

PSi PF Instruments

GPS, Data Logging and Transfer

RDS Part No.:	S/DC/500-10-573
Document Issue:	1.3 : 14/4/09

Electromagnetic Compatibility (EMC)



This product complies with Council Directive 89/336/EEC when installed and used in accordance with the relevant instructions.

IMPORTANT: PLEASE READ THE FOLLOWING BEFORE USING THE CONTROL SYSTEM

The Pro-Series installation is part of the Precision Farming System ("the System"). It is very important that you follow the described calibration procedures before operating the Apollo instrument. Calibration and operation of the Pro-Series must be in accordance with these instructions. Use of the System is subject to the following disclaimer;

1. So far as is legally permissible RDS Technology ("RDS"), or its distributors, shall not be liable, whatever the cause, for any increased costs, loss of profits, business, contracts, income, or anticipate savings or for any special, indirect or inconsequential damage whatsoever (death or personal injury excluded).
2. The capabilities and functions of the Precision Farming System ("the System") are limited as set out in the specification of the System, details of which are contained in the Help files and product literature and which must be read before using the System.
3. Without prejudice to the generality of the above it is hereby acknowledged that the System is not designed nor intended to a) originate variable treatment plans or b) achieve or avoid any application rate outside application parameters, which in both cases shall be the responsibility of the operator.
4. The standard terms and conditions of RDS (except clause 7), a copy of which is available on request, apply to the supply and operation of this System.

Service and Technical Support

PLEASE CONTACT YOUR NEAREST RDS DISTRIBUTOR If unknown then contact RDS Technology Ltd for further information,

Tel : +44 (0) 1453 733300
Fax : +44 (0) 1453 733311
e-mail : info@rdstec.com
web : www.rdstec.com

Our policy is one of continuous improvement and the information in this document is subject to change without notice. Check that the software reference matches that displayed by the instrument.

© Copyright RDS Technology Ltd 2009

\\UK573130.DOC : Pt No S/DC/500-10-573

1.	HARDWARE SETUP	5
1.1	Hardware requirements	5
1.2	Head Unit Configuration - Port Settings	6
1.3	Internal Data Card Module.....	7
1.3.1	PC Card reader - transferring data	7
1.4	GPS Receiver	7
1.4.1	General Installation Guidelines for GPS Receivers	7
1.4.2	'GPS 16' GPS Receiver	8
1.4.3	Third-party GPS Receivers	8
1.5	Printer Setup	9
1.6	Data Transfer - Pro-Series to PC Link Cable	9
1.6.1	Creating a HyperTerminal Shortcut on Windows XP Desktop.....	9
1.6.2	Setting up HyperTerminal in XP.....	9
2.	LOGGING / P.F. FUNCTIONS - SOFTWARE CONFIGURATION	11
2.1	Logging Interval	11
2.2	Tag Names.....	11
2.3	Edit Function Names and Values	12
2.3.1	Clear Store function.....	12
2.4	Set GPS Antenna Offset	12
2.5	GPS Baud Rate.....	13
3.	THE LOG SCREEN - LOGGING OPTIONS	14
3.1	MAIN Screen Information	14
3.2	Running a Variable Rate Treatment plan.....	15
3.2.1	Overriding the VRT application rate	16
3.2.2	Stop a VRT job.....	16
3.2.3	Tagging.....	16
3.2.4	Extended Data Functions	16
3.2.5	Display vehicle track - "MAP".....	17
3.2.6	Display GPS Status.....	17
3.3	Dynamic Data Logging	18
3.3.1	Start recording a Dynamic Job.....	18
3.3.2	Stop recording a Dynamic Job.....	18
3.4	Field Data Logging.....	19
3.4.1	Start recording Field Data.....	19
3.4.2	Stop recording Field Data	19
3.5	Review / Reset / Print or Download Summary Data.....	20
3.5.1	Select Summary Data to Reset or Download	20
3.5.2	Downloading Data to HyperTerminal	21
3.5.3	Downloading Data to the Data Card.....	21
3.5.4	Printing Data to a Printer.....	22
4.	SYSTEM ERIS SETUP	23
4.1	Sending Rate instructions to Kverneland controllers - Vicon (EDW) / Berthoud (Bertronic) /Lely (Centronic) Tivetronic).....	24
4.2	Sending Rate instructions to Bogballe Calibrator 2002 / 2003.....	24
4.3	Sending Rate instructions to Amazone Amatron Plus	24
4.4	Sending Rate instructions to Fieldstar (or via Fieldstar to Väderstad / Horsch (Agtron))	25
4.5	Receiving Rate instructions from Fieldstar	25
4.6	Sending Rate instructions to Väderstad	25
4.7	Receiving Rate instructions from Agrocom ACT.....	25
4.8	Receiving Rate instructions from Yara-N Sensor	26
4.9	Sending Rate instructions to LH5000 V4.....	26
4.10	Sending Rate instructions to Raven SCS Console	26
4.11	Receiving Rate instructions from John Deere Greenstar/ Greenstar 2 (GS2)	27

APPENDIX 1 – GPS INTERFACE	28
<i>Connection.....</i>	<i>28</i>
<i>NMEA 0183 Data Messages</i>	<i>28</i>
<i>Message Rate settings.....</i>	<i>28</i>
<i>GGA Message Sentence.....</i>	<i>29</i>

1. Hardware Setup

Section 1 covers P.F. and Datalogging setup for a standalone RDS control system. Please refer to section 4 if interfacing with a third-party / OEM control system.

1.1 Hardware requirements

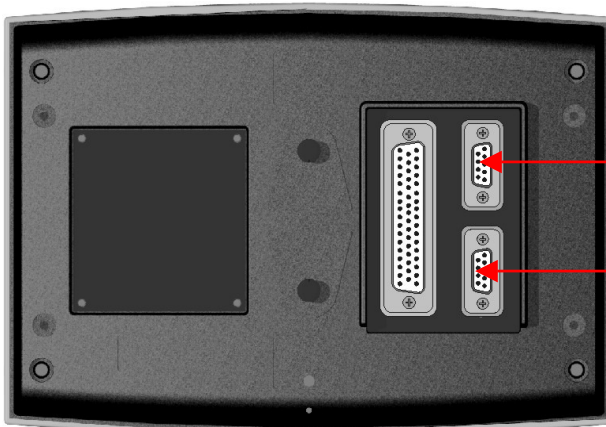
All P.F. / Data Logging applications are supplied with the 'Psi Data Card Kit' ref. **K/DATA/CARD/PSi** including the following:

RDS Part No:	Description	Reference	Qty
S/AC/311-2-001	1Gb SD Memory Card	Section	1
S/AC/311-2-002	SD – USB Adaptor	Section	1
S/AC/268-1-078	9-way 'D' Connector Clamp	Section	1
S/CB/268-1-045	GPS Cable	Section	1

You also need a compatible GPS receiver. The head unit has two RS232 ports that may be configured as required for.

- Standalone RDS P.F. control system
- Third-party P.F. interface
- Datalogging and Transfer
- Printing

Figure 1: Port connections



Top Port options

- **GPS** – e.g. GPS 16 or any compatible receiver (Std cable : S/CB/268-1-045)
- **System ERIS cable* - sending VRT instructions** to OEM controller. *Also connects DGPS.
e.g. Vicon
Fieldstar Type 1
LH5000 v4
- **Software Upload** (Cable - S/CB/268-1-032)

Bottom Port options[see note 1]

- **Printer** (RDS ICP 300 or other compatible printer)
- **PC Download** (Cable - S/CB/268-1-032)
- **System ERIS cable - receiving VRT instructions** from OEM controller
e.g. Fieldstar Type 1
Soyl Opti
Agrocom ACT
Yara-N Sensor

1.2 Head Unit Configuration - Port Settings

Having connected the hardware to the appropriate port(s), you need to configure the port settings.

Press  to select SETUP then,

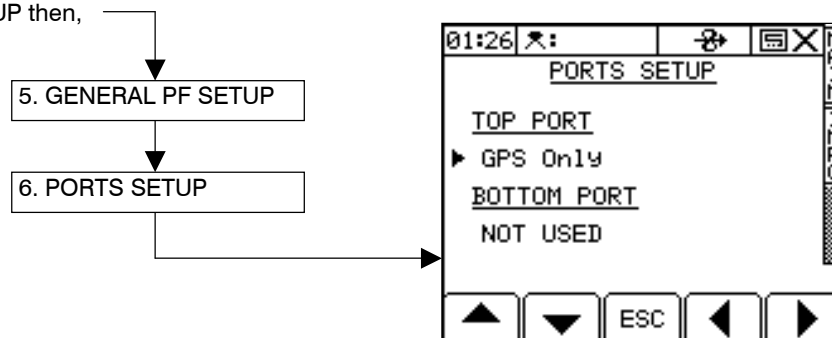


Figure 2

The 'Ports Setup' screen can also be accessed via the Technician Config menu (PIN=1234). Use the arrow keys to select the correct option and press ENTER to confirm.

Table 1: Port Options

Top Port	Function
NOT USED	Factory default setting
GPS ONLY	GPS input for a standalone RDS P.F. control system
GPS + AMATRON PLUS	Third-party interface: GPS input + <u>sending</u> Variable-rate Treatment (VRT) instructions to an OEM third-party rate controller.
GPS + BOGBALLE	
GPS + LH5000 v.4	
GPS + KVERNELAND	
GPS + RAVEN	
GPS + FIELDSTAR	
Bottom Port *	
NOT USED	Factory default setting
RDS PRINTER ICP200	Printing Field Summary data / Calibration data
PC DOWNLOAD	Output via cable to PC
RDS PF MODULE	Enables the internal Data Card Module Using an (older) external RDS Data Card Module
FIELDSTAR TYPE 1	Third-party interface: <u>Receiving</u> Variable-rate Treatment (VRT) instructions from an OEM third-party rate controller.
AGROCOM ACT	
YARA N-SENSOR	
JD GREENSTAR	
RAVEN 4800	
RAVEN 9600	

* INSERTING A DATA CARD DISABLES THE BOTTOM PORT!

1.3 Internal Data Card Module

Figure 3: SD Data Card Module



SD CARD MODULE-GS.JPG

The internal data card reader accepts SD/MMC cards of up to 2Gb, to store data generated from harvesting, soil sampling, or variable-rate treatment. It can also upload data e.g treatment plans or navigation data for soil sampling.

Typically, a 64Mb card can store data for up 2500 hectares.

Cards must have a directory called "**Rds_data.xxx**" in which all data is stored and retrieved. This directory should be automatically created when you first insert the card into the Data Module. All PF data is written to this directory. If the folder "Rds_data.xxx" is not created automatically, manually create it in the normal way from Explorer.

NOTE : The bottom port is disabled when an SD card is inserted in the internal data card module. On removing the card, the port will revert to the function configured on the **PORT SETUP** screen (Table 1).

1.3.1 PC Card reader - transferring data

SD cards can be inserted directly into many laptops. Otherwise an SD to USB adaptor (with instructions) is supplied in kit **K/DATA/CARD/PSI**

1. Transfer the flash card to the card slot on your PC card reader.

Under Windows® 95/98, the SD card will normally appear in either the 'My Computer' window, or Explorer as 'Removable Disk [D:]'.

2. Double-click on this drive to access the card and the folder "Rds_data.xxx".
3. From the **File** menu in Explorer, download yield data files or upload treatment plan files using the normal commands e.g. **Cut** or **Copy** and **Paste**, or 'drag and drop' the files.

Similarly, delete files from the card using the **Delete** command.

NOTE: Never remove the card while data is being written to it (i.e. when the red LED is on).

1.4 GPS Receiver

1.4.1 General Installation Guidelines for GPS Receivers

The following sections give an overview that should in most cases, be sufficient to successfully install the DGPS receiver.

- *Mount the antenna in the location for which you desire a position* e.g. along the centre line of the vehicle and as close as possible over the working interface.

NOTE: As this may well be impractical to achieve, the Pro-Series can be programmed via the 'GENERAL PF SETUP' menu with 'GPS ANTENNA OFFSETS' to compensate for the difference in position of the antenna from the cutter bar, spray boom etc (see section 2.4).

- *Mount the antenna to give an unobstructed hemisphere of sky.* This will ensure that GPS satellites are not masked by parts of the vehicle, potentially reducing system performance.

- *Wherever possible, avoid drilling holes in the roof to avoid both water ingress and possibly wiring / air conditioning equipment etc. If drilling is unavoidable, use silicone sealant around fixing and cable entry points.*
- *Mount the antenna as far as possible from any equipment that can cause Electromagnetic Interference (EMI) including DC motors (e.g. air conditioner), alternator, solenoids, CB radio, power cables, display units, or other electronics. Excessive EMI will degrade system performance.*

TIP: To detect possibly troublesome interference, tune a LW band portable radio off-station. With the aerial laid flat you can then (hopefully) pick up the direction and source of the interference from the increase in noise. The antenna can then be repositioned or if necessary, the source of the interference suppressed. If need be, contact RDS for further advice on suppression methods.

- *Secure the antenna cable close to the antenna mounting (using cable ties) so that in the event the antenna is knocked off it's magnetic mounting, it will be restrained and minimise the possibility of further damage.*

1.4.2 'GPS 16' GPS Receiver

Ref .Pt. No. S/HU/216-8-001

The Garmin 'GPS 16' receiver is WAAS capable (pre-configured for EGNOS - the European Geostationary Overlay System), enabling sub-metre accuracy under ideal conditions.

The receiver comes fitted with a magnetic base. Mounting on a plastic roof will require a metal base plate (not included) to be attached by suitable means. Run the combined antenna/power cable into the cab.

Connect the lead directly to the top port.

NOTE: *The lead also powers the unit.*

If interfacing with an OEM control system, please refer to section 4.

Pro-Series port settings (ref. section 1.2):

Top Port: 'GPS ONLY'

GPS Baudrate: 9600

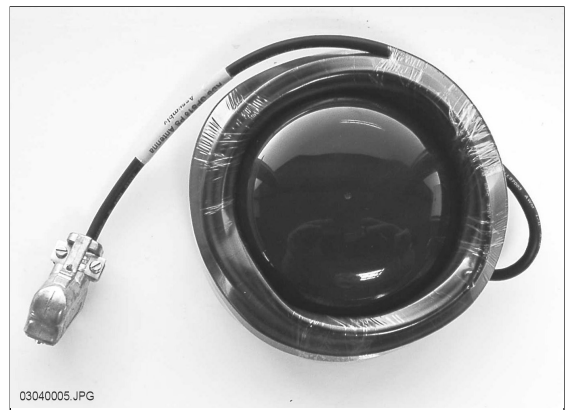


Figure 4: 'GPS 16' Receiver Kit

After the initial power-on, allow up to 5 minutes for the receiver to automatically establish its position. Subsequently the unit should establish position more quickly.

NOTE: *The GPS icon at the top of the display indicates the status of the GPS signal (refer to the Operators manual)*

1.4.3 Third-party GPS Receivers

Any DGPS receiver may be used if the output is compatible with the head unit (ref Appendix 1).

Ref. section 2.5 – changing the GPS baud rate.

Your existing GPS lead will not work if connected directly to the head unit. Connect it to the top port via the 'Pro-Series-Jupiter' lead Pt. No. S/CB/268-1-045 included in the kit ref. K/DATA/CARD/PSI.

NOTE 1: *The GPS requires a separate power supply from a suitable switched-12V source.*

NOTE 2: *If sending VRT instructions to a third-party controller, the top port shares DGPS data in and VRT data out via a custom lead. Refer to section 6 for further information.*

1.5 Printer Setup

Connect the RDS ICP300 printer to the top port using cable S/CB/268-1-049 (that also provides a power supply).

As well as the RDS ICP300 printer, the head unit will communicate with any printer if it can be configured for the following protocol,

Baud rate: 4800
Data Bits: 8
Stop Bits: 1
Parity: None
Handshake: Hardware (RTS)

These settings cannot be changed. If you are connecting a different printer, it must conform to this protocol.

Pro-Series port settings (ref. section 1.2) :

Bottom Port : 'RDS PRINTER ICP300'

NOTES: For more information on the printer, please refer to the ICP300 printer manual. For further information on printing from the Pro-Series, please see section 3.5

Ceres 8000 setup is different. To print or transfer summary data, "PF Disabled" must be selected in the "Technician" menu – '5. GPS/PF'. Please refer to section 4.4.5 of the Ceres 8000 user manual.

1.6 Data Transfer - Pro-Series to PC Link Cable

Any Pro-Series instrument equipped with data logging and download facility can transmit data to a PC or laptop running Windows and a terminal emulator programme such as Windows 'HyperTerminal'.

NOTE: 'Hyperterminal' is included with Windows XP but not with Windows Vista. If you still wish to use it you can download it from <www.hilgraeve.com>.

Connect the instrument to the serial port of the laptop/PC using a 'Pro-Series to PC Upload' cable S/CB/268-1-032. N.B. some laptops do not have RS232 ports but only have USB ports. In this case you will require a USB - Serial adapter.

Pro-Series port settings (ref. section 1.2) :

Bottom Port : 'PC DOWNLOAD'

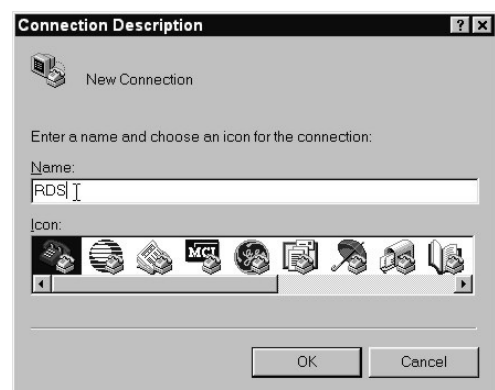
NOTE: Ceres 8000 setup is different. To print or transfer summary data, "PF Disabled" must be selected in the "Technician" menu – '5. GPS/PF'. Please refer to section 4.4.5 of the Ceres 8000 user manual.

1.6.1 Creating a HyperTerminal Shortcut on Windows XP Desktop

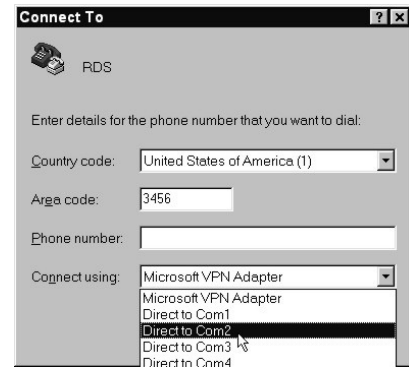
1. Select 'Start' – 'All Programs' – 'Accessories' – 'Communications', and right-click on 'Hyperterminal'.
2. Select 'Create Shortcut' and then drag the shortcut 'Hyperterminal 2' onto the Desktop.
3. Click on the shortcut description and change the name if desired.

1.6.2 Setting up HyperTerminal in XP

1. From the Windows XP desktop, double-click on the shortcut.
2. Select 'No' to the next question.
3. A 'Connections Description' box will appear. Enter a name, e.g. RDS, select an icon and click 'OK'.



4. A **'Connect To'** box will appear. In the 'Connect Using' window, select **'Com 1'** or **'Com 2'**, depending on which port you will be using. Generally on a laptop it will be Com 1. On a PC it will be Com 2 (or Com 3).
5. Click **'OK'**.

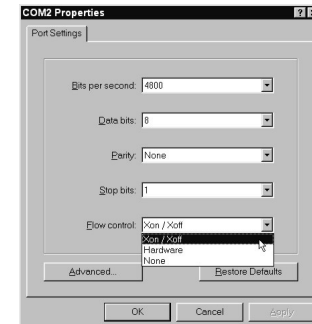


6. A 'Properties' box will appear for the selected port.

Set Bits per second: 4800
 Data bits: 8
 Parity: None
 Stop Bits: 1
 Flow Control: 'Xon/Xoff' or 'None'

and click **'OK'**.

HyperTerminal should now be in communication with the instrument. If not, a common reason is that the wrong COM port has been specified in the 'Connect Using' window' (On a PC, COM 1 is commonly used for the mouse).



7. When you exit HyperTerminal, you are prompted to save a configuration file with the name as previously entered in the 'Connections Description' window. Click **'Yes'** to save the setting.
8. Double click the 'Hyperterminal' shortcut, select **'Cancel'**, then from the Hyperterminal window select **'File'** – **'Open'**. Click and drag the file **'RDS.ht'** (or whatever you named it) onto the desktop as a new Hyperterminal shortcut and rename it if desired..
9. From then on, this shortcut will start 'Hyperterminal' with the default settings for the Pro-Series.

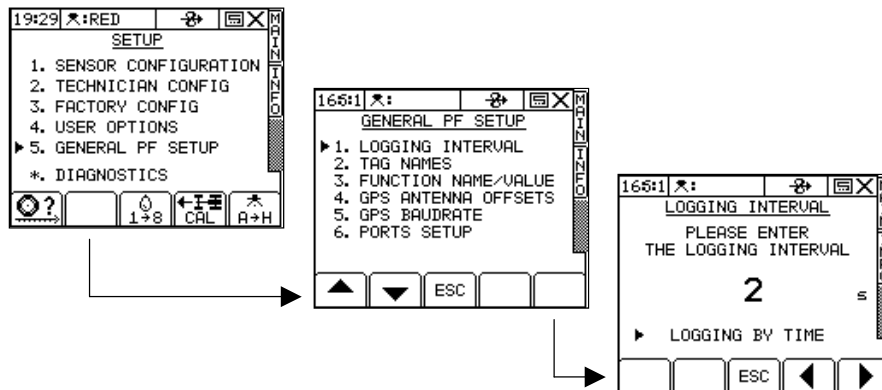
2. Logging / P.F. Functions - Software configuration

Reference: PF Driver Version 2.052

It is assumed that the hardware e.g. Data module, GPS, Third party controller etc, has already been configured.

Before commencing PF operation, you should check and adjust if necessary any of the following parameters to suit your particular application. The PF settings are found under '**5. General PF Setup**' in the calibration menu.

2.1 Logging Interval



It is recommended that you use the default setting of 2 seconds. This should be adequate for variable-rate treatment with a typical 24-metre sprayer, and yield mapping. To ensure correct application from treatment plans with a smaller cell size may therefore, require a shorter logging interval to be set.

Decreasing the logging interval may affect the responsiveness of the control system and generate larger log files. An exception is when you are boundary mapping (where less data is being generated), you can reduce the logging interval to get better definition of the field boundary.

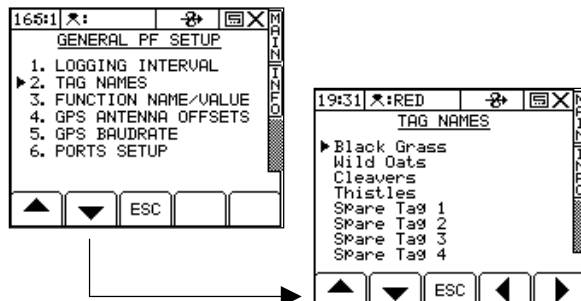
Simply enter the interval value and press the ENTER key to confirm.

NOTE: *Logging interval by distance is an option. If you choose to log by distance, data points are logged only when moving, and it enables a fixed cell size (area) for the field map.*

2.2 Tag Names

Applies to yield mapping only.

While dynamic logging is in progress the operator can switch on or off any of up to 8 'tags' which effectively place markers on subsequent yield maps to denote particular features such as weed patches etc. Each tag can be named (up to 20 characters) to denote its meaning on the yield map. The first 4 tag names are factory preset as Black Grass, Wild Oats, Cleavers and Thistles.



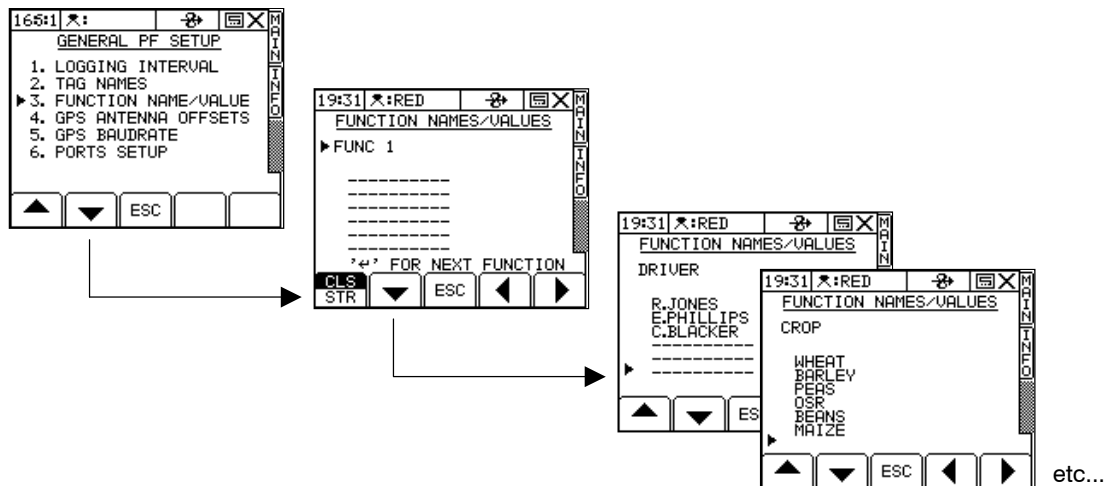
To change a name, first position the menu pointer against a tag. Using the RIGHT ARROW key, move the screen cursor across to the tag name and enter the data via the alpha-numeric keypad.

Press the ENTER key to confirm the data entry then repeat the procedure as required for further tag names.

2.3 Edit Function Names and Values

The default settings can be re-programmed for any of the extended data functions (default names = "FUNC 1" - "FUNC 12") e.g. Crop, Contractor, Driver, Product applied etc.

Further to this, for each function 1 - 12, you can then programme up to 6 different values e.g. Crop variety, Contractor name, Driver name, Product name etc.



To change a name, first select the function number using the ENTER key. Using the RIGHT ARROW key, move the screen cursor across to the function name and enter the data (up to 20 alpha-numeric characters) via the alpha-numeric keypad.

To enter a value, move the cursor down to the first line and enter the data. You can enter up to 6 lines each of 10 characters.

2.3.1 Clear Store function CLS STR

In normal operation, each time you start a job you are prompted to select a value for each extended function that is enabled on the 'Job Startup' page. The 'Clear Store' function control whether or not the default value prompt is the one selected for the previous job.

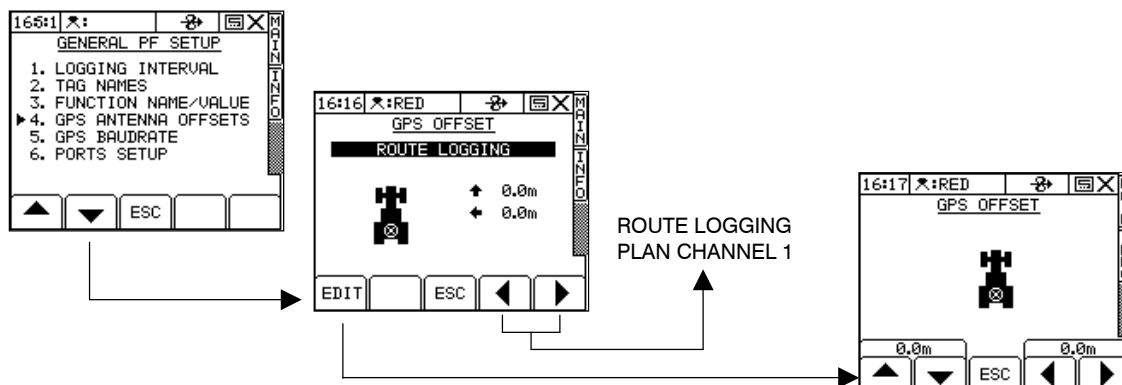
If a function on the 'Function Names/Values' page is set to CLS
STR (Clear Store), no default value will appear on the 'Job Startup' page or be logged for that function, unless the operator manually selects a value via the LIST
↓ key.

If a function is set to CLS
STR (Store), then when a new job is started, the value set for the previous job will appear on the 'Job Startup' page. It then becomes the responsibility of the operator to change the value via the LIST
↓ key if so desired.

In normal operation, it is less likely that mistakes will occur in setting the value for an extended function if 'Clear Store' is selected on the 'Function Names/Values' page. For this reason it is the factory default setting for all 12 functions.

2.4 Set GPS Antenna Offset

The "Antenna Offset" allows you to compensate for the difference in position between the GPS antenna and the feature being logged, centre of the spray boom/cutter bar/coulter bar, or the centre point of a spreading pattern.



You can have 2 separate configurations for,

ROUTE LOGGING
PLAN CHANNEL 1

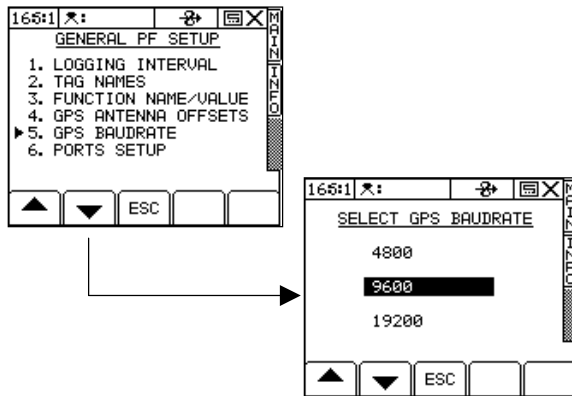
(Default for all configurations = No offset).

For example, you might need a 2-metre side offset for boundary mapping from a quad bike, so you would edit the 'ROUTE LOGGING' configuration.

Select the configuration that you wish to edit and press the **EDIT** key.

Use the arrow keys to offset the antenna position in 0.5 metre increments, and press the ENTER key to confirm.

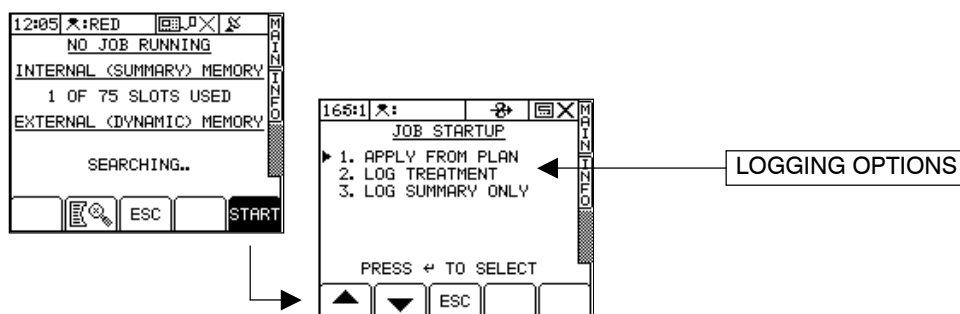
2.5 GPS Baud Rate



Default = 4800

3. The LOG Screen - Logging Options

Data is logged to internal (summary) memory and/or external (dynamic) memory depending on the logging option selected.



(i) APPLY FROM PLAN (Variable-Rate Treatment)

The variable rate instruction is implemented in one of the following setups,

- the Pro-Series receives the rate from a treatment plan on the Data Card and controls the application via the RDS control system. A full application record of the *actual* application is generated and saved on the Data Card.
- the Pro-Series receives the rate from a treatment plan on the RDS Data Card and sends it to a third party controller, which controls the application via the OEM control system (System ERIS).
- the Pro-Series receives the rate from a third-party controller and controls the application via the RDS control system (System ERIS). The Pro-Series can send back the actual application rate to the other controller

All setups allow the operator to commence a full VRT application.

For (a) and (b) a full application record of the *actual* application is generated and saved on the Data Card. The associated work record file can be viewed in the mapping/treatment plan software. Job summary data (iii) is also appended to the work record file.

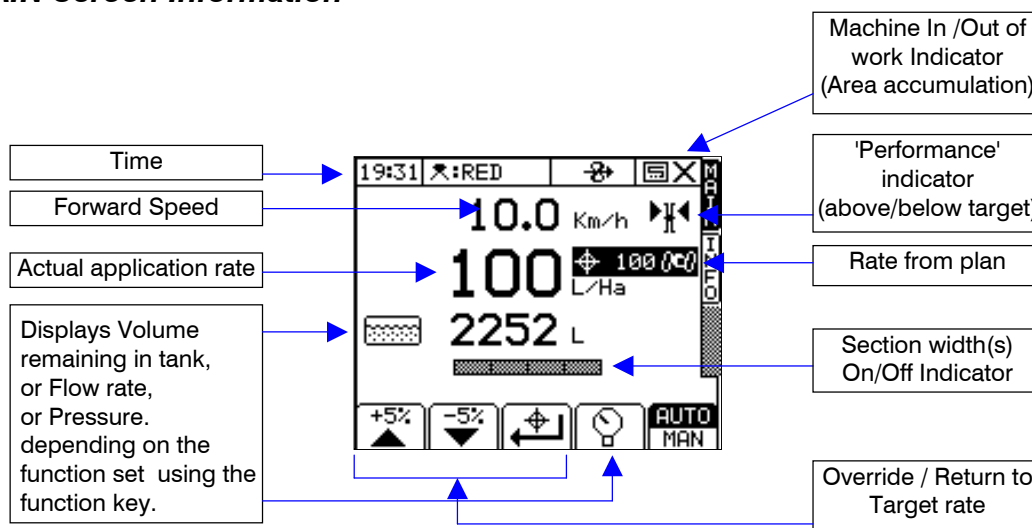
(ii) LOG TREATMENT (Dynamic Data Logging)

A full application record is generated, logging rate and other parameters (e.g. "tags") in real time, attributing this data to a specific location. The associated "Dynamic Logging" file is viewed in the mapping/treatment plan software. A large amount of data is generated by dynamic logging and therefore must be saved onto the Data Card. Job summary data (iii) is also appended to the dynamic logging file.

(iii) LOG SUMMARY ONLY (Field Data Logging)

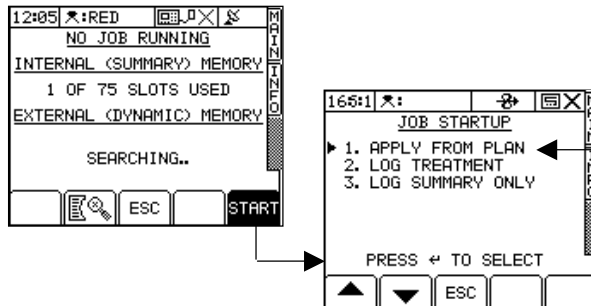
For simple farm record keeping and traceability purposes, you can record a summary of each job or work session in the internal memory, and subsequently download directly to a PC, to a Data Card, or print to an RDS ICP In-Cab Printer. The amount of summary data for each job is small, and is saved in the internal memory. The instrument can store up to 75 individual job summaries.

3.1 MAIN Screen Information



3.2 Running a Variable Rate Treatment plan

1. Press the INFO key and then the  key. The screen will display the current logging status, the number of jobs (job summaries) stored in memory, and the status of the Data Card Module.
2. Press the START key. The JOB STARTUP page is displayed. Select the logging option "1. APPLY FROM PLAN".



3. Key in the 'FARM NUMBER' and 'FIELD NUMBER'.
4. Select the appropriate plan from the list on screen and press the ENTER key to confirm.
5. Press the 'START' key. The "EXTENDED DATA FUNCTIONS" page is then displayed (section 3.2.4). If you don't wish to programme any extended functions then press .
6. Wait while the work plan file is loaded and a work record file is created on the Data Module. Once the plan is loaded, the 'RUNNING A PLANNED JOB' page appears, and displays the tag list. See section 3.2.3 about tagging.



While VRT mode is in operation a flashing satellite symbol  is displayed alongside the Target Rate on the MAIN screen.

The target rate on the MAIN screen now becomes the application rate according to the treatment plan data (Base rate x Multiplier) and the position in the field. The treatment rectangle size is defined in the treatment plan software.

Plan Status Display

Press the  key to display the current application rate according to the treatment plan, for each distribution system in operation. This is displayed as 'Base Rate x Multiplier = App. Rate'

Application Rate without a GPS Signal

If you lose the DGPS signal the treatment rate will revert to the 'Base Rate' specified in the plan.

Application Rate outside the Field Boundary

If you go outside the field boundary but are still within the treatment rectangle, a  icon flashes on the display and the instrument beeps continuously. The application rate reverts to the base rate. If you are outside the field boundary and treatment rectangle, then the application rate goes to zero.

3.2.1 Overriding the VRT application rate

You can vary the actual application rate at any time using the   keys.

The target rate display will flash until you press  to return to the target rate.

3.2.2 Stop a VRT job

To stop running a job, simply press the 'STOP' key on the data logging screen. The job summary is appended to the work record file on the data module, and saved to the internal memory.

3.2.3 Tagging

During application, you can log the presence of up to eight different features in the field, e.g. different weed infestations, pest damage etc. To switch a tag on or off, simply press the appropriate number key.



indicates the tag is off



indicates the tag is on



Tags 1 to 4 are preset for Blackgrass, Wild Oats, Cleavers and Thistles. You can however, edit the tag names from the 'GENERAL PF SETUP' menu (section 2.2).

3.2.4 Extended Data Functions

Dynamic log files and simple job summaries can include up to 12 additional data. All 12 data items can be user-defined to suit individual requirements e.g. Operator, Wind Speed, Air Temperature, Growth Stage, Product etc. Entering extended data is optional.



If you do not want to change the default value, simply press the ENTER key to accept it, and then the next 'F' function appears. If you do not need to programme any of them, simply press  at any time to start logging.

NOTE: If a function on the 'Function Names/Values' page in the setup menu is set to  (Clear Store), no default value will appear on the 'Job Startup' page or be logged for that function, unless the operator manually selects a value via the  key.

Likewise, If that function a function is set to  (Store), then when a new job is started, the value set for the previous job will appear on the 'Job Startup' page. It then becomes the responsibility of the operator to change the value via the  key if so desired.

Refer to section 2.2 to programme function names / values.

3.2.5 Display vehicle track - "MAP"

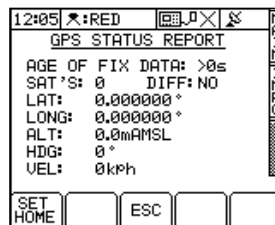
From the data logging screen, press the "MAP" key. The screen displays the real time position of the vehicle (the "+" cursor), and the vehicle track for the last 100 logged data points.

The screen also displays the latitude and longitude in decimal degrees, and the number of points. As the vehicle proceeds from the start of the job, the screen plots and automatically zooms out to display up to a maximum of 100 logged data points. Beyond this, as the job progresses, the display pans in the direction of movement to keep the previous 100 data points on screen.

Press the 'RESET' key to start the plot again from the current position. If you selected the "LOG TREATMENT" option from the data logging screen, the track data is saved to a dynamic logging file on the data module.

3.2.6 Display GPS Status

From either the data logging screen "RUNNING TREATMENT PLAN" page or "RECORDING A DYNAMIC JOB" page, press the  key to view the current GPS status.



This page displays; Age of Fix Data (when reception is good, the time should not be more than 1 second); Number of Satellites (minimum of 4 for full differential fix); Differential Status; Latitude and Longitude (in decimal degrees); Altitude; Heading and Velocity. All this data is read directly from the NMEA GGA and VTG messages.

3.3 Dynamic Data Logging

The Data Card Module and a GPS receiver must be enabled.

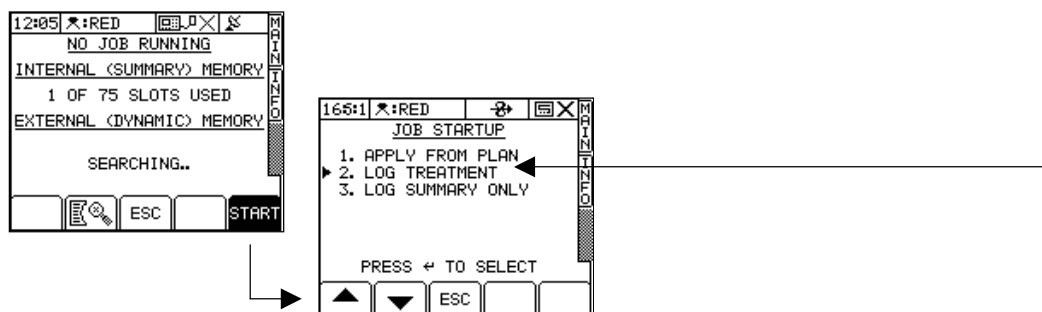
When spraying conventionally (i.e. not VRT mode), you have an option to generate a full spray application record, logging rate and other parameters (e.g. "tags") in real time, attributing this data to a specific location. The associated "Dynamic Logging" file is saved onto the Data Card Module.

3.3.1 Start recording a Dynamic Job

1. Press the INFO key and then the  key.

The screen will display the current logging status, the number of jobs (job summaries) stored in memory, and the status of the data card module

2. Press the START key. The JOB STARTUP page is displayed. Select the logging option "2. LOG TREATMENT".



When prompted, enter the FARM NUMBER and FIELD NUMBER reference. The "EXTENDED DATA FUNCTIONS" page is then displayed (section 3.2.4). If you don't wish to programme any extended functions, then press .

The screen will display "NEGOTIATING FILE STORAGE - JOB NUMBER #" as it creates the dynamic log file on the data module. Once the plan is loaded, the "RECORDING A DYNAMIC JOB" page appears, and displays the tag list. You can at any time apply the Tag functions to log features in the field (see section 3.2.3).

3.3.2 Stop recording a Dynamic Job

To stop running a job, simply press the "STOP" key on the data logging screen. The job summary is appended to the dynamic log file on the data module, and saved to the internal memory.

3.4 Field Data Logging

For farm record keeping and traceability purposes, you can record a summary of each job or work session in the internal memory, and subsequently download directly to a PC, to the Data Module, or print to an RDS ICP200 In-Cab Printer. You can store up to 75 job summaries.

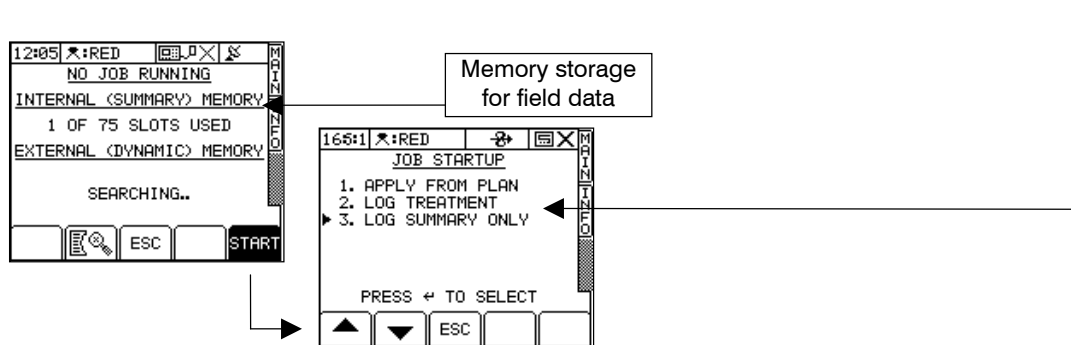
Refer to section 3.5 on downloading or printing data.

3.4.1 Start recording Field Data

1. Press the INFO key and then the  key.

The screen will display the current logging status, the number of jobs (job summaries) stored in memory, and the status of the data card module

2. Press the START key. The JOB STARTUP page is displayed. Select the logging option "3. LOG SUMMARY ONLY".



When prompted, enter the FARM NUMBER and FIELD NUMBER reference. The "EXTENDED DATA FUNCTIONS" page is then displayed (section 3.2.4). If you don't wish to programme any extended functions, then press .

The "RECORDING A JOB SUMMARY" page appears.



NOTE: The Tag functions are not available in this logging mode.

3.4.2 Stop recording Field Data

To stop running a job, simply press the "STOP" key on the data logging screen. The job summary is saved to the internal memory.

3.5 Review / Reset / Print or Download Summary Data

You can view, delete, print or download one or more jobs. Summary data downloads either in a text format as a job ticket including space for comments and signature, or in a CSV format.

Depending on your hardware setup (ref. section 1) you can 'print' from the Pro-Series to a printer, to a .txt or .csv file on the data module, or to a .txt or .csv file saved with "HyperTerminal" on the PC.

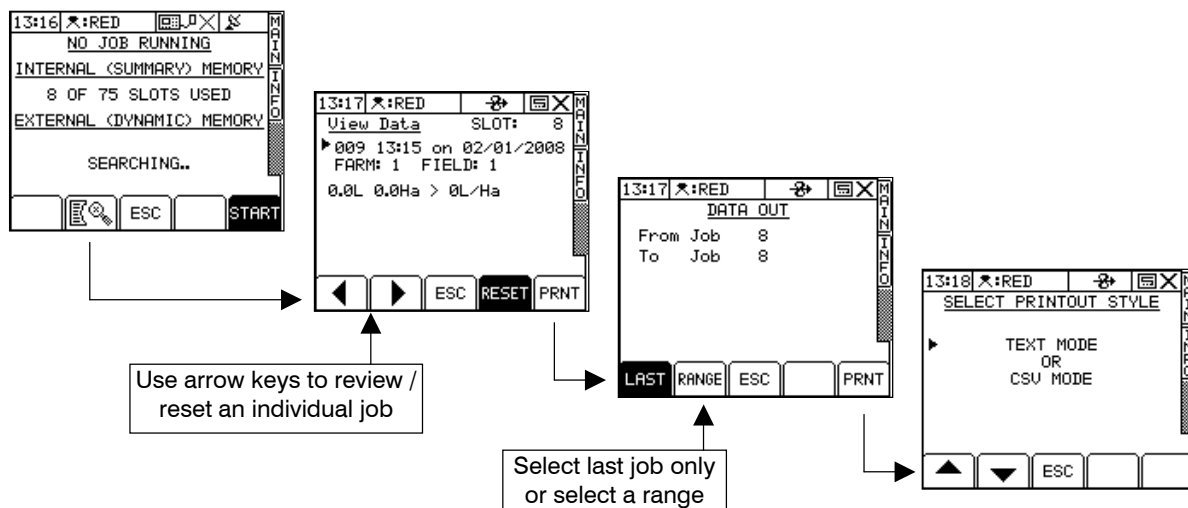
It includes all the basic data listed below along with any extended data that was programmed, for each tank that is enabled.

Job Number
Start Date
Start Time
End Time
Job Duration
Channel No.
Machine ID / Name
Farm No.
Field No.
Product / Crop
Cal Factor
Area
Work Rate
Quantity spread
Quantity loaded
Average Application Rate
Extended Functions F1 to F12 values
Comments*
Operator*
Transmit Time and Date

* Not included in .CSV format

3.5.1 Select Summary Data to Reset or Download

On the Pro-Series, select the job or jobs summaries to download as follows,



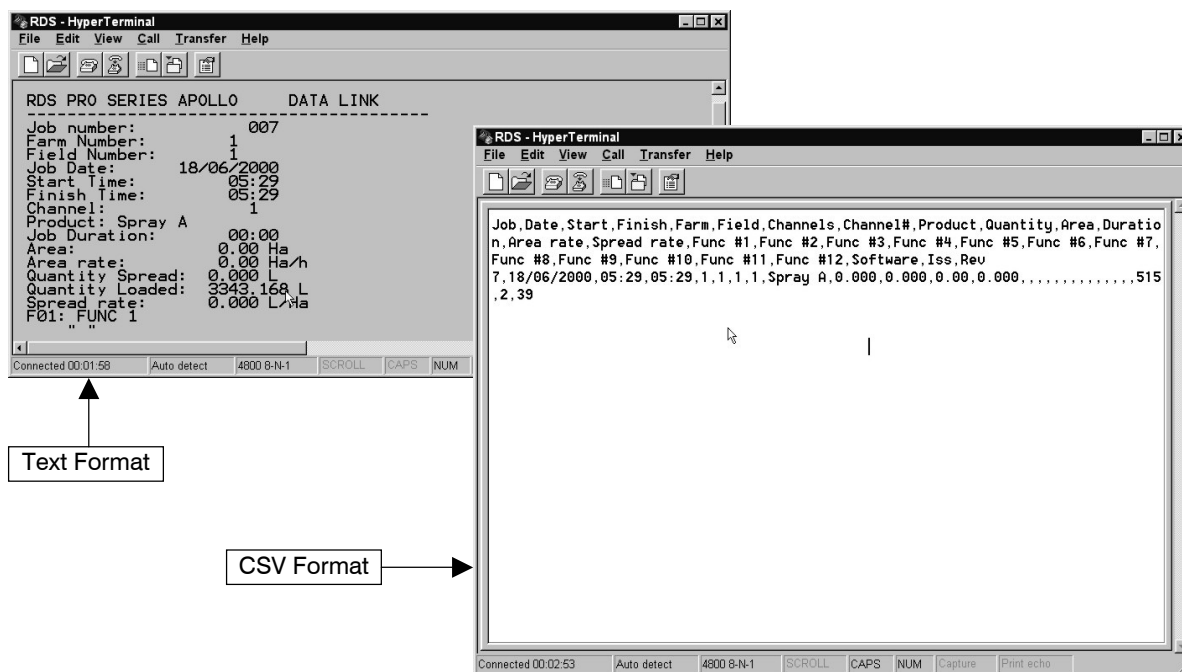
You have the option to download in Text or CSV format. CSV format is ideal for importing the data into a spreadsheet. As data is transmitted from the instrument a "progress bar" will be displayed on the Pro-Series.

Now refer to the appropriate section below on capturing the data.

3.5.2 Downloading Data to HyperTerminal

(Ref. section 1.6 for software setup).

1. On the laptop, double-click on the HyperTerminal icon on the desktop. This will open the HyperTerminal Folder.
2. Double-click on the 'RDS.ht' icon.
3. From the menu, select 'Transfer' → 'Capture Text'. A 'Capture Text' message box will appear showing the name of the text file to which data will be saved.
4. Type in the name of the folder and the name of the file that you wish to save the data as.
5. Click on 'Start'. The programme is now ready to receive the data from the Pro-Series.



7. When the transfer is complete, from the menu, select 'Transfer' → 'Capture Text' → 'Stop'. The data has now been saved to the designated file.
8. This file may now be opened as a text file in a text editor, e.g. Word, Notepad, etc and can be printed and edited as required.

3.5.3 Downloading Data to the Data Card

(Ref. Table1 for port settings).

After selecting TEXT or CSV mode, the filename is automatically created as <jobxxxxx.txt> (or jobxxxxx.csv) where 'xxxxx' is the job number stored in memory. If you are downloading a range of job summaries, then a separate file is created for each summary.

If any file with the same name already exists on the data module, the instrument will prompt you to whether to overwrite that file or not. If you want to keep an existing file then make sure you transfer it from the data card onto the PC and rename it.

3.5.4 Printing Data to a Printer

(Ref. Table1 for port settings).

Accept the default TEXT mode for printing and the job summary or summaries print out as a job ticket with space for comments and a signature as shown.

RDS PRO SERIES APOLLO		DATA LINK
Job number:	000	
Channel:	1	
Farm Number:	1	
Field Number:	2	
Job Date:	08/06/2000	
Start Time:	08:56	
Finish Time:	09:30	
Job Duration:	00:13	
Area:	2.70 Ha	
Area rate:	44.76 Ha/h	
Quantity Spread:	714.565 L	
Quantity Loaded:	850 L	
Spread rate:	264.850 L/Ha	
Product:	Spray A	
F01:	"555"	
F02:	"666"	
F03:	"FRED"	
F04:	"ROUNDUP"	
F05:	" "	
Comments:		
Operator:		
Software Issue PS515-002		
Data printed at 10:16:10 on 06/03/2001		

4. System ERS Setup

As an alternative to the Pro-Series operating as a standalone controller directly controlling an RDS retrofit system, the head unit can transmit a variable rate control signal via RS 232C to another implement controller also installed in the cab. Conversely, the Pro-Series can operate as a slave controller, receiving a rate instruction from another implement controller and acting upon it.

NOTE 1: Although certain implement controllers are able to return a message confirming the actual rate delivered, you can't receive this data and log it to the Data Module, because the RXD pin on the ERS interface receives the GPS data.

NOTE 2: Section 1 describes setup and configuration of the GPS receiver. If your receiver is not supplied by RDS and you encounter problems setting it up, then you may have to refer to the documentation supplied with the receiver.

A custom interface cable is supplied to connect the Pro-Series to the RS 232 port of the implement controller, and in most cases to also connect a GPS receiver and a power supply.

Figure 5: Typical ERS Setup – Psi sending rate instructions

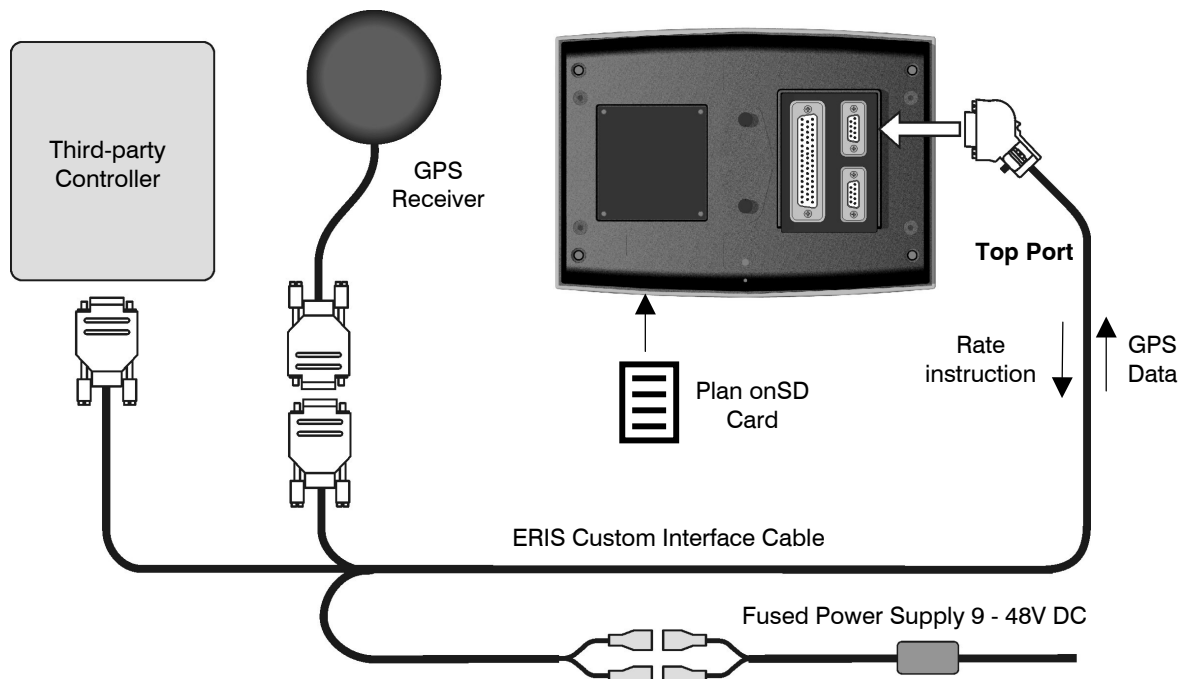
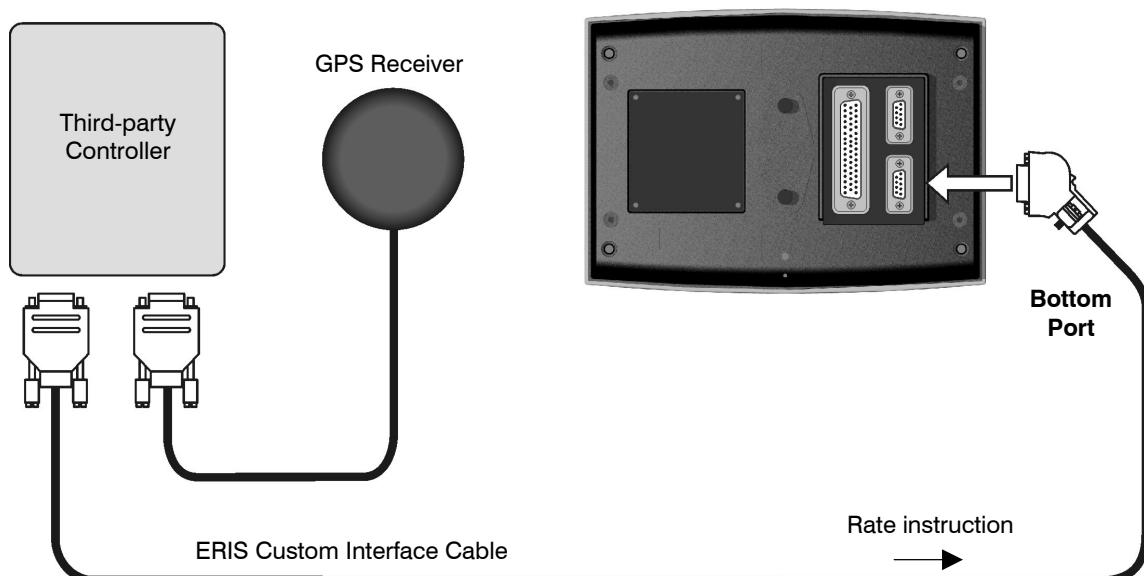


Figure 6: Typical ERS Setup- Psi receiving rate instructions



NOTE: Power Supply as normal via Pro-Series 50-way 'D' connector

The following sections give specific information for each type of implement controller. The sample messages given, allow you to verify that the correct data is being transmitted via the RS232 serial interface. To verify the message stream, connect the controller 9-way 'D' connector of the RDS interface cable to the COM port of the PC, and view the data using a terminal emulation program such as Hyperterminal within Microsoft Windows.

4.1 Sending Rate instructions to Kverneland controllers - Vicon (EDW) / Berthoud (Bertronic) / Lely (Centronic) Tive (Tivetronic)

RDS Cable Pt No. Ref. Figure 5 : Use S/CB/268-1-**053** (Tivetronic - see note below)

PS Port setup Bottom port: 'RDS PF MODULE'

Top port: 'GPS(4800) + Vicon' / 'GPS(9600) + Vicon' depending on your GPS baud rate configuration.

Serial data format (Slave): RS232 C / NMEA: 4800, 8, 1, N, no handshake

Data Message (1Hz) The message starts with a '\$' sign and ends with a '*' delimiter. Data fields are separated by a comma. Only the RATE data field is communicated. Checksum (error detection), Carriage Return and Line Feed are hexadecimal ASCII code.

Example message: **\$RATE, 100.0 * 01 <13> <10>**

Message string identifier	Checksum	Carriage Return	Line Feed
	Data field 1: Application Rate		

NOTE: To connect to the Tivetronic controller requires the 'Tivetronic/AgroNet RS232 Setpoint Receiver Module'. This connects to the Tivetronic coaxial cable and has an RS232 connector on the back.

4.2 Sending Rate instructions to Bogballe Calibrator 2002 / 2003

RDS Cable Pt No. Ref. Figure 5 : Use S/CB/268-1-**047**

PS Port setup Bottom port: 'RDS PF MODULE'

Top port: 'GPS(4800) + Bogballe' / 'GPS(9600) + Bogballe' depending on your GPS baud rate configuration.

Serial data format (Slave): RS232 C: 4800, 8, 1, N, no handshake

Data Message (1Hz): 3 bytes are sent to set the application rate. Each byte is hexadecimal ASCII code.

Example message: **4F 00 64**

	Byte 3: The lower 8-bit of the 16-bit binary application rate in kg/ha	
	Byte 2: The higher 8-bit of the 16-bit binary application rate in kg/ha	
Byte 1 (The letter 'O')		

In this example, Hex 0064 is a rate instruction for 100 kg/ha. The Calibrator 2003 can return a message confirming the actual rate (see note 1 above). The Calibrator 2002 can not.

4.3 Sending Rate instructions to Amazone Amatron Plus

RDS Cable Pt No. Ref. Figure 5 : Use S/CB/268-1-**052**

PS Port setup Bottom port: 'RDS PF MODULE'

Top port: 'GPS(4800) + Amatron' / 'GPS(9600) + Amatron' depending on your GPS baud rate configuration.

Serial data format (Slave): RS232 C: 4800, 8, 1, N, no handshake

Data Message (1Hz): The message consists of 11 bytes in hexadecimal code.

Example message: **00 FF 30 53 00 00 01 25 00 00 54**

4-byte identifier	Rate instruction (e.g. 125 kg/ha)	Checksum

4.4 Sending Rate instructions to Fieldstar (or via Fieldstar to Väderstad / Horsch (Agtron))

RDS Cable Pt No.	Ref. Figure 5 : You can use either S/CB/268-1- 047 (Bogballe), S/CB/268-1- 080 or S/CB/268-1- 053 (Tivetronic) cables. The only difference is the length of the lead.				
PS Port setup	Bottom port:	'RDS PF MODULE'			
	Top port:	'GPS(4800) + FS TYPE 1' / 'GPS(9600) + FS TYPE 1' depending on your GPS baud rate configuration.			
Serial data format (Slave): RS232 C: 4800, 8, 1, N, no handshake					
Data Message (1Hz):	The message starts with a '\$' and ends with a '*' delimiter. 5 data fields are separated by commas. Field 0 is a 5-byte header. The Pro-Series transmits the forward speed signal (field 1) and the rate instruction (the application rate will appear in fields 2, 3 and 4). Checksum (error detection), Carriage Return and Line Feed are hexadecimal ASCII code.				
Example message:	\$DOSES,8.52,100.0,100.0,100.0,*7F<13><10>				
	5-byte	Forward	Rate (seed)	Check	Line
	header	speed	(kg/ha)	sum	Feed
		Rate (Fert)	Rate (Spray)	Carriage	
		(kg/ha)	(l/ha)	Return	

4.5 Receiving Rate instructions from Fieldstar

RDS Cable Pt No.	Ref. Figure 6 : Use S/CB/268-1- 054
PS Port setup	Bottom port: 'Fieldstar type 1'
	Top port: 'NOT USED'

The data message (1Hz) sent from the Fieldstar terminal is in the format shown above.

4.6 Sending Rate instructions to Väderstad

RDS Cable Pt No.	Ref. Figure 5 : Use S/CB/268-1- 080
Otherwise, setup and the data format is the same as the Fieldstar terminal.	

4.7 Receiving Rate instructions from Agrocom ACT

RDS Cable Pt No.	Ref. Figure 6 : Use S/CB/268-1-032 (Pro-Series-PC Upload Cable). The power lead with crimped terminals is not connected as the power supply to the Pro-Series is via the 50-way 'D' connector.			
PS Port setup	Bottom port:	'Agrocom ACT'		
	Top port:	'NOT USED'		
Serial data format:	RS232 C: 4800, 8, 1, N, no handshake			
Data Message (1Hz):	The message starts with a '\$' and ends with a '*' delimiter. 3 data fields are separated by commas. Checksum (error detection), Carriage Return and Line Feed are hexadecimal ASCII code.			
Example messages:	\$FERT,1,100.0*1B<13><10>			
	\$SEED,2,100.0*09<13><10>			
	\$SPRAY,3,100.0*57<13><10>			
	Plan	Rate	Carriage	
	Type	(kg/ha	Return	
		l/ha)		
	Control	Check	Line	
	channel	sum	Feed	
	on Pro-Series			

4.8 Receiving Rate instructions from Yara-N Sensor

RDS Cable Pt No.	Ref. Figure 6 : Use S/CB/268-1- 032 (Pro-Series-PC Upload Cable). The power lead with crimped terminals is not required as the power supply to the Pro-Series is via the 50-way 'D' connector. The cable connects to the junction box of the Tractor cable harness (ref. section 5 of their operation manual).
PS Port setup	Bottom port: 'Yara-N Sensor' Top port: 'NOT USED'
Serial data format:	RS232 C: 4800, 8, 1, N, no handshake
Data Message (1Hz):	The PS8000 should be receiving the following message format,
Example message:	\$AR0150,1F<13> Header Rate (kg/ha l/ha) Check sum Carriage Return

4.9 Sending Rate instructions to LH5000 V4

RDS Cable Pt No.	Ref Figure 5: Use S/CB/268-1- 073 . There is a 25-way female 'D' on the rear of the 5000 which is the 'GPS' port. This requires an LH5000 – DataLink RS232 cable to which the RDS cable is connected.
PS Port setup	Bottom port: 'RDS PF MODULE' Top port: 'GPS(4800) + LH5000 v4' / 'GPS(9600) + LH5000 v4' depending on your GPS baud rate configuration.
Serial data format (Slave):	RS232 C: 9600, 8, 1, N, no handshake
Data Message (1Hz):	NB. The LH 5000 must be configured to have the GPS switched OFF. This stops it looking for the LH Data Link. The message consists of 8 bytes in hexadecimal code. The rate instruction is a 4-databyte field. In the example, a rate of 200 l/ha set on the PS8000 is sent as '40 0D 03 00' or 200,000 ml/ha.
Example message:	D2 00 04 40 0D 03 00 26 2-byte identifier No of data bytes Rate (g/ha , ml/ha) Check sum

4.10 Sending Rate instructions to Raven SCS Console

RDS Cable Pt No.	Ref Figure 5: Use S/CB/268-1- 053 .
PS Port setup	Bottom port: 'RDS PF MODULE' Top port: 'GPS(4800) + RAVEN' / 'GPS(9600) + RAVEN' depending on your GPS baud rate configuration.
Serial data format (Slave):	RS232 C: 9600, 8, 1, N, no handshake
Data Message (1Hz):	
Example message:	\$R,RC,100<13><10> Raven Identifier Rate Change instruction Rate (l/ha, kg/ha) Carriage Return Line Feed

4.11 Receiving Rate instructions from John Deere Greenstar/ Greenstar 2 (GS2)

Hardware requirement:

- **RDS software with PF Driver module PF2.054** or later, resolves previous problems. If all the boom sections or traps are switched off, then the message sent to Greenstar will show a width of 0.01m and the Status will be reported as "INACTIVE". If any boom section or trap is switched on, then the true working width will be sent and the status will be "ACTIVE".
- **Pro-Series-JD Greenstar Cable**, ref. RDS Pt. No. S/CB/268-1-082.
- **JD GS2 console with software revision GS2.3.1385** or later. The GS2 console must have the 'GS2 Pro Documentation' package, which will be on a data card in the side of the console.
- **JD harness kit ref. PF80807** (for Greenstar 2). Connects to the Deutsch connector on the rear of the GS2 terminal. Depending on the pins selected, this cable will provide an RS232 connector as COM1 or COM2.

NOTE: For the Greenstar GSD4 console (the 'Brown Box'), the JD harness kit ref. PF80661 is required to provide the 9-way 'D' COM1 port.

Pro-Series Setup

PS Port setup:	Bottom port:	"JD Greenstar"
	Top port:	'NOT USED'
Serial data format:	RS232 C:	4800, 8, 1, N, no handshake

Greenstar 2 Setup

Referring to the GS2 User Instruction Manual if necessary,
(the website link is http://stellarsupport.deere.com/en_US/support/OperatorManual-UserGuide.html),

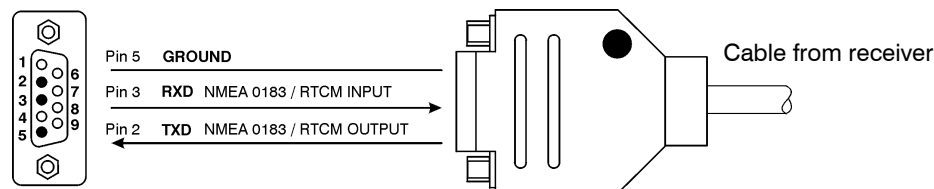
- Select settings for "Client", "Farm", "Field", and "Task" (any setting except "Documentation Off")
- Select settings for "Product Application Type" ("Single Product", or define a mixed product - "Tank Mix").
- Select the "Controller " settings ("Manufacturer" = "LH Technologies", "Model" = "LH5000"), and the COM port in use.
- Select the units l/ha or kg/ha, and "Material Type"

The GS2 status should then be "ACTIVE" and the rate display should be greyed out. The GS2 will send a rate instruction to the RDS instrument and will receive back a message of what is actually applied. The status indicator bottom left will be red when the machine is out of work and green when in work.

Appendix 1 – GPS Interface

Connection

Connection:- RS232-C interface (DB-9 **Female** Connector) with the following pin outs.

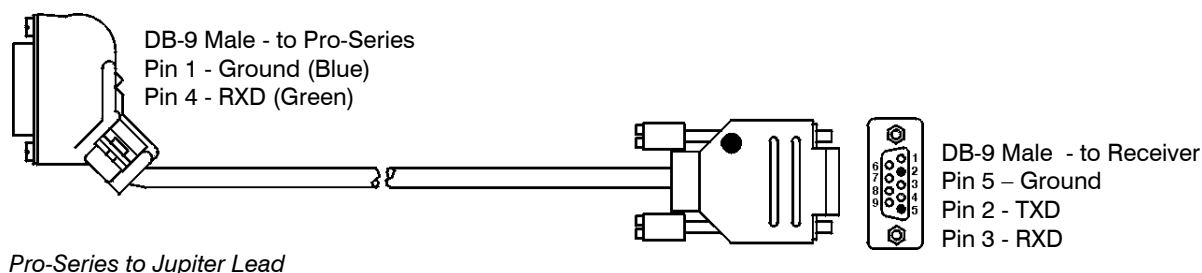


NOTE 1: Pin 3 is not utilised.

Data Protocol:-	Data format	NMEA 0183 / RTCM-104, GGA, VTG and ZDA messages
	Baud rate	4800 / 9600 / 19200
	Data output rate	1Hz / 5Hz
	Data Bits	8
	Stop Bits	1
	Parity	None
	Flow Control	Off

Connect the GPS receiver to the top port using the 'Pro-Series-Jupiter' lead Pt. No. S/CB/268-1-045 included in the kit ref. K/DATA/CARD/PSI.

NOTE 2: The GPS requires a separate power supply from a suitable switched 12V source.



NOTE 3: If sending VRT instructions to a third-party controller (System ERIS), the top port shares DGPS data in and VRT data out via a custom lead. Refer to section 4 for further information on System ERIS applications.

NMEA 0183 Data Messages

GPS data is 'packaged' into a number of standard message sentences each with a data subset suited for specific communication requirements. The most common message sentences are listed below.

Message sentence	Max. Rate	Contents
GPGGA	5 Hz	GPS Fix Data
GPGLL	5 Hz	Geographic Position - Latitude / Longitude
GPGSA	1 Hz	GPS DOP (Dilution of Precision) and Active Satellites
GPGSV	1 Hz	GPS Satellites in view
GPRMC	5 Hz	Recommended Minimum Specific GPS Data
GPVTG	5 Hz	Track Made Good and Ground Speed
GPZDA	5 Hz	Time and Date

Message Rate settings

Although the Pro-Series only requires a 1Hz input, it will continue to operate satisfactorily with a 5Hz input. No configuration is required.

For certain applications the higher rate is essential to get good guidance performance, and therefore it is recommended to always configure the GPS receiver for 5Hz output.

GGA Message Sentence

The GGA message sentence is normally the only message sentence required by the Pro-Series, except for the Ceres 8000 or Mapping Module software, where you have the option to configure the instrument to calculate forward speed from the VTG message sentence.

Broken down into its components, ('fields' divided by commas or 'comma delimited'), a typical GGA message takes the following form:-

\$GPGGA,125838, 5141.7196, N, 00213.3253, W, 1, 04, 0.98, -342.6, M, 48.5, M, ,*48

Field #	1	2	3	4	5	6	7	8	9	10	11	12	13	14

The meaning of each field is as follows:-

Field #	Syntax	Description
1	hhmmss.ss	UTC time (=GMT) in hours, minutes, seconds of the GPS position
2	ddmm.mmmmm	Latitude in degrees, minutes, decimal minutes
3	s	s = N or s = S for North or South latitude
4	ddmm.mmmmm	Longitude in degrees, minutes, decimal minutes
5	s	s = E or s = W for East or West longitude
6	n	GPS quality indicator, 0 = no position 1 = undifferentially corrected position 2 = differentially corrected position 9 = position computed using almanac
7	qq	number of satellites received
8	pp.p	Horizontal Dilution Of Precision (HDOP)* = 0.0 to 9.9
9,10	saaaa.aa,M	Antenna altitude and units, M = metres
11,12	±xxxx.xx	Geodial Separation*, M = metres
13	sss	Age of Differential correction in seconds
14	aaa	Differential Reference Station ID

* Resulting from the geometry of visible satellites i.e. their relative position over the arc of sky.

** The difference between Mean Sea Level (MSL) and the WGS-84 geo-datum (the Earth Ellipsoid).

Issue 1.0	7 /2/08	Revised from UK384-2.DOC
Issue 1.1	10/9/08	p.22 Corrections
Issue 1.2	8/10/08	Various corrections + Changes for PF driver ver. 2.052 ; ref. pages 5-13,
Issue 1.3	14/4/09	Ref section 4.11 – JD Greenstar interface.