field name. In the example the column name for the site number is **PRWINSITE**. It could not be **SITE** because the *Prwin* field name for the site number is also called **SITE**. Similarly the correction factor to compensate for different areas is called **FACTOR4** because **FACTOR** is the name of the *Prwin* irrigation delivery factor for each site.

## Column Header Section

Each column has a **title**. The titles are all printed in the **column header section**. This section can be printed either

- At the top of each page (below the page header)

or

- Below the group header.

## Output to file

The name of the **output file** can be specified, and whether the new data should be **appended** to the end of an existing file.

Output to a file or to the clipboard will be 'stripped' (no page headers, group headers, etc) and data items can be separated by a **delimiter** (comma, tab etc)

Text, dates and times can be output in "**quotes**", and numbers can be output *either* formatted (e.g. 23.2) *or* raw (e.g. 23.1728)

## Printer Options

The **margins** must be specified in **cm**. Some printers cannot print within 1 cm of the edge of the paper.

To test report layouts, **guide-lines** can be printed showing the margins and the location of each section and text item, and a grid at 1 cm intervals.

A **font** and **font size** can be specified as a default. This font will be used for all column items.

## Export Specifications

The definition file needs to be edited with **Notepad** (see Text Editor) in order to specify each item that will be printed. An item can be...

- A **label** (e.g. output = **Site Report**)
- A **text box** with data (e.g. output = **Top Paddock**)

# Export and Reports

- A line

In addition, a **column** can be specified. A column will be printed in 2 parts: the title as a **label** and the data as a **text box**. (The **titles** can be printed either in every **group header**, or once on each page in the **page header**.)

Each item that is to be printed has a specification line with format...

**SectionCode~TypeCode~Source~Left~Top~Right~Bottom~Font~Size~Bold~Format~Align~Units~Colour**

All positions (left, right, top, bottom) are specified in **cm**.

Horizontal positions (left, right) are *relative to the left margin*.

Vertical positions (top, bottom) are *relative to the top of the current section*.

For example; **RIGHT=8** is a point 8 cm from the left margin; **TOP=1.2** is a point 1.2 cm below the top of the current section.

If a **font** or **font size** is *not* specified, the report default font is used.

**Units** and **format** are only applicable for numeric formulas.

A line size is specified at **size**. (in points, 1 pt = 1/1440 inches; 0 = hairline, the thinnest line possible on the printer).

**Colours** are specified with a colour code (e.g. **RED**)

## Section Codes

Section codes specify in which section of the report the item is to be printed.

<u>SectionCode</u>	<u>Section</u>
RH	Report header - printed once at beginning of report
RF	Report footer - printed once at end of report
PH	Page header - printed at top of each page
PF	Page footer - printed at bottom of each page
GH1	Group header 1 - printed before a group break
GF2	Group footer 2 - printed after a group break
D	Detail printed for each site
Cn	Column, to go in both detail and column headers.
CH	Column header - printed either at top of page or after group header.

## Type Codes

Type codes specify the **type of data** that is to be output.

<u>TypeCode</u>	<u>Description</u>
SECTIONHEIGHT	Height of section in cm
TEXT	Text box e.g. <b>NAME</b> will print <b>Top Paddock</b>
LABEL	Label displaying fixed text e.g. <b>Site Report</b> but can include variables... e.g. <b>\OWNER1</b> displays the first line in the Owner registration file.
FORMULA	Text box will display numeric data or formula e.g. <b>FULL</b> or <b>COTTON.DWU*1.2</b>
INDIRECTFORMULA	Value of a formula e.g. <b>LOWER</b> will evaluate the <b>LOWER</b> formula

# Export and Reports

**LINE** Draws a line from **Left, Top** to **Right, Bottom**  
**size** = line width in points, 0 = hairline

## Colour Codes

**RED**  
**GREEN**  
**BLUE**  
**YELLOW**  
**MAGENTA**  
**CYAN**  
**&FF00FF**

hexadecimal (preceded by an **&**) - same as HTML.

## Examples of Export Specifications

Some examples of export specifications...

**PH,SECTIONHEIGHT,1.3**

Height of page header = 1.3 cm

**PH,LABEL,Sites Report for \OWNER1,0,0,15.8,0.5, Arial, 16, 1,,L, 0, RED**

Prints **Sites Report for Fred Delpont**

in the page header

left aligned.in a space from 0-15.8 cm, 0 to 0.5 cm high

Font = Arial, 16 pt; bold, in red

**PH,LABEL,Where: \WHERE,11,0.7,16,1.2, Arial, 12, 1,,R, 0**

Prints **Where: EPIAMT<10**

in page header

right aligned in a space from 0-5 cm wide, 0 to 0.7 cm high

Font = Arial, 12 pt, bold

**GH1,LINE,,0,1.2,16,1.2,, 2, 0,,L, 0**

Draws a line in the group header from 0 to 16 cm, 1.2 cm below top of section.

**GF1,FORMULA,COTTON.DWU,0,0,5,0.5,Arial,10,DWU,0,L,1**

Prints **3.6 mm/day**

(the value today of DWU from the file **COTTON.DWU**)

in the group footer

left aligned in a space from 0 - 5 cm, 0 - 0.5 cm high

Font = Arial, 10 pt, DWU format, not bold, with units

The **column header section** height should be specified - this section can also have lines drawn like any of the other sections.

**CH,SECTIONHEIGHT,2**

Column header section to be 2 cm high.

**CH,LINE,0,2,18,2,1**

Draws a line at the bottom of the section, 18 cm wide, 1 pt thick

## Column Specifications

Each column to be output needs a **column specification**, with the type code **Cn**, with format...

**ColNum,Source,Width,Format,Units,Align,Title,TypeCode**  
**'comments**

Each column will be printed in to two parts, the **title** going to a **LABEL** (in either the page header or group header) and the **source** to a **FORMULA** in the detail section. The horizontal position of the items will be calculated based on the column **width**.

# Export and Reports

The actual output will be suppressed if width=0. This can be used to calculate intermediate results.

<b>ColNum</b>	<b>Cn</b> n = column number
<b>Source</b>	Any reserved word see Variables
<b>Width</b>	Width of output, in cm.
<b>Format</b>	Format code for output - see Display Units
<b>Align</b>	Alignment. <b>L</b> = left; <b>C</b> = centred; <b>R</b> = right.
<b>Units</b>	1 = display units (eg <b>mm/day</b> ) 0= no units
<b>Title</b>	The title at the top of a column - use   for multiple lines.
<b>TypeCode</b>	<b>Formula</b> or <b>IndirectFormula</b>

## Examples of Column Specifications

Some examples of column specifications...

**C3,NAME,0.8,T,R,0,Site|Name**

Printed output...

```
      Site
      Name
Top Paddock
Site 33
```

**C4,PDWU,0.6,DWU,R,1,Probe|Dwu|\UDWU**

Printed output...

```
      Probe
      Dwu
      mm/day
2.3 mm/day
1.1 mm/day
```

**C5,EPIAMT\*AREA\*FACTOR4,0.8,VOL,R,1,Amount**

Printed output...

```
      Amount
      12 Ml
```

**EPIAMT** data field that contains the calculated amount or water required if scheduling is based on estimated daily water use

**AREA** is the site area

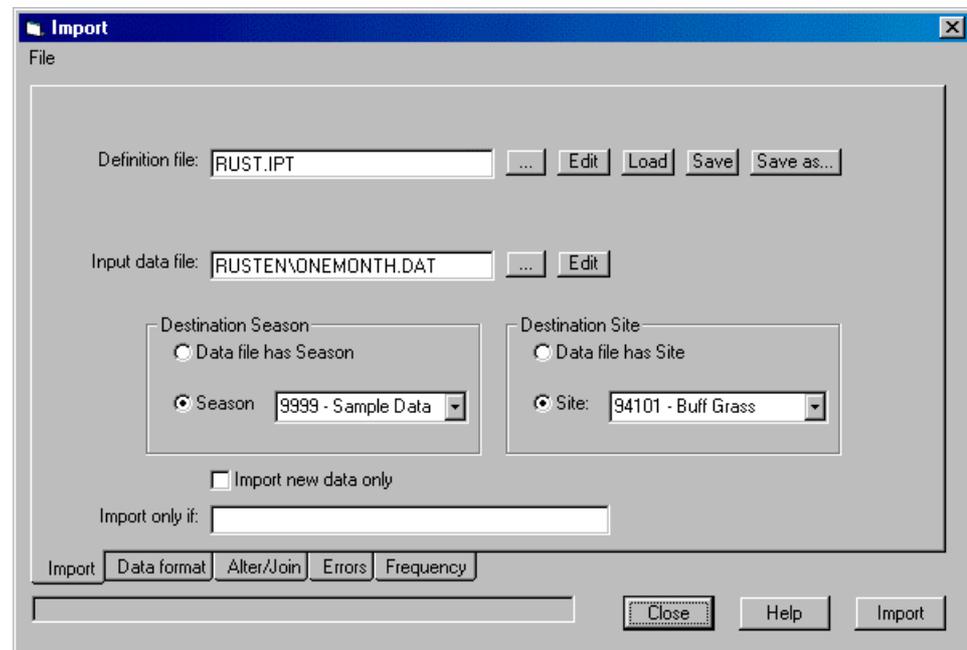
**10** is to convert from **area\*depth** to **volume**

**FACTOR4** is in the lookup table - will be specific for each valve.

The output will be in the volume units (**VOL**) as selected by the user with *ProbeMenu/DisplayUnits*.

## Import

Use **FileMenu/Import**, or **SitesMenu/Import** for just one site, to import data from irrigation controllers, weather stations, and other data loggers. ..



The data from the logger or weather station needs to be uploaded or acquired by the software supplied by the logger manufacturer, or weather data needs to be uploaded from a weather station using a modem and communications programme, or downloaded from the internet.

An **import definition file** (\*.IPT) is used to describe the input format. Part of this file is saved automatically, but individual column specifications that describe the incoming data, and where the data is going, need to be entered using **Notepad** (see Text Editor)

The import definition file can be copied by using **SaveAs**.

The name of the **input data file** must be specified. This can be changed by the user just before the import, so a single import definition file can be used with different data files

The name of a file to receive **rejected** data can be specified, for re-posting or checking.

The **criteria** for the import can be specified. For example, **DATE>LASTDATE** will only post data that is later than any existing data in the readings screen.

Any changes made to these options may be saved in the import definition file.

### Destination Season and Site

The destination season and site can be specified...

1. By the user on the import screen.
2. From the incoming data

Method 1 is applicable for data from a weather station that is being imported into a **single site**.

Method 2 allows the incoming data file to send the data to **several sites**.

## Alter

**Site numbers** in the import file might not be the same as the site numbers used in *Prwin*. If **alter** is chosen

- The incoming site numbers are altered using data in a lookup file.
- Even if there is no corresponding record in the lookup file the data can still be imported.

The fields which **join** the incoming imported data with the lookup file data need to be specified.

## Import Specifications

The import works in two steps...

1. Each line (or record) of the incoming data file is read, and the individual data items in each record saved.
2. The saved data items are then sent to a **destination**.

This is needed so that incoming data (year, month, day for example) can be combined (to give a true date in this example) before being saved in the *Prwin* database.

The import specifications therefore need to be in two parts...

1. The **input specification** - the location of the data in the incoming text file, and its format.
2. The **destination specification** - which data item (**source**) is going to which row of the readings screen (**destination**).

## Input specifications

Each line corresponds to one incoming data item, or column. Each line starts with **Cn**, where **n** is the column number. Following this will be a format code; the position on the incoming line or record; and the row number. If the imported data is separated with commas, tildes (“~”) or tabs it does not need position information.

**Column,Format,Start,Width,Row `comment**

The columns should be **C1, C2** etc. (The destination specifications will refer to the data as **\C1, \C2**, etc)

<b>Column</b>	Column number e.g. <b>C1</b>
<b>Format</b>	The only import format code required is <b>DT</b> for dates and time.
<b>Start</b>	If the data is in fixed columns, enter the start character position e.g. <b>12</b>
<b>Width</b>	The width of the incoming data, in characters.
<b>Row</b>	Typically each incoming record will be on the same line (row = 1), but some data loggers will output data spread over several lines.
<b>Comment</b>	Any text following a single quote will be ignored

## Examples of Input Specifications...

**C2, ,12, 10, 1**

Column 2 data starts at character 12 and is 10 characters wide.

**C1, , , 1**

Column 1 data is in the first column (it must be delimited with tab or comma) of the **first line** of each record.

`C3, DT, 25, 12, 3`

Column 3 data is a date and/or time, starts at character 25; is 12 characters wide; and is on the **third line** of each record.

## Destination Specifications

Each line beginning with an `On` specifies an **output**, usually to a row in the readings screen.

The incoming data is referred to as `\C1`, `\C2`, etc. If a lookup file is being joined to the incoming data then its field names (headings in the first line of the lookup file) can also be used. In the example below `PRWINSITE` is a field in the lookup file, so it can be referred to in one of the output specifications.

Irrigation amounts in volumes or time units will need to be converted to depths using the area and pump rate information in *EditSite*.

The destination specifications are in the format...

`OutputNumber, Source, Destination `comment`

<code>OutputNumber</code>	<code>On</code>	<code>O1</code>
<code>Source</code>	The source of the data e.g. <code>\C1</code> data from column 1	see Variables for a full list
<code>Destination</code>	The destination of the data. eg: <code>\D1</code> for depth row 1 <code>\K1</code> for keydata row 1	see Variables for a full list
<code>Comment</code>	any text following a `	

## Coding a Destination Site

In order to import data from a single data file to **different** sites, the destination site number can be read from the incoming data.

For example, a data file from an irrigation controller might consist of...

`SiteNumber, Date, Amount`

The import can be told to send the data to the corresponding site.

Even if the data file has...

`Block, Valve, Date, Amount`

The import can use a lookup file to find the corresponding *Prwin* site.

The special destination code `LOADSITE` is used to tell *Prwin* to load and post data to that site.

The specification line...

`O1, \C1, LOADSITE`

...will post data to the site with the site number in the first column of the data file.

The specification line...

**O1,PRWINSITE,LOADSITE**

...will post the data to the site with site number in the **PRWINSITE** column of the lookup table.

## Examples of Destination Specifications...

**O2,\C2,K1**

put the data from input column 2 into keydata row 1

**O3,\C8,D1**

put the data from input column 8 into depth row 1

**O4,14,Type**

put 14 (the code for irrigation) into the **Type** row:

**O6~@DATESERIAL(\C3,\C4,\C5)+@TIMESERIAL(\C6,\C7-1,0)~Date**

the date is in columns 3,4,5,6 and 7 as Year,Month,Day,Hour,Minute.

The data is combined as one number and put into the date row

**O4~@DATESERIAL(\C3,\C4,\C5)+@TIMESERIAL(\C6,\C7-1,0)~Date**

The date less 1 minute is put into the date row.

**O3,5.6,EDWU**

The value '5.6' is put into the **EDWU** row

**O10,SiteGDWU,EDWU**

**SiteGDWU** gives either the GlobalDWU, or a site specific dwu if a formula is entered at **SiteEdit/HistoricalDWU**.

See Variables for a list of all reserved words that may be used.

# Variables and Functions

## Variables

The following variables can be used in formulas and function for export, import and graph report definitions.

Variable Name	Comment
TODAY	Today's date
NOW	Today, now (includes time)
NULL	Empty (used in @IF ( ))
LXA	Volume = Area * Depth *LXA ( = 10)
SITE	Site number
NAME	Name of site
CROP	Name of crop
AREA	Area (in Ha)
POSITION	Position of tube (0-100)
WATERTIME	Standard water time (days and fraction)
WATERVOL	Standard delivery volume (in Kl)
LIRRDATE	Date of last irrigation
LIRRAMT	Amount of last irrigation (in mm)
REFILL	Refill point (in mm)
FULL	Full point (in mm)
LPRBDATE	Date of last probe reading
LPRBAMT	RZ1 at last probe reading (mm)
PROBEDWU	Probe dwu (in mm/day)
PPIDATE	Predicted date based on pdwu
PPIAMT	Amount to be delivered
ESTDWU	Estimated dwu (in mm/day)
EPIDATE	Predicted date based on edwu
EPIAMT	Amount to be delivered
SITEGDWU	Formula for site historical dwu
GPIDATE	Predicted date based on sitegdwu
GPIAMT	Amount to be delivered
CRNTAMT	Rz1 value in latest column
CRNTDATE	Date in latest column
PDATE	Planting date
PWP	Permanent wilting point (not used)
PREVAMT	RZ1 at previous probe readings
PREVDATE	Date of previous probe reading
DELIVIRRI	Total delivered irrigations (in Kl)

# Variables and Functions

EFFIRRI	Total effective irrigations (Kl)
DELIVRAIN	Total delivered rain (Kl)
EFFRAIN	Total effective rains (Kl)
NUMIRRI	Number of irrigations
NUMRAIN	Number of rains
UPPER	Formula for upper limit
LOWER	Formula for lower limit
UPPERAMT	Value of Upper formula (mm)
LOWERAMT	Value of Lowe formula (mm)
FACTOR2	Delivery factor
COMMENT	Comment for grower about site
XCOORD	GPS coordinate (not used)
YCCORD	GPS coordinate (not used)
ROOTZONE1	Root zone 1 definition eg 0-70cm
ROOTZONE1	Root zone 2
ROOTZONE3	Root zone 3
OWNERn	Value from owner registration file (n = 1-10)
FARMNAME	All below entered on EditFarm
FARMOWNER	
ADDRESS1	
ADDRESS2	
TOWN	
POSTCODE	
COUNTRY	
TEL	
TEL2	
FAX	
MOBILE	
EMAIL	
YEAR	

**Graphs reports only** (T = time graph; use D for depth graph)

TXMIN	Minimum value on horizontal axis
TXMAX	Maximum value on horizontal axis
TYMIN	Minimum value on vertical axis
TYMAX	Maximum value on vertical axis

# Variables and Functions

<b>TLEFT</b>	Left edge of graph (% paper)
<b>TRIGHT</b>	Right edge of graph (% paper)
<b>TTOP</b>	Top edge of graph (% paper)
<b>TBOTTOM</b>	Bottom of graph (% paper)
<b>TXLEG</b>	Horizontal position of legend (% paper)
<b>TYLEG</b>	Vertical position of legend (% paper)

## Export only

<b>SORT</b>	Sort order
<b>WHERE</b>	Where criteria
<b>FILE</b>	Name of file used for export
<b>PAGE</b>	Current page number
<b>NOW</b>	Today's date and time
<b>TODAY</b>	Today's date
<b>Cn</b>	Value of column n
<b>JOIN</b>	Name of lookup file
<b>Ln</b>	Value from column n in lookup file
<b>LName</b>	Value for named field <b>LName</b> in lookup file

## Import only

<b>Cn</b>	Value from column n in import file
<b>LASTDATE</b>	Last date in current readings
<b>LOADSITE</b>	Used to load and post to a site

# Variables and Functions

## Functions

The following Functions are available.

Function	Comments	Used...	Example
@DATESERIAL(Y,M,D)	Y=Year M=Month D=Day	Export, Import	@DATE(\C2,\C3,\C4)
@TIMESERIAL(H,M,S)	H=Hour M=Minute S=Second	Export, Import	@TIME(\C5,\C6)
@TODAY()	Todays date and time	Export, Import	@TODAY()
@DOY(Date)	Day of year since Jan 1	Export, Readings	@DOY(PPIDATE)
@LKV(file,value,style)	Looks up corresponding value in file Style: 0 =interpolate 1=Value just less than 2=Value just greater than	Export, Import, Readings	@LKV(COTTON.DWU,DOY(TODAY),1)
@IF(Test,Value1,Value2)	If 'test' is true return 'value1', else return 'value2'	Export, Import, Readings	@IF(TYPE=21,RZ1,NULL)
@RATE(Item)	Rate of change of 'item' eg fruit size growth rate	Readings	@RATE(SIZE)
@CUM(item)	Accumulate dwu - total water used by crop	Readings	@CUM(EDWU)
@SM(item,factor)	Smooth item using factor	Readings	@SM(SIZE,0.1)

## Constants

Constants such as COTTON.DWU \* 1.2 can be used.

Date constants should be enclosed in # #. For example, a criteria for a report to only output irrigations scheduled before 1 June...

**EPIDATE < #1 June 2000#**

# Neutron Probe Operation

## Neutron Probe Operation

This section describes the mechanics of operating the neutron probe in the field, with step by step instructions of which buttons to push on the probe top when taking readings.

As measurements are taken at each site, the readings are recorded in the neutron probe. When all readings have been taken the neutron probe is connected to a PC with an RS232 cable, and the data **uploaded**. After the data has been uploaded and posted, the data in the neutron probe is cleared by **formatting**. Make sure that the data has been posted correctly *before* formatting.

The current (1998+) 503TDR model records the date and time that readings are taken - the date and time is set with **MENU**, **CLOCK**. Older models do not have a clock, but the date and time can be manually recorded using keydata items 1 and 2. This is done by recording a dummy site with an **ID=0**, and the date as keydata item 1 (**K1**) and time as keydata item 2 (**K2**). The probe must be formatted with at least 2 keydata items.

### Format neutron probe

This procedure must be done before taking a new set of readings in the field.

<i>Press key...</i>	<i>Read...</i>	
FMT	REC 662	space for 662 tubes
ENTER	K DATA 0	current number of keydata items
0	K DATA 0	enter number of keydata items (2 if entering date)
ENTER	DPTH 8	just <b>Enter</b> if number is correct.
8	DPTH 8	enter number of readings taken in each tube - usually 8
ENTER	SET FMT?	just <b>Enter</b> if number is correct.
ENTER	REC 662	Confirm the settings
ENTER	READY	there will be space for 662 tubes.

The neutron probe is now ready to take readings in the field.

### Entering the date and time with 'old' model

This step is optional - when posting readings **Prwin** will always pause at the start to allow you to enter the date and time. The probe must be formatted for at least 2 keydata items.

<i>Press key...</i>	<i>Read...</i>	
LOG	ID 592	
0	ID 0	enter <b>ID=0</b> for a date/time marker
ENTER	K2 0	
1430	K2 1430	enter time as <b>hhmm</b> (e.g. 1430 for 2:30 p.m.)

# Neutron Probe Operation

ENTER	K1 0	
1306	K1 1306	Enter date as <b>ddmm</b> (or <b>mmdd</b> ) e.g. <b>1306</b> (or <b>0613</b> ) for 13 June
ENTER	TAKE 8	
STEP	DATA OK?	press <b>STEP</b> (usually 8 times) to skip until probe reads <b>DATA OK ?</b>
ENTER	READY	store date and time

The date and time is now entered into the neutron probe. This procedure can be repeated at any time during the day, but should be done at the start of each day if readings are taken over several days without the data being uploaded and the neutron probe re-formatted.

## Taking readings

To begin taking readings place the neutron probe on top of the access tube, then carefully lower the detector down the tube to the last cable stop. The bottom (typically 120 cm) reading is taken first, then the 100 cm, 80 cm etc.

The site number must first be entered as an ID number, and then the probe is instructed to take a reading and store the count. If three tubes are to be averaged the same site number is entered at each of the three tubes.

<i>Press key...</i>	<i>Read...</i>	
LOG	ID 592	
216	ID 216	enter the site number
ENTER	K2 0	
STEP	K1 0	enter keydata item and <b>ENTER</b> (or <b>STEP</b> to skip)
ENTER	TAKE 8	ready to start counting at depth 8
START	COUNT 8	start counting...
	M8 15123	'beep' and count displayed
ENTER	TAKE 7	press <b>ENTER</b> to store the count (or <b>START</b> to read again)
		lift the detector to the next cable stop press <b>START</b> and repeat for each depth
ENTER	DATA OK?	after last reading at top depth
ENTER	READY	if data is OK press <b>ENTER</b> and move onto the next tube

If the data is *not* OK, press **STEP** to cycle through the keydata and counts and re-enter the keydata or take a new count. Pressing **CLEAR** when **DATA OK?** is displayed will abandon the record.

When all the tubes at a site have been read, move onto the next site. All the tubes for one site should normally be done as successive tubes, although **Prwin** can sort the post file into site order if necessary.

Pressing **RCL** will allow previous data records to be recalled.

# Neutron Probe Operation

## Counts Mode

The neutron probe must upload the data formatted as *counts*. To check the data format...

<i>Press key...</i>	<i>Read...</i>
UNITS	MUNT CNT

If the display is **CNT** it does not need changing - just press **CLEAR**.

If the display is *not* **CNT**, press **STEP** until it displays **CNT**, and then **ENTER**.

## Uploading data

To upload data, older model neutron probes must be in **PRINT CD** mode. To check the print mode...

<i>Press key...</i>	<i>Read...</i>
PRINT	PRINT CD

If the display is **PRINT CD** it does not need changing - just press **CLEAR**.

If the display is *not* **PRINT CD**, press **STEP** until it displays **PRINT CD**, and then press **ENTER** and wait for a 'timeout'.

The **baudrate** must be the same as set on *ProbeMenu/Upload/Settings*. The neutron probe baudrate is set with...

<i>Press key...</i>	<i>Read...</i>
MENU	SELFTEST
STEP	BAUD
ENTER	300
STEP	1200
ENTER	

first menu item

step to baud rate

current baud rate

STEP until you see the baud rate you want

## Water drum count

The neutron probe should be checked at regular intervals by taking a set of readings in an aluminium access tube positioned in a 200 litre drum of water (you could consider logging the readings and posting to a 'dummy' Site 999). If the water drum count changes significantly (by about 500 counts) the probe should be checked and serviced.

## Glossary

### Daily Water Use (DWU)

The daily water use is the amount of water used by a crop in one day. *Prwin* measures it in mm per day (or ins/day - see Display Units)

**Probe daily water use (PDWU)** is calculated from the rate of change of the water content in the primary root zone – typically 0-70 cm (see Root Zones). This will be the actual crop water use if there is no surface evaporation or through-drainage – if either of these are taking place then PDWU will *not* be the crop water use but a combination of...

actual crop water use

surface evaporation

through drainage

The probe daily water use is used to calculate the date and amount of water required at the next irrigation

The **estimated daily water use (EDWU)** is a value of crop water use entered by the user that will be used to predict a second irrigation.

The **historical daily water use (SiteGDWU)** is a value of daily water use that is calculated from historical data, models, or crop factors, and is used to predict a third irrigation. Each site can have its own formula, or it can use the global daily water use.

### Root Zones

The total water content in three separate soil profiles are calculated from the volumetric soil moisture content at each depth. Each of the root zones needs the user to enter the top and bottom of the root zone. The first root zone is typically set to be 0 cm to 70 cm, but will really depend on the crop and soil type.

The water content of the first root zone (**RZ1**) is used to calculate the probe daily water use (**PDWU**)

### Full Point

Also known as field capacity.

- The maximum water content of the soil that can be maintained against gravity without through-drainage or surface run-off.
- The wettest soil profile that can be regularly obtained after through-drainage has ceased.
- Like pulling a saturated sponge out of a bath of water - when the sponge stops dripping it is at the full point.
- Expressed as mm of water over a certain depth (e.g. 0-70cm).
- The VSW will not be constant down the soil profile.
- Dependant on **soil type**, but independent of the **crop**.

### Refill point

- The water content of the soil below which the plant exhibits some form of stress, and a drop in yield.
- Expressed as mm of water over a certain depth (e.g. 0-70cm).

- The VSW will not be constant down the soil profile.
- The advent of stress might be identified by a drop in the daily use water
- The consequence might be that the roots start extracting water at a greater depth.
- Dependant on both soil and crop.
- Some crops, such as wine grapes, will be taken below the refill point to improve desired attributes.

## **Wilting Point**

The water content of the soil below which plants cannot extract any water from the soil. It is not used in *Prwin* - hopefully we never reach this point.

## **Evapotranspiration**

Evapotranspiration - or ET - is the theoretical rate that a plant should be using water, based on crop type, soil type and climate. In order to calculate (estimate) the actual crop water use, the reference ET of an ideal crop, typically grass, is multiplied by correction factors to account for soil type and the actual crop.

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